RUISI WIND POWER PLANT PROJECT

Environmental and Social Impact Assessment

Volume 1

Project Implementer:
JSC Wind Power

Prepared by:
WEG Envi Consulting LLC

October 2023

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Director:

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1 Introduction

This document is an Environmental and Social Impact Assessment (ESIA) Report for the Project on Construction and Operation of 206 MW Ruisi Wind power plant (Ruisi WPP) on the territory of Kareli and Gori Municipalities in Shida Kartli (Inner Kartli) region of Georgia. Project implementation is planned by the JSC Wind Power.

JSC Wind Power is the company whose team has a significant experience in development of renewable energy sector in Georgia. JSC Wind Power is developing the Ruisi Wind Farm Project on selected territory on the basis of the Memorandum of Understanding from 10-th of August 2021 signed with the Government of Georgia. According to preliminary assessment of wind regimes on the selected territory location of the Ruisi Wind Farm is suitable for installation of 46 wind turbines with 206 MW total installed capacity

Expected benefits from the construction of the Ruisi Wind Farm are the following:

- Development of power supply system in Georgia, increase of power supply reliability.
- Increase of domestic power generation and reduction of dependence on power imports; contribution into improvement of energy-safety and energy-independence.
- Development of renewable energy sources, diversification of power sources.
- Reduction of CO_2 emissions.
- Participation of local contractors in construction of wind power station
- Employment of local population during operation of the wind farm
- Upgrade of local infrastructure

According to design the total power capacity of the Ruisi Wind Farm will be 206 MW; installed power capacity of each wind turbine will be 4.5 MW in average. There are 46 locations selected for installation of wind turbines. Environmental impact will be assessed for worst case scenario that implies installation of 46 wind turbines with installed capacity of 4.5 MW each. In reality the impact will be lower because actual specific models of wind turbines will be selected during tendering process on the basis of best offer. 4.5 MW just corresponds to the minimum capacity of turbines and 46 to the maximum number of turbines. Finally, the number of turbines is expected to be lower, which means that capacity of some turbine will increase in a way to get 206 MW installed capacity of the entire wind power plant. Reduction of their total number will result in reduction of impact intensity. Therefore, draft environmental impact assessment (construction areas; noise and shadow flickering simulation; impact on habitats and soil, etc.) is carried out for worst case scenario, impact of which on environment exceeds the impact that Project will actually have in reality. **For the worst case scenario following assumptions have been made**:

- the number of the turbines is – 46
- height of turbines – 150m
- rotor diameter – 163m
- until the particular model of turbine is determined it is referred as Generic WTG 4.5MW platform

This ESIA Report is prepared on the basis of the EBRD Environmental and Social Policy (2019) and Environmental Assessment Code of Georgia. The ESIA is also compliant with other international guidelines, like IFC Environmental, Health and Safety Guidelines for Wind Energy (August 7, 2015).

The Project is being developed by the JSC Wind Power. This ESIA Report was prepared by the "WEG Envi Co0nsulting Ltd."

Table 1-1 Contact Information

Project implementing company	JSC Wind Power
Legal address of company	Zurab Avalishvili Street No.12, 0179, Tbilisi, Georgia.
Actual address of company	Zurab Avalishvili Street No.12, 0179, Tbilisi, Georgia.
Address of planned activity site	Kareli Municipality. Surroundings of villages Ruisi, Urbnisi, Sagolasheni, Breti, Saqasheti and Sasireti
Type of planned activity	Construction and operation of the Ruisi Wind Farm
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Director of WEG Envi Consulting Ltd.	M. Kimeridze
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Table 1-2 List of experts participating in preparation of the Environmental Impact Assessment Report

Discipline	Expert or Company	Signature
Flora and habitats (Report - Annex 1)	M. Kimeridze WEG Envi Consulting LLC.	
Ornitho-fauna (Report - Annex 4)	A. Abuladze	
Chiroptera (Report - Annex 5)	I. Natradze A. Bukhnikashvili	
Noise simulation (Annex 8)	Ekospectri Ltd	
Archeological survey (Annex 10)	Z. Giorgadze Georgia Nation Agency for Protection of Cultural Heritage	
Remaining chapters of ESIA report	M.Chelidze WEG Envi Consulting LLC.	

2 Legal Framework

This ESIA Report is prepared on the basis of the EBRD Environmental and Social Policy (2019) and Environmental Assessment Code of Georgia. The ESIA is also compliant with other international guidelines, like IFC Environmental, Health and Safety Guidelines for Wind Energy (August 7, 2015)

Environmental legislation of Georgia comprises the Constitution, environmental laws, international agreements, by-laws, normative acts, presidential orders, and governmental decrees, ministerial orders, instructions, regulations, etc. Georgia is a signatory party to international conventions, including those adopted in the field of environmental protection.

2.1 Environmental Legislation of Georgia

This EIA Report is prepared in compliance with requirement of the Law of Georgia "Environmental Assessment Code". Other environmental laws were considered during the EIA process as well. Table 2-1 provides the list of environmental laws of Georgia, while Table 2-2 includes applicable environmental standards.

Table 2-1 List of environmental laws of Georgia

Adoption Year	Law	Registration Code	Final Amendment
1994	Law of Georgia on Soil Protection	370.010.000.05.001.000.080	16/07/2015
1994	Law of Georgia on Motorways	310.090.000.05.001.000.089	24/12/2013
1995	The Constitution of Georgia	010.010.000.01.001.000.116	04/10/2013
1996	Law of Georgia on Environmental Protection	360.000.000.05.001.000.184	11/11/2015
1997	Law of Georgia on Wildlife	410.000.000.05.001.000.186	26/12/2014
1997	Law of Georgia on Water	400.000.000.05.001.000.253	26/12/2014
1997	Marine Code of Georgia	400.010.020.05.001.000.212	11/12/2015
1999	Law of Georgia on Protection of Atmospheric Air	420.000.000.05.001.000.595	05/02/2014
1999	Forest Code of Georgia	390.000.000.05.001.000.599	06/09/2013
1999	Law of Georgia on Compensating for Damage Caused by Hazardous Substances	040.160.050.05.001.000.671	06/06/2003
2003	Law of Georgia on Red List and Red Book of Georgia	360.060.000.05.001.001.297	06/09/2013
2003	Law of Georgia on Conservation of Soils and Reclamation and Improvement of Soil Fertility	370.010.000.05.001.001.274	19/04/2013
2005	Law of Georgia on Licenses and Permits	300.310.000.05.001.001.914	11/11/2015
2006	Law of Georgia on Regulation and Engineering Protection of the Sea Coast and River Banks in Georgia	400010010.05.001.016296	13/05/2011
2007	Law of Georgia on Ecological Expertise	360.130.000.05.001.003.079	25/03/2013
2007	Law of Georgia on Public Health	470.000.000.05.001.002.920	11/12/2015
2007	Law of Georgia on Cultural Heritage	450.030.000.05.001.002.815	26/12/2014

Adoption Year	Law	Registration Code	Final Amendment
2014	Law of Georgia on Public Safety	140070000.05.001.017468	16/12/2015
2014	Waste Management Code	360160000.05.001.017608	19/02/2015
2017	Law of Georgia “Environmental Assessment Code”	360160000.05.001.018492	07/12/2017

Table 2-2 Environmental standards of Georgia

Adoption Date	Name of Regulation	Registration Code
31/12/2013	Technical Regulation - Methodology for Calculation of Air Emission Limits for Air-Born Pollutants, approved by Resolution #408 of the Government of Georgia.	300160070.10.003.017622
31/12/2013	Technical Regulation on Water Protection Zone, approved by Resolution #440 of the Government of Georgia.	300160070.10.003.017640
31/12/2013	Technical Regulation - Instrumental Method to Determine Actual Air Emissions of Stationery Pollution Sources, Standard List of Special Measuring-Monitoring Equipment to Determine Actual Air Emissions from Stationary Pollution Sources and Estimation Methodology to Calculate Actual Air Emissions from Stationary Pollution Sources by Technological Processes, approved by Resolution #435 of the Government of Georgia.	300160070.10.003.017660
31/12/2013	Technical Regulation - Provisions for “Establishment of Soil Fertility Level” and “Soil Conservation and Soil Fertility Monitoring”, approved by Resolution #415 of the Government of Georgia.	300160070.10.003.017618
31/12/2013	Technical Regulation - Stripping, Storage, Reuse and Reinstatement of Topsoil, approved by Resolution #424 of the Government of Georgia.	300160070.10.003.017647
03/01/2014	Technical Regulation - Protection of Ambient Air during Unfavourable Meteorological Conditions, approved by Resolution #8 of the Government of Georgia.	300160070.10.003.017603
06/01/2014	Technical Regulation - Methodology for Inventory of Stationary Sources of Air Pollution, approved by Resolution #42 of the Government of Georgia.	300160070.10.003.017588
14/01/2014	Technical Regulation - Methodology for Estimation (Calculation) of Environmental Damage, approved by Resolution #54 of the Government of Georgia.	300160070.10.003.017673
15/01/2014	Technical Regulation - Maximum Permissible Concentrations of Air Born Pollutants in Working Zone Air, approved by Resolution #70 of the Government of Georgia.	300160070.10.003.017688
17/02/2015	The Rule for Implementation of the State Control by the Environmental Supervision Department, the State Sub-Agency under the Minister of Environmental Protection and Agriculture of Georgia. Approved by Resolution #61 of the Government of Georgia.	040030000.10.003.018446
04/08/2015	Technical Regulation - Rule for Review and Approval of Waste Management Plan of the Company”. Approved by Order #211 of the Minister of Environment and Natural Resources Protection of Georgia	360160000.22.023.016334
17/08/2015	Technical Regulation - Definition of Waste List and Classification of Wastes According to Their Types and Properties”. Approved by Resolution #426 of the Government of Georgia.	300230000.10.003.018812
11/08/2015	Resolution #422 of the Government of Georgia on Keeping Records on Wastes, Reporting Format and Content (August 11, 2015, Tbilisi City)	360100000.10.003.018808

Adoption Date	Name of Regulation	Registration Code
29/03/2016	Technical Regulation - Waste Transportation Rule, approved by Resolution #143 of the Government of Georgia (March 29, 2016, Tbilisi City)	300160070.10.003.019208
29/03/2016	Resolution #144 of the Government of Georgia on Rules and Terms of Waste Collection, Transportation, Pre-Treatment and Record-Keeping on Temporary Storage (March 29, 2016, Tbilisi City)	360160000.10.003.019209
29/03/2016	Resolution #145 of the Government of Georgia on Approval of Technical Regulations on Special Requirements for Collection and Treatment of Hazardous Waste (March 29, 2016, Tbilisi City)	360160000.10.003.019209
1/04/2016	Resolution #159 of the Government of Georgia on Approval of Technical Regulations on Special Requirements for Collection and Treatment Rule of Municipal Waste (April 1, 2016, Tbilisi City)	300160070.10.003.019224
15/08/2017	Technical Regulation - Acoustical Noise Standards for Residential and Public Buildings and Territories, approved by Resolution #398 of the Government of Georgia.	300160070.10.003.020107

2.2 International Agreements

Georgia is signatory party of many international conventions and agreements of which the following are of significance for the EIA process of the Project:

- **Preservation of Nature and Biodiversity:**
  - Convention on Biological Diversity, Rio de Janeiro, 1992;
  - Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar, 1971;
  - Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington, 1973;
  - Bonn Convention on the Conservation of Migratory Species of Wild Animals, 1983;
- **Pollution and Ecological Hazards:**
  - European and Mediterranean Major Hazards Agreement, 1987.
- **Public Information:**
  - Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention, 1998).

2.3 EBRD Environmental and Social Policy

Environmental and Social Policy (ESP 2019) of EBRD applies to the project.

Overall approach

All EBRD-financed projects undergo environmental and social appraisal both to help the EBRD decide if an activity should be financed and, if so, the way in which environmental and social issues should be addressed in planning, financing, and implementation. The EBRD's social and environmental appraisal is integrated into the EBRD's overall project appraisal, including the assessment of financial and reputational risks and identification of potential environmental or social opportunities. This appraisal will be appropriate to the nature and scale of the project, and commensurate with the level of environmental and social risks and impacts.

EBRD's environmental and social appraisal includes consideration of three key elements: (i) the environmental and social impacts and issues associated with the proposed project; (ii) the capacity and commitment of the client to address these impacts and issues in accordance with this Policy; and (iii) the role of third parties in achieving compliance with this Policy.

EBRD categorizes proposed projects as A or B based on environmental and social criteria to: (i) reflect the level of potential environmental and social impacts and issues associated with the proposed project; and (ii) determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required for each project, taking into account the nature, location, sensitivity and scale of the project, and the nature and magnitude of its possible environmental and social impacts and issues.

Bank-financed projects are expected to meet good international practice related to sustainable development. To help clients and/or their projects achieve this, the Bank has defined specific Performance Requirements (PRs) for key areas of environmental and social issues and impacts as listed below:

- PR 1: Assessment and Management of Environmental and Social Risks and Impacts
- PR 2: Labour and Working Conditions
- PR 3: Resource Efficiency and Pollution Prevention and Control
- PR 4: Health, Safety and Security
- PR 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement
- PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- PR 7: Indigenous Peoples
- PR 8: Cultural Heritage
- PR 9: Financial Intermediaries
- PR 10: Information Disclosure and Stakeholder Engagement.

The EBRD will require clients to structure projects so that they meet all applicable PRs. Central to this is a consistent approach to seek to avoid adverse impacts on workers, communities, and the environment, or if avoidance is not possible, to reduce, mitigate, or compensate for the impacts, as appropriate.

PR 1: Environmental and Social Appraisal and Management

Projects categorized by EBRD as "A" will require special formalized and participatory assessment processes. An indicative list of such projects is provided in Appendix 1 to the Policy. Projects which are planned to be carried out in sensitive locations or are likely to have a perceptible impact on such locations, are attributed to category A even if the project category does not appear in this list. Such sensitive locations include, inter alia, national parks and other protected areas identified by national or international law, and other sensitive locations of international, national or regional importance, such as wetlands, forests with high biodiversity value, areas of archaeological or cultural significance, and areas of importance for Indigenous Peoples or other vulnerable groups. Greenfield developments, or major expansions of activities, with potentially significant and diverse adverse environmental or social impacts, such as those listed in Appendix 1, will require a comprehensive environmental and/or social impact assessment, to identify and assess the potential future environmental and social impacts associated with the proposed project, identify potential improvement opportunities, and recommend any measures needed to avoid, or where avoidance is not possible, minimize and mitigate adverse impacts. This assessment will include an examination of technically and financially feasible alternatives to the source of such impacts, and documentation of the rationale for selecting the particular course of action proposed. The Environmental Impact Assessment (EIA)/Social Impact Assessment (SIA) shall meet PR 10 and any applicable requirements of national EIA law and other relevant laws.

In exceptional circumstances, a regional, sectoral or strategic assessment may be required. Projects involving involuntary resettlement or impacts on Indigenous Peoples or cultural heritage will require an assessment in accordance with PRs 5, 7 and 8 respectively, in addition to any other environmental or social due diligence studies that may be required.

Projects categorized as “B” may require a variety of due diligence investigations, depending on the project’s nature, size and location, as well as the characteristics of the potential environmental and social impacts and risks. Due diligence should identify and assess any potential future impacts associated with the proposed project, identify potential improvement opportunities, and recommend any measures needed to avoid, or where avoidance is not possible, minimize, and mitigate adverse impacts. Depending on the potential environmental and social risks, the Bank may require that existing facilities be subject to an audit to assess the environmental and social impacts of past and current operations of the existing facilities.

Projects categorized “C”, as having minimal or no adverse impacts, will not be subject to further environmental or social appraisal beyond their identification as such, and will not require an Environmental and Social Action Plan (ESAP).

Environmental and Social Action Plan (ESAP) Taking into account the findings of the environmental and social appraisal and the result of consultation with affected stakeholders, the client will develop and implement a programme of mitigation and performance improvement measures and actions that address the identified social and environmental issues, impacts and opportunities in the form of an Environmental and Social Action Plan (ESAP). Mitigation measures and actions will be identified so that all relevant stages of the project (for example, pre-construction, construction, operation, closure, decommissioning/reinstatement) operate in compliance with applicable laws and regulations and the PRs of this Policy. The ESAP should take a long-term and phased approach and also take into account expected future regulatory requirements. The ESAP shall focus on avoidance of impacts, and where this is not possible, mitigation measures to minimize or reduce possible impacts to acceptable levels. Where residual impacts affect biodiversity, environmental offsets may be required in accordance with PR 6 to promote a “no net loss” approach; compensation for involuntary resettlement and for impacts on Indigenous Peoples will be carried out in accordance with PRs 5 and 7. The ESAP will also address, where appropriate, opportunities to achieve additional environmental and social benefits of the project including, where relevant, community development programmes.

2.4 Screening Determination and Applicable PRs

According to the Addendum II of the Environmental Assessment Code for the wind farm project the screening procedure and decision of the Georgian Ministry of Environment Protection and Agriculture on necessity of preparation of the environmental impact assessment document is required. According to Section 13 of the Article 7 of the Environmental Assessment Code, if project developer is planning to carry out an activity that requires screening procedure and presume that environmental decision is necessary for this activity, then in line with the Article 8 of this Code he is authorized to submit to the Agency the application for decision on scoping report, without going through the screening stage. In this case the requirements for issuing the environmental decision set by this Code are used. Taking into consideration that Ruisi Wind Farm will be quite a large station with 206 MW total installed power capacity and will require installation of up to 46 wind turbines in agricultural land areas, the company-developer deemed necessary to prepare the Environmental Impact Assessment Report.

EBRD Performance Requirements are the main guiding documents followed during the preparation of this ESIA.

For the sake of EBRD Requirements:

- construction of Large-scale wind power installations for energy production (wind farms) is included in the indicative list (Annex 1 to ESP 2019) of the A category projects
- the project involves substantial new construction and some sections of the WPP cross Greenfield areas, although no sensitive habitats and environmental receptors are affected.
- the project implementation is associated with the need for private land acquisition with the possibility of economic displacement of affected households. No physical relocation is required.
- Accordingly, the project has been classified as of Category A in Compliance with the EBRD ESP 2019. Full scale ESIA should be prepared and public consultations should be conducted in accordance with the requirements set forth in Georgian legislation and ESP 2019 (particularly, in PR 10). guidelines.

3 Project Alternatives

This chapter presents alternative options for the planned activities, including: alternative locations for wind generators and No Action alternatives

3.1 Description of alternative areas for placement of turbine-generators

3.1.1 Approaches

The selection of optimal places for the placement of turbines is the main component of the analysis of alternatives. The selection of Wind Turbine Generators (WTGs) locations is primarily based on criteria that determine, on the one hand, enough efficiency of the turbines to make the project feasible from a technical-economic point of view, and on the other hand, ensuring the sustainability of the turbines and their safety.

These criteria are considered as basic criteria. In addition, environmental, social and additional technical criteria are used to select the final options from the appropriate areas for the placement of turbines, the consideration of which allows selecting the placement of turbines that will have less impact on the sensitive receptors of the natural and social environment and will be convenient from the point of view of the construction organization.

► **Main criteria:**

- Number of windy days in the potential project area
- Wind speed distribution on the potential project area

The mentioned parameters determine the performance of the wind power plant and the economic feasibility of the project.

- Characteristics of wind turbulence
- Risks of dangerous geological processes (landslides, landslides, avalanches, etc.) in the project area
- The mentioned parameters determine the sustainability of the wind farm and the technical feasibility of the project
- Existence of protected areas and other restricted zones, within which the construction of Wind Power Plants and other infrastructure is not allowed and prohibited by law

► **Additional criteria:**

- Engineering-Geological, logistic and other technical difficulties for construction of access roads and main facilities
- Presence of sensitive receptors in the natural environment that are vulnerable to impacts related to project implementation (construction and operation of facilities)
- Impacts on land and property owned or used by the population
- Impact on cultural heritage sites or cultural/traditional objects of particular importance to the local community (e.g. churches, cemeteries, traditional sanctuaries, etc.)

At today's stage of project development, using basic and additional criteria, 46 turbine[1] layout locations have been selected for Ruisi WPP.

For their selection were considered: wind speed distribution and turbulence maps (subsection 3.1.2, Figure 3-1 and Figure 3-2), preliminary data of the study of dangerous geological processes.

While planning the layout, great attention was paid for the selected turbine locations to have minimal impact on the environment and local population.

3.1.2 Selection of turbine deployment locations

3.1.2.1 First approximation: selection of project area nationwide

One of the important components of benefit analysis of individual wind power station projects (Feasibility Study) is the determination of the energy potential of the selected area for the station and, accordingly, evaluation of the efficiency of output. Potential locations for wind power stations in Georgia have been thoroughly studied in this direction. Wind energy observation and data collection in Georgia started 100 years ago and is constantly ongoing.

According to the wind energy Atlas of Georgia, Georgia has a significant wind energy potential with an average annual amount is estimated at up to 4 billion kWh. According to the natural potential of wind, the territory of Georgia is divided into zones.

According to the studies of the Ministry of economy (the study is launched within the framework of the Ministry of energy), several areas of prospective construction of wind efficient power plants have been identified, including:

Table 3-1 Promising places for the construction of wind power plants

Location	Power (MW)	Annual output (Million kWh)
Mountain Sabueti II	600	2,000
Gori-Kaspi	200	500
Pharavani	200	500
Mountain Sabueti I	150	450
Kutaisi	100	200
Poti	50	110
Chorokhi	50	120
Samgori	50	130
Rustavi	50	150
Sum	**1,450**	**4,160**

[1] Initially we studied 50 locations, then we added 6 alternative locations. Finally, we selected max 46 locations.

Based on the existing data and in addition on the Georgian Wind Atlas data (Figure 3-1 and Figure 3-2), we selected several alternative locations, which were compared in more detail and Gori - Ruisi district has been selected as the best area for the implementation of the project.

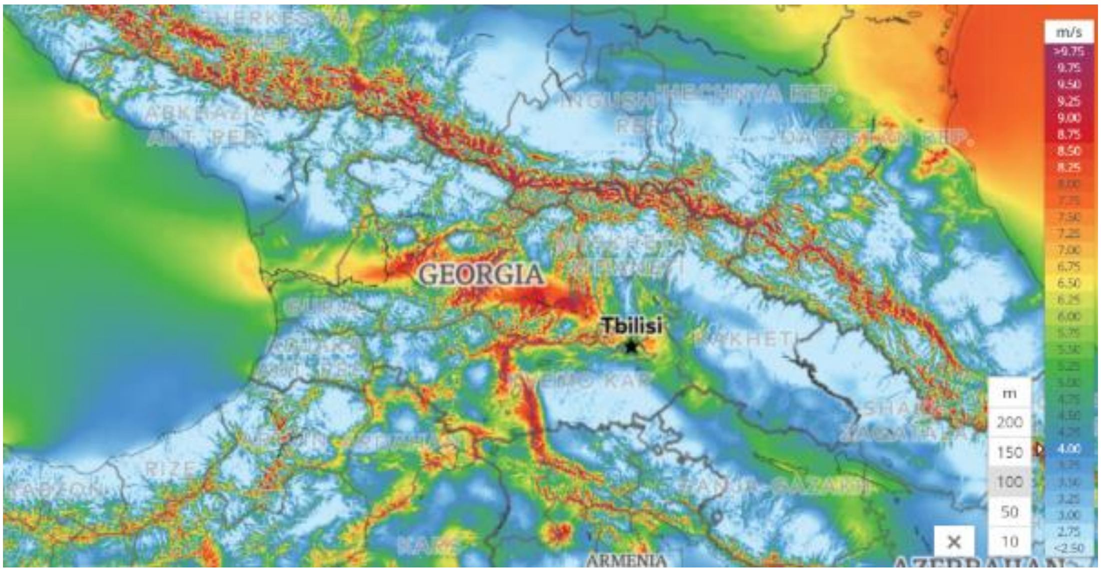

Figure 3-1 Distribution of wind energy resources on the territory of Georgia (Source: globalwindatlas.info)

This indicator is quite close to the indicator of the Kartli wind power plant already installed in the same area Gori-Ruisi territory has one of the greatest potential for wind and generation. Its net efficiency ratio exceeds (net capacity factor) 40%. This indicator is quite close to the indicator of the Kartli wind power plant already installed in the same area. As a result of the analysis of the above information, the territory of Gori and Kareli municipalities was selected to build a wind power plant in Ruisi area, as the area with the best cost-benefit characteristics. Accordingly, the company signed a memorandum of mutual understanding with the government of Georgia for the purpose of thorough study of the territory and construction of the wind power station.

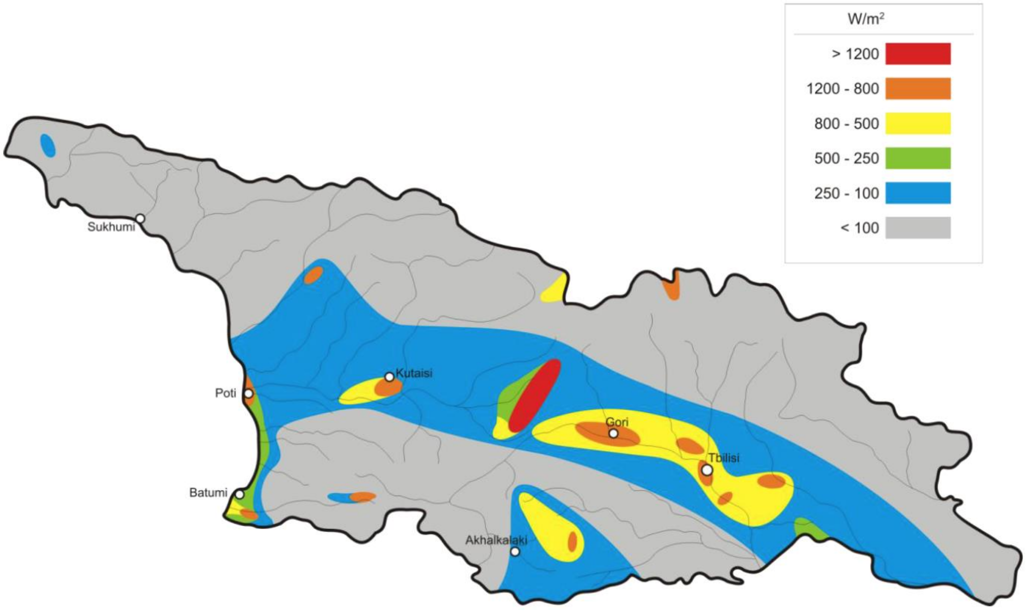

Figure 3-2 Distribution of wind energy at an altitude of 50 meters on the territory of Georgia, watts per square meter [Atlas of wind of Georgia]

In addition to the obvious energy advantages, the selected area is distinguished by the fact that it does not include protected areas, ecologically high sensitivity areas and other natural receptors (important surface water bodies, Geologically hazardous areas, etc.) The main impact will be on social environment, as a large part of the project area meets agricultural lands, but is quite remote from densely populated areas. The impact is limited to the economic displacement and does not require physical displacement of the population.

A memorandum of mutual understanding was signed between the company and the government of Georgia to study wind data for the purpose of construction, ownership and operation of wind power plant(s). After signing memorandum, wind measurements began on the potential area of the project. At the feasibility study stage, the territory of Gori and Kareli municipalities was finally selected. Between Ruisi and Variani settlement as the best area for project implementation.

Ruisi WPP project area is located in Kareli region, Shida Kartli region, 100 km west of Tbilisi. The area provided by the memorandum is about 13000 hectares and is located within the perimeter of more than 45 km, between the villages Ruisi-Bebnisi-Sagolasheni-Breti-Dzlevijvari-Sakasheti-Arashenda.

Figure 3-3 Location of Ruisi wind power plant on the political map of Georgia

The project area is partially located on the northern ridge of Ruisi with elevation ranging from 657 m to 845 m above sea level. Due to the specific hypsometry and elevated location of the terrain, this area has the best wind resource. Other clusters of the project are located on agricultural lands around the villages Dzlevijvari and Sakasheti. The district located on the northern ridge of Ruisi consists of conglomerates, sandstones, marls and clays. These rocks form a reliable basis for all kinds of structures, and their fragments can be used as a building material for laying the foundation for structures/constructions. The average thickness of the topsoil is about 30-50 cm. The northern part of the project area, located in the west of the village Sakasheti, represents small agricultural plots with fertile soil and is covered with vineyards and orchards. The district of the village Dzlevijvari is elevated and covered with grain crops.

Considering the nominal full capacity of the wind power plant, it will naturally occupy a large territory, within the perimeter of which will be whole villages. Due to its scale and elevated layout, the wind power plant overlooks the nearby E60 Highway. However, during the deployment of wind turbines, the features of the terrain will be used, which will leave large distances between wind turbines and will affect the distribution of groups of turbines in the form of space clusters.

Figure 3-4 Ruisi wind power plant area map (Source: Google Earth)

3.1.2.2 Second approximation: specification of turbine location

Since December 2021, the company has started installing wind measuring masts and collecting information on the project area. After collecting a sufficient amount of data, specific areas for the deployment of turbine-generators were selected.

► **Estimates of wind resources**

At this stage, three measuring towers/stations are located on the territory of Ruisi WPP: Ruisi *Met Mast* 1, Ruisi *Met Mast* 2 and Ruisi *Met Mast* 3, which collect wind data from the surface of the ground at an altitude of 34.7-127.5 meters.

As a result of observations and wind measurements, the prevailing wind directions were revealed. In accordance with the optimal wind intensity within the territory transferred by concession, prospective areas for deployment of towers were selected.

On the basis of detailed engineering-geological surveys, 50 Main and 6 additional (alternative) areas were selected. All 56 selected areas are acceptable based on environmental criteria, as these areas are located on solid ground, more or less away from settlements, surface water bodies and ecologically sensitive habitats. The impact on forests and other habitats is also minimized. In addition, the new area covered by the access roads connecting the turbines to each other is reduced as much as possible, since the existing roads between the plots of land are used for access, thus minimizing environmental damage. The main object of influence is agricultural lands.

► **Selection of specific areas for turbine placement**

In order to determine the optimal location of turbines, the company has been studying wind and other meteorological conditions since 2021. When selecting specific positions for the turbine, the following factors were taken into account:

1. Favorable conditions according to the energy potential (wind data)
2. Engineering-geological conditions
3. Determination of permissible noise zones for turbines
4. The possibility of using existing access roads and minimizing the total length of new paved access roads
5. Distance from surface water bodies
6. Distance from cultural heritage sites
7. Distance from residential homes

The project makes an assumption that 46 units of generic WTG of similar size and class in the industry to 4.5 MW, hub height of 150 m. The wind turbine layout aims to make optimal use of the wind potential by identifying the best performance zones on this terrain and taking into account their topographic accessibility. However, a number of technical and environmental limiting factors are taken into account. In order to develop the project in accordance with the highest standards, the turbines were deployed using optimization methods recognized by WaSP and wind energy industry.

► **Noise estimation method**

<u>Calculation method:</u>

Noise impact assessment of the project was performed using the calculation method. The software that was used for the calculations is: CadnaA® ©DataKustik GmbH Dongle: L42342.

The calculation of noise was performed on the basis of the sound propagation model, which corresponds to the standard PN-ISO 9613-2 "acoustics. Extinguishing sound when spreading in an open (outdoor) space. General method of calculation“ (directive 2002/49/EC, 25 June 2002).

The lack of accuracy in calculating the noise impact range is due to insufficient accuracy in estimating the acoustic power level of the noise source and the lack of sound propagation calculation. According to the PN-ISO 9613 standard, the unevenness (accuracy) of the calculation result is equal to ±1 dB for distances up to - 100 m, and ±3 dB for distances from 100 m to 1000 m.

<u>Calculation parameters:</u>

- Declared reporting parameters within the CadnaA software:
- Coefficient of sound suppression by land: G = 0,3;
- Meteorological conditions:

- Temperature: T = 10^0 C,
- Humidity: H = 70%;
- Grid of calculation points: 10 x10 m, 4 m above ground surface level.

At the time of calculation, the following assumptions were made:

- Wind turbines are considered as point sources of sound,
- Sound output occurs uniformly in all directions,
- In the reporting model, the noise source is located at the gondola location,
- Favorable conditions for sound propagation, meaning Sound propagation in all wind directions,
- Wind turbines operate continuously during day and night at maximum acoustic power level.

Data entered into calculation model:

- Location and parameters of wind turbines
- Measuring points, which are located on the border of the nearest noise-sensitive receptors.
- Digital relief model
- Noise spectrum of wind turbines

Table 3-2 Noise spectrum of wind turbines

Turbine model	Generic WTG 4.5MW platform								
Nominal midband fiquency Hz	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Noise level L_{WAf} [dB]	73.1	84.3	92.9	98.5	102.4	102.6	98.1	95.7	80.8

Conclusions:

Places for the deployment of wind turbines initially o be studied in terms of noise distribution with ISO 9613-2 model. The sound pressure level(LaeQ) of 45dB (A) was used in relation to the facilities receiving the impact at night in the populated areas as the requested criterion. 45dB isocurves are shown on the attached map. All villages and large-sized dwellings are located outside these isocurves. However, there are some buildings located in the zone of noise exposure and require further study and clarification of their function and the permissible level of sound pressure.

► **Analysis of alternative turbine deployment sites at ESIA stage**

Initially we studied 50 locations, then we added 6 alternative locations. Finally, we selected max 46 locations including from these alternative locations (Figure 4-3 General plan of the project area).

First of all, wind data and energy feasibility and noise modelling results were taken into account. All selected areas are located on solid ground and do not fall into the area of development of dangerous geological processes. Access roads are easily arranged using the existing access roads between the plots.

At the ESIA stage, two clusters were compared from the selected set:

- Alternative Cluster 1: turbine masts# 18; 31; 32; 33; 34; 35;
- Alternative Cluster 2: turbine masts#13 (Alt); 21 (Alt); 28 (Alt); 30 (Alt); 52 (Alt); 56 (Alt)

The layout scheme of alternative clusters and relevant turbines is shown on the map below (Figure 3-5), and the distance of turbines from residential houses, cultural heritage sites and surface water bodies is shown in Table 3-4.

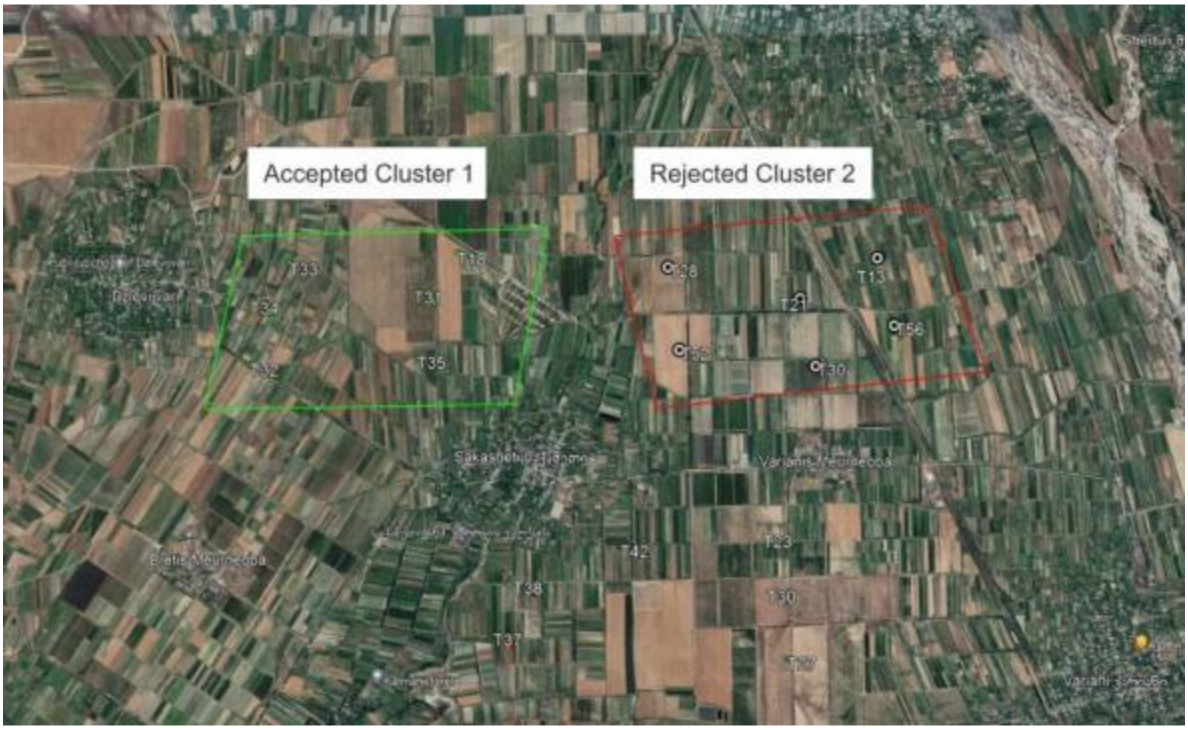

Figure 3-5 Alternative layout of turbines

As shown in Table 3-4, in case of Cluster 1, distances to populated areas and cultural heritage sites as well as surface water bodies are comparable to the case of Cluster 2. The wind regime is preferable for cluster 1 and besides the access roads for cluster 1 and connection to the substation could be arranged with shorter sections and without need to cross the railway and Variani farm land plots. Accordingly, for the ESIA stage, Cluster 1 may be preferred.

The coordinates of the sites selected at the scoping stage for wind turbines are given in Table 3-3 below.

Table 3-3 Coordinates of wind turbines

	UTM38N			UTM38N	
	X	Y		X	Y
T 1	416362	4656165	T 24	408494	4654948
T 2	415941	4655779	T 25	408788	4661538
T 3	418084	4652080	T 26	417103	4652013
T 4	415833	4656535	T 27	417016	4658726
T 5	416235	4654695	T 28	412557	4657113
T 6	418096	4656038	T 29	414831	4655492
T 7	416787	4653517	T 30	417038	4659205
T 8	417568	4652920	T 31	414129	4661859
T 9	418078	4651798	T 32	412532	4661391
T 10	416761	4655570	T 33	412897	4662256
T 11	414067	4655324	T 34	412723	4661825
T 12	410058	4660177	T 35	413962	4661398
T 13	416458	4654118	T 36	413666	4657350
T 14	412485	4655984	T 37	414699	4658932
T 15	417205	4656123	T 38	414889	4659361
T 16	417783	4655561	T 39	409084	4656879
T 17	415799	4657018	T 40	409728	4661538
T 18	414338	4662288	T 41	413149	4656799
T 19	412348	4656581	T 42	415632	4659731
T 20	409883	4660970	T 43	409064	4662059
T 21	408631	4655374	T 44	409523	4657755
T 22	408706	4655795	T 45	409188	4657353
T 23	417027	4659671	T 46	409763	4661954

Note: for the reference, please see the location of the turbines on the map Figure 4-3

The coordinates of the substation is 38T 410589.00 4657275.00.

► **Analysis of alternative turbine deployment sites at the Detailed Design stage**

According to the project, Ruisi wind power plant generates a total of 206 MW of electricity; the installed capacity of each turbine averages 4.5 MW. 46 stations are selected for placing turbines. In fact, specific models of turbines will be specified based on a better bid as a result of the tender. To ensure the permitted 206 MW, the final configuration of Ruisi WPP will include either 4.5 MW Power 46 turbine generators, or their power will be more than 4.5 MW and the number will be less than 46. For the completion of the EIA, the capacity of each turbine and the number of turbines will be finally specified. It is expected that the final number of turbines will be from 33 to 46 turbines. Accordingly, based on additional technical and environmental information, from 46 turbines selected at the ESIA stage - the final configuration will be selected.

At the Detailed Design stage, the results of detailed engineering-geological surveys will be compared from the 46 pre-selected areas for turbines to select the final planned number of sites, which will have an impact both in terms of turbine sustainability and in terms of assessing the complexity of engineering works.

Preliminary negotiations with private land owners, which the company already produces, will be especially important for the final selection of places for turbines. Private lands must be redeemed by mutual agreement.

For individual areas, the decision-making process may be facilitated by the completion of seasonal surveys of birds and bats, as well as the modeling of turbine flashes and noise.

Specifying turbine layout locations in the final design does not imply selecting radically different areas from the considered alternative areas, but envisages moving some areas only a few meters to minimize the impact. The final number of turbines will be from 35 to 46 turbines and their deployment areas will be selected from the 46 areas presented as alternatives in ESIA. The impact assessment in ESIA is done for 46 turbines, which corresponds to the "worst possible scenario".

Table 3-4 Selected alternatives and rejected options for locating turbines

Turbine N	Coordinates (38 T)		Distance (m)								
	X	Y	Villages			Surface Water Receptors			Cultural heritage objects		
Accepted Alternatives (Cluster 1)											
18	414338	4662288	550	S/E	Sakasheti cottages	73	N/E	Irrigation Canal	979	N/E	St. Nicholas church
31	414129	4661859	570	N/E	Sakasheti cottages	548	N/E	Irrigation Canal	1279	N/E	St. Nicholas church
32	412532	4661391	611	N/W	Dzlevidjvari	110	N/W	River Bretula	2297	S/E	Sakasheti St.George church
33	412897	4662256	816	N/E	Dzlevidjvari	58	N/W	River Bretula	2427	E	St. Nicholas church
34	412723	4661825	607	N/E	Dzlevidjvari	148	N/W	River Bretula	2493	S/E	Sakasheti St.George church
35	413962	4661398	731	S/E	Sakasheti cottages	1038	N/E	Irrigation Canal	1540	S/E	Sakasheti St.George church
Rejected Alternatives (Cluster 2)											
52	416218	4661384	914	S/W	Sakasheti	312	N	Irrigation Canal	1328	N/W	St. Nicholas church
28	416218	4661384	1016	S/W	Sakasheti cottages	399	S	Irrigation Canal	879	N/W	St. Nicholas church
21	417269	4661782	1210	S	Variani Farm	124	S	Irrigation Canal	2034	N/W	St. Nicholas church
13	417945	4662101	1055	N/E	Shindisi	562	S/W	Irrigation Canal	2580	N/E	Mother of God church
56	418064	4661520	1141	S/W	Variani Farm	325	S/W	Irrigation Canal	2878	N/W	St. Nicholas church
30	417376	4661200	640	S	Variani Farm	458	N	Irrigation Canal	2366	N/W	St. Nicholas church

3.2 Grid Connection Analysis and Selection of Site for Substation

3.2.1 The basis of the study

- Ten-Year Network Development Plan of Georgia 2021-2031, GES,
- Georgian National Energy and Water Supply Regulatory Resolution N10,
- IEC 60076-1, IEC 62271-1, IEC 60255-1, IEC 61936-1, IEC 62305-1.

3.2.2 Grid Topology Options

It has been assumed that the connection of the Wind Farm to the Georgian State Electrosystem will be made to the existing 220 kV overhead line from SS Khashuri 220 to SS Gori 220 by loop in loop out connection to the Wind Farm 220 kV station. The 220kV line SS Khashuri 220 to SS Gori 220 has a plan of future development described in document “Ten-Year Network Development Plan of Georgia 2021-2031, GSE”. The plan assumes upgrade of existing single circuit line to double circuit line. This initial design assumes connection to planned double circuit line system. Three connection options with various topologies of the wind farm networks has been analysed:

- Option 1 - with the connection point in planned 220/33kV Ruisi substation, located in center of the wind farm, west of Ruisi village. In this option the existing 220 kV overhead line 220 kV SS Khashuri 220 to SS Gori 220 shall be cut and extended by 2060 m to connection point. The wind farm network is distributed with 33kV underground cable lines from each wind turbine to 220/33kV Ruisi substation,
- Option 2 - with the same assumptions as option 1 but connection point in planned 220/33kV Ruisi sub-station is located in different place, in direct vicinity to the existing 220 kV overhead line 220 kV SS Khashuri 220 to SS Gori 220, east of Ruisi village. Comparing to option 1 this solution is more favourable in relation to existing grid network but as connection point is more distant from centre of the wind farm, the lengths of medium voltage lines are respectively higher,
- Option 3 - with the same connection point location as option 2 but with different wind farm network topology based on 220/110 kV step-by Ruisi substation in connection point and the main feeders replaced by 110 kV underground cable lines. Respectively there were introduced three 110/33 kV transformer stations servicing distant clusters of the wind farm.

The schematic diagrams of considered grid options are shown in the pictures below.

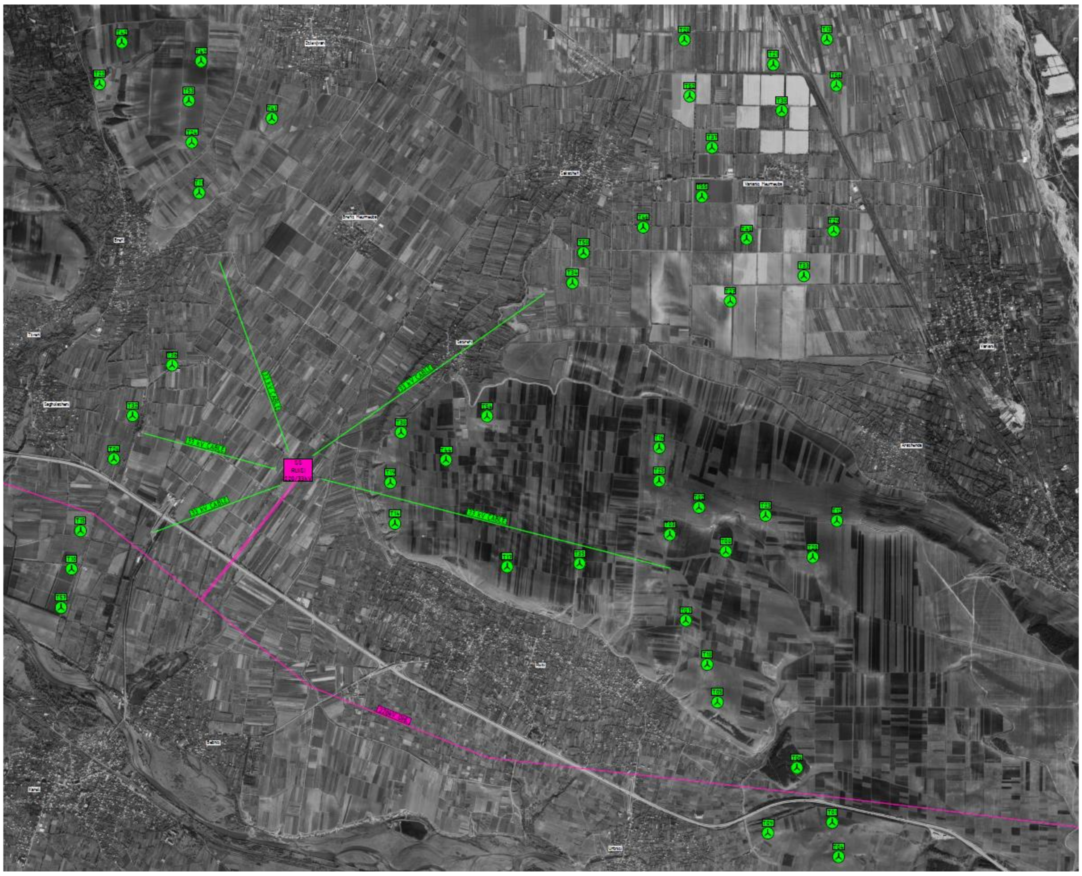

Figure 3-6 Connection to grid: alternative 1

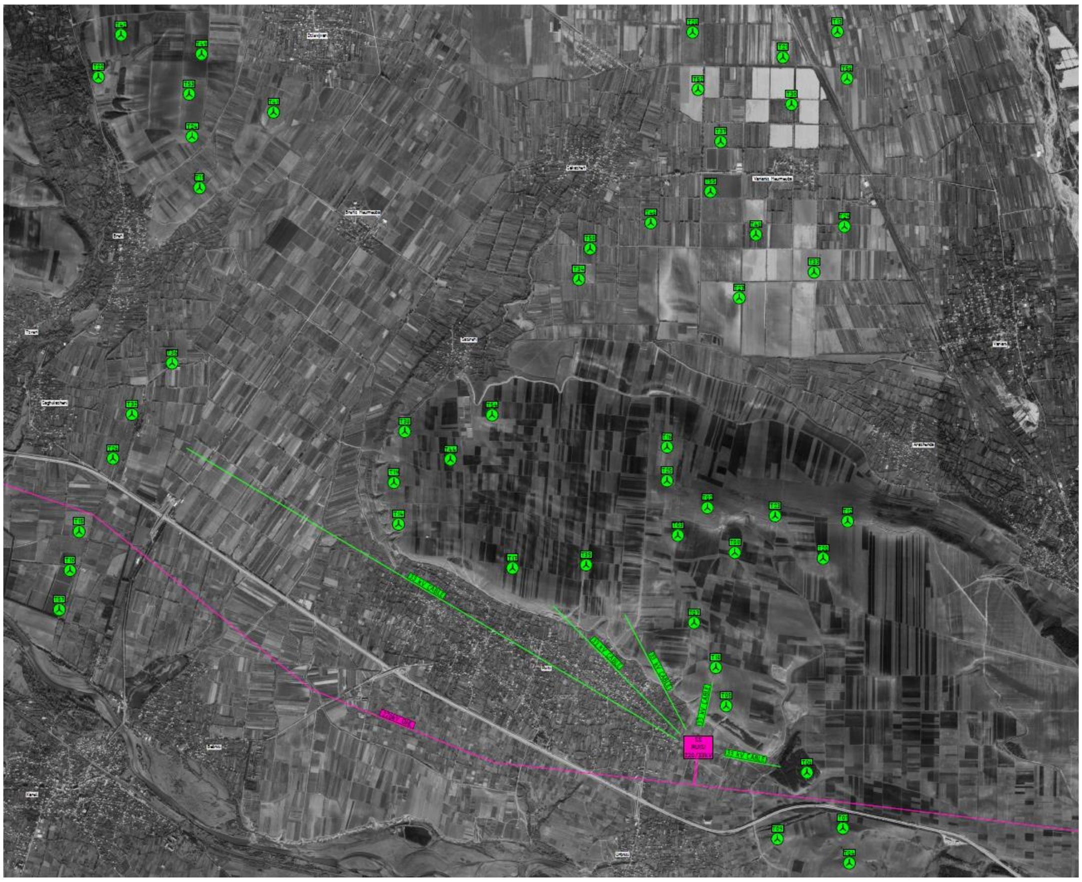

Figure 3-7 Connection to grid: alternative 2

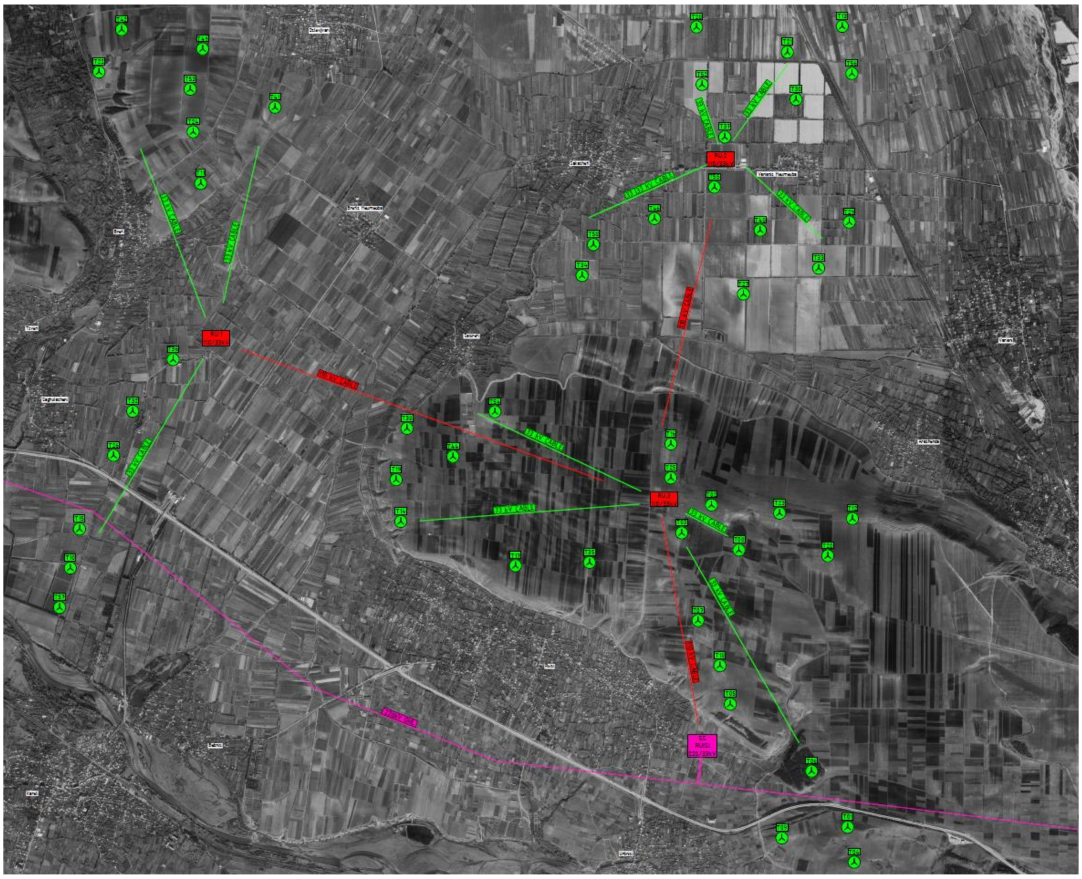

Figure 3-8 Connection to grid: alternative 3

3.2.3 Grid Connection Study

The grid connection analysis for three options were conducted by Lublin University of Technology, Electrical Engineering and Computer Science Faculty, and constitutes separate report attached to this document. The scope of this analysis includes:

- Development of grid cable routes (various option),
- Preliminary selection of transformers and cables, considering the cable load capacity, voltages and short-circuit conditions,
- Selection of the optimal option of the grid (transformers, routes, cables, voltages) due to the net-work structure and energy losses,
- Analysis of power flow, power losses and voltages for the selected option,
- Analysis of short-circuit conditions and verification of selected cables,
- Estimation of capacitive earth fault currents for the grid
- Calculations of reactive power flows and requirements for the selection of reactors and capacitors for reactive power compensation,
- Proposition for the construction of protection systems

3.2.4 Conclusions

The analysis revealed the fact that option 1 is the most preferable solution for the project. Comparing to option 2 it demonstrated considerable savings on medium voltage cable lengths and respectively power losses were approximately 2,11 MW (1,00%) on internal wind farm network comparing to 2,88 MW (1,37%) for option 2. This shall benefit in nearly 3000 MWh increase in annual power production, which is equivalent of 160 – 200 kEUR of net income. Assuming conservatively, that the CAPEX of option 1 is 800 kEUR higher than option 2, the option 1 is very competitive solution. Option 3 offers reasonable savings in power losses comparing to both option 1 and 2, but after assuming the cost of 110/33 kV step-by transformation both in investment and operation aspect, adding losses on these transformations, this option is not competitive as the wind farm is compacted in relatively small territory that do not substantiate the use of 110 kV high voltage lines for main feeders. As a conclusion of this analysis, the option 1 was recommended for further development.

This initial design is designed for option 1 of grid topology.

The proposed sites represent just conceptual alternatives. At this stage we can say that the landscapes, habitats and proximity to the villages for the proposed sites is almost similar. We do not go in detailed analysis of alternative sites for substation, as the Grid Connection is a separate project and finally will be developed by GSE.

3.3 Non-Project Alternative

The no-action or no-project alternative implies the rejection of the construction of project wind power plants and the non-implementation of the project.

In case of zero alternative project, there will be no such negative impact as, for example, alienation of lands due to placement of various communications and laying of roads, impact on biological environment, direct and indirect effect on terrestrial animals (especially birds), visual-landscape impact, etc. However, it should be noted that the project area is selected on the one hand economically acceptable and at the same time optimal in terms of environmental impact, and according to the assessments provided in this report, high risks of negative impact on the natural and social environment are not expected, in particular:

- The area chosen for the implementation of the project is a long distance from the houses and there are practically no risks of negative impact on the health and safety of the population;
- Locations for Ruisi WPP facilities have been selected in a way that minimizes impacts on sensitive habitats and protected plant and animal species.
- There are ground access roads in the project area. For the needs of the project, small-scale rehabilitation and expansion works may be carried out (there is no need to arrange high embankments or deep cuts);
- According to the results of the Engineering-Geological Survey of the places selected for the placement of wind generators, the area is reliable in terms of the development of dangerous Geodynamic processes and the arrangement of the foundations of the generators will not be associated with the risks of negative impact.

From negative impact risks it is important to consider impact on birds during the exploitation phase, but the project area is not located within the bird migration corridor and is more than 12 km away from an important Marten zone in terms of bird protection, which somewhat reduces the expected impact.

It should be noted that the implementation of the project is important from the State point of view. Putting the project wind power plant into operation will reduce the need for import during the period of energy deficit (from July-August to April), which will increase the country's energy security and independence.

Construction and operation of Ruisi wind power plant will have a positive impact on the economic development of the country, special mention needs to be made of the employment opportunities of the local population at the construction stage, as a rule, it is in the interest of the investor and the construction company that as much as possible the share of the:

- Additional funds will be included in the central and local budgets in the form of various taxes for both construction and operation phases. The funds from the local budget will be spent on infrastructure improvement and implementation of various social projects. This fact also positively affects the incomes and living conditions of the local population;
- In addition, to the widely proven approach to energy extraction in Georgia, there is a possibility of energy extraction with less environmental damage, which on the one hand is better for the environment, and on the other hand, the practice of using similar renewable energy sources will emerge in Georgia.

Based on the above mentioned, no alternative to the project is acceptable.

4 Project Description

4.1 Introduction

Alplan Sp z o.o. (hereafter “Alplan”) has been assigned by JSC Wind Power with the preparation of initial design for Ruisi Wind Farm with a total planned capacity of 206 MW, located near the village Ruisi in region of Shida-Kartli, Georgia (hereafter “the Project”).

The Project, for the purpose of easiness, assumes the 46 wind turbines as a base. A Generic WTG of 4.5 MW class and size in the industry of 150m height were assumed as a benchmark for the current study, however, this assumption doesn't represent the final turbine type that shall be defined at later stages.

This document with attached drawings poses the description and relevant drawings relating to initial design works and covers the planning of roads, assembly platforms as well as MV cabling of the foreseen wind farm project.

The initial design is elaborated as a basic concept of the wind farm and is intended to pose an input for further building permit and execution design. It may also serve as a source of technical information for professionals and managers developing the project.

This stage of initial design defines position of wind turbines, alignment of internal roads and access to the wind farm in context of the topography of the project area. Further, it shows the proposed cable routes as well as defines preliminary location of wind farm substation and its connection to state grid through transformer substation into 220 kV high voltage line.

Alplan has defined the design of the electrical power system including the cable system and extensions needed in the grid substation. The location of substation and details of the grid connection will be specified in consultation with GSE and GSE will develop the design for connection. The location of the substation has been already agreed with GSE. The grid connection agreement is also signed with GSE and the Company that contains technical conditions for grid connection.

This report contains the analyses of three various connection concepts, cable sizing with electrical losses considered, layout of electrical equipment and switchgear at the wind turbines, eventual connection point at the wind farm, extension at the existing grid substation, single line diagram.

The Foundation design was based on one (1) turbine type defined by the JSC Wind Power. Therefore, the design was based on a chosen reference turbine and on the preliminary geotechnical assessment. The foundation design consists of 1 drawing showing the concrete geometry of the foundation and indicate concrete volumes and reinforcement quantities. The state-of-art methodology has been applied for load calculations.

Other civil works consists of access and site roads, crane pads, lay-down and storage area. The design for service roads in the wind farm, including lay-down area and crane pads is provided in a site lay-out drawing. The design also includes functional requirements to the above mentioned areas being able to support handling of the chosen reference turbine. Other civil works includes an overview of a substation at the point of connection.

The report also contains bill of quantities and preliminary cost breakdown that poses an input for further commercial assumptions of the project development

4.1.1 General Information

The Ruisi project site is located in Kareli district of Georgia, in the region of Shida Kartli located in the central part of Georgia on the Shida Kartli plain, 100 km west from Tbilisi. The site area covers around 13 000 ha within perimeter of more than 45 km between villages of Ruisi-Bebnishi-Sagholasheni-Breti-Dzlevijari-Sakasheti-Arashenda.

Figure 4-1 Location of the Ruisi wind farm over Georgia political map

The project layout is shown on Figure 4-3. The site is partly located at the ridge north of Ruisi at the elevations of between 657 to 845 masl. For the turbine clusters located in this area there are best wind resources due to specific terrain hypsometry and higher elevation. Other clusters of the project are located in agricultural terrains around Dzevljari and Sakasheti villages. The site located on ridge north of Ruisi consist of conglomerates, sandstones, marls and clays. These are a reliable basis for all kinds of civil structures, and the fragments could be used as a building material for bed arrangement. However, it should be taken into consideration that also areas affected by geological processes of a physical and biological weathering, and unstable landslide areas can be encountered within the project boundaries. The average topsoil layer equals to approximately 30-50 cm. Norther part of the project area situated west of Sakasheti is a typically small agricultural land with rich soils and landmarking picture of vineyards and orchards. The area of Dzevljari is, again elevated and occupied by crops.

Considering its nominal total power, the wind farm occupies naturally large area with entire villages inside its perimeter. The wind farm will dominate over the nearby E60 motorway with its scale and elevated exposition. However, micro-siting of wind turbines extensively uses a terrain leaving large distances between wind turbines and clustering wind turbines into the groups.

Figure 4-2 Overview map of Ruisi wind farm site (source: Google Earth)

Generally, the site is nearly free of any large vegetation forms. The patch of the artificial pine forest is located in south-east corner of the site, next to the E60 motorway. These are large open spaces of pastures and fields separated by field bounds, channels and ground roads. The site has constraints that could influence the siting of wind turbines. Most of all, close vicinity of villages Ruisi, Breti, Dzevljari-Sakasheti shall be taken into account in context of noise distribution and shadow flickering. The table below summarises the main technical and environmental limitations to the design:

4.1.2 Site constraints

There are some objects of a technical infrastructure within site area which existence was to be taken into consideration while positioning of the elements of future wind turbines in order of avoiding their possible interference such as 220kV and 500kV overhead lines, high pressure gas and oil pipelines, water channels, public motorway and railway as well as secondary water, electrical and media installations and met mast installed for the wind measurements campaign. Also, some environmental limitations were considered. The table below summarizes the main technical and environmental limitations to the design

Table 4-1 Site constraints

Object	Distance to project area	Limiting factor	Comment Alplan
Housing settlement		Noise and shadow flickering	The distances come from the studies conducted by Meventus, where the specific wind turbines noise level was taken and a cumulative effect of wind farms considered to generate a noise distribution map. It has been taken into consideration the current regulation in Georgia which is based on IFC noise standards.

Object	Distance to project area	Limiting factor	Comment Alplan
Ruisi village	527 m to T11 574 m to T14 714 m to T13		
Sasireti village	549 m to T36 707 m to T28		
Sakasheti cottages	550 m to T18 570 m to T31 731 m to T35		
Sakasheti village	512 m to T42 535 m to T38		
Varianis Meurneoba village	656 m to T23		
Arashenda village	649 m to T06		
Urbnisi village	515 m to T26		
Bebnisi housing settlement	554 m to T24		
Sagholasheni village	673 m to T45 707 m to T39		
Breti village	594 m to T12 809 m to T44		
Dirbi building	408 m to T25 499 m to T43		
Dzlevijari village	607 m to T34 611 m to T32		
Forest	Around T08	Protected species, presence of birds and bats	According to the initial environmental survey prepared for the project area, there are some protected plants and birds within the foreseen area. Also, occurrence of bat is expected. It shall be considered that presence of protected species of bats may require proper distance from wind turbines (200-500 m). Currently forest does not constraint the T06 position but represent moderate risk of modifications of the wind farm layout.
Wind masts	On site	Wake effect	Wind masts are temporary site infrastructure that belong to the owner. Current positions of wind masts were not considered as an obstacle in micro-siting as they can be easily dismounted or moved to other positions

Object	Distance to project area	Limiting factor	Comment Alplan
220kV overhead line		Clearance area	In this project clearance area of 233 m was applied – distance defined by GSE.
500kV overhead line		Clearance area	The line is crossing the site. The technical strip is 233 m – distance defined by GSE.
Motorway		Clearance area	In this project 200 m criterion was applied – distance defined by Road Department.
Railway		Technical protection zone	In this project 200 m criterion was applied – distance defined by JSC Georgian Railways.
Gas and oil pipelines		Technical protection zone	In this project 250 m criterion was applied – distance defined by owners of the pipelines.
Erosive ridges		Clearance area	Mountain ridges are subject of geological processes of a physical and biological weathering, and unstable landslide areas can be encountered within the project boundaries. The distance of wind turbine foundation from unstable area shall be at least 2 x foundation diameter if not otherwise specified.

4.2 Layout of wind turbines

► **Distances to infrastructure**

As it comes of distance to technical infrastructure, the following criteria has been applied during micro-siting (measured from centre of wind turbine plan):

- min. 500 m from housing settlements,
- min. 200 from E60 motorway
- min. 200 m from railway
- min. 230 m from 500 kV overhead line
- min. 250 m from high pressure gas and oil pipeline

► **Coordinates of wind turbines and distances between turbines and objects located in the project area**

When selecting the locations of the turbines, the distance of the alternative sites from the existing objects in the project area was taken into account, primarily the distance from residential houses and settlements, monuments of cultural heritage, objects of religious and general social importance (old and new, functioning churches, cemeteries, etc.) and surface of water bodies. The distance of turbines and these objects is presented in Table 4-2. The distance from settlements is presented as the distance from the turbine to the nearest house located in this settlement.

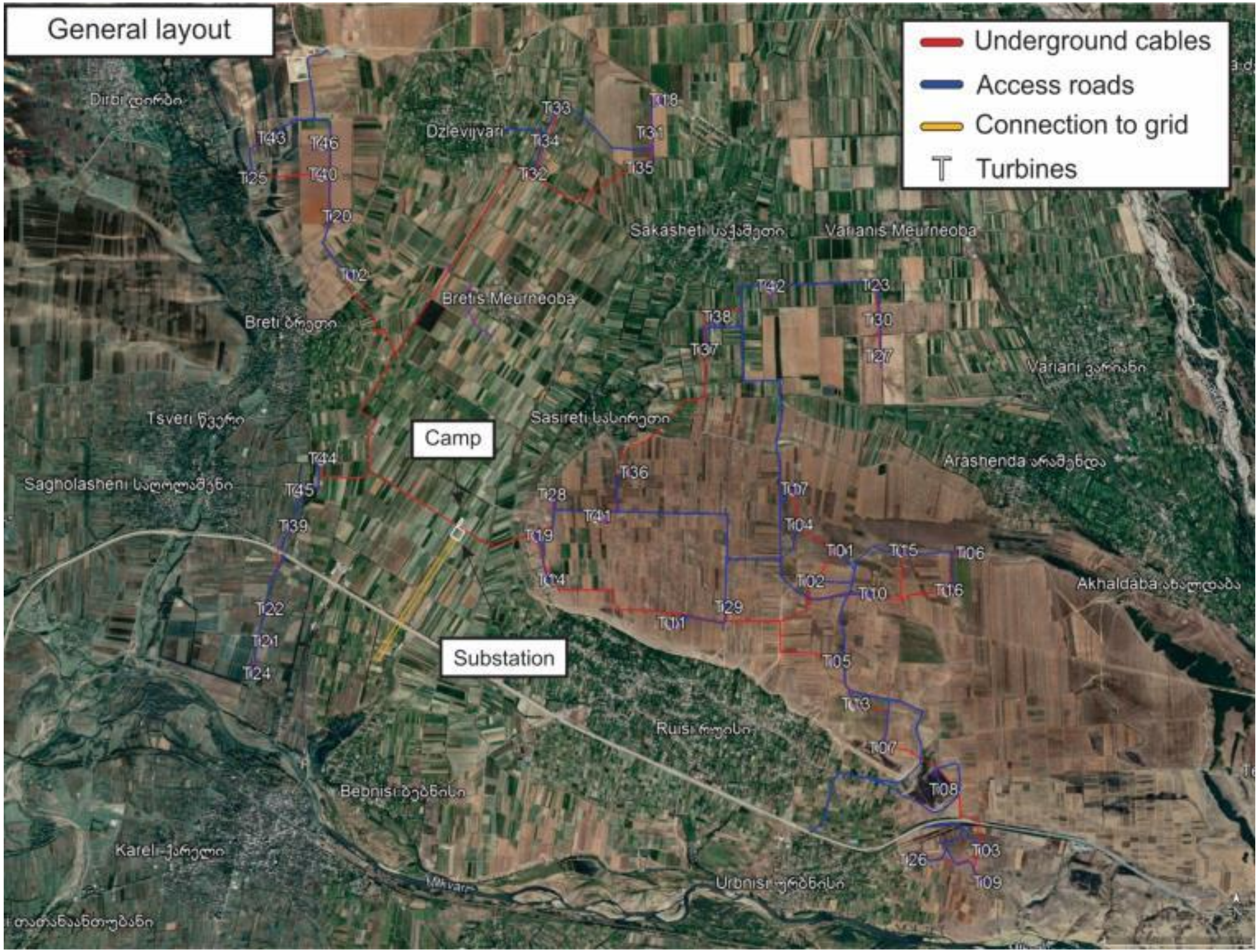

Figure 4-3 General plan of the project area

Table 4-2 Ruisi WPP turbines and substation: proximity to the residential areas, surface water and cultural heritage objects

Turbine N	Coordinates (38 T)		Distances (m)								
	X	Y	Residential area/ closest house			Surface Water Objects			Cultural Heritage Objects		
1	416362	4656165	2055	S/W	Ruisi	1129	N/E	Irrigation Canal	2073	S/W	Ruisi St. Marine church cemetery
2	415941	4655779	1500	S/W	Ruisi	1485	S/W	Zemo Ru Canal	1456	S/W	Ruisi St. Marine church cemetery
3	418084	4652080	1447	S	Skra	1253	S/W	River Mtkvari	1910	S	Skra Mother of God named church
4	415833	4656535	2105	S/W	Ruisi	1043	N	Artificial lake	1933	S/W	Ruisi Kvirackhoveli church
5	416235	4654695	903	S/W	Ruisi	819	S/W	Zemo Ru River	610	S/W	St.Kvirike and Ivlita monastery cemetery
6	418096	4656038	649	N/E	Arashenda	554	N/E	Irrigation Canal	1081	N/E	Arashenda Mother of God named church
7	416787	4653517	889	N/W	Ruisi	245	S/W	Zemo Ru River	851	S/W	Ruisi Mother of God small church
8	417568	4652920	1326	S/W	Urbnisi	536	N/W	Zemo Ru River	1664	N/W	Ruisi Mother of God church
9	418078	4651798	1015	S	Skra	825	S	River Mtkvari	1480	S	Skra Mother of God named church
10	416761	4655570	1935	N/E	Arashenda	1664	N	Irrigation Canal	1633	S/W	St.Kvirike and Ivlita monastery cemetery
11	414067	4655324	527	S/W	Ruisi	390	S/W	Zemo Ru River	633	W	Ruisi St. Demetre church cemetery
12	410058	4660177	594	S/W	Breti	279	S/W	River Bretula	610	S/W	Cemetery
13	416458	4654118	714	S/W	Ruisi	508	S/W	Zemo Ru Canal	446	S/W	St.Kvirike and Ivlita monastery cemetery
14	412485	4655984	574	S/E	Ruisi	69	S/W	Zemo Ru Canal	746	S/E	Ruisi St. Demetre church cemetery
15	417205	4656123	1276	N/E	Arashenda	1035	N/E	Irrigation Canal	1872	N/E	Arashenda Mother of God named church
16	417783	4655561	1221	N/E	Arashenda	1090	N/W	Irrigation Canal	1618	N/E	Arashenda Mother of God named church
17	415799	4657018	2413	NW	Arashenda	626	N	Artificial lake	1837	N/W	Ildaeti John The Baptist church
18	414338	4662288	550	S/E	Sakasheti cottages	73	N/E	Irrigation Canal	979	N/E	St. Nicholas church
19	412348	4656581	1171	S/E	Ruisi	86	N/W	Zemo Ru Canal	1255	S/E	Ruisi St. Demetre church cemetery
20	409883	4660970	990	S/W	Breti	922	S/E	River Bretula	884	S/W	Cemetery
21	408631	4655374	910	S/E	Bebnisi	1090	S/W	River Mtkvari	2250	S	Kareli Khareba church
22	408706	4655795	1156	N/W	Sagholasheni	1247	N/W	East Prone River	1763	N/W	Sagholasheni Zion basilica
23	417027	4659671	656	N/E	Variani Farm	1475	S/W	Artificial lake	1090	S/E	Variani Cylindrical Tower (417375.66 , 4658639.37)
24	408494	4654948	554	S/E	Bebnisi	703	S/W	River Mtkvari	1801	S	Kareli Khareba church
25	408788	4661538	408	N/W	Dirbi	356	N/W	East Prone River	1309	N/W	Dirbi St. George church

Turbine N	Coordinates (38 T)		Distances (m)								
	X	Y	Residential area/ closest house			Surface Water Objects			Cultural Heritage Objects		
26	417103	4652013	515	W	Urbnisi	993	S/W	River Mtkvari	1628	S/W	Urbnisi Church
27	417016	4658726	1497	N/E	Variani Farm	693	S/W	Artificial lake	375	S/E	Variani Cylindrical Tower (417375.66 , 4658639.37)
28	412557	4657113	707	N/E	Sasireti	97	NW	Zemo Ru Canal	1210	N/E	Sasireti St. George church
29	414831	4655492	868	S/W	Ruisi	779	S/W	Zemo Ru Canal	616	S/W	Ruisi Kvirackhoveli church
30	417038	4659205	1048	N/E	Variani Farm	1067	S/W	Artificial lake	670	S/E	Variani Cylindrical Tower (417375.66 , 4658639.37)
31	414129	4661859	570	N/E	Sakasheti cottages	548	N/E	Irrigation Canal	1279	N/E	St. Nicholas church
32	412532	4661391	611	N/W	Dzlevidjvari	110	N/W	River Bretula	2297	S/E	Sakasheti St.George church
33	412897	4662256	816	N/E	Dzlevidjvari	58	N/W	River Bretula	2427	E	St. Nicholas church
34	412723	4661825	607	N/E	Dzlevidjvari	148	N/W	River Bretula	2493	S/E	Sakasheti St.George church
35	413962	4661398	731	S/E	Sakasheti cottages	1038	N/E	Irrigation Canal	1540	S/E	Sakasheti St.George church
36	413666	4657350	549	N/W	Sasireti	222	N/W	Zemo Ru Canal	823	N/W	Sasireti St. George church
37	414699	4658932	916	N/W	Sakasheti	652	N/W	Zemo Ru Canal	386	S/E	Ildaeti John The Baptis church
38	414889	4659361	535	N/E	Sakasheti	518	N/W	Zemo Ru Canal	783	N/W	Sakasheti St.George church
39	409084	4656879	707	N/W	Sagholasheni	1310	W	East Prone River	563	N/W	Cemetery
40	409728	4661538	1221	N/W	Dzlevidjvari	1395	S/E	River Bretula	1361	S/W	Cemetery
41	413149	4656799	942	N/W	Sasireti	757	N/W	Zemo Ru Canal	1288	N	Sasireti St. George church
42	415632	4659731	512	N/E	Sakasheti	972	N/W	Zemo Ru Canal	1116	N/W	Church of the Entry of the Most Holy Mother of God into the Temple
43	409064	4662059	499	N/W	Dirbi	789	S/W	East Prone River	1489	N/W	Dirbi St. George church
44	409523	4657755	809	N/W	Breti	1233	N/W	East Prone River	730	S/W	Cemetery
45	409188	4657353	673	S/W	Sagholasheni	1364	S/W	East Prone River	347	N/W	Cemetery
46	409763	4661954	1060	N/E	Dzlevidjvari	1404	S/W	East Prone River	2191	N/W	Dirbi St. George church
Sub-station	410589	4657275	1797	S/E	Ruisi	953	S/W	Zemo Ru Canal	2379	S/E	Ruisi St. Demetre church cemetery

4.3 Access to the Wind Farm

A generic wind turbine assumed in this study, include large equipment and high hub height, both factors have a large influence on the civil works necessary access, erect and operate these wind turbines. Land transportation of wind turbine components is extremely difficult and employs complicated logistic and engineering strategies. As the vehicles used for transportation are over normative in terms of their dimensions and weight, the access road shall be surveyed by wind turbine supplier from factory or sea port to the wind farm. Such a route survey shall take into consideration technical condition of carriageways, payloads of bridges, drivable areas and their clearances and define entry points to the wind farm.

This initial design does not contain the 220 km long route survey, which is conducted from port in Poti on Black Sea, throughout the country on E60 state motorway, to the entrance points to the wind farm. This document contains the analysis of the access route from entrance points to every single wind turbine location.

There are four access points located directly on E60 motorway (See Figure 4-18):

► **Access Point 1 – at km 219** – turn left across central reserve and western carriageway into supplementary lane 203. Then backwards along the supporting road and forwards onto the projected access road to T26, T32 and T36

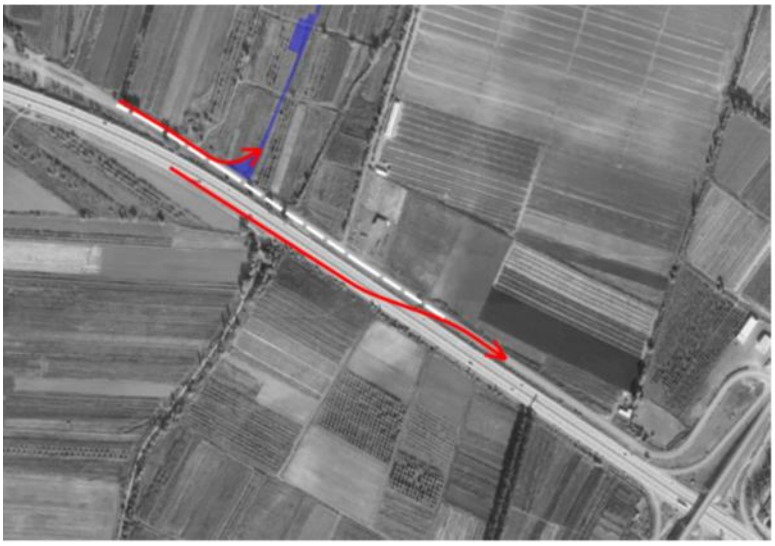

Figure 4-4 Access Point No. 1. Entrance to T26, T32 and T36

Figure 4-5 Access Point No 1

To access the northern part of the farm, a temporary exit must be made from the supplementary lane, via an existing roundabout onto the road leading to the village of Bretis Meurneoba.

Figure 4-6 Access Point No. 1. Temporary exit

Figure 4-7 The supplementary lane

Figure 4-8 Location of temporary exit

Figure 4-9 Roundabout in need of hardening

As it is not possible to drive through the village, a temporary road must be constructed between points 5 and 6.

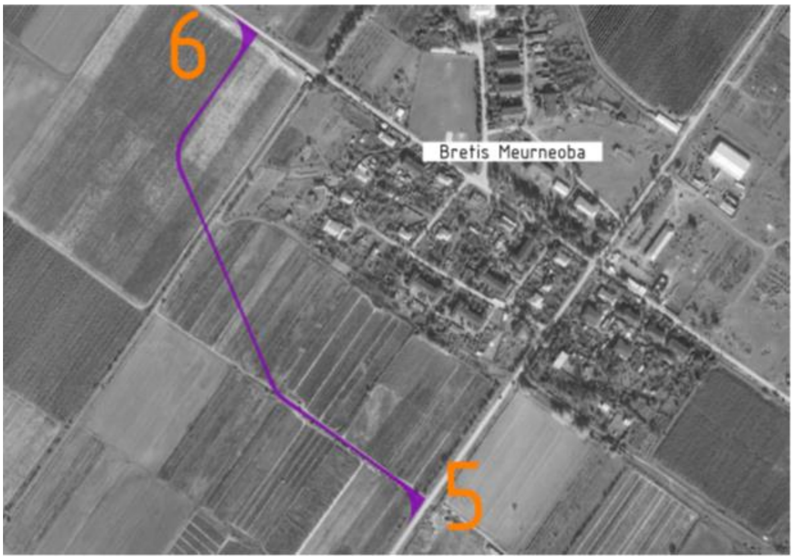

Figure 4-10 Temporary road

In order to make an exit onto the temporary road, it is necessary to rebuild a gas pipeline.

Figure 4-11 Gas pipeline to be rebuilt

The direct exit to the access road to the north-west cluster of the wind farm is from the newly constructed road (point 7).

Figure 4-12 Point 7

- ► **Access Point 2 – at km 219 –** direct exit from the motorway onto the designed access road to T15, T10 and T57

Figure 4-13 Access point 2. View from the supporting road

- ► **Access point 3 – at km 227 -** turn left across central reserve and western carriageway into supplementary lane and then through local roads to the main ridge and north eastern cluster of the wind farm

Figure 4-14 Access point3.

Figure 4-15 Access point 3. Road in need of reconstruction

► **Access point 4 – at km 228 –** turn right to T01, T04 and T09

Figure 4-16 Access Point 4.

The general map of the access route and location of entry points to the wind farm are shown on the maps below.

Notes:

- Exiting the E60 motorway is the manoeuvre that shall be performed with caution. It requires temporary hold of traffic in both directions and police assistance.
- It will necessary to dismount concrete protection barriers situated on central reserve as well as construct temporary hardened surfaces to facilitate curves. The works shall be approved but motorway authority.
- The entry points will temporarily affect safety of traffic and require temporary traffic organization.

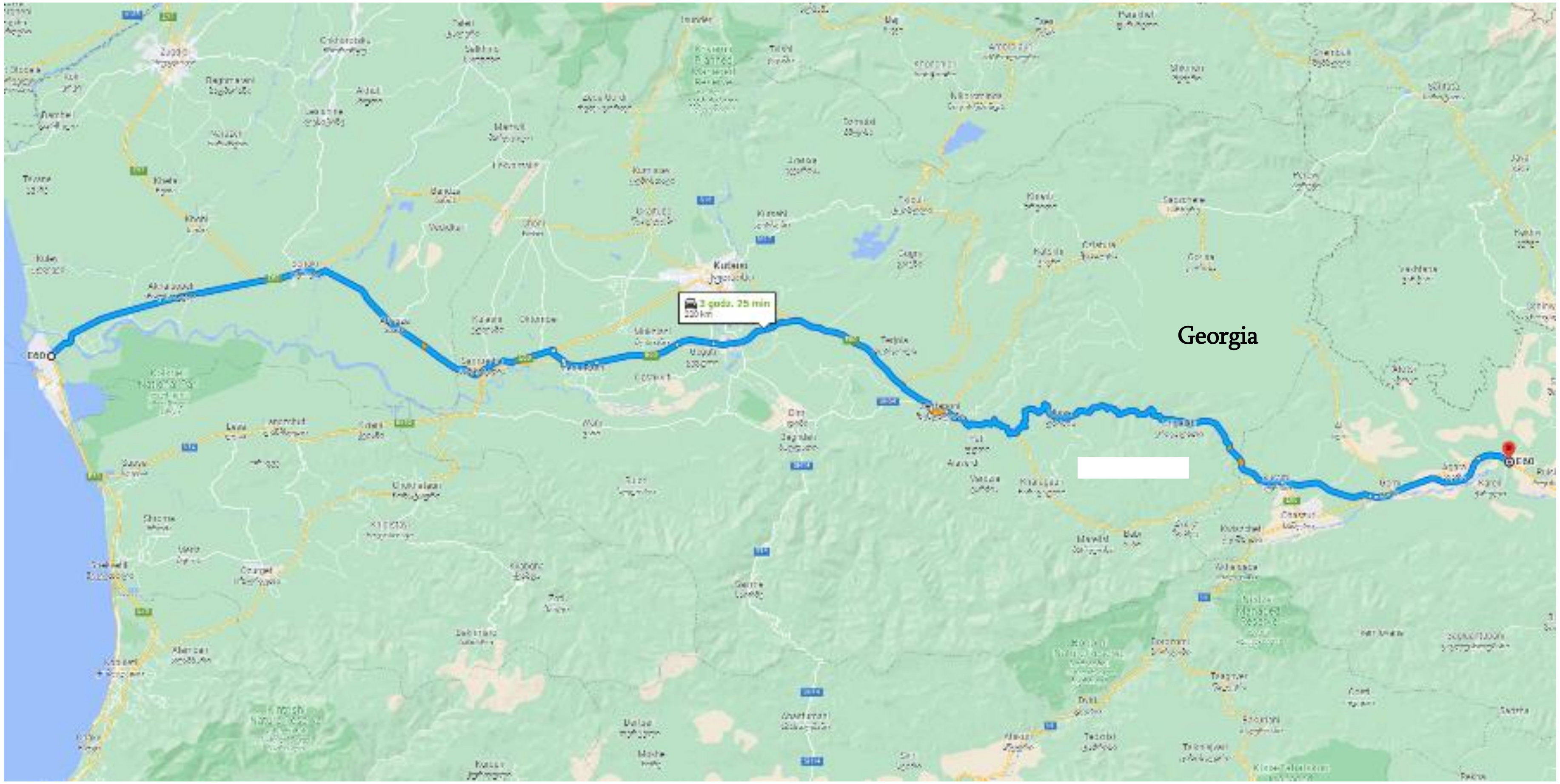

Figure 4-17 Access route via public roads to from entrance point to the project area up to the entrance to the wind farm

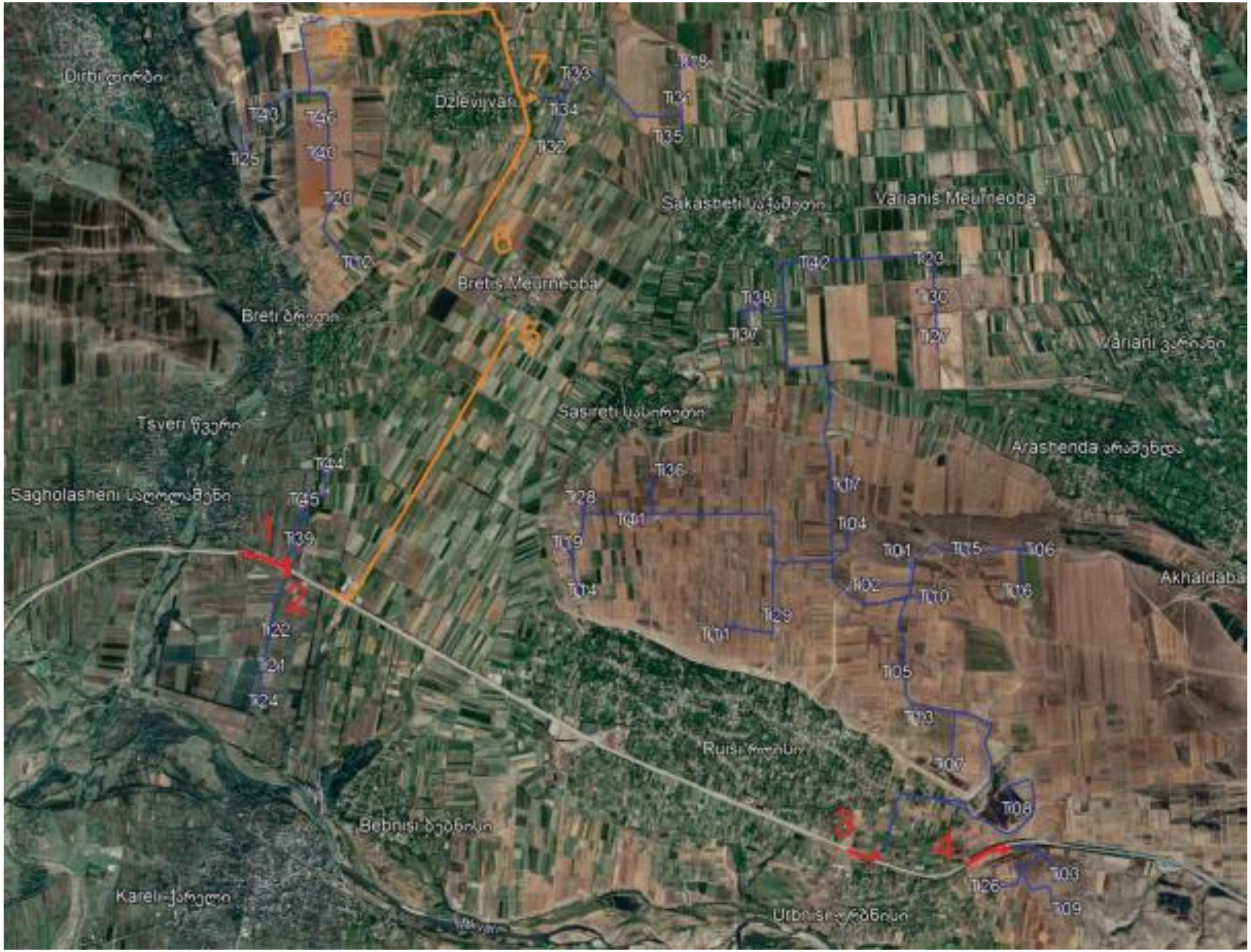

Figure 4-18 Access points to the wind farm area

4.4 Internal Access Roads and Assembly Yards

4.4.1 Introduction

Access roads are to provide the access to each WTG location during the erection and operation phase.

Roads layout is mostly determined by transportation requirements of wind turbine supplier, it means that both geometry and load parameters shall facilitate safe passage of long and heavy vehicles carrying wind turbine components. Although wind turbine components and erection techniques are all the same, every manufacturer presents their own manual for roads and crane stands construction that noticeably differs each other. These specifications correspond to individual experience of each manufacturer rather than technical regimes.

Intention of the initial project design was to implement a universally feasible layout that may be easily adopted by most wind turbine manufacturers. Thus, it shall be noted that the design may have some less significant deviations from specifications of certain turbine manufacturer.

Further, every site has its own unique conditions and challenges that might slightly exceed the requirements listed in specifications. Close cooperation between the installation contractor, the transportation company, the site owner and turbine supplier are of vital importance to ensure safe and timely execution of the project.

The Ruisi project site has in some areas a semi-semi-complex topography[2] which makes an access to some locations quite challenging. In order to achieve possibly high energy yield, the design foresees installation of the turbines at partly high elevation of the terrain. The access roads to these locations are of inclination exceeding standard specification, thus extra safety measures shall be implemented such as road perimeter signage, road widenings and auxiliary pulling tractors.

4.4.2 Project specific assumptions

General assumption for the road design has been based on a generic WTG of similar class and size to 4.5 MW in the industry. The project specific assumptions are:

Transportation Traffic Volume per WTGs	• Approx. 80 concrete transport trucks • Approx. 30 heavy trucks for crane erection • 12 heavy trucks for wind turbine components • Max. length of truck 68 m (rotor blade)
Loads	• Max. vehicle weight 180 t • Max. load per axle 22 t • Reference standard DIN18134 (Germany) • Deformation module Ev2 of the subsoil > 60MN/m^2 • Deformation module Ev2 on the top layer > 120MN/m^2 • The relation of Ev2/Ev1 must be smaller or equal to 2.5

[2] During a wind measurement campaign and met mast deployment, the terrain is classified according to its characteristics. MEASNET guidelines define two classifications: simple terrain and complex terrain, which are determined based on the slopes of hills or elevation changes. If the terrain does not strictly fall into either the simple or complex category, it can be assigned a classification of semi-complex. This means that the terrain exhibits some characteristics of complexity but is not considered fully complex according to the guidelines. Assigning a terrain classification helps in understanding and analyzing the wind flow patterns and turbulence at the site, which is crucial for accurate wind resource assessment and wind farm design

Slopes and vertical radii[3]	• Slope < 8% - standard tractor unit • Slope > 8% - pulling assistance • Normal driving direction on slope – forward • Vertical radii R_{min}=600 m • Camber 2% • Cut slope 1:1.5 • Fill slope 1:1.5
Safety distances to power lines	• Reference standard DIN VDE 0105 (Germany) • Up to 1kV – 1 m • Up to 110kV - 3 m • Up to 380 kV – 5 m • Clearance profile on straight route 5 x 5 m
Traversing and slewing areas	• Road width on straight route with a longitudinal gradient of less than 4% - 4.50 m • Intersection inner curve – R_{min} = 45.00 m

The axle loads of traffic vehicles on site are between:

- Cranes: onsite relocation of wheeled cranes between WTGS units the axle load -up to 22 t
- Transportation vehicles for WTGS components: 12-15 t

The individual total weight of transport vehicles and cranes during movements is approx. between 120 t - 145 t gross weight.

4.4.3 Access Roads

Due to semi-semi-complex terrain the road works will require significant macro levelling to fix the inclination of the terrain. The alignment lines of the roads are planned with specific concentration on balance of earth masses to avoid excessive deliveries of construction material.

On gentle slopes less than 30 percent, the centreline method was used, and the alignment line created self-balancing design so that the balance of earth masses does not create excessive surplus soil neither requires external deliveries of the material.

As a rule, the basic horizontal curve radius is to be 200 m, but numerous curves and multiple bends have reduced this radio to 100 m, 80 m, 60 m and 50 m. In such cases nominal width of the road is adequately increased.

Turning areas are as follows:

- Radius 45 m for loaded vehicles
- Radius 25 m for unloaded vehicles.

In general, the longitudinal profile of newly designed roads corresponds with the topography of the terrain. As much as possible, the topography was gently adjusted to maintain the slope below 8%. In such cases vehicles will be able to drive without any additional safety measures. However, there are

[3] Vertical radii" refers to the minimum curve radius for roads within the site. It determines how much the roads can deviate from a straight path vertically, ensuring safe navigation. It considers factors like vehicle type, speed, and terrain, ensuring practical and functional road networks

some cases where local topography enforced more steep slopes. In such cases the following measures were applied: in cases of inclination higher than 8%, there will be a necessity for one towing/pushing vehicles to be supplied. Bends are widened due to the fact that steered rear axles will have a loss of friction. These specific locations must be investigated and verified by a transportation company. No transportation during low visibility (darkness, fog), and adverse weather conditions like snow and ice on site roads is to take place.

The maximum ground clearance for tower transportation vehicles was assumed as of 30 cm. Therefore, it has been considered that local terrain waving shall be levelled, and the nominal convex and concave horizontal radius was set up on 600 m.

It was assumed that topsoil of average thickness of 30 cm shall be removed and spread over neighbourhood area. The construction material shall be local rocky sandstone that shall be extracted from site using bulldozers, excavators and explosives. Self-balanced design was implemented to avoid deliveries of construction material from outside. Extracted material shall be crushed to achieve aggregate 31,5 mm to fine. This material shall be used to form the road bed.

The minimal construction layer of the road is:

- 0-31.5 mm aggregate – 35 cm.

The road bed shall be mechanically compacted with 35 cm layers using vibrating rollers. Nominal width of drivable lane is 4.50 m. Roads have 0.5 m wide shoulders on both sides. Maximum cut slope ratio is 1:1.5, fill slope 1:1.5. Steeper cut slopes are applicable providing that geotechnical examination proves stable conditions. Access roads have an angle of inclination of 2% for proper drainage. In applicable conditions drainage ditches are designed alongside roads.

The axle loads of vehicles during traffic on site are as follows:

- Cranes: onsite movement of wheeled cranes between WTGS units the axle load can be up to 22 t
- Transportation vehicles for WTGS components: 12-15 t
- The individual total weight of transport vehicles and cranes during movements is approx. between 120 t-145 t gross weight.

According to the vehicle axle loads affecting the ground, a deformation module is to be assigned to the subsoil and to the construction layer. This Ev2 value must be checked by a VSS plate load test.

As a reference the German standard: DIN18134, or an equivalent of a national standardization can be used. The relation of Ev2/Ev1 must be smaller or equal to 2.5. An improvement of the subsoil or the construction layer will be necessary if the Ev2 value is smaller than:

Ev2 in MN/m² of the subsoil ≤ 60 MN/m²

4.4.4 Assembly yards[4]

The geometry of assembly yards is determined by the chosen erection technology, and required working space depends on crane type, turbine hub height, logistic of component delivery and a system of rotor assembly. Other relevant design criteria are land availability as well topography of the terrain.

Due to semi-semi-complex topography in part of the project area the preparation of the platforms will require substantial macro-levelling works.

The following assumptions were undertaken for the chosen geometry of the yards:

- Hub height up to 120 m
- Crawler lattice crane LG1750 or similar

The section and load parameters of assembly yards looks as follows:

- Section: 0-31.5mm aggregate – 35 cm
- Bearing capacity 260 kn/m^2
- Ev2 in MN/m^2 of the subsoil ≤ 60
- Ev2 in MN/m^2 of the construction layer ≤ 120.

The inclination of assembly yard is 1% max.

4.4.5 Turbine installation method

The below description of installation methods is based on a main crane type LR/LG1750 or similar. The installation description applies to turbines with max. HH=105 m.

4.4.5.1 Pre-installation

Pre-installation method is a technique for large wind turbines. It assumes unloading of components and assembly of bottom tower sections with use of smaller crane so that the working time of main crane is optimized and related cost reduced.

The pre-installation of the Wind Turbine takes place in the following sequence:

- The base section and typically one mid-section will be pre-installed with a 500-750 t crane (Liebherr LTM type) and a 130-assist crane; the crane will be placed at radius 12 m from the centre of the foundations. Depending on the chosen crane type, the crane will have a footprint of approx. 9 m to 12 m, between outriggers and support plates;
- The blades will be unloaded using two mobile cranes placed on the hardstand allowing the required outreach to place blades in the laydown area. The blade laydown area needs to be flat, free of obstacles and within the lifting radius of the main crane;
- The nacelle will be delivered using a standard flatbed trailer. The nacelle will be unloaded using a mobile crane and placed within the main crane working radius in such a position

[4] An assembly yard is a temporary workspace located next to each wind turbine foundation during construction. It is used for assembling turbine components. The size of the yard can vary. Typically, assembly yards are not revegetated as they are dismantled after construction. If they are permanent, vegetation control is achieved through mechanical methods (mowing, trimming), mulching, ground cover planting, and integrated weed management, avoiding the use of pesticides.

that it does not interfere with the later build and operation of the main crane. Where the drive train is delivered separately then additional space must be provided to allow for the storage of the drive train prior to being lifted into the Nacelle during the preparation phase. For the nacelle enough space (3 m) must be provided around it to allow for scaffolding during the preparation prior to final erection;

- As an alternative the nacelle could be self-offloaded using the transport legs and if within the lifting radius of the crane, it may then be prepared where it is situated, or it could then be moved as above using a mobile crane;
- The hub will be unloaded with a mobile crane and placed within main crane working radius or alternatively self-offloaded on legs
- The remaining tower sections will be unloaded using two mobile cranes.

4.4.5.2 Main Installation

The turbine foundation pad is a prepared area where the wind turbine's foundation is constructed. It serves as a stable base to support the weight of the wind turbine tower and facilitate the installation process. The assembly yard and the turbine foundation pad are two separate areas within the wind farm project. The assembly yard is the temporary workspace where the turbine components are assembled before being installed, while the turbine foundation pad is the specific location where the foundation is built. During the construction process, after the turbine components are assembled in the assembly yard, the main crane, which is used for lifting and installing the components, will be brought to the turbine foundation pad. The main crane will then be positioned and used to lift the assembled components onto the foundation, completing the installation of the wind turbine.
Summarizing, the pad refers to the turbine foundation pad, which is distinct from the assembly yard. The main crane is brought to the pad to install the assembled turbine components onto the foundation.

Once the base tower has been erected, grouted (if applicable) and the Nacelle, Blades and Hub have been prepared, then the main crane will be brought to the Pad. The main crane will probably be a Liebherr LG1750 or similar, the distance between outriggers will be approx. 16 m x 16 m plus support plates, the erection sequence will be as follows:

- The main crane will be placed at a required working radius from the centre of the foundation, the crane requires appropriate free space for boom assembly which takes place in a “straight” line, usually along and parallel to the road, the boom cannot be placed above the outriggers. The crane pads along the road will be used by a small crane to assemble the boom;
- Once assembled the main crane will commence the erection of the remaining tower sections in combination with a mobile tailing crane. The tower transports need an appropriate free area within the main crane and tailing crane working radius. The towers will be lifted directly off the trailers; space must be allowed for a working platform to be used to safely attach the lifting gear to the towers before lifting. Additional lifts for the bolts will be necessary before the next tower section is lifted;
- The Nacelle will then be lifted from the position on the pad where it has been prepared, the hub will then follow;
- The blades will be the last to be lifted from the location where they have been prepared;
- The crane is disassembled and moved to the next location.

Each crane set (for one wind turbine) consists of:

- one main crane (e.g. Liebherr LG1750),

- one crane for pre-installation (e.g. Liebherr LTM 1500-8.1),
- one auxiliary crane

It is recommended that two crane teams are used for the construction of the Ruisi wind farm.

4.4.6 List of roads and assembly yards

Table 4-3 Access roads available from junction 1 to wind turbines T39, T44, T45

Road No.	Road length [m]	Comments:
Access road 01	1 193.59	
Access road 02	531.93	
Access road 03	206.73	including a temporary section of 129 m

Table 4-4 Access roads available from junction 1 and 5 to wind turbines T12, T20, T25, T40, T43, T46

Road No.	Road length [m]	Comments:
Temporary road	858.35	
Access road 04	1 105.53	
Access road 05	1 377.23	
Access road 06	2 071.81	
Access road 07	244.91	
Access road 08	607.92	
Access road 09	589.59	
Access road 10	202.60	
Access road 11	383.03	

Table 4-5 Access roads available from junction 2 to wind turbines T22, T21, T24

Road No.	Road length [m]	Comments:
Access road 12	1 135.92	
Access road 13	291.45	including a temporary section of 129 m
Access road 14	626.35	

Table 4-6 Access roads available from junction 4 to wind turbines T03, T09, T26

Road No.	Road length [m]	Comments:
Access road 15	988.22	including a temporary section of 123 m slope between 0+595,851 and 0+759,343 is 17%
Access road 16	847.11	slope between 0+572,69 and 0+711,361 is 8%
Temporary road	75.38	
Access road 17	672.10	

Table 4-7 Access roads available from junction 3 to wind turbines T08, T07, T13, T05, T10, T15, T06, T16, T02, T01, T04, T17, T29, T11, T36, T41, T28, T19, T14, T37, T38, T42, T27, T23, T30, T18, T31, T35, T32, T34, T33

Road No.	Road length [m]	Comments:
Access road 18	895.99	
Access road 19	1 934.68	
Access road 20	2 435.29	
Access road 21	1 145,74	
Access road 22	492.52	
Access road 23	1 249.19	
Access road 24	198.90	
Access road 25	2 044.89	
Access road 26	199.65	
Access road 27	598.63	
Access road 28	577.43	including a temporary section of 129 m slope between 0+000,00 and 0+077,702 is 8,48% slope between 0+139,57 and 0+327,269 is 9,25%
Access road 29	538.28	
Access road 30	1 030.80	
Access road 31	2 267.60	
Access road 32	719.43	
Access road 33	866.02	
Access road 34	202.45	including a temporary section of 129 m
Access road 35	915.76	
Access road 36	597.66	
Access road 37	2 322.34	
Access road 38	861.26	including a temporary section of 129 m
Access road 39	206.51	including a temporary section of 129 m
Access road 40	373.91	including a temporary section of 129 m
Access road 41	523.89	
Access road 42	529.93	
Access road 43	722.43	including a temporary section of 123 m
Access road 44	552.50	including a temporary section of 123 m
Access road 45	828.39	
Access road 46	1 270.51	
Access road 47	506.88	
Access road 48	212.92	
Access road 49	223.99	
Access road 50	2 942.91	
Access road 51	203.26	including a temporary section of 123 m
Access road 52	737.78	
Access road 53	441.39	
Access road 54	200.57	
Access road 55	749.36	including a temporary section of 129 m
Access road 56	202.94	including a temporary section of 123 m
Access road 57	613.57	
Access road 58	263.19	including a temporary section of 129 m
Access road 59	935.46	
Access road 60	211.08	including a temporary section of 129 m

Road No.	Road length [m]	Comments:
Access road 61	1 287.98	
Access road 62	828.16	
Access road 63	230.61	including a temporary section of 129 m
Access road 64	679.45	including a temporary section of 129 m
Access road 65	906.86	
Access road 66	488.35	
Access road 67	287.93	including a temporary section of 129 m

- Total length of permanent access roads - 52 187.80 m
- Permanent roads and hardstands - 336 713.86 m^2
- Temporary surfaces - 150 476.73 m^2
- Access paths - 7 236.69 m^2

4.4.7 Site compound and storage area

In this project enough space have been designed in each assembly yard to deliver the components directly to the location. Therefore, the interim storage yard is not required. Nevertheless, the location of site compound nearby substation for 2 main cranes has been indicated on the topographic map. Typical compound area(s) including welfare facilities and waste management for the use of the installation team is(are) required. The size will vary depending on the number of main cranes used. On large sites, multiple compounds may be required:

- 1 main crane: 30 m x 55 m (1650 m^2);
- 2 main cranes: 30 m x 110 m (might be split depending by the site setup/layout);
- 3 main cranes: 30 m x 165 m (might be split depending by the site setup/layout);

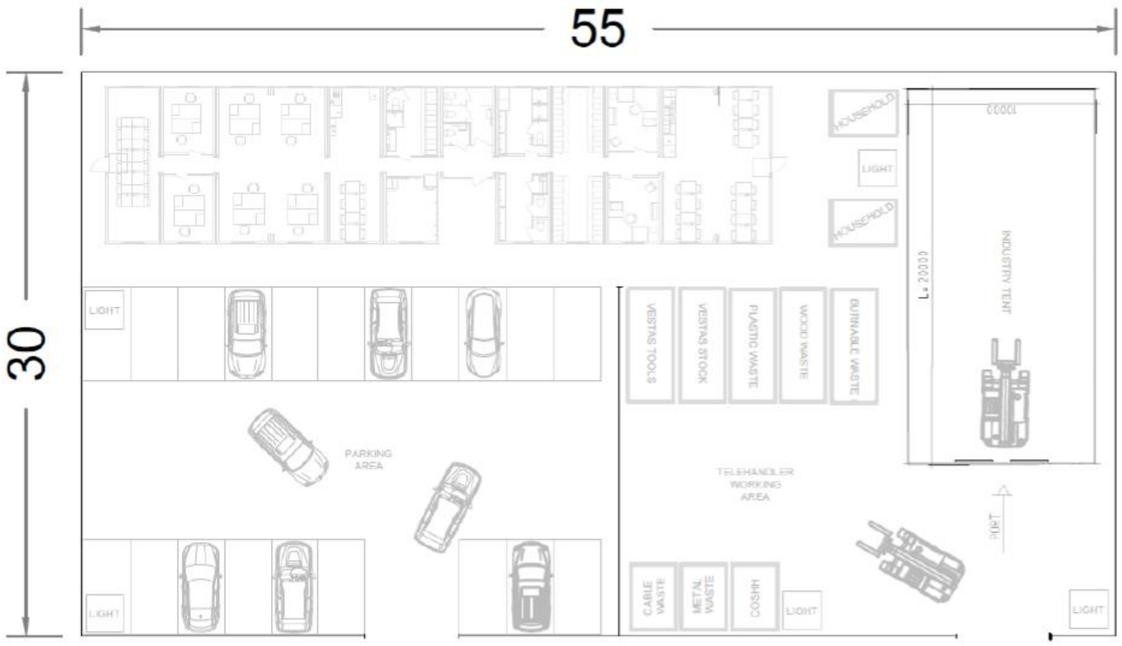

Figure 4-19 Example of site compound for 1 main crane

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Each parking lot within the parking area of the site compound is to be sized as 2,5 m x 5 m; at least 20 parking lots for a 1 main crane site compound, 26 parking lots for a 2 main cranes site compound and at least 32 parking lots for 3 and 4 main cranes site compounds. Entrance(s)\exit(s) and manoeuvring to be considered and granted within the parking area and containers area as well (those two areas to be separated/fenced to enhance HSE). The parking, shunting and loading areas must be designed for an axle load of 12 t. The other areas of the compound area are intended as storage areas (e.g. for container equipment, etc.) and must be levelled as well as free of obstacles.

4.5 Foundations

4.5.1 Basis of the study

The following codes has been applied:

- EN 1990:2004	- Eurocode. Basis of the structural design.
- EN 1991-1-1:2002	- Eurocode 1. Actions on structures. Part 1-1. General actions. Densities, self-weight and imposed loads.
- EN 1991-1-4:2005	- Eurocode 1. Actions on structures. Part 1-4. General actions. Wind actions.
- EN 1997-1:2004	- Eurocode 7: Geotechnical design. Part 1 General rules.
- EN 1997-2:2007	- Eurocode 7. Geotechnical design. Part 2: Ground investigation and testing.
- EN 1992-1-1:2004	- Eurocode 2: Design of concrete structures. Part 1-1. General rules and rules for buildings.
- EN 206-1	- Concrete – Part 1 – Specification, performance, production and conformity.

The subject of this study is to draw up a concept design for 46 foundations of wind farm within the investment entitled Ruisi Wind Farm. The project covers structural and material solutions necessary to execution of the structure.

A wind power plant is a technical device in which a tower and a foundation are separate components. For the purpose of this conceptual design, a wind turbine with a tower height of 105 m and a total height of 180 m above ground level will be used, equipped with a slow-rotating turbine with an output of 4.5 MW with a three-blade rotor with a 150 m diameter, e. g.:

- Diameter of the rotor: 150 m
- Swept area of the rotor: 17 671 m^2
- Number of rotor blades: 3 pcs.
- Tower: steel, modular, pipe cross – sections
- Height of the tower: 105 m
- Total height of the power plant: 180 m above ground level
- Foundations: reinforced concrete slab on a circular plan.

The turbines are designed on gravity foundations, directly on the existing ground (without any soil improvement). The maximum groundwater level is assumed to be below the level of the foundation – foundation without buoyancy.

4.5.2 Materials data

Foundations will consist of different strength classes of concrete, depending of the installation space.

Prior to the concreting process it is necessary to design a suitable composition of the concrete mix, which will reduce the impact of concrete shrinkage, creep and reduce heat of hydration during its applying. For this purpose, provision should be made for the use of CEM III class cement, limiting the size of the aggregate grain to 16 or 32 mm. In the area 50 cm above the foundation level and 25 cm below the construction joint, the maximum aggregate size should be 16 mm

4.5.3 Construction of the foundations

Reinforced concrete foundation on a circular base was designed, with diameter of 21,0 m. Its height varies from the smallest at the edge to its greatest in the central area. Additionally, the central section of the foundation includes a pedestal.

The basic foundation dimensions are shown below:

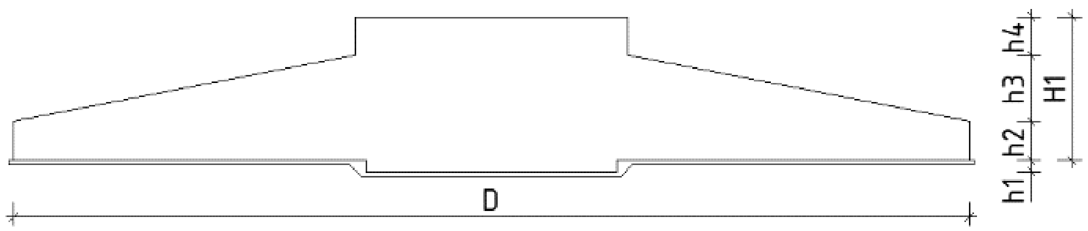

Figure 4-20 Foundation dimensions

Table 4-8 Foundation dimensions

Foundation diameter - D	Overdepth height - h1	Cylinder height - h2	Cone height- h3	Pedestal height - h4	Total height - H1
[m]	[m]	[m]	[m]	[m]	[m]
21.0	0.25	0.85	1.45	0.85	3.15

Assumptions for calculations:

- Reinforced concrete density: 25 kN/m3
- Bulk density of backfill 18.0 kN/m3

Table 4-9 Volume and weight of foundation components

Slab volume	523,31 m^3
Overdepth volume	5,94 m^3
Pedestal volume	24,03 m^3
Total volume	553,28 m^3
Weight of foundation	13832 kN
Volume backfill	511,88 m^3
Weight of backfill	9213,84 kN

In accordance with specification of turbine manufacturer the following requirements should be complied:

- respective rotating stiffness Kφ,dyn = 149 GNm/rad,
- respective horizontal stiffness Kh,dyn = 313 MN/m,
- maximum inclination of pedestal 3.00 mm/m,
- maximum crack width in concrete is = 0.20 mm

4.5.4 Concluding remarks

The foundations top level is elevated 0,3 m above the planned installation site. The foundation backfill is the load taken into consideration in the calculation, which counteracts the “overturning” moment of the foundation. The backfill shall be formed with a soil of volume weight of at least 18 kN/m^3 and compacted (with a minimum degree of compaction ID ≥ 0,7) to ensure its durability.

Backfills should be built in layers and each layer should be compacted. The works should be performed under supervision of a geologist and confirmed in the construction log.

The backfill slopes should be protected against washing topsoil away by rain water. The surrounding terrain must be shaped in a proper way to drain the rainwater outwards the foundation.

When laying the reinforcement, lightning protection and grounding system elements (according to the electrical design, in accordance with the manufacturer's guidelines) as well as electrical cable protective tubes (according to the foundation's detailed design and the manufacturer's guidelines) must be installed.

Installation of the steel tower structure including the nacelle and rotor must be done by the power plant manufacturer.

4.6 Ruisi Substation

4.6.1 General data

Ruisi substation is a connection point of the wind farm, internal power lines hub and steering and communication centre of the facility. Substation has been situated in an agricultural plot west of Ruisi village. The location of the substation is shown in Option 1 schematic diagram (Figure 3-6 Connection to grid: alternative 1).

The access to the plot is facilitated with the internal road aligning towards west to public road and motorway. The location of the substation has been optimised taking into account the following criteria:

- Situation in geographic centre of the wind farm to optimize internal grid size
- Easy access to public roads
- Access to fiber optic cable of TSO”
- Accessibility to existing 220 kV overhead line
- Plot size and shape
- Topography of the terrain and land use

Location of the substation implies modification of existing route of 220 kV overhead line SS Khashuri 220 to SS Gori 220. The line shall be cut and directed 2,1 km north towards the substation to pass through 220 kV bay in substation. Therefore, the part of Ruisi substation (220 kV bay) will function as a technological part of Georgian State Electrosystem (TSO) - GSE system being at the same time a connection point of the wind farm.

Wind farm substation works include in particular:

- Earthwork including the levelling of the substation area, drainage system, and runoff management system
- Earthing network including the earthing mesh, soil resistance measurement, and earthing of all metallic parts and equipment of the substation
- Foundations and steel structures
- Concrete canals, cable ladders, cable conduits
- Power transmission equipment and secondary distribution including, but is not limited to:
  - Overhead conductors, HV, MV, LV power cables, control-command cables, communication cables, etc.
  - HV/MV power transformers and auxiliary systems
  - Busbars
  - Surge arrestors and/or lighting arresters and/or other lightning protection system
  - Isolators or/and disconnecting switches
  - Earth switches
  - Current Transformers
  - Voltage Transformers
  - Circuit breakers
  - Neutral grounding Equipment
  - Metering, control and relay panels
  - MV switchgear
  - MV/LV auxiliary transformer(s)
  - Backup generator set
  - LV distribution system
  - AC/DC distribution system
- Communication network (panels, cabling, terminations, and communication Equipment)
- SCADA
- Access control, alarm and monitoring system
- O&M - control building with all technical installations such as heating, air conditioning etc.
- Fence
- Internal roads
- Runoff water management system

4.6.2 Design Layout

The following technical equipment designed on the premises of the station:

- transformer station TR1 220/33kV 120 MVA;
- transformer station TR2 220/33kV 120 MVA;
- equipment of 220 kV, 33kV switching station;
- grounding transformer station (own needs) No. 1 and 2,
- capacitor banks,

- shunt reactors,
- 220kV switching station

The study covers the 220/33 kV Ruisi electrical substation together with the 220 kV double-system switching station with 7 fields:

- field No. 1: voltage measurement;
- field No. 2: 220kV Overhead Line Circuit no1, SS Gori 220kV;
- field No. 3: 220kV Overhead Line Circuit no2, SS Gori 220kV (planned);
- field no. 4: 220/33kV TR1 transformer;
- field No. 5: Transformer 220/33kV TR2;
- field No. 6: 220kV Overhead Line Circuit no2, SS Khashuri 220kV (planned);
- field No. 7: 220kV Overhead Line Circuit no1, SS Khashuri 220kV;

4.6.3 220 kV switching station equipment:

Circuit breakers 220 kV type 3AP1FI-245 PSD02 by Siemens or devices another producer with similar parameters, overhead, three-pole, in SF6 insulation, mounted on a galvanized steel structure, equipped with:

- individual spring-engine drive for each FA4 type pole,
- drive equipped with a circuit breaker monitoring system. The SICEA01 monitoring system is a device used to monitor the wear and tear of the HV circuit breaker contacts based on the counting of currents as a function of time. The values obtained are summed up and compared with the reference values. If the limit values are exceeded, a warning or alarm is signalled by a light on the controller. When such a signal occurs, notify the authorised service centre in order to perform an inspection of the circuit breaker. In addition, the SICEA01 device has the ability to preview the monitored values by connecting to the computer controller using an Ethernet interface. It is possible to read the parameters from the last ten connections, such as: maximum current, current flow time, current integral and which pole has been activated.
- a system for synchronous connection of the poles PSD 02 with the following parameters:
  - rated voltage 245 kV,
  - rated continuous current 2500 A,
  - 3-phase rated short-circuit breaking current 40 kA
  - rated making short-circuit current 100 kA,
  - thunder surge voltage withstand to ground 1050 kV,
  - porcelain outer insulation with a minimum leakage path of 25 mm/kV.

Horizontal rotary insulation switches 220 kV type SGF245p100 by Hapam or devices another producer with similar parameters, overhead, three-pole, mounted on a galvanized steel structure, equipped with three motor drives (individual drives for each pole) for MT50 type main knives with the following parameters:

- rated motor voltage 400 V AC,
- rated voltage 245 kV,
- current rating continuous 2500 A,
- withstand short-time rated current 40 kA,
- withstand peak rated current 100 kA,
- porcelain insulation with a minimum leakage path of 25 mm/kV,
- distance between poles 3.5 m.

220 kV horizontal rotary insulation switches with one ground knife type SGF245p100+1E(FS) by Hapam or devices another producer with similar parameters, overhead, three-pole, mounted on a galvanized steel structure, equipped with:

- one set of ground knives on the finger side;
- six motor drives (individual drives for each pole) for main knives and ground knives type MT50: rated voltage of the motor 400 V AC, with the following parameters:
  - rated voltage 245 kV,
  - current rating continuous 2500 A,
  - withstand short-time rated current 40 kA,
  - withstand peak rated current 100 kA,
  - porcelain insulation with a minimum leakage path of 25 mm/kV,
  - distance between poles 3.5 m.

220 kV horizontal rotary insulation switches with two ground knives type SGF245p100+2E by Hapam or devices another producer with similar parameters, overhead, three-pole, mounted on a galvanized steel structure, equipped with:

- two sets of ground knives;
- nine motor drives (individual drives for each pole) for main knives and ground knives type MT50: motor rated voltage 400 V AC with the following parameters:
  - rated voltage 245 kV
  - current rating continuous 1600 A
  - withstand short-time rated current 40 kA
  - withstand peak rated current 100 kA
  - porcelain insulation with a minimum leakage path of 25 mm/kV
  - distance between poles 3.5 m.

Combined transformers 220 kV Trench or devices another producer with similar parameters, overhead, single-phase, with internal oil insulation, external porcelain insulation, mounted on a galvanised steel structure, with the following parameters:

- maximal working voltage of the current transformer 245 kV,
- rated short term thermal current 40 kA,

- rated peak current 100 kA,
- current transformer 600/1/1/1/1/1 A,
- insulation with a minimum leakage path of 25 mm/kV.

220 kV voltage transformers TVG 245 made by Overhead Trench or Arteche, single-phase, with internal insulation SF6, porcelain external insulation, mounted on a galvanized steel structure, with the following parameters:

- maximal working voltage of the current transformer 245 kV,
- insulation with a minimum leakage path of 25 mm/kV.

Surge arresters 220 kV type 3EL2 192-6PR42-4XZ1 by Siemens or devices another producer with similar parameters, overhead, single-phase, in composite insulation, mounted on a galvanized steel structure, equipped with a ProCounter A type operation counter, with the following parameters:

- voltage of permanent operation Uc154 kV,
- rated voltage Ur192 kV,
- maximum voltage of the Um245 kV system,
- rated discharge current In20 kA.

Supporting station insulators 220 kV type C6-1050 II, manufactured by Zapel or devices another producer with similar parameters, overhead, porcelain seal, mounted on a galvanized steel structure, with the following parameters:

- withstand thunder surge voltage 1050 kV
- withstand rated surge switching voltage in rain 750 kV,
- rated bending strength 6 kN,
- rated leakage path 6300 mm.

4.6.4 220 kV switching station fields

220 kV field No. 1 of voltage measurement equipped with:

- 220 kV horizontal rotary busbar insulation switches with two sets of ground knives typeSGF245p100 +2E with supporting structures and foundations;
- voltage transformers 220 kV of TVG 245 type with supporting structures and foundations;
- bus bar systems with a cable, 2x AFL-8 525 mm bundle cable.

220 kV line fields No. 2, 3, 6, 7 equipped with:

- 220 kV circuit breaker type 3AP1FI-245 with supporting structure and foundations;
- 220 kV busbar insulation switch type SGF245p100 with supporting structure and foundations;
- 220 kV busbar insulation switch with one set of ground knives typeSGF245p100 +1E(FS) with supporting structure and foundations;

- 220 kV line insulation switch with two sets of ground knives typeSGF245p100 +2E with supporting structure and foundations;
- combined transformers 220 kV (600 A) with supporting structures and foundations;
- 220 kV surge arresters type 3EL2 192 and ProCounter A operation counters with supporting structures and foundations;
- 220 kV support insulators with support structures and foundations;
- high structures – line gates for the upper bus system for fields with foundations;
- upper bus system for the field between the busbar comb and the line gate made with ACO-480 mm^2 cable suspended on insulator, tension, double-row strings,
- lower bus system for the field between the apparatus and connections to upper bus system and busbars through insulator, suspension strings, with tension and suspension clamps, made with ACO-480 mm^2 cable.

220 kV field No. 4 and 5 transformer TR1 and TR2 equipped with:

- 220 kV circuit breaker type 3AP1FI-245 with supporting structure and foundations;
- 220 kV busbar insulation switch type SGF245p100 with supporting structure and foundations;
- 220kV busbar insulation switch with one set of ground knives typeSGF245p100 +1E(FS) with supporting structure and foundations;
- 220 kV transformer insulation switch with two sets of ground knives typeSGF245p100 +2E with supporting structure and foundations;
- combined transformers 220 kV (300 A) with supporting structures and foundations;
- 220 kV surge arresters type 3EL2 192 and ProCounter A operation counters with supporting structures and foundations;
- 220 kV support insulators with support structures and foundations;
- upper bus system for the field between the busbar comb and the transformer gate made with AAC 887 mm^2 cable suspended on insulator, tension, double-row strings,
- lower bus system for the field between the apparatus and connections to upper bus system and busbars through insulator, suspension strings, with tension and suspension clamps, AAC 887 mm^2 cable.

4.6.5 220 kV switching station busbars

Busbars are designed to be made with 2x AFL-8 525 mm2 cable, suspended on insulator, tension and double-row strings.

4.6.6 Transformer stations TR1 and TR2 220/33 kV

Parameters of autotransformer TR1 and TR2:

- type of transformer 120MVA,
- YNd11 connections system,
- rated voltages: GN230 kV/DN33 kV,

- rated frequency 50 Hz,
- voltage control range ±15(17), vacuum overload tap changer,
- acceptable acoustic power level (A) LWA≤ 87 dB(A)
- tN connectors CONNEX type 4x size 3,
- current transformers HV: 300/1/1/1/1 A
- current transformers DN:2000/1/1/1/1 A
- current transformers GN "0": 315(600)/1/1 A

The parameters of the 220/33kV transformer should be verified with the Grid Connection Study. The transformer stations are equipped with oil sumps connected to the oil separator. Between TR1 and TR2 transformer stations, a separation wall was foreseen

4.6.7 33kV switchgear

Siemens 8DA10/ 36kV/40kA switchgear consisting of two sections was adopted. Each section is assigned to one 220/33kV transformer. The sections are connected by the busbar connector fields. The normal sys-tem of operation of the station with the open busbar connector on the 33kV side was adopted. Parallel operation of 220/33kV transformers with a closed busbar connector is not foreseen.

From the transformer 220/33kV TR1 to the 33kV switchgear, a cable 3x (3xXRUHKXS 1x630mm 2) was de-signed. It was designed to lay the cable on the supporting structure at the transformer 220/33kV TR1, and then lay the cable in the cable ducts on the ladders.

From the transformer 220/33kV TR2 to the 33kV switchgear, a cable 3x (3xXRUHKXS 1x630mm 2) was de-signed. It was designed to lay the cable on the supporting structure at the transformer 220/33kV TR2, and then lay the cable in the cable ducts on the ladders.

4.6.8 Rated continuous currents

Rated continuous currents for the primary apparatus 220 kV and busbars result from the standards of the designed 220 kV switching station:

- 220 kV busbars - 2000 A
- Transformer TR1 and TR2 fields - 1250 A
- 220 kV line fields - approx. 951 A

4.6.9 220kV switching station overhead insulation

The insulation of the 220 kV overhead switching station is designed for the III dirty electricity zone. The minimum lengths of leakage routes for 220 kV switching station were adopted:

- ceramic insulation of 220 kV support devices and insulators: 6100/6800 mm,
- insulation of 220 kV line insulators (cable busbar insulation): 6800 mm.
- insulation of composite-silicone, support and line insulators: 6125 mm

Table 4-10 Insulation levels for 220 kV voltage adopted to determine the insulation spacing in the air

Grid nominal voltage Un [kV] (effective value)	Highest Voltage of the device Um [kV] (effective value	Normalized withstand short-term frequency voltage of the grid Uw50Hz (effective value) [kV]	Normalized withstand thunder surge voltage Uwl [kV] (peak value)
220	245	360	850

4.6.10 Levels of rated short-circuit currents

The primary apparatus of the 220 kV switching station and the bus system for the level of short-circuit cur-rents 40 kA were adopted. Short-circuit current levels should be verified with the Grid Connection Study.

4.6.11 Load capacity of wires

220 kV switchgear bays and busbars were designed with a bus system made of the following wires:

a) aluminium wires 1x AL 887 mm^2 with load capacity:

- in summer from April to October – 1450 A
- in winter from November to March – 1670 A

b) steel-aluminium wire bundles 2x AFL 5-525 mm^2 with load capacity of:

- in summer from April to October – 2060 A
- in winter from November to March – 2440 A

c) aluminium wire ACO-480 mm2 with load capacity of:

- in summer from April to October – approx. 951A
- in winter from November to March – approx. 1081A

4.6.12 Own needs 0.4 kV and diesel generator

As the basic power supply of 0.4kV circuits (own needs), the use of ground transformers is planned. The winding power of own consumption earthing transformers 160kVA was assumed. Verify the parameters of the grounding transformers with the Grid Connection Study. The study envisages a diesel generator station - the power of the generator is to be confirmed on the basis of power balance calculations for the target station equipment. The 200 kW power of the generator was assumed.

4.6.13 Capacitor banks and shunt reactors

The 33kV switchgear is to be connected with CE60 (44MVAr) and CB2 (44MVAr) capacitors for sections 1 and 2 respectively. It is planned to connect (shunt) reactors SR1(26MVAr) and SR2(26MVr) for sections 1 and 2 of the 33kV switchgear, respectively. The battery parameters of 33kV CE60 and CB2 capacitors and 33kV SR1 and SR2 shunt reactors should be verified with the Grid Connection Study and Grid Connection Agreement.

Notes:

- *The device parameters should be verified with the Grid Connection Study and agreed with the Georgian State Electrosystem (TSO)-GSE.*
- *The number of transformer cores should be confirmed on the basis of the design of secondary circuits.*
- *It is allowed to use devices from another manufacturer with similar parameters*

4.7 Medium Voltage Circuits

4.7.1 Basis for the study

- Telefonika Cables catalogue "Clean energy - Cables for wind energy applications"
- Generic WTG 4MW planform specification, General Description 4MW Platform,
- Standard N-SEP-E-004 - "Power and signal cable lines. Design and construction "
- Standard IEC60502-2: 2005 "Cable lines with nominal voltage of 1kV (Um = 1.2kV) up to 30kV (Um = 36kV)"

4.7.2 33kV cable lines

Internal wind farm electric network evacuating power from wind turbines to Ruisi substation has been assumed as cable line system of rated power of 33 kV. The cables shall be will be laid in a trench in a triangle pattern. The depth of the ditch should not be greater than 1.4 m, and the upper surface of the cable bundle cannot be laid shallower than 1.0 m from the surface of the site. Cables shall be laid on 10 cm sand bed, covering it with the another layer of sand and covered with a plastic film of red colour. The trench shall be backfilled with native soil, which should be compacted. Cables shall be laid with a wavy line, with 1-3% of the excavation length. Identification plates shall be attached every 10 m along the entire length. The markers should indicate:

- owner name,
- designation of a phase,
- the name of the line (relation),
- cable type,
- rated voltage of the line,
- year of construction.

In a non-built-up area, far from the characteristic fixed points, the change of cable route and the place of cable connections as well as the places of the beginning and ends of cable glands should be marked above the earth's surface with permanent and visible markers embedded in the ground.

When introducing into Ruisi station switchgear and to individual switching stations of the power plant, cables shall be installed in a protective pipes fi232 and fi160 mm.

Return cable wires should be grounded. Return cable wires dimension should be agreed with Grid Connection Study.

Permanent electronic cable markers shall be laid along the course of the excavation on a wind farm, in particular from the control building to the WTG foundations, using the 3M ™ electronic marking system (3M ™ Ball Marker 1402-XR) or similar technically

4.7.3 Fibre optics installation

For the purpose of data exchange between the devices of individual wind power plants and dispatch systems, an internal fibre optic line has been designed enabling the transmission of data. The planned fibre optic network connects all wind turbines to the station of Ruisi substation and furtherly through existing media to national operator's dispatch systems.

The internal fibre optic network will be installed into protection pipeline laid in a shared trench together with MV power cables. For connections between individual wind turbines, 12-fibres optic system was assumed, and for power plant connections – 12, (24/36/48) fiber station welded in a fiber optic tray.

In individual power plants and station of EP44 windfarm fiber optic cable inventory (spare) was designed.

The protection pipeline is a high density polyethylene pipe 40x3.7 mm laid alongside MV power cables. The fibre cable shall be pulled pneumatically into this pipeline. The bends of the pipelines shall keep the minimum bending radius of 1.2 m.

For fiber optic network single-mode 9 / 125um single-mode fibre optic cables with increased resistance to rodents type Z-(XV)OTKtsd are planned. The individual sections of the pipeline will be connected with special fittings to ensure its tightness (unavailable for solid and liquid impurities) and resistance to increased air pressure (1MPa), used in various methods of pneumatic cable laying. Fiber optic protection pipes will be marked so that they can be clearly identified and distinguished from each other. The yellow signalling tape should be installed at the same height as the red tape covering the 33kV power cables

4.7.4 Cable protection pipes

Intersections with roads, rails, waters or underground devices shall be protected with polyethylene protective pipes.

All intersections in open excavations should be made in corrugated polyethylene pipe DVK 232, 160, 110 pipes, observing vertical distances according to SEP-N-004 standard. For controlled core drills, high density single-layer solid wall pipes made of polyethylene shall be used, e.g. SRS-G 200(225) / 11.4, SRS-G 110 / 6.4.

4.7.5 WTG switchgears

MV switchgears are delivered with wind turbines. The 33kV switchgear is modular in SF6 insulation and located at the lower level of the power plant.

4.7.6 Summed the length of the MV cables

1. Cable XRUHAKXS 20.8/36(42)kV 1x630/50 mm2 - 106,557 m
2. Cable XRUHAKXS 20.8/36(42)kV 1x400/50 mm2 - 64,092 m
3. Cable XRUHAKXS 20.8/36(42)kV 1x240/50 mm2 - 44,187 m
4. Cable XRUHAKXS 20.8/36(42)kV 1x120/50 mm2 - 83,568 m

4.8 Quantity of Construction Materials and Need for Soil Disposal

4.8.1 Foundations of WTG

Total soil excavation for each foundation is around 1,065 m³, out of which around 512 m³ is backfilled after pouring 553 m³ of concrete. This corresponds to around 25,438 m³ excavated soil for 46 units of WTG left after backfilling and 25,438 m³ of concrete volume required. Also, total weight of reinforcement needed for construction of foundations amounts to 2,925.6 tons.

It can be assumed that the full portion of surplus soil can be inbuilt in other places on site. The best way to balance the soil is to elevate the foundation so that the pedestal level is around 1.00 above the terrain. This is very common practice in Europe. This way we reduce the excavations and, at the same time produce a need of soil necessary to form an embankment over the foundation. The detailed solution can be given at executive stage of the project after full geology is available

4.8.2 Access Roads

35 cm layer of aggregate materials is considered for access roads with the average road width of 4.5 m. Size of the aggregate materials is suggested between 0-31.5 mm. There are around 52 km of access roads to be constructed/rehabilitated. This corresponds to around 82,000 m³ (52,000 x 0.35 x 4.5) of aggregate materials for access roads. This volume of aggregate materials shall be brought externally, from various quarries.

4.8.3 Assembly yards

Total area of the assembly yards is around 51,000 m². Therefore, the Project needs around 17,850 m³ of aggregate material for the assembly yards, considering 35 cm layer (0.35 m x 51,000 m²). This quantity of aggregate materials shall be also supplied eternally, from the nearby quarries.

4.8.4 Cable Tranches

Total soil excavation from cable trenches amounts to 40,000 m³ (depth x width x length). The total length is around 54,650 m. The width varies between 50-100 cm, while the depth is 118 cm. Around 25% of the excavated space shall be filled with sand bedding. The rest is backfilled. This leaves around 10,000 m³ (40,000 m³ x 25%) of excavated soil for other purposes. This surplus soil can be used to form road embankments, slopes etc

4.8.5 220 kV Substation

It is assumed around 2,000 m³ of soil excavation for construction of the 220 kV substation. This volume of excavated soil will be also used for other construction purposes as explained above.

4.8.6 Soil Disposal Needs

You will need to dispose temporarily excavated fertile topsoil for the time of construction. This topsoil shall be then spread over the terrain after construction and dismounting of temporary surfaces. Please mind that topsoil is valuable material, shall be separated from deeper soils and under no circumstances shall be removed from site. Please also consider that the roads have been designed in the way that balances the other soils. So, it is assumed that the balance of soil is 0.00 and in the end of construction you will not need neither to remove nor to deliver any other soils that 35 cm of top crushed stone layer.

4.9 Construction Machinery

Table 4-11 Machinery used during the Construction of Ruisi WPP

Types of construction and installation work	Technological processes and operations, which are performed simultaneously (or in parallel), and influence on the atmospheric air	Brand (model) of a technical means that ensures the fulfilment of the technological process
Delivery of general materials for construction sites	Transportation of cargo equipment on roads with hard, soil and crushed stone covering	KS-557 kr mobile crane with a 30 ton load-lifting capacity
		Scania R500 truck
		Scania R380 dump truck
Reapplication of equipment for the arrangement of drill piles	Unloading of equipment on the site for the wind power plants	LIEBHERR 1750 mobile crane
Construction of power substation for power collection	Digging the foundation ditch	Hitachi L200 excavator
	Welding of reinforced structures	TDM welding machine
	Operation of concrete pump on the site	BSA 219 concrete pump
	Concreting of foundations and sites	Two-rotor concrete machine
Construction of administration building	Digging the foundation ditch	Hitachi L200 excavator
	Welding of reinforced structures	TDM welding machine
Preparation of the foundation for wind power plants - concrete pouring	Delivery of concrete on a gravel-crashed stone road	SB-92-1 mobile concrete mixer
	Supply of concrete to the well and foundation body	SB-126A mobile concrete pump with distributing arrow
Preparation of the foundation for windpower plants – device of drill piles	Drilling wells	Bauer BG 40 well drilling unit
	Installation of anchor devices	LIEBHERR 154 EC-H mobile crane
	Welding of reinforced structures	TDM welding machine
Preparation of the foundation for windpower plants – earthwork operations	Digging the foundation ditch	Caterpillar CAT 428e loader-digger
	Transportation of excavated soil outside the construction site territory	Scania R380 dump truck
Wind Turbine installation	Lifting and fixing the nacelle	LIEBHERR 1750 mobile crane

Types of construction and installation work	Technological processes and operations, which are performed simultaneously (or in parallel), and influence on the atmospheric air	Brand (model) of a technical means that ensures the fulfilment of the technological process
Builder camp	Unloading and loading of equipment and materials	KS-557 kr mobile crane with a 30 ton load-lifting capacity
	Pouring of bulk materials on the storage site and their storage	Scania R380 dump truck
	Power supply	SDMO diesel generator (2 pcs.)
Construction of access roads and crane pads	Clearing the territory	Caterpillar D6 bulldozer
	Removal of the upper fertile soil layer with the thickness up to 0, 2 m	Volvo motor grader
	Loading of soil in the body of a Scania R380 dump truck	Caterpillar CAT 428e loader-digger
	Transportation of excavated soil outside the territory of construction site	Scania R380 dump truck
	Transportation of bulk materials on a gravel-crushed stone road	Scania R380 dump truck
	Construction of gravel-crushed stone foundation	Road roller CAT
	Arrangement of road surface on crane grounds with laying of aerodrome plates.	KShT-50.01 mobile crane with a YaMZ-238 engine
Glading the cuttings (trees)	Cutting of rough and light-bodied vegetation, standalone trees. Ripping the stumps, clearing the strip of removal from the roots, cleaning trunks and bushes cut with the help of bush cutter, grinding dry branches and knots.	Caterpillar D6 bulldozer
	Transportation of vegetation and land outside the construction site.	Scania R380 dump truck

5 Baseline environmental conditions

5.1 Social Baseline

5.1.1 Introduction

The location area of the project objects and potential impact zones (flickering, noise, transportation etc.) includes territories that belong to the inhabited localities of Shida Kartli – Gori and Kareli municipalities:

- Villages of Kareli Municipality: Ruisi, Urbnisi, Sagholasheni, Dzlevijvari, Bebnisi, Breti, Bretis Meurneoba, Dirbi, Sasireti
- Villages of Gori Municipality: Sakasheti, Sakasheti IDP Settlement, Varianis meurneoba, Arashenda, Shindisi

5.1.2 Social and economic characteristics of Shida Kartli region

The region of Shida Kartli is located in eastern Georgia, in a central part of lowland between Greater and Lesser Caucasus. It occupies 9.2% of the territory of Georgia and is home to 7% of the population. The region is bordered by Mtskheta-Mtianeti to the east, Kvemo Kartli to the southeast, Samtskhe-Javakheti to the southwest, Imereti to the west, and Racha-Lechkhumi and Kvemo Svaneti to the northwest. It shares the Northern border with the Russian Federation. The region has an advantageous transport and geographical location, in particular, proximity to the capital city, location in the area of the East-West Highway of international importance and the main line of the South Caucasus Railway.

The natural conditions of the region are quite favorable: the climate is temperate continental, with a moderately warm air temperature and moderate humidity, which creates grounds for favorable living conditions and economic activity of the population. The dense water network existing in the region belongs to the basin of the Mtkvari River, and the latter is the main water artery of the region. On the territory of the region there are natural zones specific to the middle zone, including Altitudinal zonation remarkable for a wide variety of soils and rich in forests, flora and fauna.

In the early 1990s, as a result of ethno-political conflicts that arose in this territory, the Georgian authorities lost de facto control over part of the territories that make up Shida Kartli, which negatively affected the prospects for the economic and social development of the region due to the inaccessibility of the occupied territories, difficulties with security in conflict zones and extremely limited economic activity.

In 2013 the population of the Shida Kartli region was 313,500 people, in 2016 this figure decreased to 263,800 people. Presumably, the quantitative decline in the population was caused by internal and external migration. In total, there are 250,658 refugees in Georgia, 14,298 of which live in Shida Kartli, comprising 5.7% of the country's refugees and 4.5% of the region's population. Most of the IDPs (almost 70%) live in the municipality of Gori and the city of Gori. The socio-economic integration of refugees is one of the major issues in the region.

Currently, Shida Kartli region includes 4 municipalities – Gori, Kaspi, Kareli, Khashuri. Administrative Territorial Units of Gori, Kaspi, Kareli, Khashuri including 372 settlements out of which 4 are cities (Gori, Kaspi, Kareli, Khashuri), 2 urban-type settlements (daba) (Surami, Agara) and 366 villages (Strategy 2011). The area of Tigvi, Eredvi, Kurti and Java is located on the territory not controlled by the Georgian government.

Figure 5-1 Shida Kartli Region

5.1.2.1 Population

Table 5-1 Number of population (except uncontrolled territory) (K - thousand)

Region, municipality	2018	2019	2020
Shida Kartli	259,3	257,3	255,1
Gori Municipality	123,2	122,2	121,1
Kaspi Municipality	42,8	42,3	42,0
Kareli Municipality	41,1	41,0	40,8
Khashuri Municipality	52,1	51,7	51,3

Table 5-2 Population of cities and townships (K)

Region, municipality, city, township	2020			2021			2022		
	Total	Urban settlement	Rural settlement	Total	Urban settlement	Rural settlement	Total	Urban settlement	Rural settlement
Shida Kartli	**255,1**	**101,0**	**154,2**	**254,1**	**100,6**	**153,4**	**250,5**	**99,0**	**151,5**
Gori Municipality	121,1	45,6	75,5	120,6	45,4	75,2	118,8	44,5	74,2
Gori, city	45,6	45,6		45,4	45,4		44,5	44,5	
Kaspi Municipality	42,0	12,9	29,1	41,8	12,9	28,9	41,1	12,7	28,4
Kaspi, city	12,9	12,9		12,9	12,9		12,7	12,7	
Kareli Municipality	40,8	9,9	30,9	40,7	9,9	30,8	40,3	9,8	30,5

Region, municipality, city, township	2020			2021			2022		
	Total	Urban settlement	Rural settlement	Total	Urban settlement	Rural settlement	Total	Urban settlement	Rural settlement
Kareli, city	6,9	6,9		6,9	6,9		6,9	6,9	
Agara township	2,9	2,9		2,9	2,9		2,9	2,9	
Khashuri Municipality	51,3	32,6	18,7	51,0	32,5	18,6	50,3	32,0	18,4
Khashuri, city	25,0	25,0		24,9	24,9		24,6	24,6	
Surami township	7,6	7,6		7,5	7,5		7,4	7,4	

5.1.2.2 Socio-Economic Baseline

There is a rather acute problem of employment in the region. Over the years, the number of jobs has increased slightly, the increased unemployment rate leads to labor migration. The creation of new jobs directly depends on the development of the business sector, the manufacturing sectors of the economy. A pivotal role in this process is assigned to medium and small businesses.

The main source of income in the region is income from the sale of agricultural products, as well as non-monetary income, that is, the consumption of self-produced food products. In the cash income of households in the region, the volume of remittances received from abroad and assistance from relatives is high. The self-employment rate accounts for 77% of the total workforce in the region reflecting the number of agricultural workers employed in small peasant (family) households among the rural population. As a result, employment, activity and unemployment rates in Shida Kartli are relatively higher than those on the Georgian average.

Shida Kartli has a high proportion of the population living below the poverty line (about 20%), including those living in extreme poverty (more than 8%). The very situation in the region can be explained to some extent by a large number of refugees. All medical and social programs financed from the state budget are presented in the region. Municipalities also implement programs of one-time social assistance.

The economic activity of Shida Kartli is mainly based on the following sectors: agriculture (agricultural production), industry, tourism, trade (commerce), transport and communications, energy, construction (including roads and other infrastructure) and others. The capital inflow and investment market in Shida Kartli, as in many other segments, increased significantly from 2006 (29.1 MM GEL) to 2008 (118.9 MM GEL), and in the post-war period showed a sharp downward trend. The main reason for this is the Russo-Georgian war of 2008.

Industry in Shida Kartli is not well-developed - the number of sectors, employees and production rate is not large. According to the commodity structure, the products manufactured by the industry of the region are mainly divided into two parts: food products and building materials. The following industrial enterprises of the region stand out in terms of their importance: Gori − Geoconcentrate LLC, Forte LLC, Dila LLC, the cannery Kula, etc.; Kaspi − Kaspi Cement Plant "Sakcement" LLC, "NaturalProduct" (brick production), etc.; Agara Sugar Factory.

At the current stage, the main problems hindering the development of industry in the Shida Kartli region are: low investment, high bank interest on loans, low incomes of the population, proximity to the conflict zone. However, there are also positive aspects, taking into account which it will be possible to attract investments and increase local capital investments. The positive sides of the industry development include cheap labor, proximity to roads and railways, relatively inexpensive and diverse land resources, effective management, the possibility of creating a liberal tax legislative environment, and others.

Shida Kartli is one of the most important regions of Georgia in terms of agricultural development. Its significance is particularly outstanding as a fruit-growing region in Georgia. The region has always been distinguished by the production of apples. The Shida Kartli region leads the country in terms of production of most types of fruits; It ranks 2nd in walnut production, 4th in grape production, and 2nd in vegetable production.

5.1.2.3 Business sector

In terms of the field of business activity, the majority of companies operating in Shida Kartli are involved in trade (41%) and the food industry (12%). The industry of Shida Kartli is represented mainly in the form of small and medium-sized enterprises. Constant technical and technological progress affects modern production and makes it necessary to update existing equipment and technology. Competitive production is unthinkable with relatively outdated technologies, as consumer demand for high quality, affordable prices, and products manufactured to modern standards is constantly increasing. The central and local government bodies should continue the process of importing multifunctional equipment and implementing a policy of the existing fleet renewal. The priority direction is to stimulate the technical re-equipment and construction of processing enterprises. The revival of agricultural production in the region is associated with the following innovative approaches and the introduction of new methods: the creation, strengthening, and expansion of modern fruit tree nurseries, the promotion of the introduction of new technologies, and the production of conditioned fruit tree seedlings; rehabilitation of modern refrigerated warehouses for storing fruits and construction of new ones, taking into account the specifics of each region. It is also important to improve the skills of farmers by creating more short-term courses. Publishing relevant books, pamphlets, newspapers and facilitating the provision of other information. Participation of local fruit-growers in international exhibitions, cultivation of promising, high-yielding fruit varieties in the regions of Shida Kartli; installation of modern drip irrigation systems in orchards; enhancing the participation of modern organizations and other actors.

5.1.2.4 Tourism

It is necessary to note the tourism potential of Shida Kartli, associated with the abundance of cultural, historical, and religious monuments in this area. Therefore, for the long-term development of the region, tourism potential is considered one of the key constituent areas. According to the dynamics of recent years, the flow of tourists and visitors to the Shida Kartli region has increased significantly, which is a positive trend. Among the factors responsible for the increase in the number of tourists and visitors, it should be noted measures to organize infrastructure at the regional level, improve the overall crime situation, advertise the country's tourism potential in the world's leading media, etc. The presence of factors hindering the development of tourism in the Shida Kartli region is also important. In particular, the low degree of coordination between travel agencies operating in the capital and representatives of tourist sites in the local municipalities; tourism infrastructure needs better development; it is desirable to cut on-site visit tariff rates; keeping a clean environment at tourist sites.

The region has significant tourism potential, but it is necessary to find the right travel niche, develop and offer competitive tourism products. There is a possibility of more effective development of health tourism, ecotourism, agritourism, cultural and educational tourism, active and extreme tourism in the region. The development of tourism, in its turn, is one of the conditions for the growth of incomes and employment of the population. It is desirable to create more recreational and food service facilities − private family hotels, create tourist centers near all cultural monuments, which, successively, is a means of employment for the local population and creates an additional incentive for the production and marketing of agricultural products.

The state of the service sector in the Shida Kartli region is unsatisfactory, which directly affects the low level of development of tourism and recreation. It should be noted that the region is experiencing a shortage of entertainment and recreational facilities. Therefore, after a short visit, a tourist often returns to Tbilisi not only for an overnight stay but also for entertainment, since various kinds of entertainment facilities (for example, cafes, nightclubs, entertainment centers, etc.) are not developed in the region. Tourists are often reluctant to spend overnight in the Shida Kartli and therefore only show up as “transit” visitors, which in turn reduces tourists' potential to spend money in the region.

5.1.2.5 Education

Educational programs implemented in higher educational institutions, colleges, and vocational training schools of the Shida Kartli region are typically represented by agricultural and tourism sectors, however, their quality needs to be improved, which involves strengthening those areas, developing curricula in accordance with the latest standards, establishing active communication and coordination with potential employers in specified areas.

5.1.2.6 Infrastructure of the region

► Roads

Rehabilitation of the existing road infrastructure in the region has recently been carried out with great intensity, although a certain part of the internal roads in the municipalities of the region is still in disrepair.

The international highway (Tbilisi-Senaki-Leselidze) which is completely asphalted passes through the territory of the region. The total length of internal roads is 950 km, only 262 km (28%) of which has asphalt paving, while the remaining 688 km are classified as minor roads. Among them, a large part is gravel roads, and a relatively small part has a soil surface

The main line of the East-West Railway of Georgia passes through all the municipalities of the region, and all centers of municipalities, except for Kareli, are also railway stations.

► **Types of public transport**

Passenger transportation services both inside and outside the municipalities of Shida Kartli are provided by private transport companies. Routed taxicabs (Marshrutka) mostly run within the municipalities of the region. Due to the fact that the issue of transportation in the region is not regulated by the local self-government, the prices for specific routes are mainly determined by the market.

► **Traditional and modern means of communication**

Almost all Georgian electronic communication companies are represented in the Shida Kartli with nearly 80% coverage of the region’s area.

Recently, companies have been active in the field of **wireless communication**, installing wireless phones and terminals throughout the region. With regard to **computerisation**, it is obvious that the consumption of computers and the Internet by the inhabitants of the cities of the region far exceeds the consumption by the inhabitants of the villages, although there are no more or less accurate data.

► **Housing conditions**

Shida Kartli is primarily a rural region with a majority of population living in private houses. Individual (private) houses are also abundant in urban settlements. Apartment (multi-storey) buildings are mostly available in Gori.

► Water supply and sewage system

All municipalities of the Shida Kartli region are rich in water resources, which is an important factor for the smooth functioning of the irrigation system in agricultural lands, however, it is worth noting that the water supply of the population is no longer a competence of the state (in 2008 it was withdrawn from the competence of local self-government) and is subject to market regulation. As a result, the state company is only interested in providing water to cities and small towns.

Table 5-3 Distribution of Households by Main Sources of Drinking Water (%)

Shida Kartli	2019	2020	2021
Water supply system carried down to the apartments	46,7	52,1	56,0
Faucet in the yard or neighborhood	23,2	25,5	22,7
Well in the yard or neighborhood	24,1	17,9	16,9
Natural spring in the yard or neighborhood	5,5	4,3	4,2
Other	0,5	0,2	0,2

The municipalities and villages of the region are 100% connected to electricity.

Table 5-4 Share of households supplied with natural gas (%)

2019	2020	2021
83,4	84,4	90,8

5.1.2.7 Healthcare and Social Welfare in the Shida Kartli Region

Table 5-5 Key Healthcare Indicators

	2018	2019	2020
Number of doctors by position, K*	1,3	1,4	1,0
Number of nursing staff, K*	0,8	0,9	1,0
Hospital and medical center, units	11	12	12
Number of hospital beds, K	0,8	0,8	0,8
Number of outpatient-and-polyclinic institutions, units	170	168	171
Number of visits to doctors in outpatient-and-polyclinics during the year (including prevention), K	594	677	461

► **Social Welfare**

Shida Kartli belongs to those regions of Georgia where the proportion of the population representing socially vulnerable groups is high. According to the 2010 statistics, where data on the population of Shida Kartli and Mtskheta-Mtianeti are aggregated, they make up almost half of the population. Shida Kartli has a high proportion of the population living below the poverty line (about 20%), including those living in extreme poverty (more than 8%). The very situation in the region can be explained to some extent by a large number of IDPs, although there is also a high proportion of pensioners (19% of the population), people with disabilities (4%).

All medical and social programs financed from the state budget are presented in the region. Municipalities also implement programs of one-time social assistance, although the latter cannot cover the entire vulnerable part of the population and, due to their one-time nature, cannot have a long-term positive impact on the standard of living of beneficiaries.

Table 5-6 Number of families registered and receiving subsistence allowance

	2019	2020	2021
Families registered, unit	28 567	30 012	31 487
Recipient family, unit	11 089	13 223	15 476

Table 5-7 Number of pension and social package recipients

	2019	2020	2021
Number of recipients, person	63 906	65 624	66 592

5.1.2.8 Agriculture

► **Land Resources and Land Use**

According to the Geostat data of 2009, the total area of land in Shida Kartli is 69,425 ha, or only 14,4% of the region's area controlled by Georgia, of which 56,682 ha is in private ownership. 95% of non-privatised lands or 12,116 ha was granted on lease by the state, while the area of land granted on lease by private persons is only 628 ha

► **Agricultural lands**

Although the area of Shida Kartli's agricultural lands is relatively smaller than in the other regions - Kakheti, Kvemo Kartli, Imereti, it is still considered to be one of the most important agricultural regions of Georgia. 66,237 ha are used for agricultural purposes (95.4% of total lands), of which 74% are arable lands, 21% are perennial plantations and 5% - grasslands/pastures. The share of greenhouses is small being less than 1%.

In 2009, there were 72,940 farms in the region, including 72,881 family-run farms (99.9% of all farms), 64 agricultural enterprises and 55 - other enterprises. On average, one enterprise does not hold even 1 hectare. The farms are clearly small and fragmented with a low potential for commercial production

► **Agricultural sector**

Fruits

The importance of Shida Kartli is particularly outstanding as a fruit-growing region in Georgia, ranking first in a variety of fruit produced.

Another priority area in Shida Kartli is the production of cereals - wheat and barley. Based on the 2011 data, the region ranks second in the country in the area of lands under these two crops (12,900 ha of wheat and 4,900 ha of barley). Wheat consumption is steadily increasing. However, local production cannot meet a large portion of demand and, similar to other agricultural products, 550-800 thousand tons of wheat or flour are imported every year. It is important to note that imports far outweigh local production. At the same time, local seeds are produced in small quantities; as a result, there are high losses and a large amount of low-quality wheat.

The region ranks second in walnut production and fourth in grape production. Shida Kartli ranks second in terms of areas under vegetables, and first in terms of areas under beans (see Appendix 2, Figures 6 and 7). Shida Kartli has traditionally been one of the large vegetable producers after Kvemo Kartli and Kakheti. It produces the following vegetables: potatoes, beetroot, cabbage, carrots, onions, garlic, asparagus, pepper, aubergine, etc. Suitable agricultural and climatic conditions and favourable soil, including a large area of irrigable lands, create great potential for the development of this sector of agriculture. Due to the limited number of greenhouses and their low profitability, supplies of vegetables to the domestic market in winter are not sufficient and have to be supplemented through imports.

Livestock

There is a different situation in the livestock sector as the region does not play a leading role almost in all the categories of this sector. Compared to other regions, livestock and meat production are not a priority area in Shida Kartli which ranks fifth, sixth, or seventh in this sector.

The region is behind Imereti, Samegrelo-Zemo Svaneti, and Kvemo Kartli in pork production but retains the sixth position in the production of all kinds of poultry and is fifth or sixth in the production of milk. The same situation is in the production of cow and buffalo milk and eggs.

Shida Kartli's potential in the livestock sector is realisable, including in highland areas where the soil is not used for cultivation. The development of road infrastructure might open up opportunities for the development of cattle farming.

5.1.3 Brief Information on Municipalities

5.1.3.1 Kareli Municipality

Located in the central part of Georgia on the Shida Kartli plain. The municipality is bordered on the east by Gori, on the west by Khashuri, and on the south by Borjomi. Area of the municipality – 687.9 sq.km; Population – 41 316 people. Kareli municipality includes one municipal center and 82 villages, which are united in 18 administrative units.

In total, 181 km of local roads are registered on the territory of the Kareli municipality, of which 41 km are paved with black asphalt, 101.6 km sand-gravels, and 45.5 km are unpaved. As can be seen, most of the roads (86%) are not paved. The gravel roads mostly run in the outskirts of the municipality and mostly connect the villages to each other. The international highway Tbilisi-Senaki-Leselidze passing through the territory of the municipality is completely asphalted. The total length of internal state roads in the territory of the municipality is 46.4 km, including asphalt concrete pavement – 14.1 km; sand-gravels – 23.3 km. Access roads to the project area are mainly covered with sand-gravels, which are well processed and do not cause problems as for heavy off-road vehicles, or light off-road vehicles.

The administrative center is Kareli, the administrative units are Urbnisi, Ruisi, Agara, Bebnisi, Kekhijvari, Khvedureti, Akhalsopeli, Mokhisi, Dvani, Zghuderi, Bredza, Ftsa, Dirbi, Breti, Abisi, Avlevi, Giganti.

Main rivers: Mtkvari, Dzama, Western, Middle and Eastern Prone.

In Kareli municipality there are mainly fields with investment potential: processing industry and agriculture. Agara sugar factory and food industry enterprises are also located in Kareli municipality.

The leading fields of agriculture are: fruit growing, beet growing, horticulture, melon growing, animal husbandry and others.

The Transcaucasus Railway and the main highway pass here.

Important monuments of architecture and culture are located in Kareli: Mdzovreti Castle-Hall Complex, Samtsevrisi church, Kintsvisi Monastery, hundreds of functioning churches and monasteries, and historical villages Ruisi and Urbnisi. In the valley of the Dzama River, it is worth mentioning the monastic complexes of Kozifa, Orkhevi, Ortubani, and Dzadzvi. Also, the beautiful natural lake of Bateti is located 1,313 m above sea level.

In the gorge of the river Khvedurula, there is a so-called red stone waterfall, Trekhvi boilers, where the Leonti Mroveli stone cross, and Shota's spring were discovered.

Table 5-8 Census data of the Kareli Municipality

Year	Population
1989	50 428
2002	50 317 ▼
2014	41 316 ▼
2021	40 700 ▼

Density – 60.06 people per sq. km. The main settlement area is located at an altitude of 600-1000 meters above sea level. Ethnic composition: Georgians – 93.6%; Azeris – 2.7%; Ossetians – 2.3%; Armenians – 0.8%; Russians – 0.2%.

5.1.3.2 Villages of the Kareli municipality within the project area

Sagholasheni is located on the plain of Shida Kartli, on the left bank of the East Proni River, 650 meters above sea level, and 6 kilometers from Kareli. Georgians (99.8%)

Table 5-9 Population of the village Sagholasheni

Census year	Population	Men	Women
2002[3]	508	239	269
2014	▼ 452	234	218

Breti – community center (villages: Aradeti, Doghlauri, Sagholasheni, Tsveri) is located on the Shida Kartli plain, on the left bank of the Eastern Prone River; 710 meters above sea level, 9 kilometers from Kareli.

According to the 2014 census, 899 people live in the village; Georgians (98.7%), Ossetians (0.7%).

Table 5-10 Population of the village Breti

Census year	Population	Men	Women
2002	1146	585	561
2014	▼ 899	455	444

Dirbi (Community Centre) – is located on the Shida Kartli plain, on the right bank of the Eastern Prone River; 735 meters above sea level, 16 kilometers from Kareli.

According to the 2014 census, 2,569 people live in the village; Georgians (99.3%).

Table 5-11 Population of the village Dirbi

Census year	Population	Men	Women
2002	3028	1534	1494
2014	▼ 2569	1305	1264

Dzlevijvari – is located on the Shida Kartli plain, on the left side of the Eastern Prone river; 730 meters above sea level, 9 kilometers from Kareli. According to the 2014 census, 788 people live in the village. Georgians (99.6%).

Table 5-12 Population of the village Dzlevijvari

Census year	Population	Men	Women
2002	1378	691	687
2014	▼ 788	394	394

Ruisi – located on the Shida Kartli plain, on the left bank of the Mtkvari river, on the S1 highway, 670 meters above sea level, 7 kilometers from Kareli.

According to the 2014 census, 5,139 people live in the village; Georgians (99.5%).

Table 5-13 Population of the village Ruisi

Census year	Population	Men	Women
2002[2]	6032	2947	3085
2014	▼ 5139	2588	2551

Urbnisi — the community center is located on the left bank of Mtkvari river. 640 meters above sea level, 10 kilometers from Kareli.

According to the 2014 census, 1,109 people live in the village; Georgians (99.5%).

Table 5-14 Population of the village Urbnisi

Census year	Population	Men	Women
2002[2]	1334	668	666
2014	▼ 1109	537	572

Bebnisi is a village in Georgia, in the Kareli municipality of Shida Kartli district, the community center (villages: Apnisi, Gombori, Zemo Leteti, Kvemo Leteti). It is located on the Shida Kartli plain, on the left bank of the Mtkvari river. 640 meters above sea level, 2 kilometers from Kareli. There is a church of Theodore Tiron in the village. According to the 2014 census, 1,251 people live in the village.

Table 5-15 Population of the village Bebnisi

Census year	Population	Men	Women
2002	1327	660	667
2014	▼1251	618	633

Sasireti — is a village in Georgia, in the Kareli municipality of the Shida Kartli region, in the Giganti community. It is located on the plain of Shida Kartli. 710 meters above sea level. It is 10 kilometers away from Kareli

Table 5-16 Population of the village Sasireti

Census year	Population	Men	Women
2002	370	177	193
2014	304	164	140

5.1.3.3 Gori Municipality

Gori municipality is located in the central part of eastern Georgia. It is bordered by the territory occupied by the Russian Federation (Tskhinvali region) – South Ossetia administrative district to the north, and by the municipalities of Kaspi to the east, Borjomi and Tsalka to the south, and Kareli to the west. The area of Gori municipality is 2, 327 sq. km and the population is 121,100 people.

The administrative center of the municipality is the city of Gori. Administrative units have been created in order to optimize the management of the settlements included in the self-governing unit and provide public services to the population. The administrative units of Gori municipality are Berbuki, Karaleti, Shavshvebi, Mejvriskhevi, Mereti, Skra, Tirdznisi, Tinishkhidi, Variani, Kvakhvreli, Shindisi, Dzevera, Zeghduleti, Akhalubani, Ateni, Nikozi, Mghebriani, Saqavre, Boshuri, Tkviavi, and Khidistavi administrative units.

In the northern part of the district's territory there are located the Gori Plain (approximately 39.7% of the territory, 745 m above sea level) and the vast terraced plains of the bottom of the Middle Mtkvari Valley; the northern slope of the Trialeti ridge, Kvernaki ridge (with the most elevated point of 879 m above sea level) and part of the foothills of the Trialeti ridge in the southern part.

The municipality includes 1 city (Gori), 21 rural communities (Ateni, Akhalubani, Berbuki, Boshuri, Dici, Variani, Zeghduleti, Karaleti, Mereti, Mejvriskhevi, Mghebriani, Nikozi, Saqavre, Skra, Tinishkhidi, Tirdznisi, Tkviavi, Kvakhvreli, Shavshvebi, Shindisi, Dzevera) and one central village (Khidistavi).

The main rivers are: Mtkvari, Liakhvi, Tana, Patara Liakhvi, Mejuda, Tedzami.

Table 5-17 Gori municipality population by years

Year	Population
1989	▲ 149 759
2002	▼ 131,400
2014	▼ 125,900
2020	▼ 121,100

According to the 2014 general census, Georgians (96.9%) make up the majority of the population of Gori Municipality (excluding the city of Gori), Ossetians (1.5%), Armenians (0.6%), others (1.0%) also live there. The city of Gori is inhabited by Georgians (95.6%), Armenians (1.7%), Ossetians (1.2%), others (1.5%).

The majority of the population is Orthodox (97.7% in the city of Gori, 97.1% in the villages), followed by Jehovah's Witnesses (0.9% and 1.2%) and others (1.4% and 1.7%).

The leading branches of agriculture are fruit growing, horticulture, and melon growing. There are local varieties of sparkling wine grapes and a wide variety of fruits and berries. Cereal crops – winter wheat and maize. Animal husbandry is developed.

There are many historical and cultural monuments in the Gori district. Especially noteworthy are the rock-hewn ancient settlement Uplistsikhe (Age of Antiquity – Late Middle Ages), Ateni Sioni Temple (VII century) and others.

Agriculture is diversified. Branches of specialization – horticulture, olericulture, viticulture, animal husbandry. The major source of income for the population is fruit-growing (mainly apples). The local fruits are distinguished by sugar content, aromatic quality, and transportability. Viticulture is developed, and varieties of sparkling wine grapes are common. Winter wheat, feeder greens, etc. occupy an important place in the cropland. They grow legumes, mainly beans. Animal husbandry is developed, in particular, cattle breeding, and poultry farming; engaged in beekeeping.

Manufacturing is relatively underdeveloped, mainly represented by enterprises in the food industry. Canneries, wineries, as well as construction materials production, and small local industries are represented in Berbuki, Shindisi and Kvarkhiti. On the territory of the municipality, there is a low-power Tiriphon hydroelectric power plant (built on the slope of the Tiriphon irrigation canal).

Food industry enterprises (cereal products, wine, soft drinks, canning) operate in the city of Gori.

In the Liakhvi valley, in the vicinity of the villages of Mereti and Tkviavi, there is lightweight aggregate concrete that is used in cement production; Diabase is mined in the valley of the river Vere, that is used for paving streets and as a material; Inert material – sand and gravel, which is used for various construction works, is extracted in the areas of Khidistavi, Tiniskhidi, Berbuki and Tedotsminda.

In the villages of Biisa and Gorijvari, there are healing mineral and balneological sulfuric waters.

The Transcaucasus Railway, the European route E60, and other highways pass through the territory of the municipality.

5.1.3.4 Villages of the Gori municipality within the project area

Sakasheti – Variani community. It is located on the plain of Shida Kartli. 710 meters above sea level, 18 kilometers from Gori. According to the 2014 census, 883 people live in the village; Georgians (98.8%) and Ossetians (1.2%).

Table 5-18 Population of the village Sakashetsi

Census year	Population	Men	Women
2002	1009	526	483
2014	▼ 883	452	431

Arashenda – (Variani community). It is located on the right bank of the Didi Liakhvi river. 690 meters above sea level, 11 kilometers from Gori. According to the 2014 census, 646 people live in the village; Georgians (98.6%) and Ossetians (0.6%).

Table 5-19 Population of the village Arashenda

Census year	Population	Men	Women
2002	681	345	336
2014	▼ 646	319	327

Variani is a village in eastern Georgia, in Gori municipality of Shida Kartli district, on the Shida Kartli plain, on the right bank of the Liakhvi river, on the Gori-Nikozi-Tskhinvali highway. Community center (villages: Arashenda, Akhaldaba, Sakasheti, Variani farming). 680 meters above sea level, 12 kilometers from Gori. According to the 2014 census, 1,469 people live in the village

Table 5-20 Population of the village Variani

Census year	Population	Men	Women
2002	1959	960	999
2014	▼1469	730	739

Varianis Meurneoba

Table 5-21 Population of the village Varianis Meurneoba

Census year	Population	Men	Women
2002			
2014	▼383		

Shinidisi – village in Eastern Georgia, in Gori Municipality of the Shida-Kartli District; Community Center. Village is located on the Shida Kartli plain, on the right bank of the Liakhvi river, 760m above sea level and 20km distance from Gori city. According to the 2014 census, 2,667 people live in the village

Table 5-22 Population of the village Shindisi (Gori Municipality)

Census year	Population	Men	Women
2002	3024	1493	1531
2014	2667	1342	1325

Sakasheti IDP Settlement - the IDP settlements of Shida Kartli, where 85 families live. Among many problems, the IDPs are most concerned about the fact that the agricultural plots allotted to them and used by them, have not yet been transferred to their ownership. The settlement is empty of young people. Due to the fact that Sakasheti is far from the municipal center and is not served by municipal transport, the most acute problem is unemployment. Residents of the IDP settlement work seasonally. They are mainly involved in physical labour. Movement problems make it difficult to access medical services, medicines, education, and educational institutions. There is no outpatient clinic or pharmacy in the settlement

5.1.4 Socio-Economic Profile of Villages in Project Area

A detailed description of the villages within the Project area is presented in the chapter. The data on each village was collected in September 2022. The following research methodology was applied for data collection: a qualitative study (Focus Group Discussions and In-Depth interviews).

5.1.4.1 Accumulated Socio-Demographic of target villages in Kareli Municipality

Kareli Municipality is in the Shida Kartli region. The administrative center of the municipality is in the town of Kareli. The municipality consists of the town Kareli, small town Agara, and 16 administrative units (communities). Only six administrative units are within the Project area: Ruisi, Urbnisi, Dirbi, Giganti, Breti, and Bebnisi. The following villages are affected by the Project within the mentioned communities (administrative units): Ruisi, Urbnisi, Dirbi, Bretis Meurneoba, Sasireti, Dzlevijvari, Breti, Sagholasheni, and Bebnisi.

Table 5-23 below shows population statistics of the Project Affected villages according to the National Statistics Office of Georgia 2014 Census data. The table also shows updated data presented by the representatives of local government within the qualitative study in 2022. The updated statistics reveal the tendency of population increase in Kareli Municipality over the last eight years (about 31% increase).

Table 5-23 Number of Households and Individuals in the Project Affected Villages

Village	Number of Households by GeoStat 2014 Census data	Number of Households provided by Local Government in 2022	Number of Population by GeoStat 2014 Census data	Number of Population provided by Local Government in 2022
Ruisi	1442	2200	5139	7500
Urbnisi	318	420	1109	1130
Dirbi	770	1267	2569	3020
Bretis Meurneoba	165	177	422	629
Sasireti	97	146	304	469

Village	Number of Households by GeoStat 2014 Census data	Number of Households provided by Local Government in 2022	Number of Population by GeoStat 2014 Census data	Number of Population provided by Local Government in 2022
Dzlevijvari	218	321	788	1150
Breti	269	490	899	1038
Sagholasheni	108	203	452	513
Bebnisi	317	400	1251	1509
TOTAL	**3704**	**5624**	**12933**	**16958**

Table 5-24 below shows the distribution of the population by gender in target villages according to the National Statistics Office of Georgia 2014 Census data. According to the population statistics, the population is almost equally distributed by gender. Not all local governments of the Project affected villages could provide the distribution of the population by gender, thus, it did not allow us to compare the data.

Table 5-24 Share of Population 18+ in the Project Affected Villages by gender

Village	Men	Women
Ruisi	2588	2551
Urbnisi	537	572
Dirbi	1305	1264
Bretis Meurneoba	204	218
Sasireti	164	140
Dzlevijvari	394	394
Breti	455	444
Sagholasheni	234	218
Bebnisi	618	633
TOTAL Number	**6499**	**6434**
TOTAL Shares	**50.3%**	**49.7%**

Table 5-25 below represents the numbers of pensioners, internally displaced people, people with disabilities, and the number of households receiving social assistance in the target villages. The numbers are provided by the Social Service Agency. The total population statistics are also presented in the table for a better understanding of the shares of vulnerable groups. The data reveals that socially vulnerable people (individuals receiving state social assistance) make the largest vulnerable group and represent about 23% of the population in the Project-affected villages. The largest share of socially vulnerable people is in the village Dirbi according to the provided statistics (39%).

Table 5-25 Number of Pensioners, IDPs, People with Disabilities, and Households receiving state social assistance in the Project Affected Villages in 2022

Village	Number of Pensioners provided by Social Service Agency	Number of IDPs provided by Social Service Agency	Number of People with Disabilities provided by Social Service Agency	Number of individuals receiving social assistance provided by Social Service Agency	Number of Population provided by Local Government
Ruisi	989	12	151	1296	7500
Urbnisi	213	1	35	232	1130
Dirbi	465	10	97	1181	3020
Bretis Meurneoba	64	108	15	193	629
Sasireti	68	0	7	93	469
Dzlevijvari	135	5	17	188	1150
Breti	230	40	56	191	1038
Sagholasheni	51	12	7	108	513
Bebnisi	207	24	52	368	1509
TOTAL Number	**2422**	**212**	**437**	**3850**	
TOTAL Shares	**14%**	**1%**	**3%**	**23%**	

5.1.4.2 Snapshots of Villages in Kareli Municipality

5.1.4.2.1.1 Snapshot of Village Bebnisi

An administrative Unit Bebnisi consists of the following villages: Bebnisi, Apnisi, and Leteti. Only Bebnisi is affected by the Project.

Location

Village terrain can be characterized as low land according to the respondents. The first time the village was mentioned was in 1609 in historic documents. Probably the village was founded earlier. Common surnames in the village are Ardemanashvili, Eliashvili, Berikashvili, Simonishvili, Imerlishvili, Shoshiashvili, Geliashvili, and Khorbaladze.

Demography

According to the representatives of the local government, the population of village Bebnisi is 400 households which make up about 1509 persons (930 electorates), out of which 51% are male and 49% are female. The largest age cohort among the population is people aged 18-65 (47%). It should be noted that children make up 38% of the whole population. According to the respondents, the population has increased over the last ten years (since 2012). However, seasonal migration for employment is common as well.

Ethnicity, Religion, and Language

The village itself mainly consists of Georgians (91%), with Georgian as the main language. However, there are about 20 households of Osetians, 12 households of Armenians, two households of Ukrainians, two households of Greek, and one household of Russians. The leading religion in the village is Georgian Orthodox. There are two churches and two cemeteries in Bebnisi itself. There are St. Teodore Tironi church and St. Nikoloz church.

The most celebrated holiday is “Teodoroba” (St. Teodore Tironi day) in February in the village.

Land Use

In terms of the usage of the land resources, according to the respondents, the population quite often uses the land for annual crops (all kinds of vegetables and grains, even melons) and perennials (fruit: apples, pears, plums, cherries, grapes). The Crops and fruit are cultivated for household usage as well as for commercial purposes. The land is processed mostly by agricultural machinery. 90% of the population is involved in agricultural production and the vast majority of them (95%) sell their production.

According to the local government, the village covers 822 ha, 374 ha of which are processed for agricultural production, 163 ha are used for perennial crops, 50 ha are state pastures and 104 ha are used for residential purposes. In total 641 ha are in private procession in Bebnisi. The municipality itself owns two cemeteries (6.5 ha), two stadiums, a park with training equipment, a house for rituals, a kindergarten, administrative building (there is a day center for disabled children on the ground floor of the administrative building financed by the municipality: Well-being and Development Centre “Kareli Kindness Ray”).

Housing and Utility Infrastructure

Houses in Bebnisi are mainly constructed in the Soviet Union times, around the 1950s. The houses are mostly two floors and are built with stone and blocks making up to 100-200 m2 on average. The state of the houses is assessed as normal. There are up to five houses in the village which are in poor condition according to the local municipality. None of the houses are abandoned at the moment. The population tries to do minor refurbishments of the houses annually (70%). Full renovation of the house is rare and makes about ten percent. There are two blocks of houses in the village.

The main electricity supplier for Bebnisi is “ENERGO-PRO Georgia.” According to the respondents, they have a 24-hour supply of electricity and the quality of the electricity is satisfactory. However, some study respondents (local population) complained about the service provided by ENERGO-PRO saying they do not respond on time and provide adequate repair services (for example, if the electricity post requires replacement or repair).

According to the respondents and the representatives of the local government Bebnisi population has piped gas supply in their houses. The gas provider is “SOCAR Georgia Petroleum”.

Only 10% of Bebnisi population has a centralized water supply. The municipality is responsible to provide assistance in case of any damage to the water system. Most of the population gets water supply from wells by electricity pumps. The water quality and supply are sufficient, however, there are problems during the summer season as most residents use potable water for watering agricultural production and it creates a deficit. There is no sewer system in the community.

Communications

The absolute majority of households living in Bebnisi have cellular phones (almost 100%). There are fixed broadband internet connections in the village provided by Magti and Silknet. 90% of the population uses the internet.

The street lights are available on every street of Bebnisi.

Transport and Roads

In terms of public transport, buses/minibuses do not provide services within the settlement, they are available at Kareli central road which is in one km from the village. Various mini-buses from Tbilisi are available there: Tbilisi-Kareli, Tbilisi-Kikhijvari, Tbilisi-Zghuderi, Tbilisi-Khedureti, Tbilisi-Kintsvisi. The price to travel to Tbilisi makes 7 GEL. There is also mini-bus Gori-Kareli and it costs 2 GEL to travel to Gori.

The road leading to the village is the central road which is asphalted and is in very good condition. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are partly asphalted roads. The other part is a ground road gravelled. They are gravelled once every 4-5 years. The condition of the inner roads in the settlement can be rated as normal. Light and heavy transport can move freely on the roads within the settlement during the whole year.

Employment

According to the representative of the local government, only 30% of the population is permanently employed in the village. They are mainly employed in state services (local government, law enforcement services, educational institutions, medical units, a hospital, and local businesses). As was mentioned above the vast majority of the population is involved in agricultural activities for commercial purposes. They sell their agricultural products and/or are working as temporary workers on the farms. Daily reimbursement on the farms is 50 GEL. Agricultural business is seasonal.

The majority of households in Bebnisi depend on income from agricultural production. The main crops cultivated in the village are all kinds of vegetables, melons, grains, and fruit. Cattle breeding is mainly for household usage.

The local population mainly spends money on agricultural production (50%). 50% of households are said to own vehicles and 10% agro-machinery.

Social Infrastructure

As was already mentioned above almost all residents in Bebnisi sell their agricultural production. The most common agricultural markets to sell products for locals are Kutaisi, Zugdidi, Batumi, and Tbilisi. Kutaisi is the nearest of all (120 km) and it takes about one hour and 40 minutes to travel there (Tbilisi is a bit closer but the western markets in Georgia are more popular in the village), while it takes up to three hours to travel to Zugdidi and Batumi. Locals mainly drive to the agricultural markets to sell products in their vehicles or hire mini-vans.

Bebnisi residents purchase food in local markets (two markets) or in the agricultural market at the municipal center, Kareli (1 km from the village). Locals go shopping for household supplies/industrial produce and clothes in Gori which is about 23 km from the village.

Industry and Construction

According to the respondents, there are seven trout fish farms, two pond fish farms, and one enterprise producing plastic boxes for carrying agricultural products. There is one bakery, an auto wash, a car repair, a pharmacy, a hospital (central hospital of Kareli with 15 wards), and a beer bar. There is a Gulf petrol station next to the village as well.

About 5-6 new buildings have been built in the village in recent years.

Socially Vulnerable People

According to the Social Service Agency, 52 IDPs are living in the village, while the number of socially vulnerable individuals who get state assistance is reported to be about 368 (24% of the population). There are up to 207 pensioners in Bebnisi. There are about 24 people with disabilities and six war veterans in Bebnisi.

Savings and Credits

It is very rare for the Bebnisi population to invest their savings. There may be only a few families, who can have savings and, in this case, purchasing agricultural land or equipment is more common.

The most popular practice of borrowing a considerable amount of money is from banks or microcredit organizations. Borrowing from relatives/friends is quite rare.

There are no financial institutions in the village itself. Liberty Bank representatives arrive twice per month and bring pensions for local pensioners and social assistance for socially vulnerable people. They also provide other bank services on those days. There is one pay box in the local market which is mostly out of order. Locals can get bank services in Kareli which is one km from the village.

Education

There is one public school within the settlement in Bebnisi (the longest way to school takes 40 minutes and no transportation is provided by the school itself. Crossing the central road and passing the next of two artificial lakes make be dangerous for children. Probably the school should consider providing transportation). 222 schoolchildren study there at the moment (110 girls and 112 boys). There are 28 teachers available at schools. According to the school principal number of schoolchildren has increased in the last ten years at their school.

There is a kindergarten in Bebnisi as well (the same distance from the village as the school and no transportation is available). There are 60 children registered there (33 girls and 27 boys). There are three teachers working there.

According to the respondents and the local government, about 40t young adults living in the settlement are receiving higher education at the moment. Most of the students are receiving higher education in Tbilisi. Vocational education is not popular in the municipality.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 15 minutes. The ambulance arrives from Kareli. There is one pharmacy currently functioning in the settlement. There is also one medical unit with one doctor and one nurse in Bebnisi. They are in the newly repaired building next to the hospital. According to the local nurse, they get patients three times per week. Bebnisi Medical Unit provides healthcare for Bebnisi, Leteti, and Apnisi. They are equipped with basic equipment and medicine.

In terms of different health issues in the community, cardiovascular diseases, as well as high blood pressure, is among the most common problems.

There is a private hospital with 15 wards in Bebnisi called Kareli Central Hospital. The hospital was a Covid-19 center during the pandemic.

Programs Implemented in the Settlement

Besides the local village programs which finance the repair of local infrastructure (local roads and water pipes), respondents could recall only two projects. Bebnisi school was repaired getting funding from USAID and Bebnisi kindergarten was repaired by Kareli municipality.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Bebnisi in recent years, respondents named drought (2022), frost, and hail (all previous years). A hurricane also took place in Bebnisi. According to the representative of the local government, almost everybody was affected by the above-mentioned natural disasters (agricultural products), especially drought and frost.

Overall, in terms of pollution, respondents believe that air quality in the settlement, as well as the roads, are somehow contaminated.

There are litter bins available in the village and they are taken away by the special municipal service two times per week.

Tourism

There are no guesthouses available in the village. Tourism is not developed in the settlement, however, there is some sightseeing there: St. Teodore Tironi Church and "Shota Spring" – the place next to the lake.

5.1.4.2.1.2 Snapshot of Village Ruisi

An administrative Unit Ruisi consists of only one village Ruisi.

Location

Village terrain can be characterized as low land according to the respondents. The village was presumably founded earlier than the VIII century. Common surnames in the village are Baliashvili, Ghviniashvili, Kutkhashvili, Namestsarashvili, Mghebrishvili, Razmiashvili, Nanetashvili, Egnatashvili, and Vardzelashvili.

Demography

According to the representatives of the local government, the population of village Ruisi is 2200 households. 2200 households make up about 7500 persons. Since Census 2014, the population in the village has increased (households: 1442, population: 5139). However, seasonal migration for employment is common as well.

Unfortunately, the local government does not have updated statistics on the population by gender and age. According to the Census 2014, the shares of male and female residents in the village were almost equal (male: 50%, female: 50%).

Ethnicity, Religion, and Language

The village itself mainly consists of Georgians (97%), with Georgian as the main language. However, there are about a few Osetians in the village. The leading religion in the village is Georgian Orthodox. There are five churches and four cemeteries in Ruisi itself. There are Peritsvaleba Cathedral church, Kviratskhovloba church, St Kvirike, and Ivlita church, St Demetre church, The Ruisi cathedral of the Mother of God, and St Marine church. The Ruisi cathedral of the Mother of God was built in the VIII-IX centuries. Ruisi Peritsvaleba church was also built in the VII-IX centuries.

The most celebrated holiday is “Peritsvaleba” (it is often called “Dgheoba” in Ruisi) on August 19 in the village.

Land Use

In terms of the usage of the land resources, according to the respondents, the population quite often uses the land for annual crops (barley, wheat, tomatoes, cabbage, pepper) and perennials (fruit: apples, plums). The Crops and fruit are cultivated for household usage as well as for commercial purposes. The land is processed mostly by technique. 95% of the population is involved in agricultural production and almost all of them sell their products.

According to the local government, the village covers about 4444 ha, 4000 ha of which is processed for agricultural production, and 444 ha is used for residential purposes. The municipality itself owns four cemeteries, three stadiums, three outdoor spaces with training equipment, three kindergartens, and a medical unit.

Housing and Utility Infrastructure

Houses in Ruisi are mainly constructed in the Soviet Union times, around the 1950s. The houses are mostly two floors and are built with stone and blocks making up to 150-200 m2 on average. The state of the houses is assessed as normal. About 2% of the houses are abandoned at the moment. The population tries to do minor refurbishments of the houses annually (40%). Full renovation of the house is rare and makes about five percent.

The main electricity supplier for Ruisi is “ENERGO-PRO Georgia.” According to the respondents, they have a 24-hour supply of electricity and the quality of the electricity is satisfactory.

According to the respondents and the representatives of the local government Ruisi population has piped gas supply in their houses. The gas provider is “SOCAR Georgia Petroleum”.

According to the representatives of the local government, 100% of the Ruisi population gets water supply from private wells. There is no sewer system in the community.

Communications

The absolute majority of households living in Ruisi have cellular phones (90%). There are fixed broadband internet connections in the village provided by Magti and 90% of the population uses the internet.

Street lights are available on every street in Ruisi.

Transport and Roads

In terms of public transport, minibuses provide services within the settlement in various directions. There is a minibus to Gori (the regional center) available four times a day and it costs 2 GEL to travel to Gori.

Minibus from Gori to Kareli (municipal center) is available every hour through the settlement and it costs 1.50 GEL. The minibus to Tbilisi travels three times per day and costs 5 GEL.

The road leading to the village is the central road which is asphalted and is in very good condition. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are fully asphalted as well. The condition of the inner roads in the settlement can be rated as very good. Light and heavy transport can move freely on the roads within the settlement during the whole year.

Employment

According to the representative of the local government, only 30% of the population is permanently employed in the village. They are mainly employed in state services (local government, law enforcement services, educational institutions, medical units, and local businesses). As was mentioned above the vast majority of the population is involved in agricultural activities for commercial purposes. They sell their agricultural products and/or are working as temporary workers on the farms. Daily reimbursement on the farms is 50 GEL. Agricultural business is seasonal.

The majority of households in Ruisi depend on income from agricultural production. The main crops cultivated in the village are all kinds of vegetables, grains, and fruit. Cattle breeding is mainly for household usage.

The local population mainly spends money on agricultural production (60%). 90% of households are said to own vehicles and 60% agro-machinery.

Social Infrastructure

As was already mentioned above almost all residents in Ruisi sell their agricultural production. The most common agricultural markets to sell products for locals are Gori, Kutaisi, and Tbilisi. Gori is the nearest of all (20 km) and it takes about 25 minutes to travel there, while it takes up to two and a half hours to travel to Kutaisi and one hour and a half to get to Tbilisi. Locals mainly drive to the agricultural markets to sell products in their vehicles or hire mini-vans.

Ruisi residents purchase food in local markets (eight small markets, two agricultural markets, and four big network markets: Magniti, Daily, 2 Nabiji, Express Network) or in the agricultural market at the regional center, Gori (20 km from the village). Locals go shopping for household supplies/industrial produce and clothes in Gori which is about 20 km from the village.

Industry and Construction

According to the respondents, there is one big fish farm, two car wash services, three pharmacies, one medical unit, and a branch of Liberty Bank in the village.

About 1 or 2 new buildings have been built in the village in recent years. The construction of the business center is ongoing.

Socially Vulnerable People

According to the Social Service Agency, 12 IDPs are living in the village, while the number of socially vulnerable individuals who get state assistance is reported to be about 1296 (17% of the population). There are up to 989 pensioners in Ruisi and 151 people with disabilities.

Savings and Credits

It is very rare for the Ruisi population to invest their savings. There may be only a few families, who can have savings and, in this case, purchasing agricultural land or equipment is more common.

The most popular practice of borrowing a considerable amount of money is from banks or microcredit organizations. Borrowing from relatives/friends is quite rare.

There is Liberty Bank in the village itself and local residents can get bank services there or go to the municipal or regional centers (Kareli and Gori). There is one ATM and seven pay boxes in Ruisi as well.

Education

There are three public schools in three different districts of Ruisi. Over two hundred pupils study in each school with over twenty teachers there. In total there are 714 schoolchildren are taught in Ruisi schools by 81 teachers there. According to the school principals, the number of schoolchildren has increased in the last ten years at their school.

There are three kindergartens in Ruisi as well. There are 162 children registered there. In total nine teachers work in the three kindergartens in Ruisi.

According to the respondents and the local government, about 110 young adults living in the settlement are receiving higher education at the moment. Most of the students are receiving higher education in Tbilisi. Vocational education is not popular in the municipality.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 40 minutes. The ambulance arrives from Kareli or Gori. There are three pharmacies and one medical unit currently functioning in the settlement. There is also one medical unit with two doctors and two nurses in Ruisi. They are in the newly repaired building next to the public register building. According to the local nurse, they get up to 15 patients a day. They are equipped with basic equipment and medicine.

In terms of different health issues in the community, cardiovascular diseases, as well as high blood pressure and diabetes, is among the most common problems.

Programs Implemented in the Settlement

Besides the local village programs which finance the repair of local infrastructure (local roads and water pipes), respondents could recall only two projects. Three stadiums and training equipment outdoor spaces were built by Kareli municipality.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Ruisi in recent years, respondents named drought (2022), frost, and hail (all previous years). According to the representative of the local government, almost everybody was affected by the above-mentioned natural disasters (agricultural products), especially drought and hail.

Overall, in terms of pollution, respondents believe that the air quality in the settlement is somehow contaminated, however, local roads are maintained clean.

There are litter bins available in every district of the village and they are taken away by the special municipal service once per week.

Tourism

There are no guesthouses available in the village. Tourism is not developed in the settlement.

5.1.4.2.1.3 Snapshot of Village Breti

An administrative unit Breti consists of the following villages: Breti, Sagholasheni, Aradeti, Doghlauri, Tsveri. Only Breti and Sagholasheni are affected by the Project.

Location

Village terrain can be characterized as low land according to the respondents. The village was founded before the VI century. Monks ("Beri" in Georgian) used to live here and the name of the village also originated from them (a place of "Berebi"). There are 62 surnames in Breti. Common surnames in the village are Edilashvili, Tediashvili, and Japiashvili.

Demography

According to the representatives of the local government, the population of village Breti consists of 490 households which make up about 1038 persons, out of which 46% are male and 54% are female. It should be noted that there are 35 children aged 0-6 and 90 children aged 7-17. Since Census 2014, the population in the village has increased, however, seasonal migration for employment is common as well.

Ethnicity, Religion, and Language

The absolute majority of the population are Georgians, with Georgian as the main language of the village. The leading religion in the village is Georgian Orthodox. There are two churches and two cemeteries in Breti itself. There is a VI century church and the second is under construction.

The most celebrated holiday is "Mariamoba" (St. Mary's day) in August and "Mama Pirosoba" (St. Pirosi day) on 28 May in the village.

Land Use

In terms of the usage of the land resources, according to the respondents, the population quite often uses the land for perennials and annual crops. All kinds of vegetables and grains (beans, barley, wheat, corn), as well as fruits (apple, peach, pear, grapes, prunes, melons, watermelons), were named. The crops and fruit are cultivated for household usage as well as for commercial purposes. The land is processed manually, as well as by agricultural machinery. 98% of the population is involved in agriculture.

According to the local government the village covers 880 ha, 690 ha is for agricultural purposes, 50 ha are pastures and 140 ha is used for residential purposes. The municipality itself owns a house of culture (leisure center), a medical unit, an administrative building, a kindergarten, 3 stadiums, 2 cemeteries (4ha), a bus stop area, an old building of the ministry of internal affairs, a park (1000 m2).

Housing and Utility Infrastructure

Houses in Breti are mainly constructed in the Soviet Union times, around the 1940s. The houses are mostly two floors and are built with stone and blocks making up to 150-200 m2 on average. According to the respondent, 80% of houses require refurbishments. Residents often do minor refurbishments of the houses but major reconstruction is not common. There are 10 houses in the village that are in poor condition according to the local municipality. None of the houses are abandoned at the moment.

The main electricity supplier for Breti is “ENERGO-PRO Georgia.” According to the respondents, they have a 24-hour supply of electricity. However, the service provided by ENERGO-PRO was evaluated as more or less satisfactory by some respondents.

According to the respondents and the representatives of the local government Breti population has piped gas supply in their houses. The gas provider is “SOCAR Georgia Petroleum”. However, for heating in winter locals mostly use either wood or gas. The price of 1 car full of wood (6 m3) is 900 GEL and it may not be enough for the whole season.

100% of Breti population has a centralized water supply. The municipality is responsible to provide assistance in case of any damage to the water system. The water quality and supply are sufficient. However, there are some problems during the summer season. There is no sewer system in the community.

Communications

The absolute majority of households living in Breti have cellular phones (100%). There are fixed broadband internet connections in the village provided by Trialeti Net (SkyTel), internet plates, and wireless internet.

Transport and Roads

In terms of public transport, buses/minibuses do not provide services within the settlement or directly from the settlement. There are various private mini-buses available for the following routes: Dirbi – Tbilisi, once a day and the price is 5 GEL; Dvani – Kareli twice a day and the price is 2 GEL; and buses for the following routes: Dirbi – Kareli, 3-4 times a day and it costs 2 GEL; Dirbi-Gori twice a day and the price is 2 GEL.

The road leading to the village is asphalted and is in a good condition. The last time it was repaired was in 2014. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are gravelled. The last time they were gravelled in 2021. However, the condition of the inner roads in the settlement can be rated as poor.

Employment

According to the representative of the local government, 50% of the population is permanently employed in the village. They are mainly employed in state services, local businesses (local markets, a cold storage warehouse that has 200 employees, a local pharmacy founded by the church which is also selling natural products) and in agriculture. As was mentioned above the vast majority of the population is involved in agricultural activities for commercial purposes. They sell their agricultural products and/or are working as temporary workers on the farms. Daily reimbursement on the farms is 40 GEL. Agricultural business is seasonal.

The local population mainly spends money on agricultural production (80%). 60% of households are said to own vehicles and 40% agro-machinery.

Social Infrastructure

As was already mentioned above a large portion of residents in Breti sell their agricultural production. The most common agricultural markets to sell products for locals are Khashuri, Gori, and Tbilisi. Gori is the nearest of all (25km) and it takes about 20 minutes to travel there. Similarly, Khashuri is 30km away and it takes about 30 minutes. Tbilisi is the furthest of all (100km) and it takes about 1 hour and 30 minutes to travel to Tbilisi. As it was specified, “Navtlughi” agricultural market is the most common in case of Tbilisi. Locals mainly drive to the agricultural markets to sell products in their vehicles or hire mini-vans.

Bretu residents purchase food in local markets or in the agricultural market at the municipal center. Locals go shopping for household supplies/industrial products and clothes in the agricultural market at the municipal center, in the agricultural market at the regional center, or in Khashuri.

Industry and Construction

According to the respondents, there are 4 local markets, 1 cold storage warehouse, 1 local pharmacy founded by the church which is also selling natural cosmetic products, and 1 medical unit.

About 5 new buildings have been built in the village in recent years and all of them are residential houses.

Socially Vulnerable People

According to the Social Service Agency, 40 IDPs are living in the village, while the number of socially vulnerable individuals who get state assistance is reported to be about 191 (18% of the population). There are up to 230 pensioners in Breti and 56 people with disabilities.

Savings and Credits

It is rare for the Breti population to invest their savings. There may be only a few families, who can have savings and, in this case, purchasing agricultural land, cattle, or equipment is more common.

The most popular practice of borrowing a considerable amount of money is from banks. Respondents mostly name CREDO bank, TBC bank, and Bank of Georgia.

There are no financial institutions in the village itself. Liberty Bank representatives arrive twice per month and bring pensions for local pensioners and social assistance for socially vulnerable people. There are 3-4 pay boxes in the village. Locals can get bank services in Kareli.

Education

There is one school within the settlement in Breti. On average, it takes about 10 minutes to go to school. 82 schoolchildren study there at the moment. There are 25 teachers available at schools. According to the respondent, the number of pupils has decreased in the last ten years at their school.

There is one kindergarten in Breti as well (at about the same distance as the school). There are 35 children registered there. There are two teachers working at the moment. According to the respondent, the number of children has decreased in the last ten years at their kindergarten.

According to the respondents and the local government, about 10-15 young adults living in the settlement are receiving higher education at the moment. Most of the students are receiving higher education in Tbilisi and Gori. Vocational education is not popular in the municipality and currently, there is no one receiving this type of education.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 20 minutes. The ambulance arrives from Kareli. There is one medical unit with three people working there in Breti. Breti Medical Unit provides healthcare for 5 villages of Breti. There is one pharmacy currently functioning in the settlement.

In terms of different health issues, most locals refer to the medical unit for vaccinating children.

Programs Implemented in the Settlement

The respondents recalled the following programs implemented over the last years in their village: street lights, graveling of roads, construction of a park, construction of a stadium, a music studio, a medical unit, a kindergarten, all implemented by the municipality. Moreover, the reconstruction of water systems and drainage canals was mentioned to be implemented by the village program.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Breti in recent years, respondents named drought, hail, and frost. Drought affected about 10% of locals, hail – 40%, and frost- 10%.

Overall, in terms of pollution, respondents believe that air quality in the settlement, as well as the roads, are somehow contaminated.

There are litter bins available in the village and they are taken away by the special municipal service once or twice per week. The number of litter bins is increasing each year.

Tourism

Tourism is not developed in the settlement, however, there are memorials of the Patriotic War and April 9th.

5.1.4.2.1.4 Snapshot of Village Bretis Meurneoba

An administrative unit Giganti consists of villages Bretis meurneoba, Sasireti, and Dzlevijvari.

Location

Village terrain can be characterized as low land according to the respondents. Common surnames in the village are Beruashvili, Tkhelidze, Khabareli, Meskhi.

Demography

According to the representatives of the local government, the population of village Bretis Meurneoba is 177 households which make up about 629 persons, out of which 57% are male and 43% are female. The largest age cohort among the population is people aged 31-60 (32%). It should be noted that children (0-17) make up 27% of the whole population. Since Census 2014, the population in the village has increased, however, seasonal migration for employment is common as well.

Ethnicity, Religion, and Language

The village itself mainly consists of Georgians with Georgian as the main language of the village. The leading religion in the village is Georgian Orthodox. There is one church – St. George church. There is one cemetery in the village.

The most celebrated holiday is “Giorgoba” (St. George day) on 23 November.

Land Use

In terms of the usage of the land resources, according to the respondents, the population quite often uses the land for annual crops (ex: tomatoes, cabbage, bell peppers, and grains) and perennials (fruit: cherry, apple). Beekeeping is also common. The Crops and fruit are cultivated for household usage as well as for commercial purposes. The land is processed mostly by agricultural machinery. 95% of the population is involved in agricultural production.

According to the local government, the village covers 1135 ha, 535 ha of which is processed for agricultural production, and 600 ha is used for residential purposes. The municipality itself owns a kindergarten, 2 stadiums, a training facility/playground, 2 bus stop areas, an administrative building, a house of culture, cemetery.

Housing and Utility Infrastructure

Houses in Bretis Meurneoba are mainly constructed in the Soviet Union times, around the 1950s. The houses are mostly two floors and are built with stone and blocks making up to 100-200 m2 on average. The state of the houses is assessed as normal. There are also 18 wood houses which used to be built for the employees of agriculture, however, now they are property of private persons. There are no houses in particularly poor condition according to the local municipality. None of the houses are abandoned at the moment. About 20% of the population refurbishments of houses over the last two years. There are 16 blocks of houses in the village.

The main electricity supplier for Bretis Meurneoba is “ENERGO-PRO Georgia.” According to the respondents, they have a 24-hour supply of electricity.

According to the respondents and the representatives of the local government, Bretis Meurneoba population has piped gas supply in their houses. The gas provider is “SOCAR Georgia Petroleum”.

There is a centralized water supply in the village. The municipality is responsible to provide assistance in case of any damage to the water system. There are some problems during the summer season. There is no sewer system in the community.

Communications

The vast majority of households living in Bretis Meurneoba have cellular phones (90%). There are fixed broadband internet connections in the village provided by Magti, Trialeti Net, City Net.

The street lights are available on every street of Bretis Meurneoba.

Transport and Roads

In terms of transport, minibuses provide services from the settlement to the municipal center. It commutes once a day; the travel takes about 15 minutes and costs 2 GEL. However, direct transport from the settlement to the regional center is not available.

The road leading to the village is asphalted and it is in very good condition. The last time it was repaired was in 2018. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are gravelled. The condition of the inner roads in the settlement can be rated as normal. Light and heavy transport can move freely on the roads within the settlement during the whole year.

Employment

According to the representative of the local government, only 10% of the population is permanently employed in the village. They are mainly employed in state services and local businesses (local markets, an enterprise producing plastic). As was mentioned above the vast majority of the population is involved in agriculture. They sell their agricultural products and/or are working as temporary workers on the farms. Daily reimbursement on the farms is 40 GEL. However, agricultural business is seasonal.

The local population mainly spends money on food (50%). 40% of households are said to own vehicles and 10% agro-machinery.

Social Infrastructure

As was already mentioned above almost all residents in Bretis Meurneoba sell their agricultural production. The most common agricultural markets to sell products for locals are Gori, Tbilisi, Kutaisi, Khashuri. Gori and Khashuri are the nearest of all (30km and 35km, respectively) and it takes about 30 minutes to travel there. Tbilisi is 100km away and it takes about 1 hour and 30 minutes, while Kutaisi is the furthest (135km) and 2 hours and 20 minutes are needed to travel to Kutaisi. Locals mainly drive to the agricultural markets to sell products in their vehicles or hire mini-vans.

Bretis Meurneoba residents purchase food in local markets or in the agricultural market at the municipal or regional center. Locals go shopping for household supplies/industrial produce and clothes in a regional center, in Tbilisi or Khashuri.

Industry and Construction

According to the respondents, there are 2 local markets, 1 enterprise producing plastic, and the construction of one dried fruit enterprise is in process. There is also one medical unit in the village.

There have been no new buildings built in recent years.

Socially Vulnerable People

According to the Social Service Agency, 108 IDPs are living in the village, while the number of socially vulnerable individuals who get state assistance is reported to be about 193 (31% of the population). There are up to 64 pensioners in Bretis Meurneoba and 15 people with disabilities.

Savings and Credits

It is rare for the Bretis Meurneoba population to invest their savings. There may be only a few families, who can have savings and, in this case, purchasing agricultural land or equipment is more common.

The most popular practice of borrowing a considerable amount of money is from banks and such cases are frequent.

There are no financial institutions in the village itself. Locals can get bank services in Gori or Kareli. Liberty Bank representatives arrive twice per month and bring pensions for local pensioners. There is one pay box in the local market which is sometimes out of order.

Education

There is one public school within the settlement in Bretis Meurneoba and on average it takes 10 minutes to go to school. There are 120 schoolchildren (55 girls and 65 boys) at the moment and 24 teachers available. According to the respondent, the number has not changed considerably over the last ten years.

There is one kindergarten as well. There are 48 children registered there and 3 teachers are working at the moment. The number of children at the kindergarten has decreased as for example there were 89 children in 2015.

About 20 young people living in the settlement are currently receiving higher education. Vocational education is not popular in the village.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 10 minutes. There is one medical unit with two employees. The medical unit provides healthcare for villages Dzlevijvari, Sasireti, and Bretis Meurneoba.

In terms of different health issues in the community, vaccination, as well as high blood pressure and diabetes are among the most common issues because of which locals refer to the medical unit. As specified, about 10 people refer to the medical unit per day.

Programs Implemented in the Settlement

Residents could recall the following projects: training facility/playground, mini stadium and street lights implemented by the municipality, as well as repair of the cemetery in frames of village program. The latter is still in the process.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Bretis Meurneoba in recent years, respondents named drought, hail, and frost. Drought affected about 40% of locals, hail – 50%, and frost – 10%.

Overall, in terms of pollution, respondents believe that the air quality in the settlement, as well as the roads, are not contaminated.

There are litter bins available in the village and they are taken away by the special municipal service once per week. According to the respondents, the number of litter bins is enough at the moment.

Tourism

Tourism is not developed in the settlement.

5.1.4.2.1.5 Snapshot of Village Dzlevijvari

An administrative unit Giganti consists of villages Bretis Meurneoba, Sasireti, and Dzlevijvari.

Location

Village terrain can be characterized as low land according to the respondents. Common surnames in the village are Giunashvili, Chagelishvili, Meladze, and Sherazadishvili.

Demography

According to the representatives of the local government, the population of village Dzlevijvari is 321households which make up about 1150 persons, out of which 694 (60%) are male and 456 (40%) are female. The largest age cohort among the population is people aged 31-60 (43%). It should be noted that children (0-17) make up 22% of the whole population. Since Census 2014, the population in the village has increased, however, seasonal migration for employment is common as well.

Ethnicity, Religion, and Language

The village itself mainly consists of Georgians with Georgian as the main language of the village. The leading religion in the village is Georgian Orthodox. There is one Church “Sameba Church” and another one under construction. There are also two cemeteries in the village.

The most celebrated holiday is “Sameboba”, which is celebrated on the third day after Easter.

Land Use

In terms of the usage of land resources, according to the respondents, the population quite often uses the land for annual crops (vegetables and grains) and perennials (fruit: apples). Beekeeping is also common. The Crops and fruit are cultivated for household usage as well as for commercial purposes. The land is processed mostly by agricultural machinery. 95% of the population is involved in agricultural production.

According to the local government, the village covers 1550 ha, out of which 850 ha is used for agricultural production and 700 ha for residential purposes. The municipality itself owns two cemeteries, a mini stadium, a training facility/playground, an open stadium for wrestling, and two bus stop areas.

Housing and Utility Infrastructure

Houses in Dzkevijvari are mainly constructed in the Soviet Union times, around the 1950s. The houses are mostly two floors and are built with bricks and blocks making up to 100-200 m2 on average. The state of the houses is assessed as normal. There are no houses abandoned or in particularly poor condition. About 20% of the population did minor refurbishments of their houses over the last two years. There is also one block of houses in the village.

The main electricity supplier for Dzlevijvari is “ENERGO-PRO Georgia.” According to the respondents, they have a 24-hour supply of electricity and the quality of the electricity is satisfactory.

According to the respondents and the representatives of the local government Dzlevijvari population has piped gas supply in their houses. The gas provider is “SOCAR Georgia Petroleum”.

The village has a centralized water supply. The municipality is responsible to provide assistance in case of any damage to the water system. The water is suitable for drinking. As for the water supply, there are some problems during the summer season. There is no sewer system in the village.

Communications

The vast majority of households living in Dzlevijvari have cellular phones (90%). There are fixed broadband internet connections in the village provided by Magti, Trialeti Net, and City Net.

The street lights are available on every street of Dzlevijvari.

Transport and Roads

In terms of transport, minibuses provide services within the settlement. There is one minibus available from the village to the municipal center once a day. The travel takes 25 minutes and costs 2 GEL. In case one wants to go to Tbilisi, he/she either needs to go to the highway to catch a minibus or go to Kareli. From Kareli to Tbilisi minibus costs 5 GEL.

The road leading to the village is asphalted and it is in very good condition. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are asphalted roads. The condition of the inner roads in the settlement can be rated as average. Light and heavy transport can move freely on the roads within the settlement during the whole year.

Employment

According to the representative of the local government, only 10% of the population is permanently employed in the village. They are mainly employed in state services and local businesses (local markets). The vast majority of the population is involved in agricultural activities for commercial purposes. They sell their agricultural products and/or are working as temporary workers on the farms. Daily reimbursement on the farms is 40 GEL. Agricultural business is seasonal.

The local population mainly spends money on food (50%). 70% of households are said to own vehicles and 40% agro-machinery.

Social Infrastructure

As was already mentioned large portion of residents in Dzlevijvari sell their agricultural production. The most common agricultural markets to sell products for locals are Gori, Tbilisi, Kutaisi, Khasuri. Gori and Khashuri are the nearest of all (30km and 35km, respectively) and it takes about 30 minutes to travel there. Tbilisi is 100km away and it takes about 1 hour and 30 minutes, while Kutaisi is the furthest (135km) and 2 hours and 20 minutes are needed to travel to Kutaisi. Locals mainly drive to the agricultural markets to sell products in their vehicles or hire mini-vans.

Dzlevijvari residents purchase food in local markets or in the agricultural market at the municipal center or regional center. Locals go shopping for household supplies/industrial products and clothes in the agricultural market at the regional center or go to Khashuri or Tbilisi.

Industry and Construction

There are three local markets. There are no new buildings built in the village in recent years.

Socially Vulnerable People

According to the Social Service Agency, 5 IDPs are living in the village, while the number of socially vulnerable individuals who get state assistance is reported to be about 188 (16% of the population). There are up to 135 pensioners in Dzlevijvari and 17 people with disabilities.

Savings and Credits

It is rare for the Dzlevijvari population to invest their savings. There may be only a few families, who can have savings and, in this case, purchasing agricultural land or equipment is more common.

The most popular practice of borrowing a considerable amount of money is from banks.

There are no financial institutions in the village itself. Liberty Bank representatives arrive twice per month and bring pensions for local pensioners. Locals can get bank services in Kareli or Gori.

Education

There is one public school within the settlement in Dzlevijvari. There are 137 (69 girls and 68 boys) schoolchildren at the moment. There are 23 teachers at the school.

According to the respondent, about 30 young adults living in the settlement are currently receiving higher education.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 10 minutes. There is neither a pharmacy nor a medical unit currently functioning in the settlement.

There is no kindergarten in the village.

Programs Implemented in the Settlement

The respondents could recall the following projects implemented recently: fencing of the cemetery and gravelling of roads funded by the village program. Also, construction of the mini stadium, ensuring street lights, and construction of a training facility/playground funded by the municipality.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Dzlevijvari in recent years, respondents named drought, hail, and frost. Drought affected about 40% of locals, hail – 50%, and frost – 10%.

Overall, in terms of pollution, respondents believe that the air quality in the settlement, as well as the roads, are not contaminated.

There are litter bins available in the village and they are taken away by the special municipal service once per week. According to the respondents, a number of litter bins is enough at the moment.

Tourism

Tourism is not developed in the settlement.

5.1.4.2.1.6 Snapshot of Village Dirbi

An administrative unit Dirbi consists of only one village Dirbi.

Location

Village terrain can be characterized as mountainous according to the respondents. The village was presumably founded before the VI century. Common surnames in the village are Mazmishvili, Murachashvili, Doliashvili, Khatashvili, Kalmakhelidze, Doghanadze, Kotuashvili, and Tetunashvili. There are 86 surnames in total in the village.

Demography

According to the representatives of the local government, the population of village Dirbi is 1267 households. which make up about 3020 persons, out of which 1355 (45%) are male and 1664 (55%) are female. The largest age cohort among the population is people aged 18-59 (58%). It should be noted that the children aged 0-17 are 671 in the village (349 girls and 322 boys). According to the respondents, the population has increased over the last ten years (since 2012). The main reason behind this is believed to be an increase in the birth rate.

Ethnicity, Religion, and Language

T The village itself mainly consists of Georgians, with Georgian as the main language. The leading religion in the village is Georgian Orthodox. There are two monasteries: mothers' and fathers' monasteries in the village. There are three cemeteries in village Dirbi.

The most celebrated holiday is "Zedajvroba" celebrated on the 27th day after Easter and "Ghvtismshobloba" (day of Mother of God) on the 13th of August.

Land Use

In terms of the usage of land resources, according to the respondents, the population quite often uses the land for annual crops (vegetables and grains) and perennials (fruit: apples, pears, peaches, vine). The Crops and fruit are cultivated for household usage as well as for commercial purposes. The land is processed mostly by agricultural machinery. 90% of the population is involved in agricultural production.

According to the local government, 55ha is used for residential purposes, about 2400 ha is used for agricultural production, and about 1700 ha for perennials and vineyards. According to the respondent, about 400 ha are used as pastures. The municipality itself owns the administrative building of the local government, and its yard, a sports school, a kindergarten, a stadium, arena for wrestling.

Housing and Utility Infrastructure

Houses in Dirbi are mainly constructed in the Soviet Union times, around the 1960s-70s. The houses are mostly two floors and are built with mortared stone and blocks making up to 150-200 m2 on average. The state of the houses is assessed as normal. About 5% of the population did minor refurbishments of their houses over the last two years. There are no houses in the village which are in particularly poor condition. None of the houses are abandoned at the moment.

The main electricity supplier for Dirbi is "ENERGO-PRO Georgia." According to the respondents, they have a 24-hour supply of electricity and the quality of the electricity is satisfactory. However, some study respondents (local population) complained about the service provided by ENERGO-PRO in case of some damages.

According to the respondents and the representatives of the local government Dirbi population has piped gas supply in their houses. The gas provider is "SOCAR Georgia Petroleum".

The whole population of Dirbi has a centralized water supply. The municipality is responsible to provide assistance in case of any damage to the water system. The water quality and supply are sufficient, and there are no water shortages according to the respondents. There is no sewer system in the community.

Communications

The absolute majority of households living in Dirbi have cellular phones (100%). There are fixed broadband internet connections in the village provided by Magti (30 GEL per month) and Silknet. 50% of the population uses the internet.

Transport and Roads

In terms of transport, buses/minibuses are available within the settlement and it is possible to go to the regional center by mini bus which commutes once a day, takes 1 hour and costs 4 GEL. Bus is also available from the village to the municipal center, available 3 times a day, the travel takes 30 minutes and costs 2,5GEL. A minibus is also available in Tbilisi twice a day. The price to travel to Tbilisi is 7 GEL and takes 2 hours.

The road leading to the village is asphalted and it is in very good condition. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are partly asphalted roads. The other part is a ground road graveled. They are repaired every year. The condition of the inner roads in the settlement can be rated as normal. Light and heavy transport can move freely on the roads within the settlement during the whole year.

Social Infrastructure

A large portion of Dirbi residents sells their agricultural production. A large portion of the following products is mostly sold: apples, peaches, beans, barley, wheat, garlic, and potatoes. The most common agricultural markets to sell products for locals are Khashuri, Zestaponi, Kutaisi, Gori. Gori is the nearest of all (30 km), followed by Khashuri (33 km) and it takes about 30 minutes to travel there. Zestaponi is 100km away and it takes about 2 hours. Kutaisi is the furthest (140 km) and it takes up to three hours to travel to Kutaisi. Locals mainly drive to the agricultural markets to sell products in their vehicles or hire mini-vans.

Dirbi residents purchase food in an agricultural market at the regional center, in local markets, or in Khashuri. As it was mentioned, Khashuri is the cheapest of all. Locals go shopping for household supplies/industrial produce and clothes in a regional center, in Tbilisi or Khashuri.

Employment

According to the representative of the local government, about 70% of the population is permanently employed in the village. They are mainly employed in agriculture or local businesses. Daily reimbursement on farms is 50 GEL. However, such employment is seasonal and there is no work in agriculture for 4 months in the winter period. Accordingly, income from agriculture is from February to November, for 8 months.

The local population mainly spends money on agricultural production. 90% of households are said to own vehicles and 100% agro-machinery (mini tractors).

Industry and Construction

According to the respondents, there are 10 farms of cows and pigs, 16 local markets, 1 market by network “Magniti”, 1 pharmacy, 4 beauty salons, 1 branch of Liberty bank. There are no enterprises in the village.

Three new houses have been built in the village in 2021.

Socially Vulnerable People

According to the Social Service Agency, 10 IDPs are living in the village, while the number of socially vulnerable individuals who get state assistance is reported to be about 1181 (39% of the population). There are up to 465 pensioners in Dirbi and 97 people with disabilities.

Savings and Credits

It is rare for the Dirbi population to invest their savings. There may be only a few families, who can have savings and, in this case, purchasing agricultural equipment is more common.

The most popular practice of borrowing a considerable amount of money is from banks.

There is one financial institution in the village – the Liberty Bank branch located at the administrative building of the local government. There are four pay boxes in the village Locals can also get bank services in Kareli.

Education

There is one public school within the settlement in Dirbi. It is about 2km away and takes 15 minutes to get there. There are 359 pupils at the moment (168 girls and 191 boys). There are 41 teachers available at schools. According to the respondent, the number of pupils has increased in the last ten years. The main reason behind this is believed to be available funding.

There is a kindergarten in Dirbi as well (it takes on average 15 minutes to get there). There are 80 children registered there. There are about 4 teachers in kindergarten. According to the respondent, the number of children in kindergarten has increased. It used to be 3 groups before and now the number has gone up to 4.

According to the respondents and the local government, about 162 young adults living in the settlement are receiving higher education at the moment. Most of the students are receiving higher education in Tbilisi. In 2022, 20 young people have become students. Vocational education is not popular in the municipality.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 20 minutes. The ambulance arrives from Kareli. There is one pharmacy currently functioning in the settlement. There is also one medical unit with 5 employees in Dirbi.

In terms of different health issues in the community, cardiovascular diseases, gastrointestinal diseases, as well as seasonal flues and Covid are the most common problems.

Programs Implemented in the Settlement

The respondents could recall the following projects: the construction of a park financed by a local village program, training facilities, and a stadium financed by the municipality. Moreover, street lights by the municipality and the village program were mentioned, as well as asphalting of inner roads financed by the municipality which is done regularly each year.

Besides programs implemented in the settlement, the benefits and financial support that the local population receives are noteworthy. There are some financial incentives due to being close to the occupational line: students are provided with a scholarship of 2250 GEL per year (the precondition is to have studied in the village for at least 3 years); each household receives a voucher of 200 GEL for gas; locals do not pay water fee, this is covered by the municipality; each family received one-time financial support of 600 GEL for the third child and 150GEL per month. In the case of a fourth child, one-time financial support consists of 800GEL and monthly support of 150GEL; local municipality finances 40% of health care expenses; those involved in dialyzes program receive 500Gel once a year; financial assistance for blind people consists of 400GEL and this is one-time support.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Dirbi in recent years, respondents named drought, hail, and frost. According to the respondents, 40% were affected by drought, 5% by hail, and 70% by frost. The frost damaged beans, walnuts, and fruits.

Overall, in terms of pollution, respondents believe that the air quality in the settlement is not contaminated, while the roads are somehow contaminated.

There are litter bins available in the village and they are taken away by the special municipal service two times per week.

Tourism

Tourism is not developed in the settlement, however, there are two monasteries and also 7 sacred places where people go to pray.

5.1.4.2.1.7 Snapshot of Village Sagholasheni

An administrative unit Breti consists of the following villages: Breti, Sagholasheni, Aradeti, Doghlauri, Tsveri. Only Breti and Sagholasheni are affected by the Project.

Location

Village terrain can be characterized as low land according to the respondents. The first time the village was mentioned was in the XV century in historic documents. Presumably, the village was founded earlier, before the XI century. Common surnames in the village are: Shubitidze, Dzmorashvili, Somkhishvili, Javakhishvili, and Khasazishvili

Demography

According to the representative of the local government, the population of village Sagholasheni is 203 households, which makes up about 513 people. As for the gender distribution, 274 (53%) are men and 239 (47%) are women. It is worth mentioning that there are only 30 children (5%) aged 0-6 in the village. Since Census 2014, the population in the village has increased, however, seasonal migration for employment is common as well.

Ethnicity, Religion, and Language

The village itself mainly consists of Georgians with Georgian as the main language of the village. The leading religion in the village is Georgian Orthodox. There are two churches in Sagholasheni: the Church of the Assumption of the Virgin Mary built in the XI century and one church under construction. There are two cemeteries in Sagholasheni.

The most celebrated holiday is “Mariamoba” (St. Mary’s day) in August.

Land Use

According to the local government, the village covers 270 ha, out of which 40 ha are used for residential purposes, 200 ha are for agricultural production and 30 ha are for pastures. 98% of the population is involved in agricultural production and they use the cultivated products both for household usage and commercial purposes. All kinds of vegetables, grains (wheat, corn, barley), and fruit (apple, peach, pear, grapes, prunes, melons, watermelons) were named among widespread crops. The land is processed manually, as well as by using agricultural machinery.

The municipality itself owns two cemeteries (3 ha), 2 stadiums, and 3 bus stop areas.

Housing and Utility Infrastructure

Houses in Saloghasheni are mainly constructed in the Soviet Union times, around the 1940s. The houses are mostly two-floored and are built with stone and blocks, making up to 150-200 m2 on average. As for the state of the houses, 80% require major refurbishment. There are about 2-3 houses in particularly poor condition according to the local municipality. None of the houses are abandoned at the moment. Minor refurbishments of the houses are quite common.

The main electricity supplier for Sagholasheni is “ENERGO-PRO Georgia.” According to the respondents, they have a 24-hour supply of electricity, however, the service provided by ENERGO-PRO was evaluated as more or less satisfactory.

According to the respondents and the representatives of the local government Sagholasheni population has piped gas supply in their houses. The gas provider is “SOCAR Georgia Petroleum”.

A centralized water supply system is in the process of construction. At the moment, 95% of water supply is received from wells. The water quality is poor and causes damage to agricultural machinery. There is no sewer system in the community.

Communications

The absolute majority of households living in Sagholasheni have cellular phones (100%). There are fixed broadband internet connections in the village provided by Trialeti Net (SkyTel), internet plates, and wireless internet.

Transport and Roads

In terms of public transport, there is no transport available within the settlement or directly from the settlement to the regional center (Gori), municipal center (Kareli), and to Tbilisi. However, there are minibuses available for the following routes: Agara-Kareli once every half an hour and the cost is 1,50 GEL. Dirbi – Tbilisi, once a day and the price is 5 GEL; Dvani – Kareli twice a day and the price is 2 GEL; and buses for the following routes: Dirbi – Kareli, 3-4 times a day and it costs 2 GEL; Dirbi-Gori twice a day and the price is 2 GEL.

The road leading to the village is asphalted and is in good condition. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are mostly gravelled. The condition of the inner roads in the settlement is mentioned to be in poor condition.

Employment

According to the representative of the local government, about 70% of the population is employed in the village. They are mainly employed in state services and private businesses. 80% of the population receives income from agriculture. The agricultural business is seasonal and it is the most active for about 3 months.

The local population mainly spends money on agricultural production (80%). 40% of households are said to own vehicles and 20% agro-machinery.

Social Infrastructure

As was mentioned, a large share of residents in Sagholasheni sells their agricultural production. The most common ways to sell products are to sell it to the wholesaler or take them to Khashuri. Gori agricultural market and Tbilisi agricultural market are also common. Accordingly, three the most common agricultural markets are as follows: Khashuri, Gori, and Tbilisi. The distance to Khashuri is 27km and takes about 25 minutes to travel there, Gori is the nearest of all (22km) and it takes about 17 minutes to travel there. Tbilisi is the furthers (97km) and it takes up to 1 hour and a half to travel there. Locals mainly drive to the agricultural markets to sell products in their vehicles or hire private transportation.

Sagholasheni residents purchase food in the agricultural market at the municipal center or at local markets in their community. As for household supplies/industrial produce and clothes, locals go to the agricultural market at the municipal center (Kareli), the agricultural market at the regional center **(Gori), or go to Khashuri.**

Industry and Construction

There is 1 car wash, 2 local shops, and 1 fruit and vegetable enterprise (currently not functioning) in the village.

There are no new buildings in recent years.

Socially Vulnerable People

According to the Social Service Agency, 12 IDPs are living in the village, while the number of socially vulnerable individuals who get state assistance is reported to be about 108 (21% of the population). There are up to 51 pensioners in Sagholasheni and 7 people with disabilities.

Savings and Credits

It is very rare for the Sagholasheni population to invest their savings. Among the few cases, purchasing agricultural land or cattle is common.

The most popular practice of borrowing a considerable amount of money is from banks. CREDO bank, TBC bank, and Bank of Georgia were named.

There are no financial institutions in the village itself. When locals need relevant services, mostly people go to Kareli. Liberty Bank representatives arrive twice per month and bring pensions for local pensioners and social assistance for socially vulnerable people. There is one pay box in the village.

Education

There is one public school within the settlement in Sagholasheni (on average, it takes 10 minutes to school). The school provides all levels of general education. There are 206 pupils at the moment (103 girls and 103 boys). There are 25 teachers available at schools. According to the respondent, the number of schoolchildren has decreased over the last ten years.

There is no kindergarten in Sagholasheni.

According to the respondents, about 20-30 young adults living in the settlement are receiving higher education at the moment. Most of them are receiving higher education in Tbilisi and Gori. Vocational education is popular in the village.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 20 minutes. The ambulance arrives from Kareli. There is neither a medical unit nor a pharmacy in the settlement.

Programs Implemented in the Settlement

Respondents recalled the following projects implemented since 2012: street lights, graveling of roads, and construction of a stadium funded by the municipality. Moreover, the construction of a small park and the repair of the water system was implemented by the village program.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Sagholasheni in recent years, respondents named drought, hail, and frost. About 10% of the population was affected by drought, 40% by hail, and 10% by frost.

Overall, in terms of pollution, respondents believe that air quality in the settlement, as well as the roads, are somehow contaminated.

There are litter bins available in the village and they are taken away by the special municipal service two times per week. The number of litter bins is increasing each year.

Tourism

Tourism is not developed in the settlement.

5.1.4.2.1.8 Snapshot of Village Sasireti

An administrative unit Giganti consists of villages Bretis Meurneoba, Sasireti, and Dzlevijvari.

Location

Village terrain can be characterized as low land according to the respondents. Common surnames in the village are Eliashvili, Baduashvili, Goginashvili, and Todadze.

Demography

According to the representatives of the local government, the population of village Sasireti is 146 households which make up about 469 persons, out of which 259 (55%) are men and 210 (45%) are women. The largest age cohort among the population is people aged 31-60 (41%). It should be noted that children make up only 18% of the whole population. Since Census 2014, the population in the village has increased, however, seasonal migration for employment is common as well.

Ethnicity, Religion, and Language

The village itself mainly consists of Georgians with Georgian as the main language of the village. The leading religion is Georgian Orthodox. There is one church and one cemetery in Sasireti. There is St. George's church.

The most celebrated holiday is "Giorgoba" (St. George day) on November 23rd in the village.

Land Use

In terms of the usage of land resources, according to the respondents, the population quite often uses the land for annual crops (vegetables and grains). The Crops are cultivated for household usage as well as for commercial purposes. The land is processed mostly by agricultural machinery. 95% of the population is involved in agricultural production.

According to the local government, the village covers 950 ha, out of which 450 is processed for agricultural production and 500ha is used for residential purposes. The municipality itself owns one bus stop area, 1 cemetery, a mini stadium, training facility/playground.

Housing and Utility Infrastructure

Houses in Sasireti are mainly constructed in the Soviet Union times, around the 1950s. The houses are mostly two floors and are built with bricks and blocks making up to 100-200 m2 on average. The state of the houses is assessed as normal. There are no houses in the village that are in particularly poor condition according to the local municipality. None of the houses are abandoned at the moment. About 20% of the population did some refurbishments of their houses over the last two years. There is one block of houses in the village.

The main electricity supplier for Sasireti is “ENERGO-PRO Georgia.” According to the respondents, they have a 24-hour supply of electricity.

According to the respondents and the representatives of the local government, Sasireti population has piped gas supply in their houses. The gas provider is “SOCAR Georgia Petroleum”.

Sasireti population has a centralized water supply. The municipality is responsible to provide assistance in case of any damage to the water system. In terms of water supply, there are problems during the summer season. There is no sewer system in the community.

Communications

The vast majority of households living in Sasireti have cellular phones (90%). There are fixed broadband internet connections in the village provided by Magti, Trialeti Net and City Net

The street lights are available on every street of Sasireti.

Transport and Roads

In terms of transport, there are private mini buses available from the settlement to the regional center which commutes once a day, the travel takes about 30 minutes and costs 2 GEL. There is no transport directly from the settlement to the municipal center or to Tbilisi.

The road leading to the village is asphalted and it is in very good condition. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are gravelled. The condition of the inner roads in the settlement can be rated as average. Light and heavy transport can move freely on the roads within the settlement during the whole year.

Employment

According to the representative of the local government, only 10% of the population is permanently employed in the village. They are mainly employed in state services and local businesses (local market). As was mentioned above the vast majority of the population is involved in agricultural activities for commercial purposes. They sell their agricultural products and/or are working as temporary workers on the farms. Daily reimbursement on the farms is 40 GEL. Agricultural business is seasonal.

The local population mainly spends money on food (50%). 60% of households are said to own vehicles and 20% agro-machinery.

Social Infrastructure

As was already mentioned above a large portion of residents in Sasireti sell their agricultural production. The most common agricultural markets to sell products for locals are Gori, Tbilisi, Kutaisi, Khashuri. Gori and Khashuri are the nearest of all (30km and 35km, respectively) and it takes about 30 minutes to travel there. Tbilisi is 100km away and it takes about 1 hour and 30 minutes, while Kutaisi is the furthest (135km) and 2 hours and 20 minutes are needed to travel to Kutaisi. Locals mainly drive to the agricultural markets to sell products in their vehicles or hire mini-vans.

Sasireti residents purchase food in the agricultural market of the nearest city or settlements as well as in a local market. Locals go shopping for household supplies/industrial produce and clothes in Gori, Tbilisi, or Khashuri.

Industry and Construction

According to the respondents, there is one local market in the village. There have been no new buildings built in recent years.

Socially Vulnerable People

According to the Social Service Agency, there are no IDPs are living in the village, while the number of socially vulnerable individuals who get state assistance is reported to be about 93 (20% of the population). There are up to 68 pensioners in Sasireti and seven people with disabilities.

Savings and Credits

It is rare for the Sasireti population to invest their savings. There may be only a few families, who can have savings and, in this case, purchasing agricultural land or equipment is more common.

The most popular practice of borrowing a considerable amount of money is from banks.

There are no financial institutions in the village itself. Liberty Bank representatives arrive twice per month and bring pensions for local pensioners. Locals can get bank services in Kareli or Gori.

Education

There is one public school in Sasireti that provides education for elementary grades. There is no kindergarten in Sasireti.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 10 minutes. There is neither a medical unit nor a pharmacy currently functioning in the settlement.

Programs Implemented in the Settlement

Besides the local village program which finances the repair of local infrastructure (graveling of roads), respondents could recall the construction of the mini stadium, street lights, and training facility/playground financed by the municipality.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Sasireti in recent years, respondents named drought, hail, and frost. About 40% of the population was affected by drought, 50% by hail, and 10% by frost.

Overall, in terms of pollution, respondents believe that the air quality in the settlement, as well as the roads, are not contaminated.

There are litter bins available in the village and they are taken away by the special municipal service once per week. According to the respondents, the number of litter bins are enough at the moment.

Tourism

Tourism is not developed in the settlement.

5.1.4.2.1.9 Snapshot of Village Urbnisi

An administrative unit Urbnisi consists of only one village Urbnisi.

Location

Village terrain can be characterized as low land according to the respondents. Villages were already founded when St. Nino entered Georgia (IV century). Moreover, it is noteworthy that the first wheat and the first wine cellar were found in Urbnisi. Common surnames in the village are Induashvili, Khanishvili, Kakashvili, Khizanishvili, and Khizanashvili.

Demography

According to the representatives of the local government, the population of village Bebnisi is about 420 households which makes up about 1130 persons. According to the respondent's information, there were 1352 people in 2012, so there is a slight decrease over the last ten years. The main reasons behind this are believed to be mortality, as well as internal migration, that is, young people tend to move to Tbilisi. There are 55% men and 45% women among locals. There is no age distribution available to the local government.

Ethnicity, Religion, and Language

The village itself mainly consists of Georgians which Georgian as the main language in the village, and the leading religion is Georgian Orthodox. There are two churches in Urbnisi: St. Stephane Church and St. Nino Church. There is also one cemetery in the settlement.

The most celebrated holiday is "Stephnoba" (St. Stephane day) on January 9th in the village. According to tradition, first locals go to church to light candles, and then there is a feast ("Supra") at home. Another celebrated holiday is "Urbnisoba" (Urbnisi day) on the 10th of November. This day is also the day of commemoration of the Neophyte of Urbnisi.

Land Use

In terms of the usage of the land resources, according to the respondents, the population quite often uses the land for perennials and annual crops. Common crops are wheat, barley, beetroot, potatoes, onions, carrot, and garlic, as well as fruits: apple, plum, cornelian cherry, vine, etc. 90% of the population is involved in agricultural production. The crops and fruit are cultivated for household usage as well as for commercial purposes. Vegetables are mostly sold. The land is processed manually, as well as by agricultural machinery.

According to the local government, about 535 ha of land is for agricultural production, 105ha are pastures, and about 44 ha is used for residential purposes. The municipality itself owns about 6 ha of land, as well as the following properties: an administrative building of local government and its yard, a stadium, a mini stadium, an old kindergarten building and its yard, a cemetery (about 5 ha), Neophyte Niche of Urbnisi.

Housing and Utility Infrastructure

Houses in Urbnisi are mainly constructed in the Soviet Union times. There are old and new districts. The old one was constructed in 1940 and the new one in 1958. The houses are mostly two floors and are built with stone and blocks making up to 150-200 m2 on average. In 2014 gas supply was provided to the households and during this time around 50-60% of the population refurbishments of their houses.

The state of the houses is assessed as normal. There are 2 houses in the village which are in particularly poor condition according to the local municipality. There is 1 abandoned house at the moment.

The main electricity supplier for Urbnisi is “ENERGO-PRO Georgia.” According to the respondents, 100% of the population is supplied with electricity, however, there are some problems: electricity poles are damaged and are not changed. The village does not have an electricity fee collector, that’s why they have to use hotline in case of any damage and the overall service is rated as poor. Meters were installed in 2015, however, damages are frequent.

According to the respondents and the representatives of the local government Urbnisi population has piped gas supply in their houses. The gas provider is “SOCAR Georgia Petroleum”.

Most of the population gets water supply from wells. All parts of the village have electricity pumps besides one area, where about 8 households live. The water quality and supply are sufficient. There is no sewer system in the community. Households have artesian wells.

Communications

The vast majority of households living in Urbnisi have cellular phones (95%). There are internet connections in the village provided by SkyTel and 80% of the population have access to the internet, however, the quality is bad and 95% of the population uses mobile internet. As was highlighted, Village Ruisi is provided with a fixed broadband internet connection by Magti, however, the same is not available in Urbnisi.

The street lights are available on every street of Urbnisi.

Transport and Roads

In terms of public transport, minibuses are available 5 times a day from the settlement to Gori. The travel takes about 15-20 minutes and costs 2 GEL. In order to go to Tbilisi, it is needed to go to the central road and from there many mini-buses are available to Tbilisi. The travel takes about 40 minutes (80km) and costs 5 GEL. In the case of Kareli, which is 12km away, it is also needed to go to the central road and from there Gori-Kareli minibuses are available, which costs 1.50 and commute once every hour. Another option is the Tbilisi-Kareli minibus also from the central road available once every hour.

The road leading to the village is the central road which is asphalted and is in very good condition. It was asphalted in 2015. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are partly asphalted roads. The other part is gravelled. The condition of the inner roads in the settlement is rated as very good. The last time the roads within the settlement were repaired was in 2021-2022. Light and heavy transport can move freely on the roads within the settlement during the whole year.

Employment

According to the representative of the local government, about 60% of the population is permanently employed in the village. They are mostly employed in Gori, Kareli, and Tbilisi. One fish enterprise (“Umali”) used to function in the settlement, maybe it is closed down temporarily. Locals are mostly employed at local markets, gas stations, casinos, and security services. However, it is noteworthy that 90% of the population is dependent on income from agriculture, which is seasonal.

About 70% of households are said to own vehicles.

Social Infrastructure

A large portion of residents in Urbnisi sells their agricultural production. The most common agricultural markets to sell products for locals are Gori and Tbilisi. It is also common to sell the products to resellers. Furthermore, there was a market near central road, however, this has been prohibited 3 years ago, since it was too dangerous. Gori agricultural market is the nearest of all (12km) and it takes about 15-20 minutes to travel there. Tbilisi (Navtlughi agricultural market) is 110 km away and it takes about 1 hour and 20 minutes to travel to Tbilisi. Locals mainly drive to the agricultural markets.

Urbnisi residents purchase food in local markets or in the agricultural market at the regional center. Locals prefer to shop in Gori since it is cheaper and a wider variety is offered. Locals go shopping for household supplies/industrial produce and clothes in Gori as well.

Industry and Construction

According to the respondents, there is one fish processing enterprise, which is not functioning at the moment, also one car wash, a gas station, and 4 small local markets. It is also planned to open up a cold storage warehouse.

About 2 new houses have been built in the village in 2021. Moreover, refurbishment work was done at school.

Socially Vulnerable People

According to the Social Service Agency, one IDPs are living in the village, while the number of socially vulnerable individuals who get state assistance is reported to be about 232 (21% of the population). There are up to 213 pensioners in Urbnisi and 34 people with disabilities.

Savings and Credits

It is rare for the Urbnisi population to invest their savings. There may be only a few families, who can have savings and, in this case, purchasing land is more common.

The most popular practice of borrowing a considerable amount of money is from banks. Respondents named cases of borrowing from CREDO bank, TBC bank, and Bank of Georgia.

There are no financial institutions in the village itself. Liberty Bank representatives arrive twice per month and bring pensions for local pensioners and social assistance for socially vulnerable people. It is possible to pay utility bills there or use the pay box, which is also available in the settlement. Locals can get bank services in Kareli and Gori.

Education

There is one public school within the settlement in Urbnisi. 132 schoolchildren study there at the moment (62 girls and 70 boys). There are 23 teachers available at schools. According to the school principal number of schoolchildren has decreased in the last ten years at their school. It used to be around 150 pupils there. The main reason behind this is believed to be a decrease in the birth rate. The number of teachers has not changed over the last few years.

There is one kindergarten in Urbnisi. There are 35 children registered there (15 girls and 20 boys). There are two teachers working there. The number of children in kindergarten has also decreased. It used to be around 59-60 children. Similar to the case of school, the main reason behind this is believed to be a decrease in the birth rate. It is also noteworthy that the kindergarten is currently in the administrative building of the local government. The new kindergarten building is needed.

According to the respondents and the local government, about 40 young adults living in the settlement are receiving higher education at the moment. 9 young adults have been accepted at higher education institutions recently. Vocational education is not popular in the municipality. Currently, there is no one receiving vocational education.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 15 minutes. The ambulance arrives from Kareli. Currently, there is neither a medical unit nor a pharmacy in the settlement.

Programs Implemented in the Settlement

Respondents recalled the following programs implemented in the settlement in recent years: refurbishment of the public school funded by the Municipal Development Fund, construction of roads funded by the Roads Department, street lights funded by the village program, and asphalting roads in the settlements funded by the municipality.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Urbnisi in recent years, respondents named drought (2022), hail (2020-2021), and earthquake (2021). According to the representative of the local government, almost everybody (90%) was affected by drought. Hail affected about 40% of the population, while the earthquake damaged one house.

Overall, in terms of pollution, respondents believe that the air quality in the settlement, as well as the roads, are not contaminated.

There are litter bins available in the village and they are taken away by the special municipal service once per week (on Mondays).

Tourism

Tourism is not developed in the settlement, however, there is some sightseeing there: St. Nino Church and St. Stephane church, and St. Nino Niche.

5.1.4.3 Accumulated Socio-Demographic of target villages in Gori Municipality

Gori Municipality is in the Shida Kartli region. The administrative center of the municipality is in the town Gori. The municipality consists of 23 administrative units (communities). Only two administrative units are within the Project area: Variani and Shindisi. The following villages are affected by the Project within the mentioned administrative units: Varianis Meurneoba, Sakasheti, Sakasheti IDP Settlement, and Shindisi.

Table 5-26 below shows population statistics of the Project Affected villages according to the National Statistics Office of Georgia 2014 Census data. The table also shows updated data presented by the representatives of local government within the qualitative study in 2022.

Table 5-26 Number of Households and Individuals in the Project Affected Villages

Village	Number of Households by GeoStat 2014 Census data	Number of Households provided by Local Government in 2022	Number of Population by GeoStat 2014 Census data	Number of Population provided by Local Government in 2022
Varianis Meurneoba	119	145	383	402
Sakasheti	237	380	883	1200
Sakasheti IDP Settlement[5]	90	90	325	325
Shindisi	218	1200	2667	3500
TOTAL Number	**664**	**1815**	**4258**	**5427**

Table 5-27 below shows the distribution of the population by gender in target villages according to the National Statistics Office of Georgia 2014 Census data. Sakasheti IDP Settlement data are not available in the 2014 Census data. According to the population statistics, the population is almost equally distributed by gender. Not all local governments of the Project affected villages could provide the distribution of the population by gender, thus, it did not allow us to compare the data.

Table 5-27 Share of Population 18+ in the Project Affected Villages by gender

Village	Men	Women
Varianis Meurneoba	180	203
Sakasheti	452	431
Shindisi	1342	1325
TOTAL Number	**1974**	**1959**
TOTAL Shares	**50.2%**	**49.8%**

Table 5-28 below represents the numbers of pensioners, internally displaced people, people with disabilities, and the number of households receiving social assistance in the target villages. The numbers are provided by the local government within the qualitative study as well as Social Service Agency. The total population statistics are also presented in the table for a better understanding of the shares of vulnerable groups. The data reveals that socially vulnerable people (individuals receiving state social assistance) make up the largest vulnerable group and represent about 19% of the population in the Project-affected villages in Gori municipality. The largest share of socially vulnerable people is in the village Varianis Meurneoba according to the provided statistics (32%).

[5] National Statistics Office of Georgia 2014 Census data do not include relevant data for Sakasheti IDP Settlement; accordingly, the numbers are indicated as provided by the local government

Table 5-28 Number of Pensioners, IDPs, People with Disabilities, and Households receiving state social assistance in the Project Affected Villages in 2022

Village	Number of Pensioners provided by Social Service Agency or Local Government	Number of IDPs provided by Social Service Agency or Government	Number of People with Disabilities provided by Social Service Agency or Local Government	Number of individuals receiving social assistance provided by Social Service Agency or Local Government	Number of Population provided by Local Government
Shindisi	478	54	108	662	3500
Varianis Meurneoba	33	46	3	130	402
Sakasheti	120	10	21	199	1200
Sakasheti IDP Settlement	25	184	2	38	325
TOTAL Number	**656**	**294**	**134**	**1029**	
TOTAL Shares	**12%**	**5%**	**2%**	**19%**	

5.1.4.4 Snapshots of Villages in Gori Municipality

5.1.4.4.1.1 Snapshot of Village Shindisi

An administrative unit Shindisi consists of the following villages: Shindisi, Kvemo Khviti, Kelktseuli, and Pkhvenisi. Only Shindisi is affected by the Project.

Location

Village terrain can be characterized as low land according to the respondents. The village was presumably founded earlier than the XIII century. Common surnames in the village are Mazmishvili, Khutsishvili, Tvaliashvili, Papunashvili, and Arabashvili.

Demography

According to the representatives of the local government, the population of village Shindisi is 1200 households. 1200 households make up about 3500 persons. Since Census 2014, the population in the village has increased (households: 812, population: 2667). However, seasonal migration for employment is common as well.

Unfortunately, the local government does not have updated statistics on the population by gender and age. According to the Census 2014, the shares of male and female residents in the village were almost equal (male: 50%, female: 50%).

Ethnicity, Religion, and Language

The village itself mainly consists of Georgians (99%), with Georgian as the main language. However, there is about one percent of other nationalities living in the village: Armenians, Azeri, Greeks, and Osetians. The leading religion in the village is Georgian Orthodox. There are fifteen churches and five cemeteries in Shindisi itself. There are three active churches: Kviratskhoveli church of the XVII century, St. George church of the XIII century (which is under reconstruction at the moment), and another St George church.

The most celebrated holiday is “Kviratskhovloba” the following Sunday of Easter.

Land Use

In terms of the usage of the land resources, according to the respondents, the population quite often uses the land for annual crops (barley, wheat, tomatoes, cabbage, pepper) and perennials (fruit: apples, plums). The Crops and fruit are cultivated for household usage as well as for commercial purposes. The land is processed mostly by technique. 90% of the population is involved in agricultural production and almost all of them sell their products.

According to the local government, the village covers about 2500 ha, 1500 ha of which is processed for agricultural production, and 1000 ha is used for residential purposes. The municipality itself owns five cemeteries, two stadiums, a kindergarten, and an administrative building.

Housing and Utility Infrastructure

Houses in Shindisi are mainly constructed in the Soviet Union times, around the 1980s. The houses are mostly two floors and are built with stone and blocks making up to 150-200 m2 on average. The state of the houses is assessed as normal. About 2% of the houses are abandoned at the moment and 30% are in poor condition. The population tries to do minor refurbishments of the houses annually (60%). Full renovation of the house is rare and makes about ten percent.

The main electricity supplier for Ruisi is “ENERGO-PRO Georgia.” According to the respondents, they have a 24-hour supply of electricity and the quality of the electricity is satisfactory.

According to the respondents and the representatives of the local government Ruisi population has piped gas supply in their houses. The gas provider is “SOCAR Georgia Petroleum”.

According to the representatives of the local government, 40% of Shindisi population has a central water supply system (with water meters) and tap water at homes is available for 24 hours for them. The other 60% have a water supply of only 3-4 hours a day. The municipality’s special service takes care of the water supply system in the village. There is no sewer system in the community.

Communications

Almost everybody in Shindisi owns cellular phones. There are fixed broadband internet connections in the village provided by SkyTel and Silknet and the majority in the village use the internet.

Street lights are available on every street of Shindisi.

Transport and Roads

In terms of public transport, minibuses provide services within the settlement in various directions. There is a minibus to Gori (the regional /municipal center) available every hour throughout the settlement and it costs 2 GEL. The minibus to Tbilisi travels once a day and costs 5 GEL.

The road leading to the village is the central road which is asphalted and is in very good condition. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are ground roads that are fully gravelled. The condition of the inner roads in the settlement can be rated as normal. Light and heavy transport can move freely on the roads within the settlement during the whole year.

Employment

According to the representative of the local government, only 10% of the population is permanently employed in the village. They are mainly employed in state services (local government, law enforcement services, educational institutions, medical units, and local businesses). As was mentioned above the vast majority of the population is involved in agricultural activities for commercial purposes. They sell their agricultural products and/or are working as temporary workers on the farms. Daily reimbursement on the farms is 50 GEL. Agricultural business is seasonal.

The majority of households in Shindisi depend on income from agricultural production. The main crops cultivated in the village are all kinds of vegetables, grains, and fruit. Cattle breeding is mainly for household usage.

The local population mainly spends money on agricultural production (60%). 60% of households are said to own vehicles and 30% agro-machinery.

Social Infrastructure

As was already mentioned above almost all residents in Shindisi sell their agricultural production. The most common agricultural markets to sell products for locals are Kutaisi, and Tbilisi. It takes up to three and a half hours to travel to Kutaisi and one hour and a half to get to Tbilisi from Shindisi. Locals mainly drive to the agricultural markets to sell products in their vehicles or hire mini-vans.

Shindisi residents purchase food in local markets (eight small markets) or in the agricultural market at the regional center, Gori (15 km from the village). Locals go shopping for household supplies/industrial produce and clothes in Gori which is about 15 km from the village.

Industry and Construction

According to the respondents, there is one enterprise for making agricultural boxes, three cooler warehouses, eight shops, three beauty parlors, two bakeries, two car wash services, two patrol stations, and three pharmacies

About 30 new buildings have been built in the village in recent years.

Socially Vulnerable People

According to the Social Service Agency, 54 IDPs are living in the village, while the number of socially vulnerable individuals who get state assistance is reported to be about 662 (19% of the population). There are up to 478 pensioners in Shindisi and 108 people with disabilities.

Savings and Credits

It is very rare for the Shindisi population to invest their savings. There may be only a few families, who can have savings and, in this case, purchasing agricultural land or equipment is more common.

The most popular practice of borrowing a considerable amount of money is from banks or microcredit organizations. Borrowing from relatives/friends is quite rare.

There is no financial institution in the village itself and local residents can get bank services only in the regional center (Gori). There are six pay boxes in Shindisi as well.

Education

There is one public school within the settlement in Shindisi. The longest way to school takes about an hour on foot and the school bus provides transportation for school children. 302 schoolchildren study there at the moment (133 girls and 167 boys). There are 27 teachers available at school. According to the school principal number of schoolchildren has increased in the last few years at their school.

There is a kindergarten in Shindisi but it is being repaired at the moment. There were about 60 children and two teachers last year.

According to the respondents and the local government, about 45 young adults living in the settlement are receiving higher education at the moment. Most of the students are receiving higher education in Tbilisi. Vocational education is not popular in the municipality.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 5 minutes. The ambulance arrives from Tkviavi or Gori. There are three pharmacies currently functioning in the settlement. There is also one medical unit with three doctors and three nurses in Shindisi. The medical unit is fully equipped and a laboratory is also available there. They are in the newly repaired building next to the public register building. According to the local nurse, they get up to 20 patients a day.

In terms of different health issues in the community, cardiovascular diseases, as well as high blood pressure and diabetes, is among the most common problems.

Programs Implemented in the Settlement

Respondents could recall only projects financed by the village programs in recent years: street lights, sports field, mini stadium, training facilities, graveling the roads, and purchasing litter bins.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Shindisi in recent years, respondents named drought (2022), frost, and hail (all previous years). According to the representative of the local government, almost everybody was affected by the above-mentioned natural disasters (agricultural products), especially drought.

Overall, in terms of pollution, respondents believe that the air quality in the settlement is not contaminated, however, local roads are somehow contaminated.

There are litter bins available in the village and they are taken away by the special municipal service three times per week.

Tourism

There are no guesthouses available in the village. Tourism is not developed in the settlement. There is a memorial of Shindisi heroes who died during the war in 2008.

5.1.4.4.1.2 Snapshot of Village Sakasheti

An administrative unit Variani consists of the following villages: Variani, Akhaldaba, Sakasheti, Arashenda, Varianis Meurneoba, Sakasheti IDP settlement. However, project-affected villages are Sakasheti, Varianis Meurneoba, and Sakasheti IDP settlement.

Location

Village terrain can be characterized as low land according to the respondents. The village was presumably founded before the XI century. Common surnames in the village are Taruashvili, Khutsishvili, and Naskidashvili.

Demography

According to the representatives of the local government, the population of village Sakasheti is 380 households which make up about 1200 persons, out of which 598 (50%) are male and 602 (50%) are female. According to the respondents, the population has decreased over the last ten years (since 2012). The main reason behind this is believed to be migration.

Ethnicity, Religion, and Language

The village itself mainly consists of Georgians, with Georgian as the main language. However, there are about 4 families of Jehovah's witnesses. The leading religion in the village is Georgian Orthodox. There is a church of Mother of God built in the XVI century. There is also a cemetery in the settlement.

The most celebrated holiday in the village is "Amaghleba" (Ascension Day) celebrated on the 40th day of Easter.

Land Use

In terms of the usage of the land resources, according to the respondents, the population quite often uses the land for annual crops (all kinds of vegetables and grains,) and perennials (fruits). Cattle breeding is also common (mostly cows). 90% of the population is involved in agricultural production. The Crops and fruit are cultivated for household usage as well as for commercial purposes. The land is processed mostly by agricultural machinery; however, it is difficult to hire a combine harvester.

According to the local government, about 100ha is used for residential purposes, while 1200 ha is for processing for agricultural production, and 500 ha is used for perennial and annual crops. There are no pastures in the village. The municipality itself owns a medical unit, a dance studio, a kindergarten, a stadium (about 140ha) on the territory of which is located the kindergarten, and a cemetery (12 ha).

Housing and Utility Infrastructure

Houses in Sakasheti are mainly constructed around the 1970s. The houses are mostly two floors and are built with stone, blocks, making up to 100-200 m2 on average. The state of the houses is assessed as normal. There are up to 15 houses in the village which are in particularly poor condition according to the local municipality. 2 houses are abandoned at the moment. About 40% of the population did some refurbishments of their houses over the last two years.

The main electricity supplier for Sakasheti is "ENERGO-PRO Georgia." According to the respondents, they have a 24-hour supply of electricity.

According to the respondents and the representatives of the local government Sakasheti population has piped gas supply in their houses. The gas provider is "SOCAR Georgia Petroleum".

About 70% of Sakasheti population has a centralized water supply. The municipality is responsible to provide assistance in case of any damage to the water system. The water quality and supply are sufficient, however, there are problems in the summer season, and during that time specific water schedule is created. There is no sewer system in the community.

Communications

The vast majority of households living in Sakasheti have cellular phones (95%). There are fixed broadband internet connections in the village provided by Magti, Silknet, and SkyTel.

However, the speed of the internet is evaluated as slow.

The street lights are available on about 90% of the streets of Sakasheti

Transport and Roads

In terms of transport, minibuses are available from the settlement to Gori which commutes 5 times a day, the travel takes about 30 minutes and costs 2 GEL. In order to travel to Tbilisi, first, it is needed to travel to Gori and then from Gori there are mini buses available which cost 5 GEL.

The road leading to the village is asphalted and it is in very good condition. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are ground roads that are partly gravelled. The condition of the inner roads in the settlement can be rated as normal. Light and heavy transport can move freely on the roads within the settlement during the whole year.

Employment

According to the representative of the local government, only 2% of the population is permanently employed in the village. The vast majority of the population (95%) receives income from agricultural production. Daily remuneration on farms is 40 GEL, however, this work is seasonal. The are some local businesses too, such as 4 local markets and a dance studio.

The local population mainly spends money on agricultural production (50%). 80% of households are said to own vehicles and 50% agro-machinery.

Social Infrastructure

As was already mentioned above a large portion of residents in Sakasheti sell their agricultural production. The most common agricultural markets to sell products for locals are Gori, Kutaisi, and Zestaponi. Gori is the nearest of all (20 km) and it takes about 30 minutes to travel there. Zestaponi is 100 km away and the travel takes up to 2 hours. Kutaisi is the furthers of all (150 km) and it takes up to three hours to travel to Kutaisi. Locals mainly drive to the agricultural markets to sell products in their vehicles or hire mini-vans.

Sakasheti residents purchase food in local markets or in the agricultural market at the regional center. Locals go shopping for household supplies/industrial produce and clothes in a regional center.

Industry and Construction

According to the respondents, there are 4 local markets in the village, and a dance studio. There are no enterprises in the village.

About 4 new houses have been built in the village in recent years.

Socially Vulnerable People

According to the Social Service Agency, 10 IDPs are living in the village, while the number of socially vulnerable individuals who get state assistance is reported to be about 199 (17 % of the population). There are up to 120 pensioners in Sakasheti and 21 people with disabilities.

Savings and Credits

It is rare for the Sakasheti population to invest their savings. There may be only a few families, who can have savings and, in this case, purchasing land or agricultural equipment is more common.

The most popular practice of borrowing a considerable amount of money is from banks.

There are no financial institutions in the village itself. Liberty Bank representatives arrive twice per month and bring pensions for local pensioners and social assistance for socially vulnerable people. Locals can get bank services in Gori.

Education

There is one public school in Sakasheti. On average it takes about 20 minutes to go to school. There are 180 schoolchildren at the moment (72 girls and 108 boys). There are 27 teachers (among which 2 are male) available at school. According to the respondent, the number of schoolchildren has increased in the last ten years at their school.

There is a kindergarten in Sakasheti as well (it takes about 10 minutes on average to go there). There are 26 children registered there (12 girls and 14 boys). There are 2 teachers working there. The number of children at the kindergarten has decreased in the last ten years as some parents transferred their kids to new kindergarten located in Varianis Meurneoba.

According to the respondent, about 15 young adults living in the settlement are receiving higher education at the moment. Most local youth tend to study to become teachers. Vocational education is not popular in the municipality.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 20 minutes. There is one medical unit in Sakasheti. The medical unit provides healthcare for Sakasheti, Sakasheti IDP settlement, and Varianis Meurneoba. There are no pharmacies in the settlement. About 7 people per day refer to the medical unit. And this rate has increased compared to the last 10 years.

In terms of different health issues in the community, diabetes, as well as high blood pressure and endocrine diseases are among the most common problems.

Programs Implemented in the Settlement

The respondents could recall the following programs: construction of a kindergarten which is still ongoing (financed by the municipality), installing water meters (financed by the municipality), as well as a program for purchasing tractors that offer 50% co-funding. The latter is implemented by the Ministry of Agriculture of Georgia.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Sakasheti in recent years, respondents named drought, frost, heavy winds, and hail. According to the respondent, about 30% of the population was affected by drought, 40% by hail, 20% by heavy winds, and 10% by frost.

Overall, in terms of pollution, respondents believe that the air quality in the settlement is not contaminated, while the roads and streets are somehow contaminated.

There are litter bins available in the village and they are taken away by the special municipal service two times per week. However, the number of litter bins is not sufficient and the locals wish to have at least 2 more.

Tourism

Tourism is not developed in the settlement, however, there is some sightseeing there: Geri Niche, where locals go to pray. There used to be a big oak tree, which fell down on a house. There is a memorial for the 9 of April and a memorial of the patriotic war. Moreover, there is a remaining of the fortress near the church.

5.1.4.4.1.3 Snapshot of Village Varianis Meurneoba

An administrative unit Variani consists of the following villages: Variani, Akhaldaba, Sakasheti, Arashenda, Varianis Meurneoba, Sakasheti IDP settlement. However, project-affected villages are Sakasheti, Varianis Meurneoba, and Sakasheti IDP settlement.

Location

The village terrain can be characterized as low land according to the respondents. The village was founded in the 20th century as an agricultural farm and households were settled there from various places. There are no specific traditions or leading surnames in the village.

Demography

According to the representative of the local government, the population of the village Varianis Meurneoba is about 145 households which make up around 402 people (220 women and 182 men). According to the respondents, the population has decreased over the last ten years and the main reason is believed to be migration abroad.

Ethnicity, Religion, and Language

The village itself mainly consists of Georgians, with Georgian as the main language. However, there are also Ukrainians, Polish, Moldovans, Osetians, and Armenians. The Russian language is also common. The leading religion in the village is Georgian Orthodox. There is one church, however, it's not functioning at the moment. There is one cemetery in the settlement.

The most celebrated holiday is "Ghvtismshobloba" (Day of Mother of God) on the 21st of September. People go to church and if they can afford it, they hold a feast.

Land Use

In terms of the usage of the land resources, according to the respondents, the population quite often uses the land for annual crops (vegetables) and perennials (fruit: apple, plum). The crops and fruit are cultivated for household usage as well as for commercial purposes. The land is processed mostly by agricultural machinery. Cattle breeding is also common.

According to the local government, 800 ha is processed for agricultural production, and 120 ha is used for residential purposes. The municipality itself owns a cemetery (0.9ha), a kindergarten, a stadium (0.9ha), and land for a training facility (0.7 ha).

Housing and Utility Infrastructure

Apartments in Varianis Meurneoba are constructed in the Soviet Union times, around the 1960s. There are mostly two floored blocks of houses in the village and only two private houses. The state of the residential buildings is assessed as poor in the case of half of them. There are 4 buildings in particularly poor condition.

The main electricity supplier for Varianis Meurneoba is “ENERGO-PRO Georgia.” According to the respondents, they have a 24-hour supply of electricity and the quality of the electricity is satisfactory.

According to the respondents and the representatives of the local government, Varianis Meurneoba population has piped gas supply in their houses. The gas provider is “SOCAR Georgia Petroleum”.

A centralized water system is installed in the village, however, only 50% have a centralized water supply in their homes. The water quality is sufficient and it is suitable for drinking, however, the quantity is not sufficient. The municipality is responsible to provide assistance in case of any damage to the water system. There is no sewer system in the community.

Communications

The vast majority of households living in Varianis Meurneoba have cellular phones (90%). There are fixed broadband internet connections in the village provided by Magti and Silknet.

Transport and Roads

In terms of transport, minibuses are available to the regional center and municipal center. In the case of the regional center, transport is available five times a day, the travel takes about 30 minutes and costs 2 GEL. There is no direct transport from the settlement to Tbilisi.

The road leading to the village is asphalted and it is in very good condition. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are ground roads, partly gravelled. The condition of the inner roads in the settlement can be rated as normal. Light and heavy transport can move freely on the roads within the settlement during the whole year.

Employment

According to the representative of the local government, only 20% of the population is permanently employed in the village. The locals are mostly self-employed in the agricultural sector, which also includes working on someone else’s farm for daily remuneration. However, it is seasonal.

The majority of households depend on income from agricultural production. Cattle breeding is also common.

The local population mainly spends money on agricultural production (50%). 50% of households are said to own vehicles and 20% agro-machinery.

Social Infrastructure

As it was mentioned, some portion of residents depends on income from agricultural production. The most common agricultural market to sell products for locals is Tbilisi (Navtlughi agricultural market). Tbilisi is 70 km away and it takes about one hour and 30 minutes to travel there. Locals mainly drive to the agricultural markets to sell products in their vehicles or hire mini-vans.

Varianis Meurneoba residents purchase food in local markets (two local markets) or in the agricultural market at the regional center. Locals go shopping for household supplies/industrial produce and clothes at the regional center.

Industry and Construction

According to the respondents, there are no enterprises in the settlements. There are two local markets in the village.

There have been no new buildings built in the village in recent years.

Socially Vulnerable People

According to the official representatives of the local government, IDPs constitute about 11% of the population, while 32% of the residents are socially vulnerable individuals who get state assistance. There are three people with disabilities in Varianis Meurneoba.

Savings and Credits

According to the respondents, locals in Varianis Meurneoba do not have enough to have savings, this practice is not common.

The most popular practice of borrowing a considerable amount of money is from banks.

There are no financial institutions in the village itself. Liberty Bank representatives arrive twice per month and bring pensions for local pensioners and social assistance for socially vulnerable people. Locals can get bank services in Gori.

Education

There is no school within the settlements in Varianis Meurneoba.

There is one kindergarten in the village. There are 74 children registered there. There are 7 teachers. According to the respondent, the number of children at kindergarten has increased because children from Sakasheti also go there.

According to the respondents, about 5 young adults living in the settlement are receiving higher education at the moment. Most of the students choose humanitarian subjects. Vocational education is not popular in the village.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 15 minutes. Currently, there is neither a medical unit nor a pharmacy in the village.

Programs Implemented in the Settlement

The respondents could recall fencing of kindergarten funded by the village program as well as street lights.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in Varianis Meurneoba, respondents named drought, hail, frost, and heavy winds. Drought affected about 30% of the population, hail -40%, heavy winds – 20%, and frost – 10%.

Overall, in terms of pollution, respondents believe that air quality in the settlements is not contaminated, while roads and streets are moderately contaminated.

There are litter bins available in the village and they are taken away by the special municipal service two times per week.

Tourism

Tourism is not developed in the settlements.

5.1.4.4.1.4 Snapshot of Village Sakasheti IDP Settlement

An administrative unit Variani consists of the following villages: Variani, Akhaldaba, Sakasheti, Arashenda, Varianis Meurneoba, Sakasheti IDP settlement. However, project affected villages are: Sakasheti, Varianis Meurneoba and Sakasheti IDP settlement.

Location

Village terrain can be characterized as low land according to the respondents. The village was founded in 2009. Common surnames in the village are Jojishvili, Kazishvili, and Tsertsvadze.

Demography

According to the respondents, there are 90 households in the village, which make up about 325 persons (160 women, 165 men). According to the respondents, the population has decreased over the last ten years (since 2012). The main reason behind this is believed to be migration.

Ethnicity, Religion, and Language

The main language in the settlement is Georgia and the leading religion is Georgian Orthodox. There are 3 households of Jehovah's witness. There are neither churches, nor cemeteries in the settlement.

There is no holiday specifically celebrated in the village.

Land Use

In terms of the usage of the land resources, according the respondents, part of the population is involved in agricultural production. However, the crops are mostly cultivated for household usage. The land is processed mostly by agricultural machinery.

As for the village area, about 15ha is used for residential purposes and 50 ha for agricultural production.

Housing and Utility Infrastructure

Houses in the settlement are constructed in 2009. The houses are mostly one-floor houses and they are built with blocks making up to 80 m2 on average. The state of the houses is assessed as good. About 10% of the population did some refurbishments of their houses over the last two years. None of the houses are abandoned at the moment.

The main electricity supplier for the village is “ENERGO-PRO Georgia.” According to the respondents, they have a 24-hour supply of electricity.

According to the respondents, the local population has piped gas supply in their houses. The gas provider is “SOCAR Georgia Petroleum”.

A centralized water supply is available in the settlement. The municipality is responsible to provide assistance in case of any damage to the water system. The water quality and supply are sufficient. As for the sewer system, a separate one is constructed for the settlement by the ministry of internally displaced people. It is noteworthy that the locals do not have to pay for electricity and water supply.

Communications

The vast majority of households living in the village have cellular phones (90%). There are fixed broadband internet connections in the village provided by Magti and Silknet.

Transport and Roads

In terms of transport, there is a minibus available from the settlement to the regional center which commutes five times a day, the travel takes up to 35 minutes and costs 2 GEL. There is no transport directly from the settlement to Tbilisi.

The road leading to the village is asphalted and it is in very good condition. Light and heavy transport can move freely on the roads to the settlement during the whole year.

The roads within the settlement are ground roads and they are in very poor condition.

Employment

According to the representative of the local government, only 5% of the population is permanently employed in the village. They are mainly employed in Gori. The main source of income for the locals is state assistance and agricultural production. However, the latter mostly refers to working on someone else’s farm for daily remuneration and it is seasonal. There are also two mills in the village.

The local population mainly spends money on food (50%). 50% of households are said to own vehicles and 60% agro-machinery (mini tractor).

Social Infrastructure

As was already mentioned, a large portion of the local population is involved in agricultural production. The most common agricultural markets to sell products for locals are Gori and Tbilisi. Gori is 22km away and it takes about 35 minutes to travel there, while it takes about 1 hour and 35 minutes to travel to Tbilisi (77km). Locals mainly drive to the agricultural markets to sell products in their vehicles or hire mini-vans.

Locals purchase food in the agricultural market at the regional center or in Sakasheti. Locals go shopping for household supplies/industrial produce and clothes in a regional center.

Industry and Construction

As mentioned above, there are two mills in the village. There are no enterprises. There have been no new buildings built in recent years.

Socially Vulnerable People

According to the official representatives of the local government, 184 IDPs are living in the village, while there are no socially vulnerable individuals who get state assistance. IDP status holders receive separate assistance. Besides, there are 12% of socially vulnerable individuals receive state social assistance. About 8% of the population are pensioners. There are two people with disabilities living in the settlement at the moment.

Savings and Credits

According to the respondents investing their savings is not common for the locals and there is no one who has savings at the moment.

The most popular practice of borrowing a considerable amount of money is from banks.

There are no financial institutions in the village itself. Liberty Bank representatives arrive twice per month Locals can get bank services in Gori.

Education

There is neither a school nor a kindergarten in the settlement.

Health Care

Currently, it is possible to call for an ambulance in the settlement anytime, and the average time it takes for the ambulance to arrive is 35 minutes. There is neither a medical unit nor a pharmacy in the settlement at the moment.

Programs Implemented in the Settlement

The respondents could not recall any projects implemented in the settlement since 2015.

Climatic and Environmental Conditions

When asked about natural disasters that had occurred in the village in recent years, respondents named drought, hail, and frost. Drought affected about 30% of the population, hail – 40%, and frost – 10%.

Overall, in terms of pollution, respondents believe that the air quality in the settlement is not contaminated, while the roads and streets are somehow contaminated.

There are litter bins available in the village and they are taken away by the special municipal service two times per week.

Tourism

Tourism is not developed in the settlement.

5.2 Cultural Heritage

The project area is located in the territory of Kareli and Gori municipalities and includes the surrounding areas of Kareli and villages of Dzlevijvari, Dirbi, Tsveri, Breti, Sagholasheni, Bebnisi, Urbnisi, Ruisi, Arashenda, Sasireti, Sakasheti and Variani.

The project area (area 10X10 km) is an area of almost square shape (thick, red figure on the map), which is represented by four main (corner) boundary points. According to the provided coordinates, we tentatively called these points Point1, Point2, Point3 and Point4. [6] The location point of the turbines (the same as the masts) was given as a yellow mark and we left it like that; Roads by which the turbines should be connected to each other and/or by which the transport should reach the turbines are indicated by blue lines; The electricity cable connecting the turbines, which according to the project should be buried in the ground - is marked with red lines; The physically possible working area of the place where the turbine is located is presented as blue rings; Purple and white lines represent the areas adjacent to the turbine placement area, where, within the project, it is also possible to plan earthworks; The orang line on the map shows approx. 4 km long section, which crosses Tbilisi-Senaki-Leselidze highway E60 (GPS coordinates of the place: 410420.17 m E, 4655528.48 m N) and runs from the north-east of Kareli to the north-west of Ruisi village.

It falls within the total project area (largely) and extends a little on the northern side, having a rhombic shape of approx. 2.3 km long and 1.4 km wide area (approx. 298 ha) - green rhombus on the map. Six turbines may be located in this area (their conventional numbering is as follows: T38, T40, T39, T27, T35 and T47). The roads connecting these turbines to each other and to the plots of land located in the village area and the directions of the electricity line connecting the turbines to each other were not given, while for the rest of the territory they were already marked (see above).

Points marked on the map:

White marks - the four main (corner) boundary points of the project area;

Yellow mark - locations of masts determined according to the provided coordinates;

Green marks - cultural heritage monuments and/or objects included in the agency's document repository (base), whose location is precisely known;

Red marks - cultural heritage monuments and/or objects included in the agency's document repository (base), whose exact location is not known;

Blue marks - cultural heritage monuments and/or objects included in the agency's document repository (base), which have been assigned the category of national importance;

Flag-marked - areas considered by us to be noteworthy archaeological sites. Also the area where the archaeologist's supervision will be required during the earthworks.

Below are the cultural heritage monuments and objects located in the territory of Kareli and Gori municipalities, which are located closest to the area under consideration of the project area and which are listed in the database (base) of the National Agency for the Protection of Cultural Heritage of Georgia:

[6] Any interesting sections/points located in the entire project area (be it border points, roads, power lines, monuments/objects or areas of interest) are presented in the form of an appendix (Annex 1, Table 1-5).

Church of the Virgin Mary.

Registration number: 17589.

District/municipality: Kareli

Settlement: Kareli.

GPS coordinates: 408291.00 m E, 4652667.00 m N - to be confirmed.

Date: XIX century. (1850).

Initial Status: Object without status.

Current status: cultural heritage monument (30/03/2006, N3/133, Ministry of Culture, Monument Protection and Sports of Georgia).

Original Category:-

Current Category: Object/Monument Uncategorized.

The Church of the Virgin Mary stands in the north of the city.

Brief description: according to the construction inscription, it was built in 1850 by order of Fanaskerteli-Tsitsishvili, son of Eustatis. The church is damaged. During the repair, it was covered with tiles (on wooden structures). The church has a hall (15.7x9 meters). It is built with cobble stone and brick. It has two entrances, south and west. Both entrances are rectangular inside and outside, covered with an architrave. The deep semicircular apse has an arched window on the axis, with wide arched niches on both sides. Inside and below the northern niche is another small niche in each. The sanctuary is elevated by two steps. There are two wide arched windows in each the south and north walls. In the north-west corner of the church, in the thickness of the wall, there is a rectangular room, which has an arched entrance at the height of 2 m from the outside. The storeroom was connected to the church hall through an opening (now sealed). On the longitudinal walls of the hall there is a pair of two-tiered pilasters. The first level of pilasters supports decorative arches of the wall, the second level supports vaulted arches with shelf capitals at the heels. There are three semicircular niches on the eastern facade of the church. Indented crosses are depicted between the niches. On the south facade, on both sides of the entrance, there is a pair of pilasters. On the right, between the pilasters, there is a window, and below it is a niche (sealed). On the left side of the entrance, between the pilasters, there is an indented cross above, the entrance below (stoned). A construction inscription is carved on the stone of the architrave of the southern entrance of the church.

According to the coordinates (which, as mentioned, need to be clarified), the monument is located in the project distribution area, 2.3 km south of the location of the nearest towers (T57, T25).

Berikldeebi village and burial ground.

Registration number: 21018.

Original Category:-

District/municipality: Kareli.

Settlement: Bebnisi.

The village of Berikldeebi and its burial ground are located in the northeast of the confluence of the Mtkvari and East Prone rivers, 3 km west of the village.

GPS coordinates: 409756.00 m E, 4652916.00 m N - to be confirmed.

Date: The period from the Bronze Age to the earlier Iron Age (4th millennium BC - 10th-8th centuries BC).

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: Beriklebi village and its burial ground are located in the northeast of the confluence of the Mtkvari and Eastern Prone rivers, 3 km west of the village. 1979 During the aerial photo reconnaissance, the archaeological expedition of the Prone (dedoplis mindori - Queen's field) of the National Museum of Georgia (led by I. Gagoshidze) traced the burial mound and the Little settlement. Excavations were carried out in 1979-1983. The settlement (area 4000 sq/m.) is located directly at the confluence of the rivers Mtkvari and Eastern Prone on the crest of a high cape. In the trench cut at the edge of the settlement (area 400 sq/m) in 2 m. deep cultural layer, 4 periods were identified in stratigraphic sequence: 1. The weak layer of the Late Bronze Age settlement - traces of cobble stone buildings and fragments of typical black pottery. 2. Remains of sunken burials of the Middle Bronze Age, black, gray and light gray ceramics. 3. Two (?) construction horizons of the settlement of the Bedena culture fortified by the adobe wall - weak traces of the adobe and picket-wattle buildings, rectangular clay sacrificial platforms, high-quality black-gloss Bedena ceramics, as well as chestnut and pale clay vessels, a fragment of a bronze ax, stone and bone weapons; 4. Remains of a settlement of the Early Bronze Age. The ruins of a burnt circular building (diameter 10 m.) with a disk-shaped plastered central hearth, ritual cylindrical vessels, plastered platforms and fragments of typical pottery. The Bedena layer of rocks is dated by the C14 method to 2900 BC on burial ground, on the second terrace of Mtkvari river (area approx. 1 sq/m), there are about fifty burial mounds (Korgani). The diameter of the biggest mound reaches 50 m, and the height is 2.5 m. In 1980-1982 four pits and inhumation hill burials were excavated (supervised by I. Gagoshidze). Two mounds (I, II) were dated to the Early Bronze Age (XXIII-XXI centuries BC), one (III) - to the Middle Bronze Age (beginning of the II millennium BC), one (IV) from the Middle Bronze to the Late Bronze Age with the transition period (15th century BC). Pit burials of the early Iron Age (VII-VI centuries BC) were found in the corners of II and III mounds. Burial ground should be connected with the settlement of Berikldeebi. In the mound, the dead were buried in a four-wheeled cart tied to oxen. In addition to ceramics, a bronze dagger, a bronze clothes pin with a silver cover, and beads were included. The remains of chariots were also confirmed in mounds II and III. It is worth noting mound IV, dated to the 15th century B.C., surrounded by a circular wall of cobblestones, 40 m. in diameter and 1.5 m. (Kromlekh). The pit (9X4.5 m.; depth - 3 m.) was roofed with poles resting on wooden pillars. In the tomb there was a two-wheeled wooden chariot drawn by two horses, the yoke and head of which are decorated with figured bronze casings and standards with bird and deer statues. Bronze bridles, which are worn in the mouths of horses, are still the oldest among the bridles found on the territory of Georgia. On the chariot lay a bronze so called pre-Asian type of dagger with a frame-like handle, a ritual flat knife with a wooden handle, a leather quiver decorated with bronze plates with up to forty arrows with flint and bronze blades, etc. On the right side of the tomb, a tribal chieftain was buried with bent arms and legs, with sardine beads hanging from his neck and a bronze headdress inlaid with blue and red paste gems and decorated with a thin, ornate plate of gold. A 20-25-year-old woman was buried there, with a silver plate diadem on her forehead, gold, cornelian and glass beads and pendants around her neck, and a gold-headed and silver-handled brooch on her chest. Up to forty ornamented black glossy clay vessels were found in the tomb. Some of them have images of deer, horses and goats. There are ceramic figures of swans on the false handles of the same vessel. Several complete skeletons of a sheep and a pig and the heads and feet of four bulls were found. The heads of the bulls were decorated with cornelian and glass beads.

According to the coordinates (which, as mentioned, need to be clarified), the monument is located in the area of the project, 2.4 km southeast of the location of the nearest towers (T57, T25).

Salariani Church and settlement.

Registration number: 20967.

District/municipality: Kareli

Settlement: Aradeti.

GPS coordinates: 408504.00 m E, 4656787.00 m N - to be confirmed.

Date: Late Middle Ages.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

It is located 1 km southeast of the village, near the Gori-Khashuri highway, on the bank of the Eastern Prone River.

Brief description: The eastern wall of the church is built on a rock, on a high substructure made of limestone concrete, the arrangement of which is different from the arrangement of the walls of the main body of the building. The church has a hall (6x4.5 m.), built of rubble and cobble stone. The entrance is from the south. The sanctuary is rectangular. There is a narrow rectangular window in the west wall with a hewn stone jamb on the outside. The interior walls are smoothed and plastered with limestone. The facades are only lined with limestone. There are ruins of villages around the church.

According to the coordinates (which, as mentioned, need to be specified), the monument is located in the project distribution area, 0.46 km west of the location of the nearest mast (T26).

Settlement.

Registration number: 20962.

District/municipality: Kareli.

Settlement: Aradeti.

GPS coordinates: 411559.00 m E, 4657786.00 m N - to be specified.

Date: Late Middle Ages.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: The settlement is located 2 km north-east of the village, on a high ground. It is spread over an area of about 500 sq/m. The remains of the church and various buildings can be seen on the settlement.

According to the coordinates (which, as mentioned, need to be clarified), the monument is located in the project distribution area, 1.2 km northwest of the location of the nearest towers (T30 and T38).

Al. Proneli's (Kipshidze) residence.

Registration number: 17582.

District/municipality: Kareli.

Settlement: Sagholasheni.

GPS coordinates: 409269.00 m E, 4657195.00 m N - correct.

Date: XIX-XX centuries.

Initial Status: Object without status.

Current status: cultural heritage monument (23/02/2006, N3/46, Ministry of Culture, Monument Protection and Sports of Georgia).

Original Category:-

Current Category: Object/Monument Uncategorized.

Located in the project spread area, 0.17 km southeast of the nearest towers (T32 and T44).

The settlement (coincides with the site of Breti's nunnery).

Registration number: 21021.

District/municipality: Kareli

Settlement: Breti.

GPS coordinates: 409260.00 m E, 4659521.00 m N - in the data archive is noted as subject to confirmation, but coincides with the location of the Breti nunnery.

Date: Middle Ages.

Initial Status:-

Current status: cultural heritage monument (30/03/2006, N3/133, Ministry of Culture, Monument Protection and Sports of Georgia).

Original Category:-

Current Category: National (07/11/2006, N665, President of Georgia).

Short description: There is a village around Father Pyros's and St. George's Church, which dates back to the Middle Ages. The foundations of buildings built with cobblestones, fragments of blue-glazed clay vessels characteristic of the Middle Ages and red-fired, rough clay vessels of the late Middle Ages, as well as fragments of blue-glazed tiles, with which the church of Father Pyros was supposed to be roofed, can be observed.

It is located in the project spread area, 1.0 km southwest of the nearest towers (T11 and T13).

Tsveri complex (church and tower).

Registration number: 21020.

District/municipality: Kareli

Settlement: Breti, Tsveri.

GPS coordinates: 408549.00 m E, 4659181.00 m N - correct.

Date: Church - XVI-XVII centuries; Tower - XVII century.

Initial Status:-

Current status: cultural heritage monument (06/04/2021, N02/20, National Agency for Cultural Heritage Protection of Georgia).

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: the complex consists of a church and a tower. It is located in the north of the village, on the plateau (in Tsveri settlement). The church has a hall (8.6X4.6 m.), built of cobble stone and brick. It has an entrance from the south and west. The doors are arched and made of bricks. The west door has been removed after the construction of the tower. In the south, west and east walls, there is one arched and jamb-widenes window in each. The building had a toothed brick cornice, and today a stone shelf cornice is attached to it. It is covered with tiles. The apse is semicircular, separated from the hall by a shoulder. There are rectangular niches on both sides of the window. The conch rests on the triumphal arch over the shoulders. The hall is finished with a cylindrical vault. The interior is plastered. The iconostasis is new, made of stone. Later on the western wall of the church was annexed the church tower, which was due to the favorable strategic location of the plateau (the valley of Mtkvari and the road leading to the south can be clearly seen). The tower is rectangular (4.6x4 m.), built of cobblestones and limestone. The tower has four floors and has a two-tone roof. There are windows/crenelle in the walls at every floor level. The roof between the floors was made of wood. The arched entrance is in the south wall of the 2nd floor. The solid-walled first floor is for commercial purposes; The tower is connected to the church with arches cut on this floor. The second floor is residential and military. In its northern wall, there is a fireplace in the middle, semicircular niches in the corners. To the east, along the window of the church, there is also a window cut here. The 3rd floor is a battle room, in its three walls there are two gun crenelles. The fourth floor has the same solution. After the rehabilitation of the tower, a rectangular window was made in the western wall. In recent years, a stone staircase was built on the south wall of the tower to climb into the tower. There are also the remains of a settlement on the plateau, where ceramic material can be seen in abundance.

The north and west walls of the tower are wet at the first floor level. A metal-plastic window was inserted into the window on the fourth floor of the tower. On the south side of the tower, a stone staircase was built to climb into the tower. A building for church life and a toilet were built a few meters west of the church, which disturbed the historically established environment of the monument.

It is located in the project distribution area, 1.8 km southwest of the nearest towers (T11 and T13).

Temple complex – Dedoplis Mindori (Queen's field).

Registration number: 17579.

District/municipality: Kareli.

Settlement: Breti.

GPS coordinates: (at the base): 404922.00 m E, 4659417.00 m N - to be specified.

GPS coordinates: (from archaeological report): 405081.00 m E, 4658773.00 m N - accurate.

Initial Status: Object without status.

Current status: cultural heritage monument (30/03/2006, N3/133, Ministry of Culture, Monument Protection and Sports of Georgia).

Original Category: Object/Monument Uncategorized.

Current Category: National (07/11/2006, N665, President of Georgia).

Brief description: the temple complex is located between the Eastern Prone River and Western Prone Rivers, 3 km west of Aradeti village. It dates back to 1st century B.C. In 1972-78 the National Museum of Georgia conducted archaeological works on the Dedoplis Mindori, and in 1973 G. Chubinashvili Expeditions of the Georgian Art History Institute (led by I. Gagoshidze). The complex includes a system of cult buildings - temenos, residential and commercial buildings for temple servants and priests, temple slave settlements and burial grounds. The place where Temenos was found is known as St. George's niche. Main and minor temples, 6 other temples, gates and several other buildings were discovered here. All the buildings of the rectangular temenos (255x150 m.) are tilted along their longitudinal axis from south to north and slightly (by 6◦) to the west. Its central part is occupied by a square inner courtyard (105X105 m.), which is bordered from the south by the north balcony of the main temple, from the north by the south portico of the small temple, and from the east and west by the gates. The main temple occupies a central place in the southern part of Temenos. It was damaged by a strong fire. The temple is rectangular in plan (46X30 m.), built on cobble stone with adobe (0.5X0.5X0.12 and 05X0.25X0.12 m.). The walls (the remaining height is up to 2 m, the thickness of the capital walls is 1.6 m.) were plastered with a clay-chaff mixture solution and, apparently, were also painted (fragments of red, white and blue painted plaster were found). The main entrance is from the south - through a large, four-columned portico (17.2X11 m.) wide open to the south, which is connected to the central hall by a door cut to the east of the longitudinal axis. In the center of the square cella (17.2X17.2 m.) is a low square platform (1.6X1.6X0.15 m.) for the altar. The floor is made of clay. In the cella and portico stood paired wooden posts plastered with clay on square wooden bases, which were inserted into pits dug in the floor. In the center of the cella, above the altar, was erected a two-tiered crown supported by four free-standing columns with a wide opening in the center. A system of corridors surrounds the portico from the east and west, and the cella from the east-west and north. Corridors (total of 9 rooms) are divided by partitions into three isolated parts, which have independent entrances from the outside (two doors on each side). Two windows are cut in the north wall of each storeroom and one in the east and west walls. The corridor had a plain roof and was covered with red tiles. There are two types of tiles - flat and side-folded. The church has a rectangular loggia-balcony (11X6.5 m.), open on one side, connected to the church by a door. The columns are finished with bell-shaped capitals of incised yellowish-white fine-grained sandstone, on which relief petals of an open lotus flower are carved. The cella, the portico and the balcony were roofed flat with wooden rafters joined together with nails and resting on the columns. In the southern corner of Temenos stood two symmetrically located buildings (each 46 m long). The southern portico of the main temple was flanked by these structures. A small temple is located in the central part of the northern bank of the internal courtyard. The entrance to the temple is from the south, through an open two-columned portico that leads into the inner courtyard and is symmetrical to the north balcony of the main temple. It is connected to the portico cella (7.5X8 m.) by a double door. In the center of the cella stood a single column crowned with a sandstone capital. The altar was arranged at the south-west corner of the cella. A clay platform, similar to the one in the main temple, but smaller (1.1X1X0.15 m.) has been preserved. The cella is surrounded by a walking around area from the east and north. It can also be accessed from the portico. The portico was covered with a two-tone tile roof. A hump tile (width 0.6 m.) is used on the top. To the east and west of the small temple, there are three quadrangular courtyards surrounded by walls on all sides and separated from each other. Three buildings (13x20 m.) separated by a wall were excavated in the northeastern part of Temenos, each consisting of a square room, a corridor to the west of the room, and an open portico on the south side. Temples are surrounded by courtyards from the south and north. Each neighboring temple yard is connected to each other by an exit. These temple complexes are separated from the courtyards to the east of the small temple by a wide street-exit. The north-western part of temenos is symmetrical to the north-eastern part, and three temple complexes have been identified there as well. There are two gates (20x22 m.), they are located to the east and west of the inner courtyard of temenos. Each one consists of two large and two small porticos connected to each other. The large porticoes (internal dimensions 17.2X11 m.) are four-columned and open to the outside. Small porticoes (internal dimensions 11X6.5 m.) have two columns and go into the yard. To the north and south of the small porticos are rectangular rooms (6.5x2 m.) which are connected to the portico by a door. The capitals of the inner porticoes are similar to those of the minor temple and the north balcony of the main temple. The capitals of the outer porticoes differ from them by abaca ornament. Three-petaled lotus palmettes connected by semicircular stems are carved here, and six-petaled rosettes are inserted between them. The gates were covered with tiles. To the north of Temenos, at a distance of 70 m, 3 m wide wall (fence?) was excavated. Fragments of two stone capitals were found there. Similar remains were discovered west and south of Temenos. To the east of the temple complex, in the area immediately adjacent to it, the remains of cobblestone walls, ceramic products of the II-I centuries and others were confirmed. It is likely that the temple priests' homes and farm buildings were located here. Further east, 1 km from Temenos, to the northeast of so called Dampala Spring, on a low hill, the remains of the palace of the Late Hellenistic period were found. The building was roofed with tiles painted red similar to those used in the temple complex. To the north of the palace, at the foot of the hill, there was a burial ground of the same age. In Late Antiquity and Early Middle Ages, a large village was located on the western slope of the palace hill. Fragments of kvevri and other clay vessels, hand grinders, etc., were found in large quantities at the settlement. To the west of the village, several pit tombs closed with medieval tiles were excavated. 400 m to the northeast of Temenos was revealed workshops belonging to the temple and homes of slave-artisans of II-I centuried B.C. The chamber kiln for firing clay pots is arranged directly in the clay soil. 3 m long ramp descends from the surface of the ground to its vaulted fire pit. To the east of the vaulted kiln, a couple of meters away, there was a second ceramic rectangular kiln (3x1.3 m.). It is likely that it was used for firing tiles. Several agricultural pits were dug around the kilns. To the east of the kilns, at a distance of 50 m, a clay quarry was traced, which was filled with calcareous concretions sorted out from ceramic raw materials and ceramic products that were crushed or broken during transportation. The amount of defective material, as well as the dimensions of the quarry, indicate the large scale of production of the temple workshop. Apparently, a stone-working workshop and forges were located near the ceramic factory. In Late Antiquity and Early Middle Ages, there was a village on the settlement of temple artisans. Cultural layers of IV-V centuries and several pit tombs covered with tiles were studied. During the construction of the irrigation system, a clay sarcophagus of the same period was discovered here. To the south of the craftsmen's settlement and to the west of Temenos, at 280 m, there is a medieval settlement. The remains of half-pithouse buildings were studied. Numerous archaeological materials, 8th century Arab silver dirham, millstone, etc. were found. The discovery of a millstone indicates the existence of a water mill here, and therefore of a stream. Hellenistic and Late Antiquity settlement and burial ground are located northwest of Temenos, at 600 m. Here, on the area of several hectares, fragments of clay vessels were collected in the field. In the tomb, which was damaged during plowing, a red-hot clay jug was found. On the edge of the Dedoplis Mindori, to the east of the so-called “Kvavis Sakdari” (Crow's Church), in the mozvleulebi area, there is a late Hellenistic period settlement and burial ground, which belong to the same age as the church. A variety of archeological material has been found. In the pit graves, in which the dead were laid on their sides, with folded hands and feet, red painted jugs and heeled jars, black glossy clay vessels, colorful stone and glass beads, bronze bracelets and others were found. To the west of the settlement is a burial ground of the ancient times (7th-6th centuries BC). Early medieval tombs (stone boxes) were found south of the temple complex, on the right bank of the Tashiskari canal, as well as in two places: on the edge of the Dedoplis Mindori, in the north, on the southern slope of the Kvernaki series, on the so-called Paraskevas Gora (Friday Hill) and near the Siskhlis Jvari (Cross of Blood). At the so-called Dampalas Tskaro, 600 m southeast of Temenos, there is a Late Bronze Age mound burial ground. In two damaged tombs was found fragments of baked clay vessels from the end of the 2nd millennium. On the eastern side of the Dedoplis Mindori, the remains of a late medieval tower and other buildings have been preserved.

Nearby, during the excavation of the ground, a fragment of a small plaster sculpture of a Parthian craft was accidentally found - a female head with a high headdress and earrings. The statue was gilded, dates back to 1st century BC. On Dedoplis Mindori it was collected superficially and during the excavation it was revealed Old Stone Age flint, argillite and basalt tools and sherds, as well as two Acheulean handaxes. The temple complex discovered on the Dedoplis Mindori belongs to the type of ancient-eastern temples, which were completed in the Achaemenid era (Temple of Fire in Suza, 4th century BC). The discovery of the entire system of capital cult buildings of the pre-Christian era in the territory of Eastern Georgia confirms the existence of a highly organized pagan cult, a complex cult ritual and a developed temple economy in ancient Iberia.

According to the coordinates (which, as mentioned, need to be specified), it is located outside the project distribution area, 4.3 km to the northwest of the nearest towers (T32 and T44).

Tower-column.

Registration number: 10609.
District/municipality: Kareli.
Settlement: Breti.
Date: Unknown.
GPS coordinates: 409267.00 m E, 4659528.00 m N - to be confirmed.
Initial Status:-
Current status: Object with no status.
Original Category:-
Current Category: Object/Monument Uncategorized.

According to the coordinates (which, as mentioned, need to be clarified), it is located in the project distribution area, 1.0 km southwest of the nearest towers (T11 and T13).

Father Pyros's Church, St. George's Church and Bell Tower.

Registration number: 6712.

District/municipality: Kareli.

Settlement: Breti.

Date: VI century.

GPS coordinates: 409249.00 m E, 4659514.00 m N - correct.

Initial Status:-

Current status: cultural heritage monument (30/03/2006, N3/133, Ministry of Culture, Monument Protection and Sports of Georgia).

Original Category:-

Current Category: National (07/11/2006, N665, President of Georgia).

Brief description. Two construction layers can be distinguished in the structure: the church of Father Pyros (originally it was an independent building - chapel), which was built in the 6th century by one of the Syrian fathers, the disciple of Ioane Zedazneli, Pyros (buried here) and St. George's Church (main church) VIII-IX centuries. The Church of Father Pyros has been rebuilt, it is connected to St. George's Church and leaves an impression of an annex. The interior of the building has also been remodeled. The vault has been restored. The lower parts of the apse wall are unchanged. There is a narrow window on the axis of the deep, fluted apse. The only door cut to the south leads into the main church. The southern and western buildings are continuously connected to each other and form a walking-around area. Both are covered with a semi-circular vault made of limestone. The south window has a semicircular (deformed) apse. St. George's Church can be accessed through the entrance cut in the southern wall of the building. St. George's Church has a hall (14.35X13.2 m.). Despite the numerous reconstructions, the building's plan, masses, individual forms remain unchanged. The church has three entrances - north, south and west. The interior space is quite spacious. There is a wide window on the axis of the semicircular apse, and deep niches on both sides. The longitudinal walls of the hall are divided into two parts by two-level pilasters. The middle step supports the arch of the vault, and the side steps support decorative wall arches. The church is adjoined to the north by chapel (Church of Father Pyros), and to the south and west by annexes. The belfry is a brick-built six-arch pavilion with a round base and a pyramidal roof. Every corner of the pavilion is decorated with decorative shafts and arches.

It is located in the project spread area, 1.0 km southwest of the nearest towers (T11 and T13).

Burial mound.

Registration number: 21227.

District/municipality: Kareli.

Settlement: Tsveri.

GPS coordinates: 410408.00 m E, 4659177.00 m N - to be confirmed.

Date: Bronze Age (IV-II millennium BC).

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Short description: the burial mound is located 3 km from Tsveri village, on the edge of Dedoplis Mindori, in the north, on Kvernaki Ridge. This place is called Siskhlis Jvari (the cross of blood). The hill is surrounded by a circular fence made of coarsely broken cobblestones.

According to the coordinates (which, as mentioned, need to be specified), the facility is located in the project distribution area, 2.0 km southeast of the location of the nearest towers (T11 and T13). However, it should be noted here that the power line (cable) provided by the project, which will connect the different towers, should go 200 meters away from the possible location of the burial mound (as far as we know, it should be buried in a trench with a width of approx. 0.4-0.5 m). In the above-mentioned location, earthworks must be carried out under the supervision of an archaeologist.

Church of the Virgin Mary.

Registration number: 7973.

District/municipality: Gori.

Settlement: Sakasheti.

GPS coordinates: 414851.86 m E, 4660558.86 m N - correct.

Date: XIX century.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: the church has a hall and is built with alternating rows of cobblestones and bricks. Reddish stone blocks are used in the corners. Arched door jambs are also made of stone. The entrance is to the south and west. In the semicircular apse there is one window and two large niches. Two large windows are in the south and north walls. The hall is covered with a cylindrical vault. Internal roofing: arched - vaulted; Cylindrical. The church has a two-colored roof of blue grooved tiles. A brick belfry is built on the western wall. The church has a three-story bell tower from the west.

It is located in the project distribution area, 1.1 km northwest of the nearest towers (T46 and T50).

St. George's Church.

Registration number: 7974.

District/municipality: Gori.

Settlement: Sakasheti.

GPS coordinates: 414233.00 m E, 4659872.00 m N - correct.

Date: XIV-XVIII centuries.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: the church is a hall, built of cobble stone and brick. The door is on the south side. There is one window in the east, south and west walls each. The hall is covered with a cylindrical vault. The roof is two-colored. Internal roofing cylindrical.

It is located in the project distribution area, 0.8 km northwest of the nearest towers (T58 and T43).

Tower ruins.

Registration number: 14572.

District/municipality: Gori.

Settlement: Sakasheti.

GPS coordinates: not provided.

Date: Middle Ages.

Initial Status:-

Current status: Object with no status.
Original Category:-
Current Category: Object/Monument Uncategorized.

Burial Mound Goraka.
Registration number: 14663.
District/municipality: Gori.
Settlement: Sakasheti.
GPS coordinates: not provided.
Date: Bronze Age - year 4th-2nd millennia BC.
Initial Status:-
Current status: Object with no status.
Original Category:-
Current Category: Object/Monument Uncategorized.

The object is about 1 km away from the village, at the location Goraka between villages Variani and Sakasheti.

Brief description: It was discovered in 1961, by accident, during land cultivation. It dates back to the Bronze Age. It is damaged. According to oral tradition, several dead were buried in the burial mound. The manner of burial is unclear. Next to the bones of the deceased, black-burnt clay pots of different sizes were found.

Burial ground
Registration number: 21031.
District/municipality: Gori.
Settlement: Sakasheti.
GPS coordinates: 415461.00 m E, 4660409.00 m N - to be confirmed.
Date: Bronze Age (IV-II millennium BC); Late Bronze Age (XVI-XI centuries BC).
Initial Status:-
Current status: Object with no status.
Original Category:-
Current Category: Object/Monument Uncategorized.

The facility is located in location Gorani (the same as Chakiruli).

Brief description: The burial ground was discovered by chance during land cultivation. The deceased was buried with his hands and feet folded, his head towards the north. Fragments of black-burnt, rough-hewn clay vessels of various sizes were found in the territory of the burial ground.

According to the coordinates (which, as mentioned, need to be specified), the facility is located in the project distribution area, 0.96 km northwest of the location of the nearest mast (T55).

The tomb.
Registration number: 21032.
District/municipality: Gori.
Settlement: Sakasheti.
The monument is located in Tsotskhebi, in the village cemetery.
GPS coordinates: 414306.00 m E, 4659876.00 m N - to be confirmed.

Date: Antiquity (5th BC-3rd century BC).
Initial Status:-
Current status: Object with no status.
Original Category:-
Current Category: Object/Monument Uncategorized.

Brief description: The tomb was discovered in 1973 accidentally, during land cultivation. The burial position of the deceased is unclear. A cup made of red baked pure clay with a glossy surface and a hollow hande was discovered.

According to the coordinates (which, as mentioned, need to be specified), it is located in the project distribution area, 0.8 km to the north-west of the nearest towers (T58 and T43).

Burial Mound of Khatinatkha.
Registration number: 21033.
District/municipality: Gori.
Settlement: Sakasheti.
Burial mound is located in Khatinatkha.
GPS coordinates: 415710.00 m E, 4660818.00 m N - to be confirmed.
the date Bronze Age (IV-II millennium BC).
Initial Status:-
Current status: Object with no status.
Original Category:-
Current Category: Object/Monument Uncategorized.
Brief description: The burial mound is rocky. It is poorly protected.

According to the coordinates (which, as mentioned, need to be specified), it is located in the project distribution area, at a distance of 0.78 km to the west of the nearest mast (T37).

Cylindrical tower.
Registration number: 5927.
District/municipality: Gori.
Settlement: Varian.
GPS coordinates: 417373.82 m E, 4658639.71 m N - correct.
Date: XVII-XVIII centuries.
Initial Status:-
Current status: Object with no status.
Original Category:-
Current Category: Object/Monument Uncategorized.

Brief description: 2 km to the northwest of the village, there is a cylindrical tower in the field. The wall of the first floor from the south has been demolished and the floor is filled with rubble. The roofs of the 1st and 2nd floors were dome-shaped. The second floor is rectangular. The arched entrance is in the south wall, on its sides there are lancet-shaped windows with two crenellations. In the east wall there is a large, lancet-shaped niche with a narrow window and a crenellation. On the sides there are small niches with crenellations. In the center of the north wall is a fireplace with one crenellation. There was a staircase built into the wall to the west, which has collapsed. The third floor is literally destroyed. The tower is built of cobble stone with thick mortar. The walls are cracked, part of the first floor has been demolished. The upper parts of the walls have been demolished. The roof between the floors has collapsed.

It is located in the project spread area, 0.37 km west of the nearest tower (T32), and 0.55 km southwest of the location of the T33 tower.

Settlement.

Registration number: 20414.

District/municipality: Gori.

Settlement: Variani.

Date: XVIII century.

GPS coordinates: 417497.00 m E, 4658444.00 m N - to be confirmed.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: near the cylindrical tower, in the Lelistavebi area, at the settlement, the remains of the foundations of cobblestone buildings were found. Fragments of red-fired coarse clay vessels and kvevris and others were found. According to reports, the population deserted this area during the Leki invasions.

According to the coordinates (which, as mentioned, need to be specified), it is located in the project distribution area, 0.55 km south-east of the nearest tower (T32).

St. George.

Registration number: 17357.

District/municipality: Kareli

Settlement: Sasireti.

GPS coordinates: 413283.00 m E, 4658087.00 m N - correct.

Initial Status: Object without status.

Current status: cultural heritage monument (01/05/2015, N2/83, National Agency for Cultural Heritage Protection of Georgia).

Original Category:-

Current Category: Object/Monument Uncategorized.

It is located in the project distribution area, 0.8 km northwest of the nearest mast (T41 and T54).

Church of the Virgin Mary.

Registration number: 8029.

District/municipality: Kareli.

Settlement: Ruisi.

GPS coordinates: 414797.00 m E, 4654187.00 m N - correct.

Date: XIX century.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: The Church of the Mother of God is located in Kveitshua area. It is a cross-domed building (14.15X9.2 m.), built with alternating rows of bricks and cobblestones. The entrance is on the south (sealed) and west. The church has a small semicircular apse compared to its overall dimensions. The altar is elevated by 0.8 m and has four-step staircases at both ends. There is one wide window and three arched niches in the apse, and on its sides there is a narrow rectangular pastophorium and a deacon's room covered with a semicircular vault. Above them are hiding cells, the front wall of which has been demolished, at the intersection of the arms covered with semicircular arches of the cross, on the walls of the apse and on the two free-standing columns of the west, there is a low vaulted windowless dome (neckless hemisphere). There is one window in each arm of the cross. In the wall of the northern arm, in a wide niche, a baptismal niche is carved. The western arm opens on all three sides with large semicircular arches. The arm vault rests on two supporting curved arches. The vaults of the inter-arm sections are perpendicular to the vault of the western arm. The facades are decorated with decorative semicircular arches and rectangles. The edges of the entrances are made of hewn stone.

It is located in the project spread area, 1.3 km south of the nearest towers (T33 and T35).

Kviriketsminda Church.

Registration number: 8030.

District/municipality: Kareli.

Settlement: Ruisi.

GPS coordinates: 415888.00 m E, 4653996.00 m N - correct.

Date: XIV-XVIII centuries.

Initial Status:-

Current status: cultural heritage monument (18/01/2019, N02/2, National Agency for Cultural Heritage Protection of Georgia).

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: the church is located in the northern part of the village of Tsinaubani. It has a hall (10.6X6.3 m.), it is built with cobble stone, basalt was used during the repair (19th century). The walls are plastered inside and outside. The exterior edges of the door and window are made of hewn stone, the roof was originally tiled. The entrance is to the south, the west door is sealed. During the repair, a stone with a grave inscription was placed on the outside of the door as an architrave. There is one arched window on the axis of the semicircular apse. The floor of the altar, which is raised by one step, is bricked. In the south wall, there are two windows, arched on the inside, and rectangular on the outside. In the western part of the hall there was a wooden gallery, which is evidenced by the horizontal pits made for the post in the longitudinal walls. On the east facade, under the pediment, there is a small relief cross. The building is surrounded by a Shirimi stone profiled cornice. A four-pillared brick bell tower with a pyramidal roof is built on the pediment hump of the western facade.

It is located in the project distribution area, 0.58 km southwest of the nearest towers (T15 and T18).

Ruisi Mother of God Church Complex.

Registration number: 10630.

District/municipality: Kareli.

Settlement: Ruisi.

GPS coordinates: 413685.00 m E, 4654488.00 m N - correct.

Date: Middle Ages (several construction layers can be distinguished on the church: ancient - VIII-IX centuries; repaired - X century; renovated - XI century; periodical restoration works were carried out on the church including the XVIII century).

Initial Status:-

Current status: cultural heritage monument (30/03/2006, N3/133, Ministry of Culture, Monument Protection and Sports of Georgia).

Original Category:-

Current Category: National (07/11/2006, N665, President of Georgia).

Brief description: The complex of the Cathedral of the Mother of God is located in the center of the village. The complex includes: Cathedral of the Mother of God, bell tower, rampart. According to the tradition, the temple was built by Vakhtang Gorgasali, however, the building of this age did not survive. Several construction layers can be distinguished on the church: the oldest - VIII-IX centuries; Repaired - X; Renovated - 11th century; In the 11th century, the church was decorated by Bishop Giorgi, as evidenced by the two-line Asomtavruli inscription near the conch heel of the apse of the north gate: "Christ, have mercy on the soul of Bishop Giorgi, Amen." At the bottom of the inscription is written: "of Queen Mariam". The episcopal cathedral was helped by Queen Burdukhan, the mother of King Tamar: "Queen Burdukhan took care". During the invasions of Tamerlane, the church was badly damaged. According to the inscription on the western facade, the temple was rebuilt by King Alexander I (1411-1442). “May God praise the reign of the king Alexander the great who built this church, may God bless him and may his soul be blessed." The builder is mentioned in the inscription on the south facade of the church: "May God grant peace on Shalva the builder, Amen." In the 16th century, the church was rebuilt again by Mrovi Bishop Dionyse Laradze, and in the 17th century, it was renovated and decoraed by Queen Mariam, the wife of King Rostom (1632-1758). In the 18th century, the Mrovi bishop's congregation covered quite a large area. According to Vakhushti Bagrationi: "The bishop sits, the shepherd of this Ruisa Zeiti Kartli, to Likh-Tashiskari and shepherds the valley and Sadgeri...". Priest Nikoloz Orbeliani gives interesting information about the economy of the Diocese of Ruisi in his "Congregation Register" compiled in 1715. 1803 Yustine Maghaladze built a pulpit in the temple. 1811 Diocese of Ruisi was abolished. The 1920 February earthquake severely damaged the monument, which was restored in 1936-38 by the Department of Monument Protection of the Department of Art Affairs of the Council of People's Commissars, and in 1950-1953 - a special restoration enterprise workshop.

It is located in the project distribution area, 0.94 and 0.99 km southwest of the nearest towers (T11 and T17).

Ruisi Church of St. Demetre.

Registration number: 8033.

District/municipality: Kareli.

Settlement: Ruisi.

Date: XIV-XVIII centuries.

GPS coordinates: 413297.00 m E, 4655452.00 m N - correct.

Initial Status:-

Current status: cultural heritage monument (30/03/2006, N3/133, Ministry of Culture, Monument Protection and Sports of Georgia).

Original Category:-

Current Category: Object/Monument Uncategorized.

Short description: The Church of St. Demetre is located 1 km northwest of the village, on a hill. It has a hall (6.3X10.3 m.), it is built with different sizes of sandstone, tufa is used occasionally. It has an entrance from the south. There is one window in the east, west and south walls. It is covered with tin. To the east is a semi-circular apse, separated by two-step shoulders. The conch rests on the vault over the shoulders. Longitudinal walls are separated with one pair of pilasters. The pilasters are two-tiered. The upper steps, crowned with capitals, have a vaulted arch, and the lower steps form a decorative arch of the longitudinal walls. There are similar half-pilasters in the edges of the western wall. In the eastern arch of the southern wall there is a preserved painting (Holy Riders?). The church has been greatly changed: cement has been used on the outside, and a 50 cm high concrete step is placed below the western and northern walls. The upper part of the interior is plastered with plaster and the lower part - with cement. The eastern arch of the northern wall is completely covered with cement.

It is located in the project distribution area, 0.62 km west of the nearest tower (T17). However, it should be noted here that the church is located in the village cemetery, from the extreme northern part of which the electricity line (cable) provided by the project, which will connect the different towers, should pass a few meters away (as far as we know, it should be buried in a trench with a width of approx. 0.4-0.5 m). In the above-mentioned location, earthworks must be carried out under the supervision of an archaeologist.

St. Marine Church.

Registration number: 10632.

District/municipality: Kareli.

Settlement: Ruisi.

GPS coordinates: 415356.66 m E, 4654365.48 m N - correct.

Date: Early Middle Ages.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Short description: St. The Marine Church is located in the center of the village, in the Zurabaant neighborhood, on the roadside, at the cemetery. The church has a hall (5.6X4.14 m.), it is built with hewn blocks of shirimi stone, cobble stone and sandstone boulders. The arched entrance is to the west. There is one rectangular window on the axis of the apse with deep flattened, rounded corners. The hall had a single vault concreted with limestone. A single stone of the massive shelf cornice survives in the northwest corner. The church was roofed with hewn stone tiles, which were later replaced with tiles. The church is heavily damaged: the vault and a large part of the conch are collapsed, the upper section of the southern wall is destroyed.

It is located in the project distribution area, 0.9 km southwest of the nearest towers (T05 and T07).

Kviratskhoveli Church.

Registration number: 21164.

District/municipality: Kareli.

Settlement: Ruisi.

GPS coordinates: 414693.13 m E, 4654890.23 m N - correct.

Date: XVIII-XIX centuries.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: The church is located in the north of the village, in the cemetery. It has a hall plan (7.43X4.47 m.), it is built with sandstone and cobblestone. The entrance is from the south. There is one window on the axis of the semicircular apse, one niche on both sides. The longitudinal walls of the hall are directly connected to the apse conch, the heels of which rest on the imposts. There is one window in the south wall. The church is covered with a two-tone tile roof.

It is located in the project distribution area, 0.6 km south of the nearest towers (T33 and T35).

Settlement.

Registration number: 21165.

District/municipality: Kareli.

Settlement: Ruisi.

GPS coordinates: 414316.00 m E, 4654965.00 m N - to be confirmed.

Date: Late Middle Ages.

First Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: The settlement is located 1 km north of the village, on the location Serebi. In the territory of the settlement, fragments of red-burnt, coarse-grained clay vessels and fragments of kvevri, the surface of which is plastered with lime, are confirmed. Remains of the foundations of several cobblestone buildings have been preserved.

According to the coordinates (which, as mentioned, need to be clarified), it is located in the project distribution area, at a distance of 0.45 and 0.63 km to the southeast of the nearest towers (T11 and T17).

Church of the Virgin Mary.

Registration number: 21166.

District/municipality: Kareli.

Settlement: Ruisi.

GPS coordinates: 414048.98 m E, 4654151.08 m N - correct.

Date: End of XIX – beginning of XX centuries.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: the church is located in the northeast of the village's anterior neighborhood. It dates back to the developed Middle Ages, and was renovated in the 19th-20th centuries. The church has a hall (8.35X5.8 m.), built of cobblestone and crushed stone. The facades are covered with well-polished shirimi stone blocks; here and there basalt blocks are also used. The entrance is from the south. On the axis of the semicircular apse is a rectangular window with deep niches on both sides. The west window is also rectangular, with a strongly curved lower part. The interior space is high. Initially, the interior walls were plastered. After the repair, they were polished again and whitened. At the same time, a four-pillared brick bell tower with semicircular arches on all four sides was built on the pediment hump of the western facade, which has a spherical vault on the inside, and is finished with a pyramidal roof on the outside. The church has preserved the old cornice of shirimi stone, which consists of a smooth shaft and a shallow circular pattern. It is covered with a two-tone tile roof.

It is located in the project spread area, 1.2 km south of the nearest towers (T11 and T17).

Ruisi St. David the Builder Church.

Registration number: does not have.

District/municipality: Kareli.

Settlement: Ruisi.

GPS coordinates: 414182.00 m E, 4654389.00 m N - correct.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Date: Late Middle Ages.

It is located in the project distribution area, 0.94 km south of the nearest tower (T11).

Urbnisi St. Stepane Cathedral (Urbnisi monastery complex).

Registration number: 7236.

District/municipality: Kareli.

Settlement: Urban.

GPS coordinates: 415510.25 m E, 4651484.94 m N - correct.

Date: boundary of V and VI centuries.

Initial Status:-

Current status: cultural heritage monument (30/03/2006, N3/133, Ministry of Culture, Monument Protection and Sports of Georgia).

Original Category:-

Current Category: National (07/11/2006, N665, President of Georgia).

Brief description: Zion of Urbnisi - the three-nave basilica is located in the village of Urbnisi, Kareli municipality. Based on the stylistic features and paleographical study of the Asomtavruli inscription on the northern facade, it dates to the boundary of the 5th and 6th centuries. In the mentioned inscription, the founders of the temple, named Constanti and Father Mikel, are mentioned. The other three inscriptions of different times talk about the restoration of the church. The Zion of Urbnisi is a basilica with three naves (32.1X22.4 m.), its plan, spatial solution and external masses bear clear signs characteristic of a basilica. In the interior and facades of the church, the original (boundary of the VI-VII centuries) and later (II half of the IX century and 1668) construction layers of repair and restoration are clearly visible. The earlier layers are built with well-smoothed blocks of sandstone. In the next period, stones of different shapes are used for reconstruction, the arrangement is irregular. There are three entrances to the temple: from the south, west and north. In the interior of the church, the naves are separated from each other by four cruciform pillars. The pillars and the semicircular brick arches resting on them divide the space of the middle nave into five, almost equal sections. The nave is covered with a brick semicircular vault. On the eastern facade of the temple, a cross is made of bricks. There is a similar cross on the west facade. In the western section of the north facade, under the window, there is a stone with the image of a cross, and further down is the image of a horse. The church has a serrated brick cornice. The roof is tiled. The temple had an extension to the south and north, along its entire length. The southern extention, which ends in the east, is contemporaneous with the original building (later it was redone several times). The other parts of the extensions are later. Fragments of the church are embedded in them. The church also had an extension in the west - the remains of the walls have been revealed 2.5 m from the church. Urbnisi Zion belongs to the group of great basilicas of Georgia of the earlier feudal era (analogs - Katsreti Trinity, Khirsa).

It is located in the project spread area, 1.76 km southwest of the nearest towers (T09 and T17).

St. Nino's Church.

Registration number: none.

District/municipality: Kareli.

Settlement: Urbnisi.

Date: new and latest period (XX-XXI centuries).

GPS coordinates: 414882.18 m E, 4651706.08 m N - correct.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

It is located in the modern-day cemetery of the village, in the southwestern part of the village, on the bank of Mtkvari River.

It is located in the project spread area, 2.35 km southwest of the nearest towers (T09 and T17).

Tower.

Registration number: 10604.

District/municipality: Kareli.

Settlement: Urbnisi.

Date: Middle Ages.

GPS coordinates: 415435.00 m E, 4651927.00 m N - to be confirmed.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

According to the coordinates (which, as mentioned, need to be clarified), it is located in the project distribution area, 1.7 km southwest of the nearest towers (T09 and T17).

Old cemetery.

Registration number: 10619.

District/municipality: Kareli.

Settlement: Urbnisi.

GPS coordinates: 415708.00 m E, 4651506.00 m N - to be confirmed.

Date: Unknown.

Initial Status:-

Current status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Short description: Both Kaspi and Urbnisi are mentioned as ancient cities in "Moktsevai Kartlisai". "The upper stream of the river was divided into four towns... Sarkine City, Kaspi, Urbnisi and Odzrkhe"... In the life of St. Nino, Urbnisi is mentioned as a city. "Countless people from the city (of Urbnisi) go the big city to Mtskheta… for trade." Urbnisi is also known in history with the church meeting that took place in the villages of Ruisi and Urbnisi in 1103 during the time of David the Builder. It is written about this meeting in "Dzeglis Tsera": "The two bishops of Ruisi and Urbnisi gathered near Kartli region." Vakhushti Batonishvili says about Urbnisi: "And to the west of this mountain, on the edge of Mtkvari, there is Urbnisi. Uplos, son of Kartlos, built the city up to "Krusad", and now there is a big church without a dome, there sits a bishop, the shepherd of the Great Liakhvi and which is watered by the Liakhvi River. King Vakhtang decorated the icon of St. Stepane the First Martyr and surrounded it with a wall. It is self-evident that the old cemetery of such a village is of scientific interest, and it is also connected to the fact that material monuments were found in the cemetery: a clay coffin, a jug, etc.

According to the coordinates (which, as mentioned, need to be clarified), it is located in the project distribution area, 1.6 km southwest of the nearest towers (T09 and T17).

Kvatskhela Settlement.

Registration number: 20231.

District/municipality: Kareli.

Settlement: Urbnisi

GPS coordinates: 417340.00 m E, 4651079.00 m N - correct.

Date: Bronze Age (IV-II millennium BC. Early Bronze Age - 3500-2500 BC).

Initial Status:-

Current Status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Brief description: Kvatskhela settlement is located in Kareli district, on the left of the high terrace of Mtkvari, which is bounded from the east and west by small ravines, and from the south the steep slope of the river. As a result of archaeological excavations, three cultural layers were found here. It belongs to the Upper-Pre-Feudal Age. The two lower layers B and C contain three horizons each and represent the advanced and late stages of the Early Bronze Age. In layer C, the settlement C1 horizon is the best preserved, where parts of the building are preserved intact under a thick layer of rubble. Here were identified and excavated 25 buildings of the "standard" type characteristic to Shida Kartli. 22 of them are framed and plastered with clay, 3 are built with aliz bricks. In layer B were excavated 15 buildings, which almost exactly replicate the building type of layer B. It seems that the planning of the settlement does not change during the entire existence of the Kvatskhela settlement. The houses are arranged in straight rows close to each other and are grouped around small squares and passages. The settlement has a terraced appearance, due to the slope of the territory. The houses are rectangular, elongated, with rounded corners. The building, as a rule, consists two parts - an almost square room and an entrance corridor, separated from it by a wall, extending to the facade. The room is residential, and the corridor had an economic purpose. The entrance to the room is in the center of the wall. Often there is a small rise near the back wall of the room. In the center of the room there is a stationary round, fluted hearth; Behind him, in a pit made by cobblestones, stood a square pole with a roof. Houses were built on a pre-aligned horizontal square, without a special foundation. The walls were built either by aliz bricks in one row, or by a spun clay frame; The floor was plastered by the clay and well polished. Certain parts of the walls and floor and the edges of the rise were painted red and cover with gold drawings. Numerous clay vessels of various shapes and sizes, zoomorphic sculptures, sickle inserts, hand grinders, bone and stone tools, and metal artifacts were found at the settlement.

It is located in the project area, 0.9 km southwest of the nearest towers (T04 and T06).

Kvatskhela Burial Ground

Registration number: 20232.

District/municipality: Kareli.

Settlement: Urbnisi

GPS coordinates: 417369.00 m E, 4651080.00 m N - correct.

Date: Bronze Age (IV-II millennium BC. Early Bronze Age - 3500-2500 BC).

Initial Status:-

Current Status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Short description: Kvatskhela settlement is one of the chrestomatous monuments of the Mtkvar-Araks period in Shida Kartli. Two burial grounds have been studied on Kvatskhela, one of which is located directly on the territory of deserted village, on its northern bank, and is tentatively known as the Kvatskhela burial ground, while the other burial ground was traced near Kvatskhela and is known as the "Tvlepia spring" burial ground. Burial ground (Kvatskhela) excavated directly in the territory of the settlement consisted of two tiers. The two pit burials studied here (N1 and N5) belong to the lower or first tier; The upper tier contained 13 tombs, lined up on a northwest-southeast line. All the tombs studied at Kavatskhela belong to the group of pit tombs, they were located at different depths, almost all the tombs (except for the two tombs of the lower tier and the N13 tomb of the upper tier) had roughly rectangular cobblestones, some of the tombstones were badly damaged. Burial pits were filled with stones, the pits were mostly rectangular, rarely oval, the dimensions of which were different in all cases from 0.9X0.8 m to 1.9X2.3 m. Specially selected flat cobblestones were arranged in orderly rows on the walls of the pit of one of the tombs (N2). Another tomb had a floor paved with fine pebbles. Three tombs (NN7, 10, 15), unlike the others, should have had a wooden roof, and then the stone was laid. Except for two burials on Kvatskhela burial grounds (N2 - two dead and N12 - three dead), all are individual. The posture of the dead is uniform: crouched on the left or right side. The inclination of the deceased is uniform, which is mainly oriented with the head towards the south. All fifteen tombs were inventoried. Individual burials contained clay vessels of different sizes and shapes, crucifixes, copper tools, jewelry, etc. Among them, some tombs are distinguished by their rich inventory (eg N2).

It is located in the project area, 0.9 km southwest of the nearest towers (T04 and T06).

"Tvlepia Source" Burial Ground

Registration number: 20233.

District/municipality: Kareli.

Settlement: Urban.

GPS coordinates: 417566.00 m E, 4651292.00 m N - correct.

Date: Bronze Age (IV-II millennium BC. Early Bronze Age - 3500-2500 BC).

Initial Status:-

Current Status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Short description: Burial ground of Tvlepia spring is located two and a half kilometers from the village of Urbnisi to the east, on the left bank of Mtkvari, on the old terrace of the river. Near the settlement of Kvatskhela, 200 meters north-east from it. Tvlepia at the head of the spring ravine. Four tombs have been studied at Tvelpias-Tskaro burial ground. One of the burials (N1) was a cracked cobblestone Enrockment (2 x 2 m. in size), mixed with ash, pottery shards, and a small amount of burnt human bones. The thickness of the Enrockment was 40-50 cm. Under it was a small clay square, in the middle of which, about 60-70 cm in diameter, traces of strong action of fire could be seen. The ground was visible under the field at a depth of 25-30 cm. Among the material found in the pile, noteworthy are the teeth of a child, burnt fragments of a barrel bone, metal slag, two copper "hoe-like" pendants and various types of beads, which also bore traces of fire. The noted tomb is considered a cremation tomb. All the other three burials are inhumation and were pits dug into the ground, which were covered by a 20-30 cm thick square stone (the size of the stone varies between 2-2.5 X 2-2.7 m). The burials were oriented on a N-S line. The sides of one of the tombs (N3) were surrounded by cobblestones. The tombs were badly damaged and only fragments of the skeletons of the dead could be seen. In tomb N2, 3 dead people were supposed to be buried, and in N3, bone fragments were observed between the stones at different levels, so that neither its direction nor the number of dead people could be determined from them. Only fragments of a child's skull survived near the NE corner of the tomb. In tomb N4, the skeleton had almost disappeared, so it was not possible to determine the orientation of the tomb. All the tombs of Tvelepias-Tskaro contained quite diverse inventory, the ceramic material is mainly presented in the form of fragments, there are many copper hooks, beads and pendants, it is worth noting the copper spearhead, in addition, there are many beads of different shapes made of different types of stone.

It is located in the project distribution area, 0.6 km southwest of the nearest towers (T04 and T06).

Khizanaant Gori Settlement.

Registration number: 20234.

District/municipality: Kareli.

Settlement: Urbnisi.

GPS coordinates: 415250.00 m E, 4651425.00 m N - to be confirmed.

Date: Antiquity (5th BC-3rd century BC); Middle Ages (IV-XVIII centuries); Bronze Age (IV-II millennium BC. Early Bronze Age (3500-2500 BC)).

Initial Status:-

Current Status: Object with no status.

Original Category:-

Current Category: Object/Monument Uncategorized.

Short description: Khizanaant Gori settlement is located in Kareli district, village near Urbnisi, On the left bank of the river Mtkvari, on the ridge of the elevated terrace. It was created as a result of layers of inhabitants. The thickness of the cultural layer here exceeds 8 meters, the area is 340 square meters. Here, under the feudal and ancient layers were found 4 layers of the Early Bronze Age (B, C, D, E). These layers are heavily damaged and do not give a clear picture of the planning. Two types of residential buildings have been confirmed on Khizanaant Hill: round (layers E, D) and quadrangular (layers C, B). The lower, E layer of Khizanaant Gori is represented by two horizons. One entire square, compacted with clay, should have been supported by small conical or double-roofed gabled tholoses. In the center of the building, on the floor, there was a stationary hub. This layer differs from the upper layers by the abundance of cultic and agricultural s. A burial was cut into one of these pits. Round buildings are also found in the next layer D. The building of this time is a circular plan braided room with clay plastered walls on both sides. The floor is covered with ash, layered and painted red. The stationary hearth was also painted, behind which the motherbodze pit has been removed. Layers C and B contain three horizons each. More than 13 structures have been excavated in them. The construction technique is the same as in layer D. The buildings verified in these layers are very close to the buildings of Kvatskhela, which is especially clear on layer B of Khizanaant Gori. Some peculiarities are observed in layer C, especially in its early horizons, where the corners and even the walls of the building are somewhat rounded. The pit behind the hearth is not visible here. Various archaeological materials were found in all four layers of the settlement. Clay pots of various shapes and sizes, hand grinders, sickle inserts, etc. are especially prevalent. It is worth noting the copper sickle found on the settlement.

According to the coordinates (which, as mentioned, need to be specified), it is located in the project distribution area, 2.0 km southwest of the nearest towers (T09 and T17).

Early Bronze Age Burial Ground Of Urbnisi

Registration number: 20253.

District/municipality: Kareli.

Settlement: Urban.
GPS coordinates: 415092.00 m E, 4651661.00 m N - to be confirmed.
Date: Bronze Age (IV-II millennium BC. Early Bronze Age - 3500-2500 BC).
Initial Status:-
Current Status: Object with no status.
Original Category:-
Current Category: Object/Monument Uncategorized.

Brief description: Early Bronze Age burials have been studied in Urbnisi. In total, nine tombs of this period have been identified in different areas of the settlement, seven of them are located in the western part of the settlement (N36 area), one - in the XX-2 area, and one burial was traced directly on Khizanaant Hill. All of them are individual pit burials, most of which were partially damaged by later period activities. Four of the seven pit burials (NN16, 17, 28, 29) studied in the western part of the settlement were so damaged that it was not possible to determine the full dimensions and inclination of the burial. The skeleton of the deceased was also fragmentary, so we cannot say anything about the burial posture. According to the relatively better preserved tombs (N5, N44 and N45), it is established that the dead were buried in specially dug pits, the contours of the tombs are not distinguished, so we cannot say anything about their dimensions. As for the depth (from the surface), it varies from 1 meter to 2 meters. In two cases (NN44, 45) the inclination is from north to south, with the head south, and one is from southwest to northeast, with the head SW. In all burials, one individual was buried, crouched, on his right side. All graves studied in this part of the settlement are inventoried. The pit burial excavated at the XX-2 site, which was partially damaged, was also inventoried. Cobblestones were arranged around and on top of the tomb. The deceased was lying on his right side, heavily curled up. The tomb was inclined in the N-S direction. As for the only pit burial discovered directly on Khizanaant Gora, which was damaged by a later pit, this burial was inclined on the S-N line. The deceased was lying on his right side, crouched. The inventory in the tomb was not confirmed. All the tombs studied in Urbnis belong to the group of pit tombs, and most of them are inventoried. The inventory is represented by clay pots of various shapes and sizes and copper items. Clay vessels were present in all burials, while metal objects were confirmed only in two burials (N 44 and XX-2 studied at site).

According to the coordinates (which, as mentioned, need to be clarified), it is located in the project distribution area, at a distance of 2.15 km to the southwest of the nearest towers (T09 and T17).

Urbnisi Late Antiquity Burial Ground

Registration number: 26574.
District/municipality: Kareli.
Settlement: Urbnisi
GPS coordinates: 415537.00 m E, 4651408.00 m N - to be confirmed.
Date: Antiquity (5th BC-3rd century BC); Late Antiquity (Late Roman) - AD I-III centuries).
Initial Status:-
Current Status: Object with no status.
Original Category:-
Current Category: Object/Monument Uncategorized.

Brief description: the archaeological study of Urbnisi began in 1953. A total of 280 tombs were excavated on burial ground, most of which dated back to the Late Antiquity. There were also Late Bronze and Hellenistic age tombs. The tombs of the Late Antiquity period are pit tombs. The dead were buried on their backs, often in a distended position. The tombs contain numerous inventories - ceramics, glassware, jewelry and coins.

According to the coordinates (which, as mentioned, need to be specified), it is located in the project distribution area, 1.8 km southwest of the nearest towers (T09 and T17).

Table 5-29 Monuments/objects protected in the Agency's database

N	Title	E coordinate	N coordinate	Coordinate accuracy
1	Church of the Virgin Mary	408291.00 m E	4652667.00 m N	to be specified
2	Berikldeebi settlement and burial ground	409756.00 m E	4652916.00 m N	to be specified
3	Salariani Church and settlement	408504.00 m E	4656787.00 m N	to be specified
4	Settlement	411559.00 m E	4657786.00 m N	to be specified
5	Settlement	409260.00 m E,	4659521.00 m N	to be specified
6	Al. Proneli's (Kipshidze) house	409269.00 m E	4657195.00 m N	correct
7	Tsveri Complex	408549.00 m E	4659181.00 m N	correct
8	Church Complex – Dedoplis Mindori	404922.00 m E 405081.00 m E	4659417.00 m N 4658773.00 m N	to be specified
10	Tower-column	409267.00 m E	4659528.00 m N	correct
11	Mound	410408.00 m E	4659177.00 m N	to be specified
12	Church of the Virgin Mary	414851.86 m E	4660558.86 m N	to be specified
13	St. George Church	414233.00 m E	4659872.00 m N	correct
14	Ruins of a tower	Not provided		
15	Mound Goraka	Not provided		
16	Burial ground	415461.00 m E	4660409.00 m N	to be specified
17	Tomb	414306.00 m E	4659876.00 m N	to be specified
18	Khatinatkhi Mound	415710.00 m E	4660818.00 m N	to be specified
19	Cylindric tower	417373.82 m E	4658639.71 m N	correct
20	Settlement	417497.00 m E	4658444.00 m N	to be specified
21	St. George	413283.00 m E	4658087.00 m N	correct
22	Church of the Virgin Mary	414797.00 m E	4654187.00 m N	correct
23	Kviriketsminda Church	415888.00 m E	4653996.00 m N	correct
24	Ruisi Virgin Mary Church Complex	413685.00 m E	4654488.00 m N	correct
25	Ruisi St. Demetre Church	413297.00 m E	4655452.00 m N	correct
26	St. Marine Church	415356.66 m E	4654365.48 m N	correct
27	Kviratskhoveli Church	414693.13 m E	4654890.23 m N	correct
28	Settlement	414316.00 m E	4654965.00 m N	to be specified
29	Church of the Virgin Mary	414048.98 m E	4654151.08 m N	correct
30	Ruisi St. David the Builder Church	414182.00 m E	4654389.00 m N	correct
31	Urbnisi St. Stepane Cathedral	415510.25 m E	4651484.94 m N	correct
32	St. Nino Church	414882.18 m E	4651706.08 m N	correct
33	Tower	415435.00 m E	4651927.00 m N	to be specified
34	Old cemetary	415708.00 m E	4651506.00 m N	to be specified
35	Kvatskhela settlement	417340.00 m E	4651079.00 m N	correct
36	Kvatskhela burial ground	417369.00 m E	4651080.00 m N	correct

N	Title	E coordinate	N coordinate	Coordinate accuracy
37	“Tvlepia Tskaro” burial ground	417566.00 m E	4651292.00 m N	correct
38	Khizanaant Gora settlement	415250.00 m E	4651425.00 m N	to be specified
39	Urbnisi Early Bronze burial ground	415092.00 m E	4651661.00 m N	to be specified
40	Urbnisi Late Antiquity burial ground	415537.00 m E	4651408.00 m N	to be specified

Table 5-30 Archaeologically noteworthy sections

N	Title	E coordinate	N coordinate
1	Mound	410408.00 m E	4659177.00 m N
2	Ruisi St. Demetre Church	413297.00 m E	4655452.00 m N
3	„Ceramics1“	416353.98 m E	4654187.04 m N
4	„Cross 1“	416104.35 m E	4654467.61 m N
5	„Cross 2“	417728.10 m E	4655682.41 m N
6	„Settlement“	408799.00 m E	4661364.00 m N
7	Paniashvili family obelisc	416974.00 m E	4652794.00 m N
8	“-Stone mound in the shape of an arc”	415835.00 m E	4656676.00 m N
9	“Small stone mound”	417450.45 m E	4655531.41 m N

Local, national and international intangible cultural heritage

There are 65 objects with the status of intangible cultural heritage in the territory of Georgia.

Accordingly, as a result of the research of background information and in case of communication with the population of the villages listed above in Kareli and Gori municipalities, it is not excluded that a number of monuments of intangible cultural heritage will be confirmed in the research area.

Table 5-31 List of intangible cultural heritage sites (2021 data):

N	Title	Date of registration	Category	Note
1	Georgian polyphony	17.11.2011	National	In 2001, it was included in the UNESCO list of intangible cultural heritage.
2	Kvevri	17.11.2011	National	Technology of making kvevri
3	Ancient Georgian traditional method of making Kvevari wine	27.03.2012	National	On December 4, 2013, it was included in the UNESCO list of intangible cultural heritage.
4	“Dedaena” (mother tongue) (Yakob Gogebashvili's method of compiling the Georgian alphabet manual)	25.03.2013	National	
5	Berikaoba	25.03.2013		
6	Kalakuri Mravalzhamieri	25.03.2013		
7	Chidaoba (Georgian wrestling)	25.09.2014		On November 29, 2018, it was included in the UNESCO list of intangible cultural heritage.

N	Title	Date of registration	Category	Note
8	"The Living Culture of Three Ancient Types of the Georgian Alphabet"	20.03.2015	National	On November 30, 2016, it was included in the UNESCO list of intangible cultural heritage.
9	Tradition of oral knowledge of “Vepkhistkaosani” (“The Knight in the Panther’s skin”)	7.10.2015		
10	The tradition of wood carving – ornament in Svan traditional living and household items	15.10.2015		
11	“Bazieroba” (hunting with a bird of prey)	27.10.2016		
12	Georgian traditional table culture (Georgian Supra (feast))	29.03.2017	National	
13	Georgian folk medical knowledge and traditions of its use	23.08.2017		
14	Georgian-Jewish tradition of 26 centuries of unique relationship	13.04.2018		
15	Georgian silk	12.06.2018		
16	“Ksnuri Ulami” – a tradition of gratituous labor manual aid	10.08.2018		
17	Georgian folk equestrian games - isindi, tskhenburti (horseball), kabakhi, marula	31.08.2018		
18	Georgian wheat culture (endemic species and local varieties)	7.09.2018		
19	The tradition of bagpiping in Georgia	3.10.2019		
20	The tradition of musical education of children in the "Decade of Talents"	2.03.2020		
21	The tradition of wearing Chokha-Akhalukhi, the symbol of Georgian identity	9.06.2020		
22	The tradition of preparation and consumption of Georgian “matsoni” (yoghurt)	22.07.2020		
23	Dance “Kartuli”	19.09.2020		
24	Georgian tradition of making kvevri	6.04.2021		
25	Tradition of making “doki” (wine jug)	29.04.2021		

Figure 5-2 Project area (red rectangle). Orthophoto

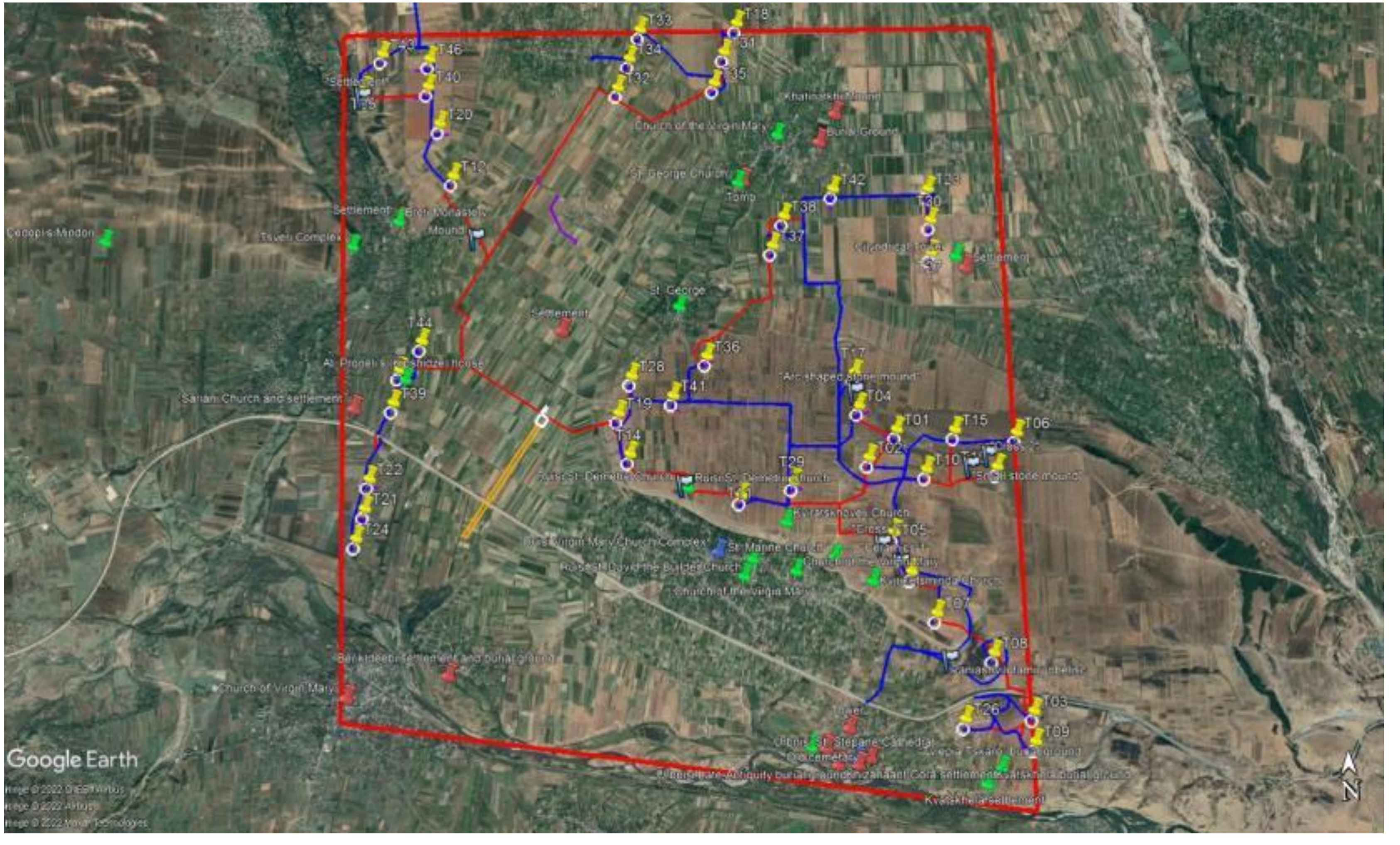

Figure 5-3 Protected monuments/objects (green, red and blue marks), towers (yellow marks), access roads to them (blue lines), power lines (red lines) and archaeologically interesting areas (flag-marks) in the project area

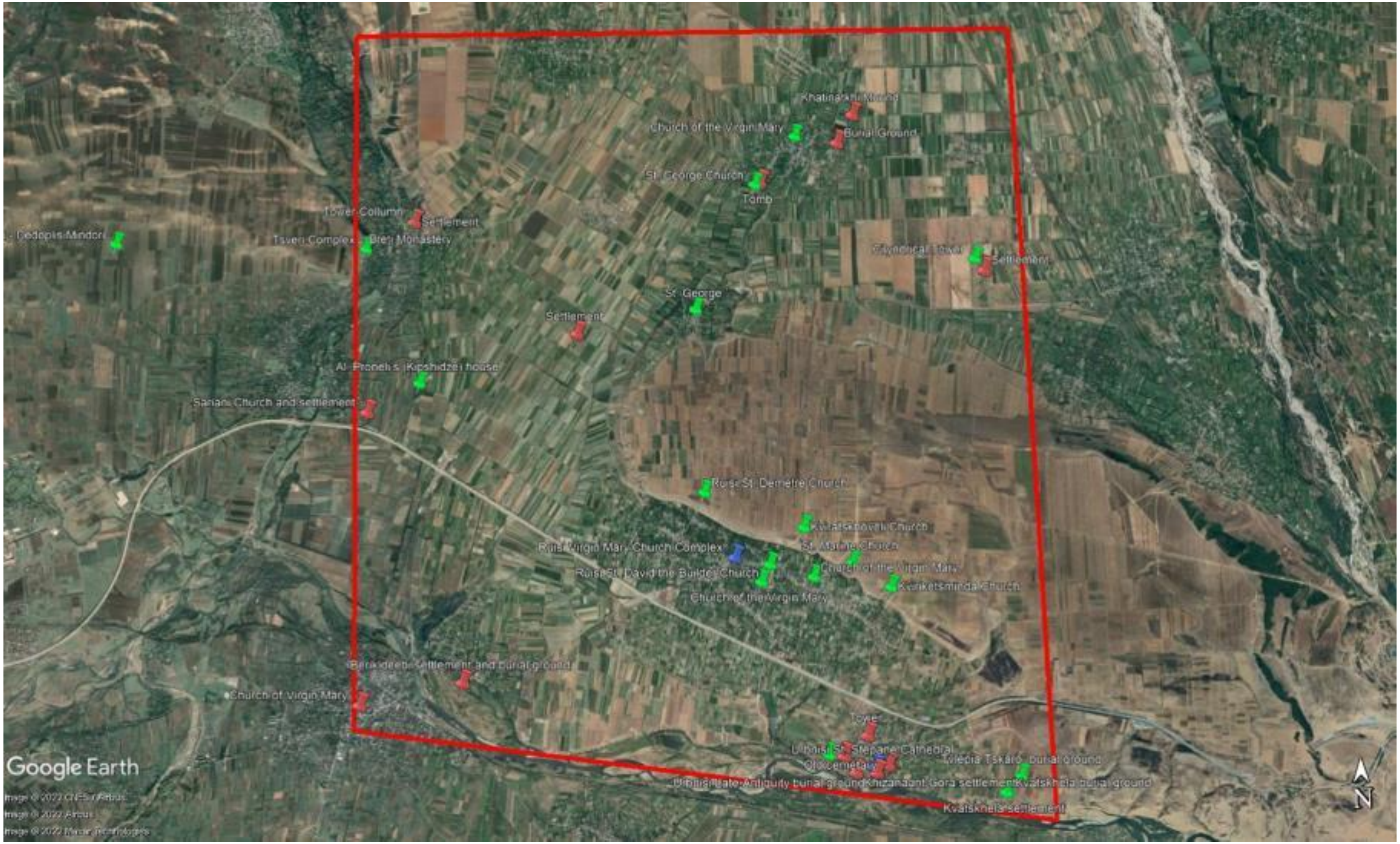

Figure 5-4 **Monuments/objects (green, red and blue marks) protected in the Agency's database (base) in the project area. Orthophoto**

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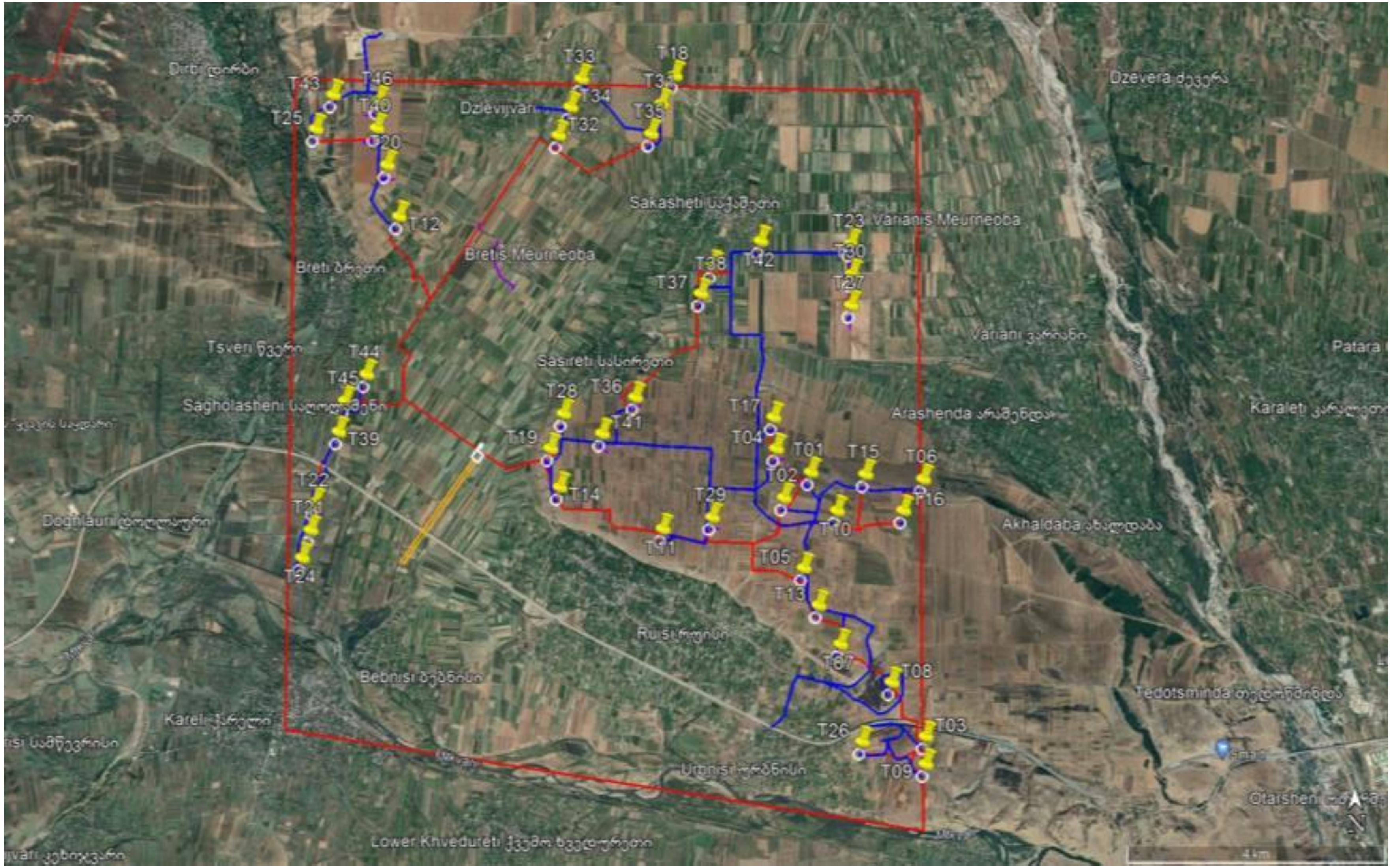

Figures 5-5 **Masts (yellow marks), access roads to them (blue lines) and power lines (red lines) in the project area. Orthophoto**

Figure 5-6 Archaeologically noteworthy areas (flags) on the project territory. Orthophoto

5.3 Physical Environment

5.3.1 Geographical location

The study area is a part of Kareli municipality. It is located on Tiriponi Valley of Shida Kartli, on the left bank of the Mtkvari River. It is 7 km from the administrative center of Kareli. The East-West International Highway (E60) of Georgia runs in close proximity to the project area in the south.

5.3.2 Climatic Conditions

The climatic data of the study area were taken from Gori weather station, with coordinates: 4200' latitude and 4407 longitude, at an altitude of 602.0 m above sea level, occupying a plain and foothill zone of East Georgia.

In terms of building and climatic zoning, the study area is a hot sub-region of moderately humid region of East Georgia with average air temperatures ranging from +21-26 to -1+2°C, with average relative humidity of 55-75% in the hottest month, average wind speeds ranging from 0.5 to 4.2 m/s in the hottest month and from 0.4 to 4.0 m/s in the coldest month. In terms of building and climatic zoning, the study area is classified as IIb.

According to the data published by the Hydrometeorological Center of Georgia, the climatic conditions in the study area are as follows:

Average annual air temperature in the area is 10.8°C. The coldest month is January with average temperature of -4.1°C, with many frosty days; the absolute minimum is -26.1°C. The warmest month of the year are July and August, with an absolute maximum of 37.0°C.

Table 5-32 Average annual nd monthly air temperature, °C

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average annual
-0.7	0.7	5.2	11.1	15.4	18.9	21.8	21.4	17.5	11.5	5.8	1.3	10.8

Table 5-33 Average minimum air temperature in different months, °C

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average annual minimum
-4.1	-3.3	0.5	5.2	9.7	13.4	16.7	16.3	12.3	6.8	1.4	-2.3	6.1

Table 5-34 Absolute minimum of air temperature in different months, °C

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Absolute annual minimum
-26.1	-23.5	-15.1	-8.6	-2.3	3.4	6.7	5.1	-0.8	-4.9	-17.5	-20.1	-26.1

Table 5-35 Average maximum air temperature in different months, °C

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Absolute annual maximum
4.1	5.8	11.3	17.8	21.9	25.4	28.1	27.6	23.9	17.8	11.4	6.0	16.8

Table 5-36 Absolute maximum of air temperature in different months, °C,

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Absolute annual maximum
16.0	21.5	25.4	28.4	30.8	36.2	37.0	36.5	33.8	26.8	24.0	20.6	37.0

Maximum relative air humidity in hot and cold months is 67% and 81.9%, respectively.

Table 5-37 Average monthly and annual relative air humidity, %,

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average annual
80.3	77.5	70.9	67.0	69.4	69.4	68.5	67.4	71.1	75.6	80.3	81.9	73.3

The annual amount of precipitation in the area is 521.8 mm. Their maximum falls in June 63.1 mm, and the minimum amount falls in January 32.6 mm. The average daily maximums of precipitation in different months are given in the tables below.

Table 5-38 Average amount of atmospheric precipitations, mm

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
32.6	30.5	32.3	49.5	60.2	63.1	47.5	42.1	33.9	44.9	46.3	38.9	521,8

Table 5-39 Number of days with different amounts of precipitations (days)

Month	>0,1	>0,5	>1	>5	>10	>20	>30	>50
I	10.6	8.5	I 7.1	1.9	0.7	0.1	0.0	0.0
II	8.9	7.5	6.1	1.9	0.6	0.1	0.0	0.0
III	9.1	7.9	6.4	2.2	0.7	0.1	0.0	0.0
IV	10.6	9.4	8.0	3.3	1.2	0.4	0.1	0.0
V	13.4	11.9	10.1	4.4	1.6	0.2	0.0	0.0
VI	11.9	10.7	9.1	4.0	1.8	0.4	0.2	0.0
VII	8.3	7.4	6.0	2.5	1.4	0.6	0.2	0.0
VIII	7.2	6.0	5.0	2.4	1.4	0.4	0.1	0.0
IX	8.2	6.9	5.4	2.2	0.9	0.2	0.0	0.0
X	9.5	8.6	6.9	2.4	1.3	0.4	0.1	0.0
XI	9.5	8.3	7.4	2.9	1.3	0.3	0.1	0.0
XII	10.7	9.0	7.3	2.6	1.0	0.2	0.0	0.0
Annual	**117.9**	**102.1**	**84.8**	**32.7**	**13.9**	**3.4**	**0.8**	**0.1**

Table 5-40 Average decade height of snow cover, cm

Decade	Month									
	IX	X	XI	XII	I	II	III	IV	V	VI
I			*	1	3	6	*			
II			*	*	4	5	*			
III			*	3	6	1	*			

Table 5-41 Maximum decade height of snow cover, cm

Of the greatest decade height	Maximum of decades	Minimum of decades	Daily maximum	Date
12	45	1	63	03.02.1988

Table 5-42 Number of days with snow cover in different decades

Decade	Month									
	IX	X	XI	XII	I	II	III	IV	V	VI
I			*	1	3	5	*			
II			*	1	4	4	*			
III			*	3	5	2	*			

Table 5-43 Snow load characteristics, Table

Water content of snow cover, mm	Maximum water content of snow cover, mm	Weight of snow cover (possible once in 50 years), KPa	Weight of snow cover (possible once in 25 years), KPa
31	111	1.05	0.85

The prevailing wind direction is predominantly northeastern and southeastern, with recurrence probability of 29.4 and 35.8. Their maximum speed reaches 3.4 m/s in March and April. Rated wind pressure values reach 0.30 kPa in every 5 years and 0.38 kPa in every 15 years (according to Building Climatology).

Average monthly and annual wind speeds are given in Table 5-44.

Table 5-44 Average monthly and annual wind speeds, m/s

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
2.3	2.7	3.4	3.2	2.9	2.8	2.9	2.8	2.6	2.2	1.7	1.8	2.6

Table 5-45 Wind direction and still reoccurrence, %%

N	NE	E	SE	S	SE	E	NE	Still
1.7	1.0	9.0	35.8	4.5	4.4	14.2	29.4	47.9

Table 5-46 Rated wind velocity, m/s

Possible maximum wind velocity once in 1, 2, 5, 10, 15, 20, 50 and 100 years							
18	26	29	32	33	34	36	38

Table 5-47 Rated ground freezing depth, cm

Clay and loam	Fine and dusty sand and sandy loam	Coarse and medium gravely sand	Coarse
19	23	25	28

5.3.3 Background Noise

IFC Requirements for noise impact assessment: ENVIRONMENTAL, HEALTH, AND SAFETY GUIDELINES FOR WIND ENERGY August 7, 2015:

- If noise criteria based on ambient noise are to be used, it is necessary to measure the background noise in the absence of any wind turbines. **This should be done at one or more noise-sensitive receptors.** Often the critical receptors will be those closest to the wind energy facility, but if the nearest receptor is also close to other significant noise sources, an alternative receptor may need to be chosen.
- The background noise should be measured over a series of 10-minute intervals, using appropriate wind screens. At least five of these 10-minute measurements should be taken for each integer wind speed from cut-in speed to 12 m/s

5.3.3.1 Used Measuring Devices

The consulting organization used the equipment of the Polish company "SVANTEK", "SVAN 971" series for measuring noise (Figure 5-7).

SVAN 971 series Sound Level Meters by Polish Svantek are appliances with Class 1 IEC 61672-1:2013 accuracy, capable of storing up to 100000 records. SVAN 971 offers a wide range of results in all needed weighting filters (A, C, Z), as well as 1/1 and 1/3 Octave spectra. SVAN 971 Sound Level Meter allows gaining most resultant noise units: Lpeak, Lmax, Lmin, L, Leq, LE, Lden, LEPd, Ltm3, Ltm5, Leq statistics (Ln), expected Leq value (EX), standard Leq deviation (SD), measurement time and overload time % (OVL), etc. SVAN 971 software allows developing graphical, table or text results of the accomplished measurements. The noise meter can store the received signals in internal memory and describe each signal according to level and date stamp. The device has a wind protective cap reducing the impact of environmental conditions (wind, temperature) during recording.

As per the International Finance Corporation, the noise level must be measured by using the 1st or 2nd class noise meter meeting the requirements of the guideline of the “International Electrotechnical Committee”. As per the same guideline, the noise monitoring is possible to provide with the aim to identify the existing background noise level of the environment adjacent to the design or existing facility or to examine the noise level in the operation phase.

Figure 5-7 Equipment used for noise measuring

Noise meter configurations during the study were:

- Noise measurement range: 30-130 dB;
- Noise meter response speed: Slow (1 second);

- Frequency weighting: A.
- Type of mycrophone: 0.5" (12.7 mm.) el. Condensator.

5.3.3.2 Selection of Points and Conducted Measurement

The identified receptors sensitive to noise impacts are dwelling houses and residential zones, as well as potential commercial zones. No sensitive ecological receptors (habitats, animal and bird breeding or nesting sites etc.) are located within the project area. Thus the noise impact assessment was focused on potential impacts on the residential sites.

The baseline measurements were performed on the area of the residential buildings adjacent to the project wind farm. Before the onset of the study, the examination laboratory service of the Consultation Company developed a study plan. The study of the project wind farm buffer revealed several sensitive areas, where it was advisable to carry out the measurements (namely, villages Ruisi, Sasireti, Sakasheti and Sagolasheni). For each measurement the measurement locations were selected, which are the nearest residential buildings adjacent to the turbines (construction and operation sites).

The measurement was performed from 2022/09/17 to 2022/09/18. The noise measurement was performed continuously for 24 hours. Baseline noise measurements were performed at 5 locations adjacent to the project wind farm: these locations represent the dwelling houses closest to the turbines (IFC regulations recommend one or more sites for baseline studies).

The sites selected as measurement locations are shown on Figure 5-8.

Below are the GPS coordinates of the measurement locations (WGS/UTM/Zone 38):

- Noise N1 - Vill. Ruisi - X 415387 Y 4654055;
- Noise N2 - Vill. Ruisi - X 413427 Y 4655080;
- Noise N3 - Vill. Sasireti - X 413407 Y 4657939;
- Noise N4 - Vill. Sakasheti - X 414983 Y 4660133;
- Noise N5 - Vill. Sagolasheni - X 408432 Y 4657174;

The measurement process was not affected by any weather conditions (rain, wind). The air temperature during the measurements was as follows:

- 2022/09/17 - 24 ^{o}C - Relative humidity 41%.[7]
- 2022/09/18 - 23 ^{o}C - Relative humidity 42%.[8]

[7] Source - http://meteo.gov.ge/.

[8] Source - http://meteo.gov.ge/.

Legend: N1 - Vill. Ruisi, N2 - Vill. Ruisi, N3 - Vill. Sasireti, N4 - Vill. Sakasheti, N5 - Vill. Sagolasheni

Figure 5-8 Noise Measurement Locations

The baseline levels of noise were measured in line with the requirements of Georgian Legislation and the methodology and procedures developed by the Company. The baseline measurement was performed to identify the levels of baseline noise. The average values of the conducted measurements see in Table 5-48.

Table 5-48 Result of noise measurements

Measurement Parameter			Value	Source of Noise
Noise dBA	Norm of Georgian legislation (Adjacent to Residential house)	Day	55	Baseline
		Night	45	
	Result - N1 Point	Day	40	
		Night	36	
	Result - N2 Point	Day	43	
		Night	38	
	Result - N3 Point	Day	43	
		Night	32	
	Result - N4 Point	Day	48	
		Night	36	
	Result - N5 Point	Day	48	
		Night	46	

As it can be seen from the obtained results, the recorded noise level for all five locations are below the admissible daily noise levels established by the Georgian legislation or international regulations (e.g. IFC noise standards).

The night noise levels recorded by the measurements, with the exception of location N5 (village Sagolasheni), are below the night noise levels established by the Georgian legislation. At location (point) N5, the noise level during the night was 46 dBA what is 1 dB higher than the night noise norm. The background noise at this sampling point is mostly associated with the highway noise, as the site is located close to the highway and there are no noise barriers between the road and the village.

The highest noise level during the measurements was recorded at points N4 and N5 making 48 dBA. In both cases the highest noise level was recorded during the day.

The hourly and daytime and night-time noise levels could be seen in Volume 2 0f this ESIA, Annex 8 Baseline Noise Measurements and Noise Impact Modeling.

5.3.4 Geomorphological conditions

The study area is a plain region of Shida Kartli, with 4 sub-areas to distinguish depending on geomorphological properties:

1. Low and medium hilly, intensely fragmented erosion-denudation relief spread on the Tertiary substrate.
2. Low-hilly Ruisi massif, dissected due to denudation-erosion processes, formed on the Molasse substrate of the Miocene-Pliocene age.

3. Tiriponi-Saltvini accumulative plain with a slight southern slope.
4. Slightly sloping terrace-accumulative relief stretching over the alluvial-proluvial deposits of the Mtkvari River and its tributaries

5.3.5 Geological conditions

According to the tectonic zoning map of Georgia, the study area is a part of Mukhrani-Tiriponi subzone of the eastern subsidence of the Georgian Block. A syncline depression of the river East Prone and vault-shaped anticline elevation of Miocene-Pliocene rocks with the outcrop of mountain Malkhazis Tsveri near village Ruisi can be identified immediately in the study area.

The site along the left bank of the Mtkvari River, near the village of Urbani, where Upper Eocene rocks overthrust on Upper Cretaceous rocks is noteworthy. At this location, the incidence of the angle of fracture plane to the northeast is 60-65 degrees. The geological structure of the study area is mainly represented by marine molasse deposits of the Middle Miocene and Sarmatian ages: clays, sandstones, conglomerates, and with marls and limestones at some locations

5.3.6 Engineering-geological conditions and hazardous geological processes

According to the Engineering and Geological Zoning of Georgia suggested by Professor Ioseb Buachidze, the study area is a part of Khashuri-Zemo Avchala subregion ($VI^{2}2$) of aranaceous sandy and shingle and plastic rocks of the Mtkvari river plains of the eastern subsidence of the Georgian Block, presented by gravelly sandy loam and sandy aggregate. In general, the engineering-geological conditions of the study area are of medium complexity, and according to SNiP 1.02.07-87 it belongs to the II category.

In terms of the development of geological processes and events, no significant threats are fixed in the study area. The rocks forming the slopes are mostly in a stable state. Their development is mainly expected on the deeply cut river slopes as erosion processes and related landslide phenomena, mainly in the erosion valleys of the Mtkvari River and its tributaries (see engineering-geological map Figure 5-9), Therefore, the study of landslide phenomena in the study area involves immediately studying erosion processes.

Most of such these landslides are on the left bank of the Mtkvari River, where lateral erosion develops quite intensely. Often they break off the shoreline as large clumps built with slightly bound alluvial deposits.

As for the left small tributaries of the Mtkvari River developed in molassa rocks of Miocene-Pliocene age, they totally depend on the intensity of atmospheric and surface runoff and participate in the regime of erosion processes occurring in the valleys. Therefore, they are activated with spring floods and periods of rainy weather, especially heavy rainfalls. It should be noted that the said landslide bodies are not only locally spread near the valley. Rather, they often extend and occupy adjacent areas, what is once again due to the development of erosion processes, especially lateral erosion. Erosion processes, as mentioned above, are associated with the left tributaries of the Mtkvari River. The erosion network has dense branches and covers large areas in the northern areas of Urbnisi village taking place due to easily erodible constituent rocks.

Another type of erosion to distinguish among the erosion processes occurring in the study area is plane erosion, more related to the crests and other positive relief forms in the area, especially in areas devoid of the tree and grass cover.

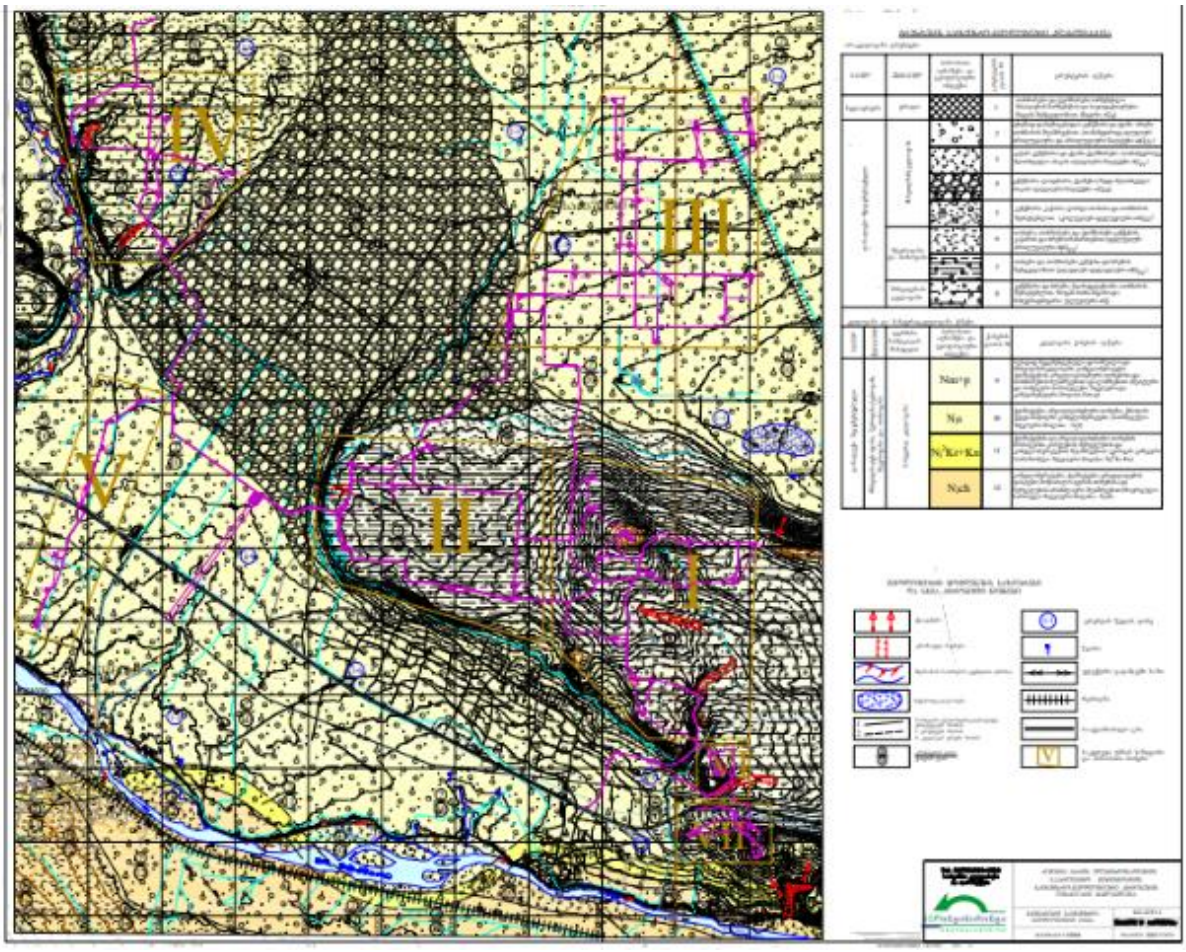

Figure 5-9 Engineering-geological map

As for the hazardous geological processes and phenomena developed within the study area (following the project goals), attention should be paid to suffosive phenomena, which may develop in the clay-sandy rocks of Pliocene age. It should also be noted that suffosive forms are not characterized by mass distribution, although they often develop in a latent form, and it requires some effort for researchers to identify them.

In addition to the above-mentioned, we can note bogging of some areas caused by the failure of irrigation systems or improper use of the irrigation water.

There are also rock avalanches over the steep sections of high slopes, which mostly appear in the area of Pliocene conglomerates.

Landslides occupy limited areas within the study area and are mostly associated with the same valleys where landslide and erosion processes occur, although their occurrence is less dangerous and they flow into the valley bed only as small streams.

The hazardous geological processes and phenomena described above develop in places remote from the study areas (7 areas) and therefore, do not pose any threat to the construction of the design tower-turbines.

5.3.7 Seismic Conditions

According to PN 01.01.09 (“Seismic Construction”), Kareli Municipality mainly belongs to the 8-point seismicity zone. According to the macroseismic intensity map of Georgia (see Figure 5-10) all 7 districts of the study area have similar seismic conditions.

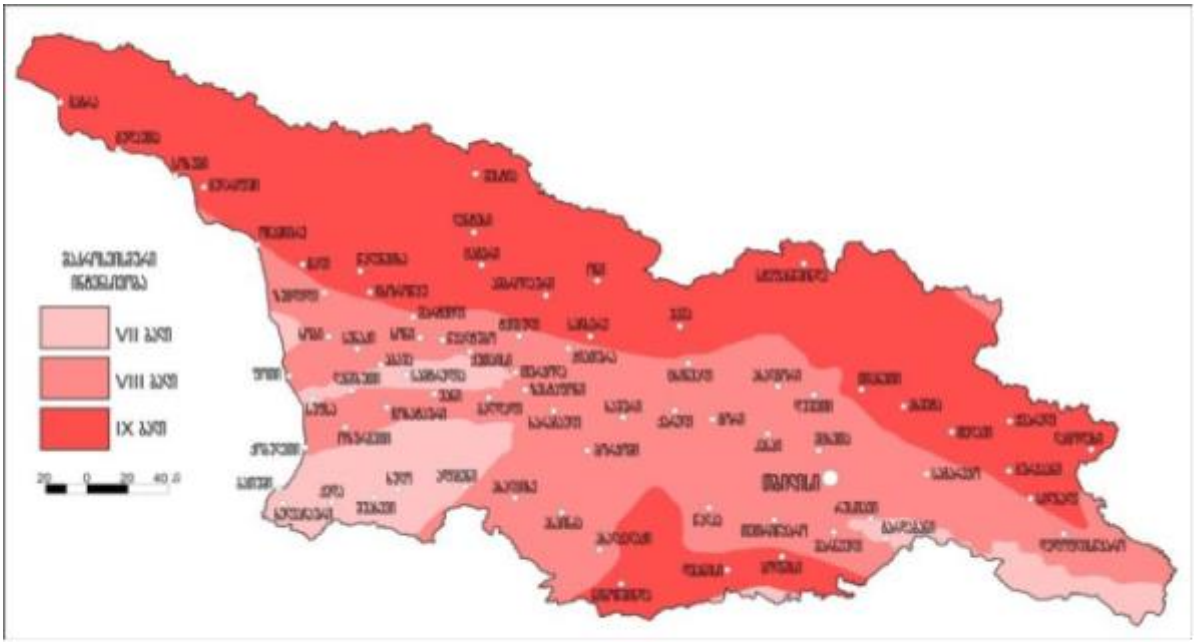

Figure 5-10 Macroseismic intensity map of Georgia

Table 5-49 below gives the seismic data of administrative units of Kareli municipality, within the PTL area:

Table 5-49 Seismic data of administrative units of Kareli Municipality

Municipality	Village	A – dimensionless seismicity ratio	Points (MSK 64 scale)
Kareli	Ruisi	0,20	8
	Urbnisi	0,21	8
	Bebnisi	0,20	8

5.3.8 Hydrogeological conditions

According to the hydrogeological zoning of Georgia, the study area belongs to Kartli sub-zone of porous-fissure and fissure-karst waters being a part of the artesian basin of the Georgian Block, which is represented by aranaceous sandy and shingle rocks building the marine and river terraces of Postpliocene age what plays an important role in identifying the engineering and geological conditions. Among them, karst waters and groundwaters of alluvial and alluvial-marine sediments, which are often hydrodynamically connected to the underlying artesian horizons, are identified (Figure 5-11).

Porous and porous-fissure waters with shallow circulation are water-abundant. They receive considerable amounts of atmospheric precipitations and they drain at the level of the local erosion base as fairly big springs and karst rivers. Due to this, powerful underground streams of the Mtkvari river are formed within Tiriponi Valley. Particularly important are the resources of underground waters of old riverbeds. The natural groundwater resources of Kartli artesian basin, calculated with a hydrograph, are 24.4 m³/day.

Three (III, IV and V) of the conditionally identified 7 sites (see Figure 5-11) in the area deserve special attention from the hydrogeological point of view, where groundwaters may outcrop at the depths of 1-3 and 3-6 m. In other four sites (I, II, VI and VII) groundwater is not expected to outcrop in the foundations of the project tower-turbines.

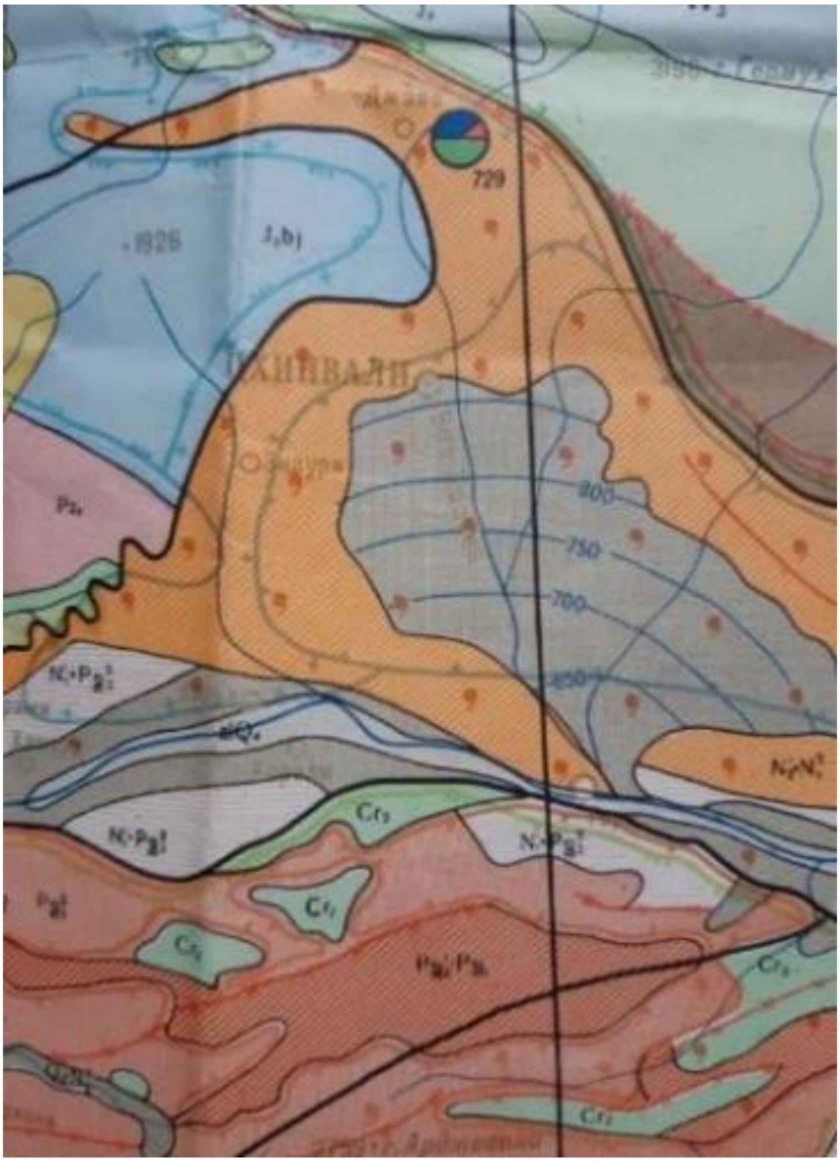

Figure 5-11 Hydrogeological map

5.3.9 Hydrographic network

The hydrographic network of the study area is connected to the Caspian basin. It is mainly fed by surface runoff from rain and snowmelt, and consequently, the water level fluctuates and changes rapidly during the day. Fluctuations in the levels are more unchanged in autumn and winter. Small rivers and tributaries are practically deprived of permanent water flow.

The major river of the study area is the Mtkvari river, which does not cross the project area provided by the memorandum and borders it from the south. Among the smaller rivers, Eastern Frone should be mentioned, which borders the project area from the west and is close to the site of several turbines in a number of areas. The territory is crossed by small streams - Bretula and Bebiula, that have been converted into irrigation canals and are integrated into a single irrigation system. The largest component of the irrigation system within the project area is the Upper Ru irrigation system (main canal, secondary canal and network system).

► **Rivers:**

Mtkvari River

The main surface water body of the region is Mtkvari river along with its tributaries Suramula (near Khashuri); West and East Frone (near Agara and Aradeti), Didi Liakhvi, Mejuda and Tortla near Gori. The majority of them flow from north to south and join Mtkvari, except Suramula, which flows parallely to Mtkvari, from the north of E-60 and joins Frone's Agara from the east. Between Sveneti and Ricoti, the E-60 highway is crossed by 60 rivers/streams with bridges, drainage pipes, concrete culverts and other constructions.

Mtkvari river is the largest river in the South Caucasus and represents the dominant hydrological feature of the study area. It flows from the altitude of 2,720 m, from the eastern slope of the Kizil-Gyadik mountain in Turkey and flows for 1,364 km through the territory of Turkey, Georgia and Azerbaijan and joins the Caspian Sea from the south of Baku. The major part of the Mtkvari basin includes the Greater and Lesser Caucasus ranges and the tectonic plain between them, its area consists of 188,000 km2. The river is fed by glaciers, snow, rain and groundwater. About 50% of the annual runoff falls on spring time, and 25% on the summertime. Flash floods are common when heavy rains coincide with snowmelt during spring. The river is polluted by poorly treated and untreated sewage, irrigation and industrial waters (although, in the 1990s industrial pollution has been significantly reduced). As a result of deforestation in the upper part of the river basin, the soil became vulnerable, which led to the activation of mud flood processes. Due to the loss of forest cover and overgrazing, erosion and consequently, water turbidity has increased. Most of the rivers within the study area flow into Mtkvari.

Table 5-50 Mtkvari – maximum discharge/flow (Q_0Qm^3/s)

Section	*F*, km^2	Q_0, m^3/s	C_V	C_S	*K*	Probability *P* %			
						1	2	5	10
Likani	10500	549	0.41	1.64	_	1310	1190	970	835
Agara	11400	596	_	_	1.086	1420	1290	1050	905
Gomi	11350	583	_	_	1.081	1415	1285	1045	900

The distance between the main and alternative project objects and Mtkvari river for the most part exceeds 1 km. Closest to Mtkvari is located the Turbine #10 (943m).

River Eastern Frone:

The river in Eastern Georgia, in Tighvi and Kareli Municipalities, the left tributary of Mtkvari. It originates from the eastern slope of the Likhi ridge, at 1705m above sea level. The length of the river is 41 km and the area of the basin is 231 km². From the left, it is joined by Tsunariskhevi. It is fed by snow, rain and groundwater. Floods are more common during spring, while inconsistent water scarcity occurs in summer and winter and freshet in autumn. Average annual flow at the estuary — 2.5 m³/s. Total drop - 996 m. Its water is used mainly for irrigation and water mills.

The distance between the main and alternative project objects and Eastern Frone river for the most part exceeds 1 km. Closest to Easter Frone are located the Turbine #22 and Turbine #42 (796m).

► **Streams**

Bretula is the left tributary of eastern Frone river, while **Bebiula** is tributary of Mtkvari river. Both of these small streams are integrated into the irrigation system. Several turbines are planned to be installed in the vicinity of Bretula, while Bebiula is located further away from the project facilities.

Following turbines are located relatively close to Bretula: Turbine #41 (149m), Turbine #11 (263m) and Turbine #24 (758m). From alternative sites: Turbine #39alt (58m), Turbine #38alt (110m) and Turbine #40alt (148m).

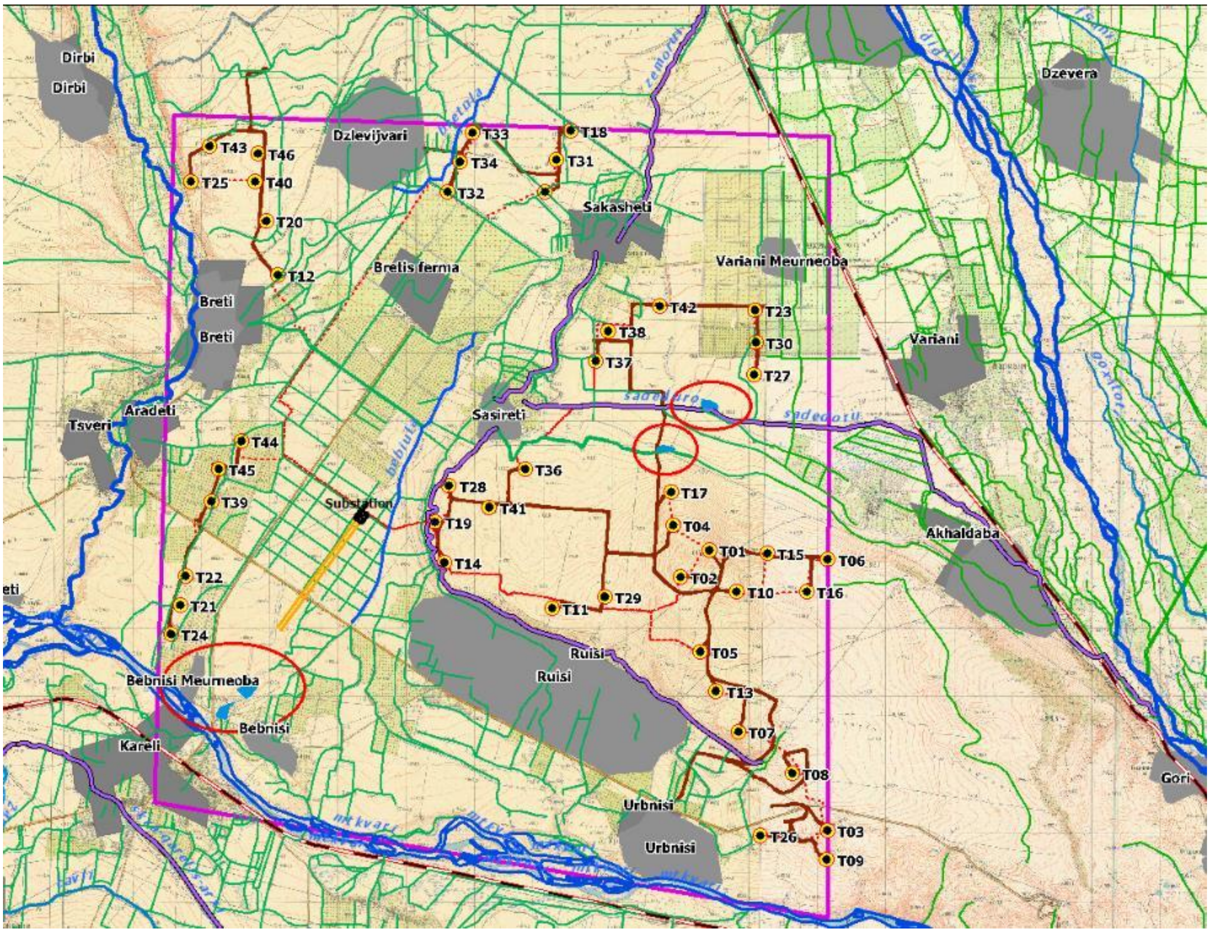

Figure 5-12 Hydrographic network within the project area and immediate neighbourhood

Rivers – blue lines, artificial ponds - blue polygons in red ovals, the main large irrigation channel – wide violet lines, irrigation channels and ditches – light green lines. Project area – magenta line, WGT – red circles with black points in the centers; the projected internal roads – dark red lines, the internal underground power cables – red lines, the residential areas – grey polygons, the existed internal ground-roads – grey lines, the railway – red and black dashed line.

► **Saltvisi Irrigation System**

Most of the study territory is cute by irrigation canals and ditches. All water courses crossing the project territory are integrated into Saltvisi Irrigation System (See Figure 5-12). There are a few remnants of the smaller rivers Bretula and Bebiula. They are coming into the project area via irrigation canals and are ending in the irrigation canals and ditches. The water current there is fully being regulated by farmers. The permanent presence of the water can be expected in large irrigation channels. Main channels are Zemo (Upper) Ru, Didi Ru and Sadedoru.

Zemo (Upper) Ru crosses the northern border of the project area (provided by the memorandum) coming from the Shindisi village in south-western direction. This channel flows through the villages Sakasheni and Sasireti, near village Ruisi it turns to south-east and flows along northern limit of the residential area of this village. It ends south-east of the Ruisi village in the net of smaller canals and irrigation ditches. Its part between villages Sakasheni and Sasireti are known as Didi Ru.

Upper-Ru main canal supplies irrigated area located on 2,304 ha territory. Water is taken from the headwaters of the Liakhvi River, near Kvemo Nikozi. Canals/pipes cross the following villages: Pkhvenisi, Shindisi, Sakhasheti, Sasireti, Ruisi and Urbnisi. Irrigation water distributing channels within the irrigated area are: concrete, parabolic troughs, pipes and earth channels.

Sadedoru channel flows in the latitudinal direction from village Sasireti to the border of the project area and railway, next along the railway to the south-east, to Akhaldaba village and Gori, where it confluences with Didi Liakhvi River. This channel feeds a number of lesser canals and irrigation ditches.

The water is presented in these large main channels year-round. However, level of water, speed of current, and therefore oxygen content in their water greatly varies seasonally. Other irrigation canals and ditches of the second, third and fourth order that are shown on Figure 5-12 contain water only during irrigation season (April-September).

The Ruisi pumping station has been renovated, the pressure pipeline has been restored, and new pump units were installed, which ensures continuous water supply to the main canals of Tashiskari and Upper Ru.

Most of the existing open channels (parabolic troughs, concrete slabs, ground) are converted into pressurized pipe systems due to their poor physical condition. But the canals of second order G-1, G2, G3, G4, G5, G-6, G-7 and G-8 with their third and fourth order canals will be maintained as open concrete lined canals. The main and third order canals will be under the management and supervision of the Georgian amelioration.

The flow of water distributed in the irrigation system will be 2.5 m^3/s. The length of channels and pipes that will be laid instead of existing open channels (ground, parabolic troughs, concrete) is as follows:

- Second order pipes: 46.12 km
- Third order pipes: 35.08 km
- Fourth order pipes: 6.67 km
- Total: 87.87 km

► **Ponds:**

The stagnant water bodies are presented within the project area by four artificial ponds and many puddles. Ponds are small less than 5 ha. All ponds are integrated into the irrigation system and are used as reservoirs for watering in case of water shortage. The water level varies in seasons and in different seasons and years. One can say that ponds are temporary water storage.

The nearest project facility (turbine #27) is 559 m away from the ponds.

Figure 5-13 Ponds within project area

Distances from specific project sites (turbines and substation) to surface water bodies are shown in Table 5-51.

Table 5-51 Distance of project infrastructure from surface water bodies

N	Turbine	Coordinates (38 T)		Spacing (m)		
		X	Y	Surface water bodies		
1	1	416362	4656165	1129	N/E	Irrigation Canal
2	2	415941	4655779	1485	S/W	Zemo Ru River
3	3	418084	4652080	1253	S/W	River Mtkvari
4	4	415833	4656535	1043	N	Artificial Pond
5	5	416235	4654695	819	S/W	Zemo Ru River
6	6	418096	4656038	554	N/E	Irrigation Canal
7	7	416787	4653517	245	S/W	Zemo Ru River
8	8	417568	4652920	536	N/W	Zemo Ru River
9	9	418078	4651798	825	S	River Mtkvari
10	10	416761	4655570	1664	N	Irrigation Canal
11	11	414067	4655324	390	S/W	Zemo Ru River
12	12	410058	4660177	279	S.W	River Bretula
13	13	416458	4654118	508	S.W	Zemo Ru River
14	14	412485	4655984	69	S.W	Zemo Ru Canal
15	15	417205	4656123	1035	N.E	Irrigation Canal
16	16	417783	4655561	1090	N.W	Irrigation Canal

N	Turbine	Coordinates (38 T)		Spacing (m)		
		X	Y	Surface water bodies		
17	17	415799	4657018	626	N	Artificial Pond
18	18	414338	4662288	73	N.E	Irrigation Canal
19	19	412348	4656581	86	N/W	Zemo Ru Canal
20	20	409883	4660970	922	S.E	River Bretula
21	21	408631	4655374	1090	S.W	River Mtkvari
22	22	408706	4655795	1247	N.W	East Prone River
23	23	417027	4659671	1475	S.W	Artificial Pond
24	24	408494	4654948	703	S.W	River Mtkvari
25	25	408788	4661538	356	N.W	East Prone River
26	26	417103	4652013	993	S.W	River Mtkvari
27	27	417016	4658726	693	S.W	Artificial Pond
28	28	412557	4657113	97	N.W	Zemo Ru Canal
29	29	414831	4655492	779	S.W	Zemo Ru River
30	30	417038	4659205	1067	S.W	Artificial Pond
31	31	414129	4661859	548	N.E	Irrigation Canal
32	32	412532	4661391	110	N.W	River Bretula
33	33	412897	4662256	58	N.W	River Bretula
34	34	412723	4661825	148	N.W	River Bretula
35	35	413962	4661398	1038	N.E	Irrigation Canal
36	36	413666	4657350	222	N.W	Zemo Ru Canal
37	37	414699	4658932	652	N.W	Zemo Ru Canal
38	38	414889	4659361	518	N.W	Zemo Ru Canal
39	39	409084	4656879	1310	W	East Prone River
40	40	409728	4661538	1395	S.E	River Bretula
41	41	413149	4656799	757	N.W	Zemo Ru Canal
42	42	415632	4659731	972	N.W	Zemo Ru Canal
43	43	409064	4662059	789	S.W	East Prone River
44	44	409523	4657755	1233	N.W	East Prone River
45	45	409188	4657353	1364	S.W	East Prone River
46	46	409763	4661954	1404	S.W	East Prone River
47	Alt 13	417945	4662101	562	S.W	Irrigation Canal
48	Alt 21	417269	4661782	124	S	Irrigation Canal
49	Alt 28	416218	4661384	399	S	Irrigation Canal
50	Alt 30	417376	4661200	458	N	Irrigation Canal
51	Alt 52	416218	4661384	312	N	Irrigation Canal
52	Alt 56	418064	4661520	325	S.W	Irrigation Canal
53	Substation	410589	4657275	953	S.W	Zemo Ru Canal

5.4 Biological Environment

5.4.1 Protected Areas

Historically protected territories in Georgia were established in woodlands, because of its peculiarities and sensitiveness for human impact. Over 40% (2,706,600.0 ha) of the territory of Georgia is covered with various types of forests, about 40% among them keep primary structure, 5% of natural forests are virgin, and only 59,500.0 ha are artificial. (Zazanashvili, 1997). The Law of Georgia on the Protected Areas System (7 March 1996) gives the legal basis for the establishment, management, control, territorial and functional organization of the protected territories, and human activities within their boundaries. This Law determines following categories for protected areas: State Nature Reserve (conventionally first category of protected areas according IUCN rules), National Park (second category), Natural Monument (third category), Managed Nature Reserve (fourth category), Protected Landscape, Multiply Use Protected Area, and protected areas included in the international network - Biosphere Reserve, World Heritage Unit, Wetland of International Importance (Ramsar-site). The protected areas system of Georgia and layout of the project areas in relation to them is shown on Figure 5-14.

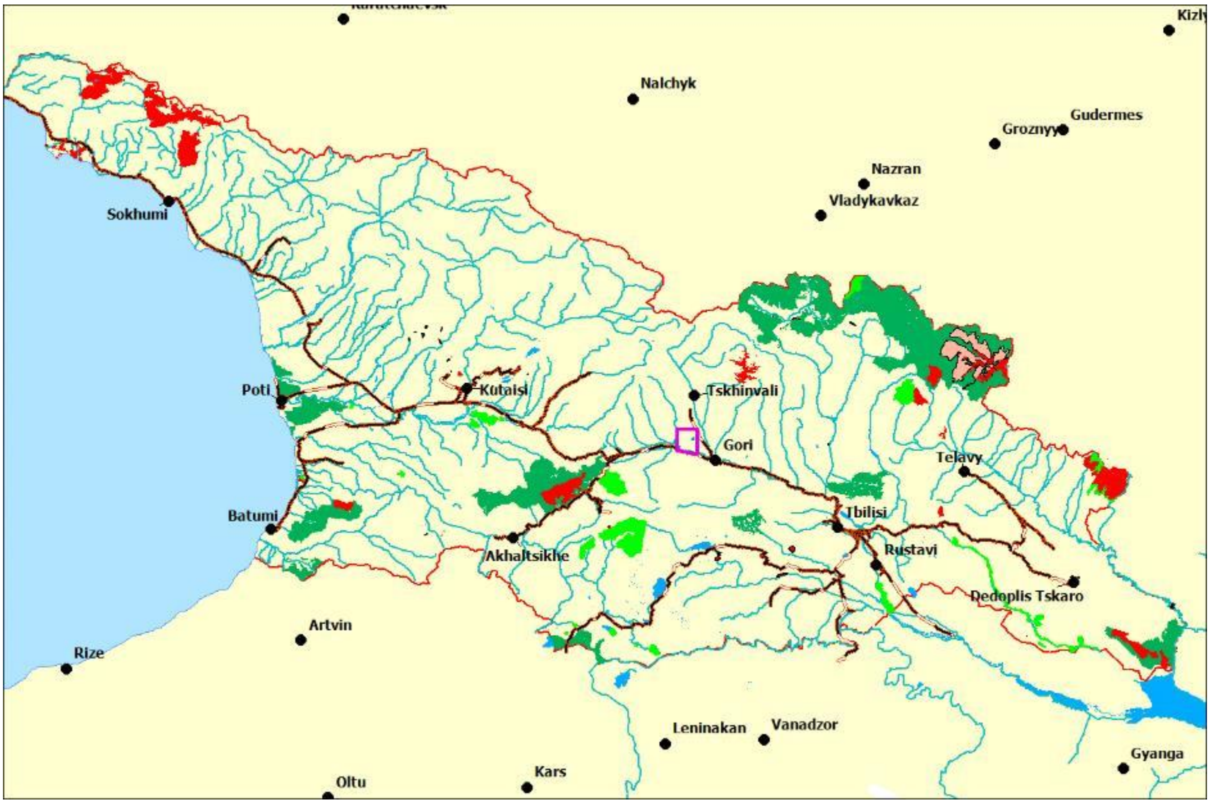

Figure 5-14 Protected areas system of Georgia and Ruisi WPP Project Area

State Nature Reserves – red polygons, National parks - dark green polygons, Managed reserves - light green polygons, Protected landscape – orange polygon; Project Area – magenta line.

Figure 5-15 shows protected areas that are closest to the Rustavi WPP. According to this map, the Ruisi WPP is not located within or in the immediate vicinity of protected areas. The Liakhvi Nature Reserve is the nearest protected area, which is situated in more than 28 km north-east from the limits of the project area, upstream of the Patara Liakhvi River in Tskhinvali Region occupied by Russian army. The Borjomi-Kharagauli National Park is situated in 35 km, and its part – Nedzvi Managed Reserve are in about 29.5 km west off the limits of the project area; the Ktsia-Tabatskuri Managed reserve is situated in about 36 km south-west, and the Algeti National Park is in about 33 km south-east of these limits. Both these protected areas are behind Trialeti Mountain Ridge on the another bank of the Mtkvari River. The border of the Tbilisi national park lies on the other side of the Aragvi River about 62 km east of the limits of the construction area.

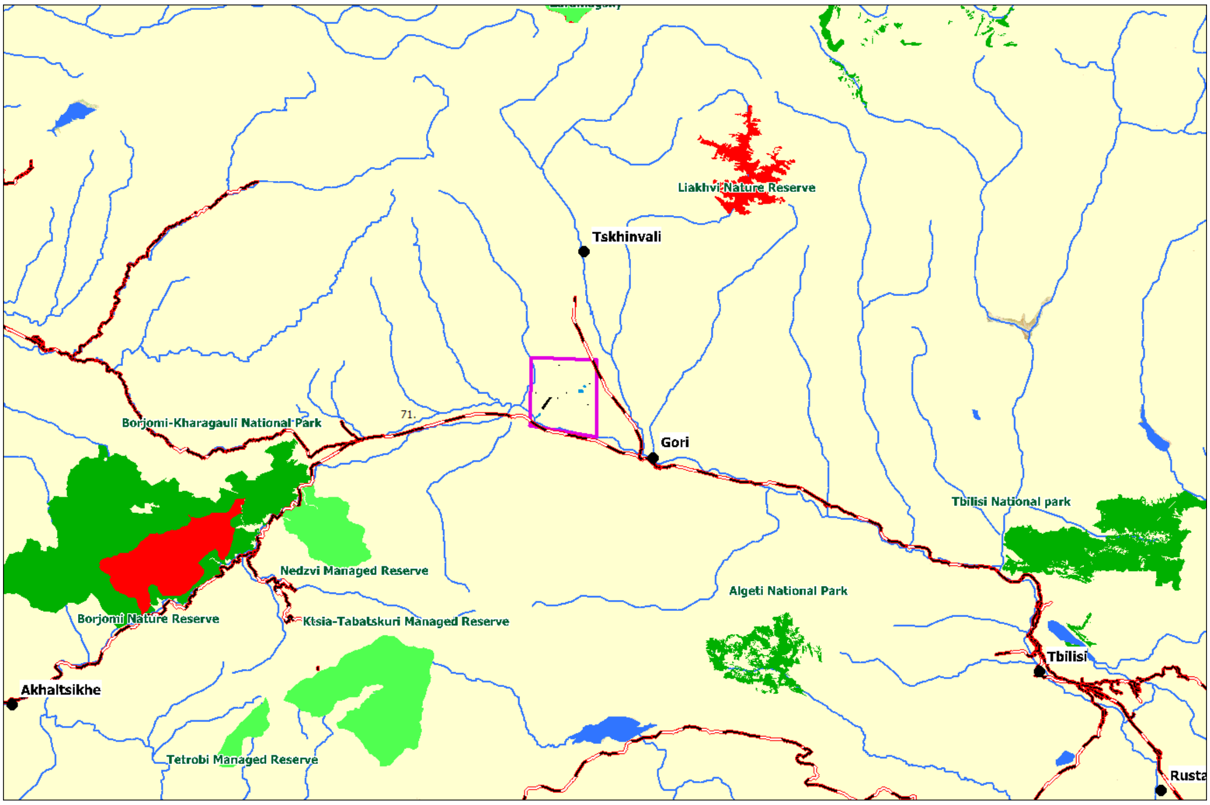

Figure 5-15 Protected areas established under national law and Ruisi WPP Area

State Nature Reserves – red polygons, National parks - dark green polygons, Managed reserves - light green polygons, Protected landscape – orange polygon; Project Area – magenta polygon.

5.4.1.1 Emerald sites and Important Birds Areas

In addition to the national system of protected areas, there are Special Protection Areas (SPAs) in Georgia. These are the Emerald Sites (of Natura 2000) and Important Birds Areas (IBAs) envisaged by EU Directive 79/409/EEC (Birds Directive). These designated areas are shown in Figure 5-16. As the figure shows, there are three Emerald sites, one SPA and one IBA in the project region.

The minimal distance between the eastern limits of the project area and the western border of the nearest designated Emerald Site GE0000046 Kvernaki Ridge is about 14.7 km. Two proposed Emerald sites GE0000034 and GE0000049 are in 19 km to the north-west and 21 km to the west respectively. They both are situated in forested areas and thus have a different set of species from those in the project area.

The territory of the Emerald Site GE0000046 Kvernaki Ridge overlaps with the territory of the Special Protection Area 10 "Kvernaki" and IBA GEO20 "Kvernaki". The habitat of this site differs from habitat within the project area. However, the Kvernaki emerald site is surrounded by agricultural lands and rural habitats similar to those within the project area. All other nearby IBAs and Emerald sites are situated within forest zone in the above mentioned protected areas of national designation.

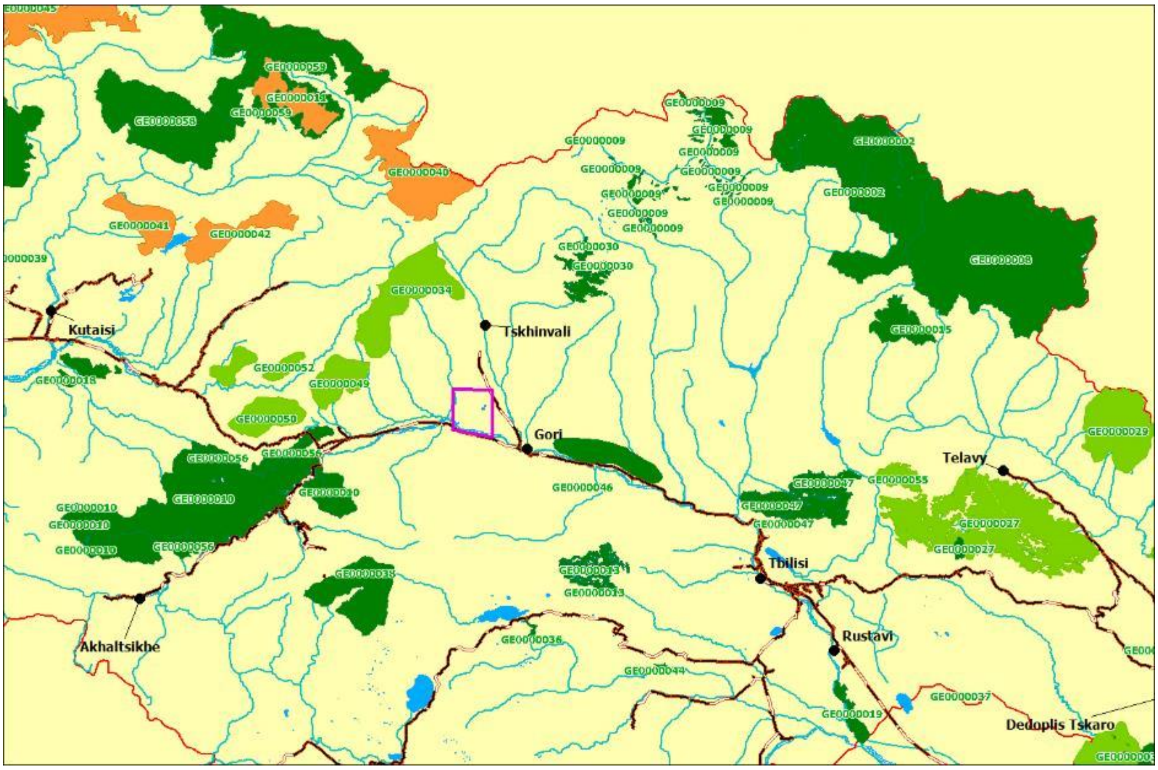

Figure 5-16 Emerald sites and IBAs near Ruisi WPP Area

Designated Emerald sites - dark green polygons, the candidate sites – orange polygons and the proposed sites - light green polygons; Project Area – magenta line.

Due to the above mentioned, only SPA 10 "Kvernaki" which is same IBA GEO20 "Kvernaki" could be of concern for Ruisi WPP project. Brief description of this SPA including species of concern is given below.

Name: Kvernaki
Category: B2, C2
Area: 12978,589 ha
Protection Status: SPA 10 is same as IBA (GEO20).
Central Coordinate: Latitude: 41.967483° / Longitude: 44.335983°

Species of concern: Eastern imperial eagle (*Aquila heliaca*), Griffon vulture (*Gyps fulvus*), Cinereous vulture (*Aegypius monachus*), Egyptian vulture (*Neophron percnopterus*). Nesting here: 2-3 pairs of Egyptian vulture and 1 pair of Eastern imperial eagle. Cinereous vulture and Griffon vulture are not nesting in this area, but can be observed during whole year period. All these species are included into Red List of Georgia: Eastern imperial eagle, Griffon vulture and Egyptian vulture as vulnerable (VU) and Cinereous vulture – as endangered (EN). Three species are included into IUCN Red List: Egyptian vulture as endangered (EN), Eastern imperial eagle – as vulnerable (VU) and Cinereous vulture – as near threatened (NT).

Description of the site: Kvernaki is located in central part of Georgia at 500-1000 m elevation from sea level. Northern slopes of Kvernaki ridge are covered with deciduous forest fragments and agricultural land plots and Southern slopes are presented with semi-desert and steppe vegetation fragments. The following main species of vegetation are found here: Jerusalem thorn (Paliurus spina-christi), Oriental hornbeam (Carpinus orientalis), Botriochlora ischaemum, Dog rose (Rosa canina), Blackthorn (Prunus spinosa) and hawthorn (Crataegus kyrtostyla) (Kvachakidze 2010)[9].

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[9] Source: Special protected territories in Georgia for birds/ Ilia State University, 2016, http://aves.biodiversity-georgia.net /

5.4.2 Flora

5.4.2.1 Introduction

The comprehensive report describing regional context in relation with flora, legal basis, survey methodology and results of the field survey are presented in the Annex 2 in the volume 2 of this ESIA Report.

5.4.2.2 Detailed Description of Flora and Vegetation of the Project Corridor

As mentioned, the detailed botanical survey covered the area of the proposed Ruisi Wind Power Plant, which is located in the geobotanical district of Shida Kartli lowland. On this basis, potential adverse impacts and anticipated residual impacts of the planned construction and operation activities have been predicted for flora and vegetation of the project corridor and adjacent areas. The plant communities and species of the conservation value (Red List, endemic and/or rare species) and economically valuable plants were identified within the project impact zone as a result of these surveys.

Cover and abundance of vegetation were estimated using the Drude Scale during the botanical survey. The symbols of the Drude Scale denote cover-abundance of plant species. These symbols include: Soc (socialis) – dominant species, coverage is more than 90%; Cop^3 (coptosal) – very abundant species, coverage 70-90%; Cop^2 – species is presented by many individuals, coverage 50-70%; Cop^1 – coverage 50-70%; Sp^3 (sporsal) – coverage about 30%; Sp^2 (sporsal) – coverage about 20%; Sp^1 (sporsal) – coverage about 10%; Sol (solitarie) – few individuals, coverage about to 10%; Un (unicum) – a single individual.

In addition, all habitats identified during the botanical surveys of the Project Area were assigned codes according to the **EUNIS** Habitats Classification as well as the codes according to the **EU Habitat Directive** where applicable (the field surveys were carried out on 7- 12. 06. 2022; and on 1-10.07.2022).

Plot 1. Wind Turbine #39. GPS coordinates X 409213.08/ Y 4656841.26. 672m AMSL. Sagholasheni Village. Agricultural landscape - bean field, plum garden. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 1. Wind Turbine #39. Bean field

Plot 1. Wind Turbine #39. Plum garden

Plot 2. Wind Turbine #45. GPS coordinates X 409213.08/ Y 4657236.94. 676m AMSL. Sagholasheni Village. Agricultural landscape: wheat field, Epilobium parviflorum grows at the canal side. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**


Plot 2. Wind Turbine #45. Epilobium parviflorum

Plot 2. Wind Turbine #45. Wheat field

Plot 3. Wind Turbine #44. GPS coordinates X 409755.5/ Y 4658002.31. 682m AMSL. Breti Village. Agricultural landscape: pepper field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**


Plot 3. Wind Turbine #44. Pepper field

Plot 3. Wind Turbine #44. Pepper field

Plot 4. Wind Turbine #12. GPS coordinates X 410045.54/ Y 4660163.82. 718m AMSL. Breti Village. Agricultural Landscape: maize field, apple garden. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**


Plot 4. Wind Turbine #12. Maize field

Plot 4. Wind Turbine #12. Apple garden

Plot 5. Wind Turbine #20. GPS coordinates X 410124.4/ Y 4660725.24. 727m AMSL. Dirbi Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 5. Wind Turbine #20. Wind metering pylon

Plot 5. Wind Turbine #20. Wheat field

Plot 6. Wind Turbine #40. Wheat field

Plot 6. Wind Turbine #40. GPS coordinates X 409818.23/ Y 4661413.98. 727m AMSL. Dirbi Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 7. Wind Turbine #46. Wheat field

Plot 7. Wind Turbine #46. GPS coordinates X 409849.63/ Y 4661879.23. 734m AMSL. Dzlevijvari Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 8. GPS coordinates X 410623.03/ Y 4660956.01. 723m AMSL. Dzlevijvari Village. Agricultural Landscape: maize field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

At the early stages of the project development – it was planned to locate here Wind Turbine #41. Currently, no turbines are located at this site

Plot 8. Maize field

Plot 9. Wind Turbine #43. GPS coordinates X 408950.37/ Y 4662291.84. 739m AMSL. Dirbi Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 9. Wind Turbine #43. Wheat field

Plot 10. Wind Turbine #25. Gramineous-forb meadow-pasture, EUNIS Category: **E1. (Dry grasslands); 62GE04 Vegetation of urban and rural areas**

Plant Community Type	**Gramineous herb meadow-pasture**
Conservation value	**Low**
Location	Dirbi Village.
Site No	Plot 10. Wind Turbine #22.
Assessed plot size (m^2)	10
GPS Coordinates	X 408830.02/Y 4661593.34
Altitude (m AMSL)	731მ
Aspect	_
Inclination	0^0
Structural Features of Community	
Height of herblayer (cm)	40
Coverage of herblayer (%)	50-60
Coverage of mosslayer (%)	_
Number of higher plant species	18
Number of moss species	_
Species	**Cover-abundance by Drude Scale**
Herblayer	
Agropyron repens	Cop^2
Thymus tiflisiensis - endemic to the Caucasus	Sp^3
Teucrium polium	Sp^2
Achillea millefolium	Sp^2

Achillea bieberstainii	Sp^{2}
Plantago media	Sp^{1}
Teucrium nuchense - endemic to the Caucasus	Sp^{1}
Lappula squarrosa	H-40cm, Sp^{1}
Gypsophylla elegans	Sp^{1}
Coronilla varia	Sp^{1}
Taraxacum officinalis	Sp^{1}
Medicago coerulea	Sp^{1}
Eryngium caucasicum	Sol
Sideritis commosa	Sol
Euphorbia seguieriana	Sol
Scabiosa georgica - endemic to the Caucasus	Sol
Falcaria vulgaris	Sol
Salvia aethiopis	Unicum
Mosslayer	
Moss species not found	–

Plot 10. Wind Turbine #25. Gramineous herb meadow-pasture

Plot 10. Wind Turbine #25. Gramineous herb meadow-pasture

Plot 10. Wind Turbine #25. Teucrium polium

Plot 10. Wind Turbine #25. Achillea bieberstainii

Plot 10. Wind Turbine #25. Achillea millefolium

Plot 10. Wind Turbine #25. Plantago media

Plot 10. Wind Turbine #25. Eryngium caucasicum

Plot 10. Wind Turbine #25. Teucrium nuchense

Plot 10. Wind Turbine #25. Sideritis commosa

Plot 10. Wind Turbine #25. Salvia aethiopis

Plot 11. Wind Turbine #21, Riparian woodland (degraded fragment), EUNIS Category: **G1. 1. (Riparian and gallery woodland, with dominant alder, birch, poplar or willow);**
91F0 GE Riparian mixed forests

Plant Community Type	**Oak-Oriental hornbeam forest**
Conservation Value	**Low**
Location	Sagholasheni Village
Site No	Plot 11. Wind Turbine #10.
Assessed plot size (m^2)	100

GPS Coordinates	X 408526.03/Y 4655428.26
Altitude (m AMSL)	659მ
Aspect	_
Inclination	0^0
Structural Features of Community	
Max. DBH (cm)	10
Average DBH (cm)	8
Max height of trees (m)	7
Average height of trees (m)	5
Number of trees on sample area	1-2
Coverage of tree layer (%)	50-60
Coverage of shrublayer (%)	70-80
Height of shrublayer (cm)	150
Coverage of herblayer (%)	60-70
Height of herblayer (cm)	100
Coverage of mosslayer (%)	_
Number of higher plant species	17
Species	**Cover-abundance by Drude Scale**
Treelayer	
Populus canescens	D-10cm, H-7m (max.) Cop^1
	D-8cm, H-5m (aver.)
Prunus divaricata	D-9cm, H-6m Sp^1
Malus orientalis	D-10cm, H-7m Sp^1
Cerasus silvestris	D-14-16cm, H-8-10m Sp^1
Acer campestre	D-6cm, H-6m Sol
Shrublayer	
Rubus sp.	Cop^2
Rosa canina	H-1.5m, Sp^2
Swida australis	Sp^1
Crataegus pentagyna	Sp^1
Herblayer	
Agropyron repens	Cop^2
Festuca rubra	Sp^1
Coronilla varia	Sp^1
Galium verum	Sp^2
Potentilla inclinata	Sp^1
Origanum vulgare	Sp^1
Agrimonia eupatoria	H-1m, Sol
Convolvulus arvensis	Sol
Mosslayer	
Moss species not found	_

Plot 11. Fruit-growing farm adjacent to **Wind Turbine #21**

Plot 11. Wind Turbine #21 Agrimonia eupatoria

Plot 11. Wind Turbine #21, riparian woodland

Plot 11. Wind Turbine #21, Populus canescens

Plot 11. Wind Turbine #21, Galium verum

Plot 11. Wind Turbine #21, riparian woodland

Plot 12. Wind Turbine #24. GPS coordinates X 408342.73/ Y 4654941.27. 655m AMSL. Bebnisi Village. Agricultural landscape: apple garden. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 12. Wind Turbine #24. Apple garden

Plot 12. Wind Turbine #24. Apple garden

Plot 13. Wind Turbine #22. GPS coordinates X 408569/ Y 4655828. 663m AMSL. Sagholasheni Village. Agricultural landscape: wheat and maize fields, land parcels under bean, cabbage, onion, potato and tomato. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 13. Wind Turbine #22. Land parcel under the cabbage

Plot 13. Wind Turbine #22. Wheat field

Plot 13. Wind Turbine #22. Bean field

Plot 13. Wind Turbine #22. Land parcel under the tomato

Plot 13. Wind Turbine #22. Land parcel under the onion

Plot 13. Wind Turbine #22. Potato field

Plot 13. Wind Turbine #22. Maize field

Plot 14. Wind Turbine #26. Gramineous-forb meadow-pasture, EUNIS Category: **E1. (Dry grasslands); 62GE04 Vegetation of urban and rural areas**

Plant Community Type	**Gramineous herb meadow-pasture**
Conservation Value	**Low**
Location	Bebnisi Village.
Site No	Plot 14. Wind Turbine #9.
Assessed plot size (m^2)	10
GPS Coordinates	X 417196.77/Y 4652107.02
Altitude (m AMSL)	709მ
Aspect	_
Inclination	0^0
Structural Features of Community	
Height of herblayer (cm)	40
Coverage of herblayer (%)	60-70
Coverage of mosslayer (%)	_
Number of higher plant species	18
Number of moss species	_
Species	**Cover-abundance by Drude Scale**
Herblayer	
Festuca rubra	Cop^1
Achillea millefolium	H-40cm, Sp^3
Achillea bieberstainii	Sp^2
Xeranthemum squarrosum	Sp^2
Teucrium polium	Sp^2
Euphorbia seguieriana	Sp^2
Centaurea solstitialis	Sp^1
Medicago tricornutum	Sp^1
Hirschfeldia incana	Sol
Sideritis comosa	Sol
Carthamus lanatus	Sol
Echium vulgare	Sol
Ajuga chia	Sol
Cardus crispus	Sol
Salvia verticillata	Sol
Plantago media	Sol
Eryngium caucasicum	Sol
Nedicago minima	Sol
Mosslayer	
Moss species not found	_

Plot 14. Wind Turbine #26. Achillea millefolium

Plot 14. Wind Turbine #26. Achillea millefolium

Plot 14. Wind Turbine #26. Achillea millefolium

Plot 14. Wind Turbine #26. Achillea bieberstainii

Plot 14. Wind Turbine #26. Achillea bieberstainii

Plot 14. Wind Turbine #26. Xeranthemum squarrosum

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Plot 14. Wind Turbine #26. Gramineous herb meadow-pasture

Plot 14. Wind Turbine #26. Salvia verticillata

Plot 14. Wind Turbine #26. Salvia verticillata

Plot 14. Wind Turbine #26. Salvia verticillata

Plot 14. Wind Turbine #26. Xeranthemum squarrosum

Plot 14. Wind Turbine #26. Carthamus lanatus

Plot 14. Wind Turbine #26. Carthamus lanatus

Plot 14. Wind Turbine #26. Eryngium caucasicum

Plot 14. Wind Turbine #26. Carthamus lanatus

Plot 14. Wind Turbine #26. Centaurea solstitialis

Plot 14. Wind Turbine #26. Ajuga chia

Plot 14. Wind Turbine #26. Ajuga chia

Plot 14. Wind Turbine #26. Centaurea solstitialis

Plot 14. Wind Turbine #26. Xeranthemum squarrosum

Plot 14. Wind Turbine #26. Xeranthemum squarrosum

Plot 14. Wind Turbine #26. Echium vulgare

Plot 14. Wind Turbine #26. Echium vulgare

Plot 15. Wind Turbine #03. Gramineous-forb meadow-pasture, EUNIS Category: **E1. (Dry grasslands); 62GE04 Vegetation of urban and rural areas**

Plant Community Type	**Gramineous herb meadow-pasture**
Conservation Value	**Low**
Location	Urbnisi Village.
Site No	Plot 15. Wind Turbine #1.
Assessed plot size (m^2)	10
GPS Coordinates	X 418021.3/Y 4652219.65
Altitude (m AMSL)	608მ
Aspect	South
Inclination	5-7^0
Structural Features of Community	

Height of herblayer (cm)	50
Coverage of herblayer (%)	80-90
Coverage of mosslayer (%)	_
Number of higher plant species	16
Number of moss species	_
Species	**Cover-abundance by Drude Scale**
Herblayer	
Festuca rubra	H-50cm, Cop^2
Xeranthemum squarrosum	Sp^2
Festuca ovina	Sp^1
Teucrium polium	Sp^1
Euphorbia seguieriana	Sp^1
Potentilla inclinata	Sp^1
Sideritis comosa	Sol
Centaurea iberica	Sol
Onobrychis cyri - endemic to the Caucasus	Sol
Jurinea cartaliniana - endemic to the Caucasus	Sol
Falcaria vulgaris	Sol
Lappula squarrosa	Sol
Achillea millefolium	Sol
Stipa pulcherrima	Sol
Achillea biebersteinii	Sol
Salvia nemorosa	Sol
Mosslayer	
Moss species not found	_

Plot 15. Wind Turbine #03. Gramineous herb meadow-pasture

Plot 15. Wind Turbine #03. Gramineous herb meadow-pasture

Plot 15. Wind Turbine #03. Jurinea cartaliniana

Plot 15. Wind Turbine #03. Jurinea cartaliniana

Plot 15. Wind Turbine #03. Jurinea cartaliniana

Plot 15. Wind Turbine #03. Onobrychis cyri

Plot 15. Wind Turbine #03. Teucrium polium

Plot 16. Wind Turbine #09. Gramineous-forb meadow-pasture, EUNIS Category: **E1. (Dry grasslands); 62GE04 Vegetation of urban and rural areas**

Plant Community Type	**Gramineous herb meadow-pasture**
Conservation Value	**Low**
Location	Urbnisi Village.
Site No	Plot 16. Wind Turbine #4.
Assessed plot size (m^2)	10
GPS Coordinates	X 418136.44/Y 4651995.14
Altitude (m AMSL)	747მ
Aspect	North-West
Inclination	3-5^0
Structural Features of Community	
Height of herblayer (cm)	50
Coverage of herblayer (%)	70-80
Coverage of mosslayer (%)	_
Number of higher plant species	15
Number of moss species	_
Species	**Cover-abundance by Drude Scale**
Herblayer	

Festuca rubra	Cop^{2}
Xeranthemum squarrosum	Sp^{2}
Teucrium polium	Sp^{1}
Centaurea solstitialis	Sp^{1}
Potentilla inclinata	Sp^{1}
Hirschfeldia incana	Sp^{1}
Euphorbia seguieriana	Sp^{1}
Sideritis comosa	Sp^{1}
Centaurea iberica	Sp^{1}
Echium vulgare	H-50cm, Sp^{1}
Lappula squarrosa	Sp^{1}
Stipa pulcherrima	Sol
Salvia nemorosa	Sol
Eryngium coeruleum	Sol
Carduus crispus	Sol
Mosslayer	
Moss species not found	_

Plot 16. Wind Turbine #09. Gramineous herb meadow-pasture

Plot 16. Wind Turbine #09. Gramineous herb meadow-pasture

Plot 16. Wind Turbine #09. Centaurea solstitialis

Plot 16. Wind Turbine #09. Sideritis comosa

Plot 16. Wind Turbine #09. Teucrium polium

Plot 17. Wind Turbine #08. Pine forest (planted), EUNIS Category: **G3. 4. (Pine forests)**

Plant Community Type	**Pine forest (planted)**
Conservation Value	**Medium**
Location	Ruisi Village
Site No	Plot 17. Wind Turbine #6.
Assessed plot size (m^2)	100
GPS Coordinates	X 417575.47/Y 4652925.48
Altitude (m AMSL)	753მ
Aspect	_
Inclination	0^0
Structural Features of Community	
Max. DBH (cm)	40
Average DBH (cm)	20
Max height of trees (m)	8
Average height of trees (m)	6
Number of trees on sample area	2-3
Coverage of tree layer (%)	30-40
Coverage of shrublayer (%)	_
Height of shrublayer (cm)	_
Coverage of herblayer (%)	60-70
Height of herblayer (cm)	50
Coverage of mosslayer (%)	_
Number of higher plant species	31
Species	**Cover-abundance by Drude Scale**
Treelayer	
Pinus nigra	D-40cm, H-7-8m (max.) Cop^3
	D-20cm, H-6-7m (aver.)
	D-10cm, H-5-6m (aver.)
Shrublayer	
Shrublayer is not developed.	-
Herblayer	
Festuca rubra	Cop^2
Stipa pulcherrima	Cop^1
Thymus tiflisiensis - endemic to the Caucasus	Sp^3
Dactylis glomerata	Sp^2
Phleum pratense	Sp^2
Medicago coerulea	Sp^1
Poa angustifolia	Sp^1
Euphorbia seguieriana	Sp^2
Teucrium polium	Sp^1

Achillea bieberstainii	Sp[1]
Plantago lanceolata	Sp[1]
Taraxacum officinalis	Sp[1]
Achillea millefolium	Sp[1]
Agropyron repens	Sp[1]
Stachys atherocalyx	Sol
Carduus crispus	H-50cm, Sol
Artemisia caucasica	Sol
Galium tricornutum	Sp[1]
Coronilla varia	Sp[1]
Tripleurospermum nummularium	Sol
Galium verum	Sol
Allium atroviolaceum	Sol
Scabiosa georgica - endemic to the Caucasus	Sol
Teucrium nuchense - endemic to the Caucasus	Sol
Falcaria vulgaris	Sol
Achillea millefolium	Sol
Salvia verticillata	Sol
Tragopogon graminifolius	Sol
Lapulla squarrosa	Sol
Mosslayer	
Moss species not found	_

Plot 17. Wind Turbine #08. Pine forest (planted)

Plot 17. Wind Turbine #08. Pine forest (planted)

Plot 17. Wind Turbine #08. Stachys atherocalyx

Plot 17. Wind Turbine #08. Stachys atherocalyx

Plot 17. Wind Turbine #08. Teucrium polium

Plot 17. Wind Turbine #08. Achillea bieberstainii

Plot 17. Wind Turbine #08. Artemisia caucasica

Plot 17. Wind Turbine #08. Carduus crispus

Plot 17. Wind Turbine #08. Falcaria vulgaris

Plot 18. Wind Turbine #07. GPS coordinates X 416479.04/ Y 4653661.11. 744m AMSL. Ruisi Village. Agricultural landscape: sunflower field, wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 18. Wind Turbine #07 Sunflower field

Plot 18. Wind Turbine #07. Sunflower field

Plot 18. Wind Turbine #07. Wheat field

Plot 19. Wind Turbine #7. Bean field, wheat field

Plot 19. Wind Turbine #07. GPS coordinates X 416151.06/ Y 4654791.76. 775m AMSL. Ruisi Village. Agricultural landscape: bean field, wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 20. Wind Turbine #13. Sunflower field

Plot 20. Wind Turbine #13. GPS coordinates X 416431.31/ Y 4654244.13. 753m AMSL. Ruisi Village. Agricultural landscape: sunflower field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 21. Wind Turbine #10. GPS coordinates X 416644.78/ Y 4655589.38. 800m AMSL. Ruisi Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 21. Wind Turbine #10. Wheat field

Plot 22. Wind Turbine #15. Gramineous-forb meadow-pasture, EUNIS Category: **E1. (Dry grasslands); 62GE04 Vegetation of urban and rural areas**

Plant Community Type	**Gramineous herb meadow-pasture**
Conservation Value	**Low**
Location	Arashenda Village.
Site No	Plot 22. Wind Turbine #23.
Assessed plot size (m^2)	10
GPS Coordinates	X 417153.32/Y 4656074.71
Altitude (m AMSL)	805მ
Aspect	North-East
Inclination	$2-3^0$
Structural Features of Community	
Height of herblayer (cm)	40
Coverage of herblayer (%)	30-40
Coverage of mosslayer (%)	_
Number of higher plant species	16
Number of moss species	_
Species	**Cover-abundance by Drude Scale**
Herblayer	
Festuca rubra	H-40cm, Sp^3
Lappula squarrosa	Sp^2
Euphorbia seguieriana	Sp^2
Plantago lanceolata	Sp^2
Dactylis glomerata	Sp^1
Teucrium polium	Sp^1
Achillea bieberstainii	Sp^1
Sanguisorba officinalis	Sp^1
Salvia aethiopis	Sol
Teucrium nuchense - endemic to the Caucasus	Sol
Carduus crispus	Sol
Scabiosa georgica - endemic to the Caucasus	Sol
Salvia verticillata	Sol
Xanthium spinosum – invasive species	Sol
Achillea millefolium	Sol
Falcaria vulgaris	Sol
Mosslayer	
Moss species not found	_

Plot 22. Wind Turbine #15. Gramineous herb meadow-pasture

Plot 22. Wind Turbine #15. Salvia verticillata

Plot 22. Wind Turbine #15. Salvia verticillata

Plot 22. Wind Turbine #15. Teucrium polium

Plot 22. Wind Turbine #15. Achillea bieberstainii

Plot 23. Wind Turbine #06. GPS coordinates X 418082.92/ Y 4656054.78. 785m AMSL. Arashenda Village. Agricultural landscape: arable land. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 23. Wind Turbine #06. Arable land

Plot 24. Wind Turbine #16. GPS coordinates X 417805.22/ Y 4656035.79. 782m AMSL. Arashenda Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 24. Wind Turbine #16. Wheat field

Plot 25. Wind Turbine #02. GPS coordinates X 416147.68/ Y 4656021.81. 820m AMSL. Arashenda Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 25. Wind Turbine #02. Wheat field

Plot 25. Wind Turbine #02. Wheat field

Plot 26. Wind Turbine #01. Gramineous-forb meadow-pasture, EUNIS Category: **E1. (Dry grasslands); 62GE04 Vegetation of urban and rural areas**

Plant Community Type	**Gramineous herb meadow-pasture**
Conservation Value	**Low**
Location	Arashenda Village.
Site No	Plot 26. Wind Turbine #2.
Assessed plot size (m^2)	10
GPS Coordinates	X 416221.89/Y 4656151.42
Altitude (m AMSL)	815მ
Aspect	_
Inclination	0^0
Structural Features of Community	
Height of herblayer (cm)	35
Coverage of herblayer (%)	30-40
Coverage of mosslayer (%)	_
Number of higher plant species	16
Number of moss species	_
Species	**Cover-abundance by Drude Scale**
Herblayer	
Festuca rubra	Sp^3
Plantago lanceolata	Sp^2
Dactylis glomerata	Sp^2
Euphorbia seguieriana	Sp^2
Lapulla squarrosa	Sp^2
Teucrium polium	Sp^1
Salvia nemorosa	Sp^1
Achillea bieberstainii	Sp^1
Sanguisorba officinalis	Sol
Teucrium nuchense - endemic to the Caucasus	Sol
Scabiosa georgica - endemic to the Caucasus	Sol
Carduus crispus	H-35cm, Sol
Salvia verticillata	Sol
Falcaria vulgaris	Sol
Salvia aethiopus	Sol
Artemisia caucasica	Sol
Mosslayer	
Moss species not found	_

Plot 26. Wind Turbine #01. Salvia nemorosa

Plot 26. Wind Turbine #01. Gramineous herb meadow-pasture

Plot 26. Wind Turbine #01. Artemisia caucasica

Plot 27. Wind Turbine #04. Gramineous-forb meadow-pasture, EUNIS Category: **E1. (Dry grasslands); 62GE04 Vegetation of urban and rural areas**

Plant Community Type	**Gramineous herb meadow-pasture**
Conservation Value	**Low**
Location	Ruisi Village.
Site No	Plot 27. Wind Turbine #25.
Assessed plot size (m^2)	10
GPS Coordinates	X 415835.23/Y 4656488.01
Altitude (m AMSL)	807მ
Aspect	_
Inclination	0^0
Structural Features of Community	
Height of herblayer (cm)	30
Coverage of herblayer (%)	30-40
Coverage of mosslayer (%)	_
Number of higher plant species	15
Number of moss species	_
Species	**Cover-abundance by Drude Scale**
Herblayer	
Festuca rubra	Sp^3
Agropyron repens	Sp^2
Lapulla squarrosa	Sp^2
Centaurea ovina	Sp^2
Sanguisorba officinalis	Sp^3
Teucrium polium	Sp^1
Euphorbia seguieriana	Sp^1
Achillea bieberstainii	Sp^1
Plantago lanceolata	Sp^1
Carduus crispus	Sol
Salvia verticillata	Sol
Sideritis commosa	Sol
Scabiosa georgica - endemic to the Caucasus	H-30cm, Sol
Reseda lutea	Sol
Salvia aethiopus	Sol
Mosslayer	
Moss species not found	_

Plot 27. Wind Turbine #04. Salvia verticillata

Plot 27. Wind Turbine #04. Gramineous herb meadow-pasture

Plot 28. Wind Turbine #17. Gramineous-forb meadow-pasture, EUNIS Category: **E1. (Dry grasslands); 62GE04 Vegetation of urban and rural areas**

Plant Community Type	**Gramineous herb meadow-pasture**
Conservation Value	**Low**
Location	Ruisi Village.
Site No	Plot 8. Wind Turbine #16.
Assessed plot size (m^2)	10
GPS Coordinates	X 415815.78/Y 4656759.1
Altitude (m AMSL)	804მ
Aspect	_
Inclination	0^0
Structural Features of Community	
Height of herblayer (cm)	35
Coverage of herblayer (%)	30-40
Coverage of mosslayer (%)	_
Number of higher plant species	17
Number of moss species	_
Species	**Cover-abundance by Drude Scale**
Herblayer	
Festuca rubra	Sp^3
Centaurea ovina	Sp^2
Agropyron repens	H-30cm, Sp^2
Lapulla squarrosa	Sp^2
Sanguisorba officinalis	Sp^2
Plantago lanceolata	Sp^1
Achillea bieberstainii	Sp^1
Salvia verticillata	Sol
Sideritis commosa	Sol
Salvia aethiopus	Sol
Carduus crispus	Sol
Teucrium polium	Sol
Euphorbia seguieriana	Sol
Achillea millefolium	Sol
Falcaria vulgaris	Sol
Salvia nemorosa	Sol
Taraxacum officinale	Sol
Mosslayer	
Moss species not found	_

Plot 28. Wind Turbine #17. Achillea bieberstainii

Plot 29. Wind Turbine #29. Wheat field

Plot 29. Wind Turbine #29. GPS coordinates X 414815.84/ Y 4655492.83. 750m AMSL. Ruisi Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 30. Wind Turbine #11. Wheat field

Plot 30. Wind Turbine #11. GPS coordinates X 413908.31/ Y 4655479.39. 860m AMSL. Ruisi Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 31. Wind Turbine #36. GPS coordinates X 413641/ Y 4657454.91. 742m AMSL. Ruisi Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 31. Wind Turbine #36. Wheat field

Plot 32. Wind Turbine #41. GPS coordinates X 413118.58/ Y 4656858.28. 730m AMSL. Ruisi Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 32. Wind Turbine #41. Wheat field

Plot 33. Wind Turbine #28. GPS coordinates X 412551.17/ Y 4657054.34. 735m AMSL. Ruisi Village. Agricultural landscape: wheat field, carrot field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 33. Wind Turbine #28. Wheat field, carrot field

Plot 34. Wind Turbine #19. GPS Coordinates X 412533.94, Y 4656737.87 727m AMSL. Ruisi Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 34. Wind Turbine #19. Drop irrigation

Plot 34. Wind Turbine #19. Wheat field

Plot 35. Wind Turbine #14. Land parcel under the onion

Plot 35. Wind Turbine #14. GPS coordinates X 412463.1/ Y 4655938.91. 732m AMSL. Ruisi Village. Agricultural landscape: onion field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 36. Wind Turbine #37. GPS coordinates X 414716/ Y 4659024. 710m AMSL. Sakasheti Village. Agricultural Landscape: maize field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 36. Wind Turbine #37. Maize field

Plot 36. Wind Turbine #37. Maize field

Plot 37. Wind Turbine #38. Apple garden

Plot 37. Wind Turbine #38. GPS coordinates X 4659453.81/ Y 414886.97. 711m AMSL. Sakasheti Village. Agricultural landscape: apple garden. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 38. Wind Turbine #42. Maize field

Plot 38. Wind Turbine #42. GPS coordinates X 415656.27/ Y 4659501.34. 710m AMSL. Sakasheti Village. Agricultural Landscape: maize field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 39. Wind Turbine #27. GPS coordinates X 416764.95/ Y 4658951.01. 715m AMSL. Variani Village. Agricultural landscape: apple garden. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 39. Wind Turbine #27. Apple garden

Plot 39. Wind Turbine #27. Apple garden

Plot 40. Wind Turbine #23. GPS coordinates X 416904.81/ Y 4659723.95. 705m AMSL. Variani Village. Agricultural landscape: apple garden. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 40. Wind Turbine #23. Apple garden

Plot 41. GPS coordinated X 416251.55/Y 4660097.52. 711m AMSL Sakhasheti village. Agricultural landscape: Maize field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

At the early stages of the project development – it was planned to locate here Wind Turbine #55. Currently, no turbines are located at this site.

Plot 41. Maize field

Plot 42. GPS coordinates X 418031.89/ Y 4659708.53. 702m AMSL. Variani Village. Agricultural Landscape: maize field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

At the early stages of the project development – it was planned to locate here Wind Turbine #29. Currently, no turbines are located at this site

Plot 42. Maize field

Plot 43. Wind Turbine #30. GPS coordinates X 417651.41/ Y 4659044.98. 705m AMSL. Variani Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 43. Wind Turbine #30. Wheat field

Plot 44. GPS coordinates 417420.26/4661246.77. 714m AMSL. Variani Village. Agricultural landscape: cherry garden. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

At the early stages of the project development – it was planned to locate here Wind Turbine #30. Currently, no turbines are located at this site

Plot 44. cherry garden

Plot 45. Wind Turbine #Alt21. Sakasheti Village. Agricultural landscape: Lucerne field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

At the early stages of the project development – it was planned to locate here Wind Turbine alternative #21. Currently, no turbines are located at this site

Plot 45.. Lucerne field. **Wind Turbine #Alt21.**

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Plot 46. Variani Village. Agricultural Landscape: maize field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

At the early stages of the project development – it was planned to locate here Wind Turbine #56. Currently, no turbines are located at this site

Plot 46. Maize field

Plot 47. Wind Turbine #Alt13. Variani Village. Agricultural Landscape: maize field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 47. Wind Turbine #Alt13. Maize field

Plot 48. GPS coordinates X 416480.12 Y 4660973.20, 716m AMSL. Variani Village. Agricultural Landscape: maize field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

At the early stages of the project development – it was planned to locate here Wind Turbine #37. Currently, no turbines are located at this site

Plot 48. Maize field

Plot 49. Wind Turbine #Alt52. Wheat field

Plot 49. Wind Turbine #Alt52. GPS coordinates X 416480.12/ Y 4660973.2. 716m AMSL. Sakasheti Village. Agricultural landscape: wheat field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

► **Alternative locations**

Plot 50. Pepper and cabbage fields

Plot 50. GPS coordinates X 412744.92/ Y 4661817.23. 724m AMSL. Dzlevijvari Village. Agricultural landscape - pepper and cabbage fields. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

At the early stages of the project development – it was planned to locate here Wind Turbine #40. Currently, no turbines are located at this site

Plot 51. Wind Turbine #28. Maize field

Plot 51. Wind Turbine #28. GPS coordinates X 412522.23/ Y 4661414.32. 717m AMSL. Dzlevijvari Village. Agricultural Landscape: maize field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

Plot 52. Maize field

Plot 52. GPS coordinates X 412917.56/ Y 4662251.69. 730m AMSL. Dzlevijvari Village. Agricultural Landscape: maize field. The site has low conservation value. **EUNIS** Category: **I. (Regularly or recently cultivated agricultural, horticultural and domestic habitats).**

At the early stages of the project development – it was planned to locate here Wind Turbine #39. Currently, no turbines are located at this site

5.4.2.3 Sensitive Areas/Habitats

The detailed botanical survey of the project corridor enabled to identify and comprehensively characterize sensitive sites in this area. Based on the literature review and field surveys only one medium sensitivity site/habitat has been identified in the project corridor.

► **The methodology used to assess the sensitivity of flora and vegetation receptors is as follows:**

Morris&Therivel (1995) has been used to assess the significance of various plant communities (see Table 5-52):

Table 5-52 Assessment criteria according to Morris&Therivel (1995)

Criterion	High	Medium	Low
Species abundance	High diversity of species is recorded or may be recorded. Endemic or threatened species of the Red List of Georgia and/or Red List of IUCN is recorded or could be present.	Characterized by medium species diversity. Only few rare or threatened species are present.	Characterized by low species diversity. Threatened species are not impacted virtually.
Naturalness and modification level	Natural or insignificantly modified habitats	Moderately modified habitats, e.g. those which are still capable to maintain characteristic species	Highly modified habitats
Anthropogenic impact	Anthropogenic impact is very low or absent.	Anthropogenic impact is low.	Anthropogenic impact is high (grazing, logging, etc.)
Rareness and geographic extent of habitat	Rare or threatened habitat at the country or regional level.	Habitat is not very characteristic to the region	Habitat is characteristic for the country.

► **Medium Sensitivity Sites/ Habitats**

Plot 17. Wind Turbine #08. Pine forest (planted), EUNIS Category: **G3. 4. (Pine forests).** Ruisi Village. GPS coordinates X 417575.47/ Y 4652925.48. Altitude (m AMSL) 753. Of the tree species is recorded: Pinus nigra; shrublayer is not developed; and grass species are represented by: *Festuca rubra, Stipa pulcherrima, Thymus tiflisiensis* - endemic to the Caucasus, *Dactylis glomerata, Phleum pratense, Medicago coerulea, Poa angustifolia, Euphorbia seguieriana, Teucrium polium, Achillea bieberstainii, Plantago lanceolata, Taraxacum officinalis, Achillea millefolium, Agropyron repens, Stachys atherocalyx, Carduus crispus, Artemisia caucasica, Galium tricornutum, Coronilla varia, Tripleurospermum nummularium, Galium verum, Allium atroviolaceum,* Scabiosa georgica - endemic to the Caucasus, *Teucrium nuchense* - endemic to the Caucasus, *Falcaria vulgaris, Achillea millefolium, Salvia verticillata, Tragopogon graminifolius, Lapulla squarrosa*. Moss layer is not developed.

5.4.2.4 Other Areas/Habitats of Concern

Xanthium spinosum, which is invasive species for Georgia, is recorded within the Project Area, in the environs of Arashenda Village (Turbine #15). The habitat is represented by **gramineous-forb meadow-pasture, EUNIS** Category: E1. **(Dry grasslands); 62GE04 Vegetation of urban and rural areas.** Usually it grows in the lower and middle mountain zones, in rural areas, road sites, pebbly terrain, nearby residential areas, abandoned and cultivated fields, along irrigation canals and pebbly beaches, as well as at the edges of vegetable gardens and crop fields as weed species. Invaded from America. This species is spread almost in all regions of Georgia, and also encounters throughout the Caucasus region. The global EOO of the species include: West Siberia, Far East, Middle Asia, Europe, Mediterranean Region, Asia Minor, America, Australia.

The Project Area comprises only small population of this species (Sol (solitarie) - few individuals, coverage about to 10%). Considering that small population of the invasive species is already present in the Project Area and widespread throughout Georgia, associated potential risks and relevant mitigation measures will be defined to avoid distribution of this species in the territories where it has not intruded yet.

5.4.2.5 Rare, Endemic and Georgian Red List Species Recorded in the Project Corridor

The plant species of the Red List of Georgia have not been found in the project corridor during the detailed botanical field surveys

It should be also mentioned, that the species protected under the Bern Convention and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1975; universal) do not grow within the project corridor either.

On the other hand, five species that are endemic to the Caucasus have been found there, including:

1. Thymus tiflisiensis - endemic to the Caucasus. Originally described in Georgia. The extent of occurrence (EOO) comprises: Kartli, Kakheti and Trialeti in Georgia, and Quazax and Eilar-Oughy in Azerbaijan. Grows in the lower and middle mountain zones in dry terrain, could be encountered in the Jerusalem thorn and Jerusalem thorn - beard-grass communities, in the beard-grass - feather-grass meadows.
2. Teucrium nuchense - endemic to the Caucasus. Originally described in Azerbaijan. The EOO comprises: Svaneti, Racha, Lechkhumi, Trialeti, Kartli, Khevsureti, Kakheti, Javakheti and Meskheti regions in Georgia, and Azerbaijan. Grows in dry slops, screes, forest glades, shrublands from the mountain foothills to 2350 masl elevation.

3. Scabiosa georgica - endemic to the Caucasus. Originally described in Georgia. The EOO: Racha-Lechkhumi, Imereti, Kartli, Kakheti, Trialeti in Georgia, the North Caucasus (Dagestan), Transcaucasia (Azerbaijan, Armenia). Grows in forest zone, on dry and stony slopes, in shrublands, forest edges, pebbly terrain.
4. Onobrychis cyri - endemic to the Caucasus. Originally described in Georgia. The EOO: Kartli, Kakheti, Trialeti in Georgia, North Caucasus (Dagestan), Transcaucasia (Azerbaijan). Grows on stony slopes in the lower mountain zone.
5. Jurinea cartaliniana - endemic to the Caucasus. Originally described in Georgia. The EOO: Kartli, Meskheti in Georgia, the North Caucasus (central). Grows in the middle mountain zone, on rocks.

5.4.3 Critical Habitat Assessment for Habitats and Flora Component of Biodiversity

5.4.3.1 Overview

The critical habitat assessment (CHA) has been carried out to meet the requirement of EBRD PR6 (2019). The purpose of the CHA is to define habitats and species within the Project's study area that qualify for Critical Habitats (CH) or Priority Biodiversity Features (PBF) as of the EBRD definition to feed the findings in the impact assessment sections of the ESIA to ensure that potential risks to all threatened features of biodiversity are properly identified, adequate mitigation measures are designed, and recommendations regarding subsequent management and monitoring are defined.

The CHA approach involves assigning a value of the biodiversity within the study area based on pre-defined criteria, and through this process identifying PBFs and CHs. For the given Project, the identification of priority biodiversity features and critical habitats has been based on the criteria given in the Guidance Note - PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (September 2022).

The CHA process has been based on the above described baseline studies (desk study and field surveys), followed by the assessment of findings against CH/ PBF criteria, in line with the logical flow of CHA recommended by the EBRD Guidance Note 6.

Please note that Section 5.4.3 concerns only habitats and flora components of the biodiversity. The same exercise for the faunal component has been also carried out, and its findings are described in Section 5.4.4.

5.4.3.2 Requirements of EBRD PR6 for Critical Habitat Assessment

The EBRD PR6 (2019) aims to protect and conserve biodiversity through precautionary approach, to maintain core ecological functions of habitats, biodiversity and ecosystem services; to ensure mitigation hierarchy to achieve no net loss/net gains; and to promote sustainable management of living natural resources.

EBRD PR6 defines critical habitats as the most sensitive biodiversity features, and the priority biodiversity features as "a sub-set of biodiversity that is irreplaceable or vulnerable, but at a lower priority level than critical habitats".

For Critical Habitats, the PR6 defines the following five criteria:

(i) highly threatened or unique ecosystems;
(ii) habitats of significant importance to endangered or critically endangered species;
(iii) habitats of significant importance to endemic or geographically restricted species;
(iv) habitats supporting globally significant migratory or congregatory species; or
(v) areas associated with key evolutionary processes.

It should be highlighted that of these criteria, criterion (iv) is not relevant to the flora and their habitats.

For the Priority Biodiversity Features, PR6 gives the following four criteria:

(i) threatened habitats;
(ii) vulnerable species;
(iii) significant biodiversity features identified by a broad set of stakeholders or governments; and
(iv) ecological structure and functions needed to maintain the viability of priority biodiversity features listed above.

The EBRD's Guidance Note - PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (2022) sets conditions/ thresholds for some of the criteria to enable identification of the PBFs and CHs.

The criteria of PBF and CH as of EBRD PR6 are provided in Table 5-53 below.

Table 5-53 Criteria and conditions for identifying priority biodiversity features and critical habitats[10]

Criterion	Priority Biodiversity Features	Critical Habitat
1. Priority ecosystems		
Threatened ecosystems (a) Habitats listed in Annex 1 of EU Habitats Directive (EU members only) or Resolution 4 of Bern Convention (signatory nations only) (b) IUCN Red-List EN or CR ecosystems	(PR6 para. 12-i) (a) EAAA is habitat type listed in Annex 1 of EU Habitats Directive or Resolution 4 of Bern Convention (b) EAAA < 5% of the global extent of an ecosystem type with IUCN status of CR or EN	(PR6 para. 14-i) (a) EAAA is habitat type listed in Annex 1 of EU Habitats Directive marked as "priority habitat type" (b) EAAA ≥5% of global extent of an ecosystem type with IUCN status of CR or EN (c) EAAA is ecosystem determined to be of high priority for conservation by national systematic conservation planning

[10] EBRD, Guidance Note - PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, September 2022

Criterion	Priority Biodiversity Features	Critical Habitat
2. Priority Species and their Habitats		
Threatened species (a) Species and their habitats listed in EU Habitats Directive and Birds Directive (EU members only) or Bern Convention (signatory nations only) (b) IUCN Red List EN or CR species (c) IUCN Red List VU species (d) Nationally or regionally (e.g., Europe) listed EN or CR species	(PR6 para. 12-ii) (a) EAAA for species and their habitats listed in Annex II of Habitats Directive, Annex I of Birds Directive, or Resolution 6 of Bern Convention (b) EAAA supports < 0.5% of global population OR < 5 reproductive units of a CR or EN species. (c) EAAA supports VU species (d) EAAA for regularly occurring nationally or regionally listed EN or CR species	(PR6 para. 14-ii) (a) EAAA for species and their habitats listed in Annex IV of the Habitats Directive (See EU restrictions) (b) EAAA supports ≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species (c) EAAA supports globally significant population of VU species necessary to prevent a change of IUCN Red List status to EN or CR, and satisfies threshold (b) (d) EAAA for important concentrations of a nationally or regionally listed EN or CR species
Range-restricted species	(PR6 para. 12-ii) (a) EAAA for regularly occurring range-restricted species	(PR6 para. 14-iii) (a) EAAA regularly holds ≥ 10% of global population AND ≥ 10 reproductive units of the species
Migratory and congregatory species	(PR6 para. 12-ii) (a) EAAA identified per Birds Directive or recognized national or international process as important for migratory birds (esp. wetlands)	(PR6 para. 14-iv) (a) EAAA sustains, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population at any point of the species' lifecycle (b) EAAA predictably supports ≥10 percent of global population during periods of environmental stress

On the other hand, the Guidance Note for PR6 does not gives pre-determined conditions/ quantitative thresholds for some criteria such are:

- PBFs' criterion (iii) "significant biodiversity features identified by a broad set of stakeholders or governments"
- PBFs' criterion (iv) "ecological structure and functions needed to maintain the viability of priority biodiversity features described in this paragraph", and
- CHs' criterion (v) "areas associated with key evolutionary processes".

As recommended by the Guidance note, the CH assessment must rely upon expert judgement for these criteria.

To ensure that biodiversity baseline studies encompass all relevant features, the Guidance Note 6 recommends to identify the following types of features on the scoping phase to ensure the selection of appropriate baseline study methods and plan focus studies as appropriate:

- Ecosystems that are a priority for conservation – habitats listed by the EU Habitats Directive (Annex 1), Bern Convention (Resolution 4), Key Biodiversity Areas (including Important Bird Areas and Ramsar sites), UNESCO Natural World Heritage Sites, Alliance for Zero Extinction (AZE) sites, ecosystems evaluated using the IUCN Red List of Threatened Ecosystems method with a status of Vulnerable, Endangered, or Critically Endangered, and ecosystems recognized by the scientific community as being associated with key evolutionary processes.

- Species and their habitats that are a priority for conservation – a) species listed by the EU Habitats Directive and Birds Directive, Bern Convention, IUCN Red List of Threatened Species with a status of Vulnerable, Endangered, or Critically Endangered, or listed at a national level using the IUCN Red List methodology; b) species with restricted ranges; and, c) migratory and congregatory species that utilize the area.
- Protected areas – areas with existing or planned legal conservation protection in the relevant jurisdiction(s), including Natura2000 and Emerald sites, as well as protected areas that are not within those networks.

Furthermore, the Guidance Note 6 requires to define the study area at the appropriate spatial scale for baseline studies. It recommends to define and fully encompass the ecologically appropriate areas of analysis (EAAA) for features that may require additional focused study. The study area should be large enough to encompass a project's direct and indirect impacts and to characterize the ecological patterns, processes, and functions occurring in the project area.

5.4.3.3 CHA Methodology

The following key steps were planned and carried out to study flora and habitats, and then to carry out critical habitat assessment for these biodiversity features:

- Scoping to define the scope of flora and habitat surveys and the study area for field surveys. It included:
    - Initial review of relevant literature and databases to identify which valuable features of biodiversity, and specifically flora and habitats that could be present in the project area and its neighbourhoods, including designated areas, red-listed, rare and/or endemic species of plants, habitats of concern
    - Consultations with key stakeholders to verify information regarding valuable features of flora and habitats within the area of concern
    - Field recognisance to understand the project area to enable proper planning of field surveys and selection of relevant survey methodology
    - Definition of the spatial extent of field surveys based on the findings of the above listed steps
- Detailed studies of flora and habitats – this included in-depth analysis of literature sources, field surveys, and verification on site if the study area requires refinement to ensure that all landscape components that could comprise ecologically appropriate area of analysis (EAAA) have been covered
- Critical Habitat Assessment (CHA), when collected information has been screen against the EBRD criteria for presence of CHs or PBFs.

5.4.3.4 Critical Habitat Assessment

To identify features that should be assessed against the critical habitat criteria, all habitats and flora species described in the study area have been screened using the references recommended by the Guidance Note 6, including:

- Annex 1, Annex 2 and Annex 3 of EU Habitats directive
- Resolution #4 and Resolution #6 of the Bern Convention
- Red List of Georgia and global red list of IUCN

Then the habitats and species identified as potentially CH or PBF have been assessed using the relevant conditions/ thresholds defined by the Guidance Note 6, or based on the expert judgement, as appropriate.

5.4.3.4.1 Assessment against CH criterion (i) and PBF criterion (i) – Threatened Ecosystems

According to the baseline studies, the following four habitat types have been mapped in the EAAA:

Table 5-54 Habitats described in the study area

EUNIS		Bern Convention, Resolution #4	EU Habitats Directive, Annex 1		Area, ha
Code	Habitat Name		Code	Habitat Name	
I.	Regularly or recently cultivated agricultural, horticultural and domestic habitats	No		No	3,330
E1.	Dry grasslands	No	**62GE04**	Vegetation of urban and rural areas	370
G1.1.	Riparian and gallery woodland, with dominant alder, birch, poplar or willow	No	**91F0 GE**	Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers (Ulmenion minoris)	4
G3.4.	Pine forests (planted)	No		No	35

The habitat's map for the project area is presented in Figure 5-17 below. As Table 5-54 shows, none of the EAAA habitats is listed in the Resolution #4 of Bern Convention. Two habitats are included in Annex 1 of the EU Habitat Directive, though none of them belong to priority habitat types marked with (*). Considering the conditions of the Guidance Note 6, these **Annex 1 habitats (62GE04 and 91F0 GE)** does not trigger CHA, but **require assessment for PBF** as priority ecosystems. The detailed characterization and PBF assessment of these two habitats of concern is given Table 5-55 below:

Table 5-55 Characterization and PBF assessment of habitats of concern

Code and Name of Habitat	Description
62GE04 Vegetation of urban and rural areas	This habitat type is widespread in Georgia. It is developed around and in proximity of settlements. Vegetation of village settlements and cultivable land is interesting in terms of plants of economic importance. Generally, this habitat type is characterized by various species of aborigine, invasive and adventive cosmopolitan plants related to wild relatives of cultural plants and those used in traditional (folk) and scientific medicine. Such plants are widely distributed on the territories of settlements, along roadsides and in modified habitats. Often vegetation of this habitat type includes pioneer plants creating primary successions on slopes eroded in result of various economic activities. Within the EAAA, this habitat type is present at four locations (see Figure 5-17), and their total area is around 370 ha. In the EAAA and adjoining areas, this habitat type is represented by semi-natural dry grasslands of low ecological value that are used by local population for cattle grazing. Usually they are represented by overgrazed degraded meadows with the notable signs of erosion. The botanical field surveys showed that plant composition of this habitat is not characterized by high diversity. It does not support any threatened plant species of Georgian and/or IUCN Red Lists, or

Code and Name of Habitat	Description
	species protected by Bern Convention and/or EU Habitat Directive that may qualify as CH or PBF (see Section 5.4.2.5.2). The habitat contains some endemic plants, though in low amount and they do not represent restricted-range species. Worthy to mention that an invasive species - *Xanthium spinosum* – has been found in this habitat within the EAAA. Due to the above mentioned, **for the EAAA this habitat type cannot be classified as irreplaceable or vulnerable and does not represent PBF according to PBF Criterion (i).**
91F0 GE Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers (Ulmenion minoris)	The riparian forest is common for the banks of large rivers and their larger tributaries in lower areas in Georgia. This habitat is present in many regions of the country both in the western and eastern parts, though by different sub-types. In Kartli region, in the river Mtkvari valley the riparian forest is dominated by oak and aspen. Riparian forests of Georgia are characterized by different level of anthropogenic impact. In the eastern part of the country, the most valuable riparian forest is presented in in the river Iori floodplain nearby the state border with Azerbaijan, where is preserved in its original form as tugai forest and protected within the boundaries of the Iori Managed Reserve. In general, the riparian habitat is valuable due to its numerous ecosystem services, including river bank stabilization, flood attenuation, water purification, food provision, etc. Besides, it is important habitat both for aquatic and terrestrial species. With the EAAA, this habitat type is presented only at one location over small area (ca. 4 ha) (see Figure 5-17). As the field surveys showed, this fragment of the riparian forest could be classified as semi-natural habitat, which is imposed to high anthropogenic pressure due to agricultural activities in the vicinity, including cattle grazing. As the botanical field surveys showed, within the EAAA the area covered by riparian forest does not distinguishes with high diversity of plant species. It does not support any threatened plant species of Georgian and/or IUCN Red Lists, or species protected by Bern Convention and/or EU Habitat Directive that may qualify as CH or PBF. Due to the mentioned, the riparian forest of the EAAA has been assessed as low value habitat. Due to the above mentioned, **for the EAAA this habitat type cannot be classified as irreplaceable or vulnerable and does not represent PBF according to PBF Criterion (i).**

The region where the EAAA is located has not been assessed for a priority ecosystem having IUCN status of CR or EN. On the other hand, the EAAA habitats do not belong to ecosystem types identified as CR or EN in the IUCN Red List of Ecosystem. Considering the value of the project area dominated by agricultural landscape, it is not anticipated that such an assessment may come to the different conclusion. Thus, for this condition of the Guidance Note 6 further CHA is not required.

Furthermore, the baseline studies, including consultations with the relevant national authorities have not identified the presence of an ecosystem that would be of high priority for conservation within the EAAA or its proximity. The closest designated area is the Emerald Site GE0000046 „Kvernaki", which is in more than 12 km from the Project Area.[11] Therefore, any impact on flora and habitats of this site either direct or indirect is not anticipated. As mentioned above, the EAAA does not include Bern

[11] The territory of this emerald site overlaps with the SPA 10 "Kvernaki" and IBA GEO20 "Kvernaki". Though, they are not of concern in terms of flora and habitats, and will be addressed in fauna section as appropriate.

Convention habitats, and respectively EAAA habitats are not listed in the Data Sheet of this site. Thus, this Emerald Site does not call for further CH/PBA assessment in the context of flora and habitats.

Thus, none of the habitats of the EAAA classify as a Critical Habitat or Priority Biodiversity Feature according to CH criterion (i) and PBF criterion (i) – Threatened Ecosystems.

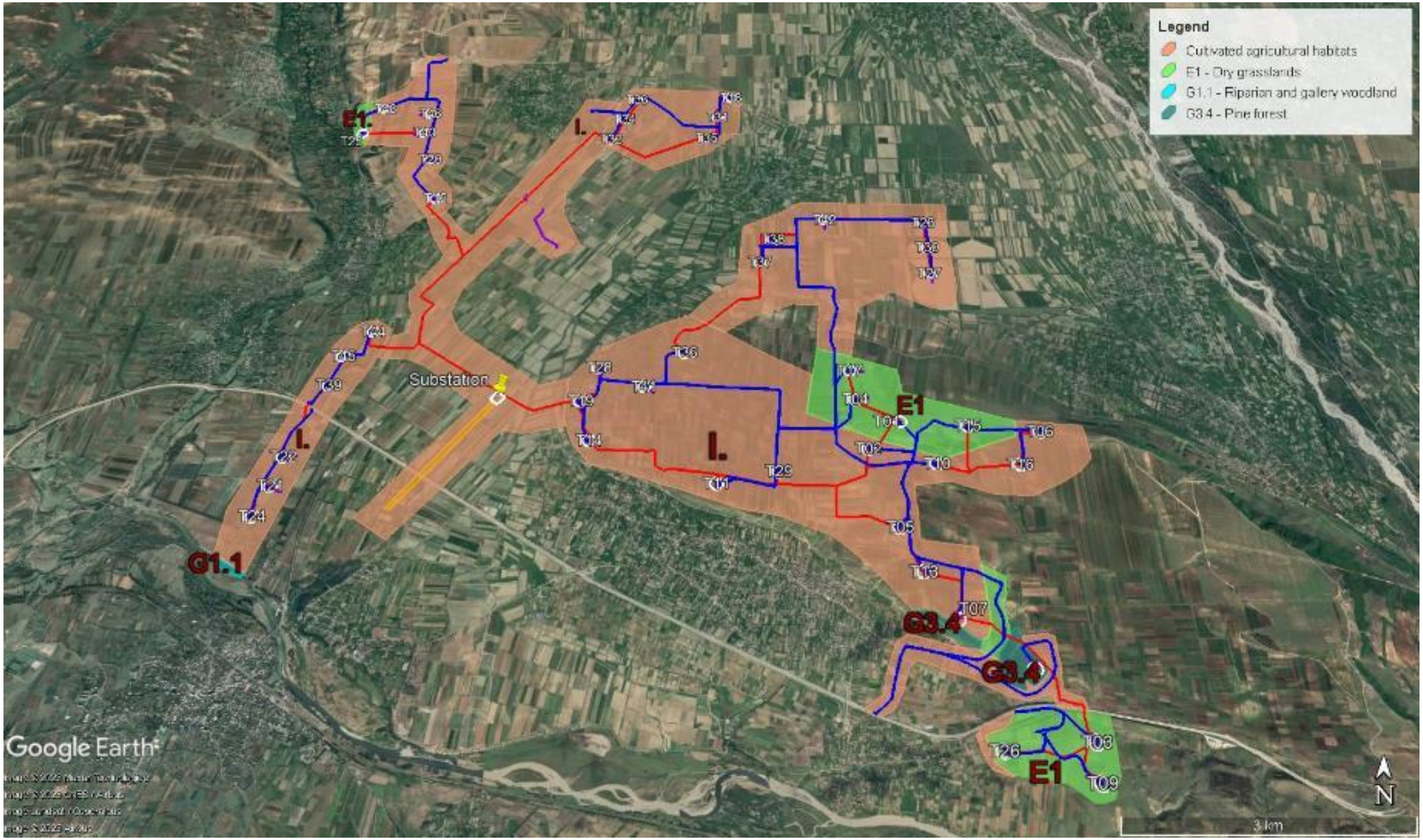

Figure 5-17 Map of Habitats

Medium sensitivity habitat G 3.4 (artificial pine forest); Low sensitivity habitats G.1.1; E 1 and I1 (agricultural land)

5.4.3.4.2 Assessment against CH criterion (ii) and PBF criterion (ii) – Threatened Species

The biodiversity baseline studies have described 66 species of plants in the EAAA. These flora species are listed below, with indication of their status according to the above listed references are listed in Table 5-56 below:

Table 5-56 Plant species recorded in the study area

#	Plant species	Red List of Georgia	IUCN Red List	Bern Resolution #6	Habitat Directive Annex II	Habitat Directive Annex IV	Endemism
1.	Acer campestre	-	LC	-	-	-	-
2.	Achillea bieberstainii	-		-	-	-	-
3.	Achillea millefolium	-	LC	-	-	-	-
4.	Agrimonia eupatoria	-	LC	-	-	-	-
5.	Agropyron repens	-		-	-	-	-
6.	Ajuga chia	-		-	-	-	-
7.	Allium atroviolaceum	-	DD	-	-	-	-
8.	Artemisia caucasica	-		-	-	-	-
9.	Carduus crispus	-		-	-	-	-
10.	Carthamus lanatus	-		-	-	-	-
11.	Centaurea iberica	-		-	-	-	-
12.	Centaurea ovina	-		-	-	-	-
13.	Centaurea solstitialis	-		-	-	-	-
14.	Cerasus silvestris	-		-	-	-	-
15.	Convolvulus arvensis	-		-	-	-	-
16.	Coronilla varia	-	LC	-	-	-	-
17.	Crataegus pentagyna	-	LC	-	-	-	-
18.	Dactylis glomerata	-		-	-	-	-
19.	Echium vulgare	-		-	-	-	-
20.	Epilobium parviflorum	-	LC	-	-	-	-
21.	Eryngium caucasicum	-		-	-	-	-
22.	Eryngium caeruleum	-		-	-	-	-
23.	Euphorbia seguieriana	-		-	-	-	-
24.	Falcaria vulgaris	-	-	-	-	-	-
25.	Festuca ovina	-	LC	-	-	-	-
26.	Festuca rubra	-	DD	-	-	-	-
27.	Galium tricornutum	-	-	-	-	-	-
28.	Galium verum	-	LC	-	-	-	-
29.	Gypsophylla elegans	-	-	-	-	-	-
30.	Hirschfeldia incana	-	-	-	-	-	-
31.	Jurinea cartaliniana	-	-	-	-	-	Endemic to Caucasus
32.	Lappula squarrosa	-	-	-	-	-	
33.	Malus orientalis	-	DD	-	-	-	-
34.	Medicago coerulea	-	-	-	-	-	-
35.	Medicago tricornutum	-	-	-	-	-	-

#	Plant species	Red List of Georgia	IUCN Red List	Bern Resolution #6	Habitat Directive Annex II	Habitat Directive Annex IV	Endemism
36.	Nedicago minima	-	-	-	-	-	-
37.	Onobrychis cyri	-	-	-	-	-	Endemic to Caucasus
38.	Origanum vulgare	-	LC	-	-	-	-
39.	Phleum pratense	-	LC	-	-	-	-
40.	Pinus nigra	-	LC	-	-	-	-
41.	Plantago lanceolata	-	LC	-	-	-	-
42.	Plantago media	-	-	-	-	-	-
43.	Poa angustifolia	-	LC	-	-	-	-
44.	Populus canescens	-	-	-	-	-	-
45.	Potentilla inclinata	-	-	-	-	-	-
46.	Prunus divaricata	-	LC	-	-	-	-
47.	Reseda lutea	-		-	-	-	-
48.	Rosa canina	-	LC	-	-	-	-
49.	Rubus sp.	-	LC	-	-	-	-
50.	Salvia aethiopis	-	-	-	-	-	-
51.	Salvia nemorosa	-	-	-	-	-	-
52.	Salvia verticillata	-	-	-	-	-	-
53.	Sanguisorba officinalis	-	LC	-	-	-	-
54.	Scabiosa georgica	-	-	-	-	-	Endemic to Caucasus
55.	Sideritis comosa	-	-	-	-	-	-
56.	Stachys atherocalyx	-	-	-	-	-	-
57.	Stipa pulcherrima	-	-	-	-	-	-
58.	Swida australis	-	-	-	-	-	-
59.	Taraxacum officinale	-	LC	-	-	-	-
60.	Teucrium nuchense	-	-	-	-	-	Endemic to Caucasus
61.	Teucrium polium	-	-	-	-	-	-
62.	Thymus tiflisiensis	-	-	-	-	-	Endemic to Caucasus
63.	Tragopogon graminifolius	-	-	-	-	-	-
64.	Tripleurospermum nummularium	-	-	-	-	-	-
65.	Xanthium spinosum	-	-	-	-	-	-
66.	Xeranthemum squarrosum	-	-	-	-	-	-

As the table shows, none of the recorded plant species are listed in Annex II or Annex IV of the Habitat Directive and Resolution 6 of Bern Convention to qualify for the priority species for the assessment against CH criterion ii or PBF criterion ii of EBRD PR6. Furthermore, the EAAA habitats does not support globally or nationally protected plant species at all. **Thus, the EAAA does not support any threatened species of flora that would qualify for priority species and further assessment for CA/PBF is not needed under this criterion.**

5.4.3.4.3 Assessment against CH criterion (iii) and PBF criterion (ii) – Range-restricted Species

As Table 5-56 shows, five endemic species of the Caucasus have been recorded in the EAAA as a result of the field surveys.

For the terrestrial species, Guidance Note 6 defines the range-restricted species as “those species that have an extent of occurrence (EOO) less than 50,000 square kilometers (km^2)”.

The extent of occurrence of the identified endemic species is discussed in Table 5-57 below.

Table 5-57 Extent of occurrence of the endemic species recorded in the EAAA

Species	Description
Thymus tiflisiensis	Endemic to the Caucasus. Originally described in Georgia. The extent of occurrence (EOO) comprises: Kartli, Kakheti and Trialeti in Georgia, and Quazax and Eilar-Oughy in Azerbaijan. Grows in the lower and middle mountain zones in dry terrain, could be encountered in the Jerusalem thorn and Jerusalem thorn - beard-grass communities, in the beard-grass - feather-grass meadows.
Teucrium nuchense	Endemic to the Caucasus. Originally described in Azerbaijan. The EOO comprises: Svaneti, Racha, Lechkhumi, Trialeti, Kartli, Khevsureti, Kakheti, Javakheti and Meskheti regions in Georgia, and Azerbaijan. Grows in dry slopes, screes, forest glades, shrublands from the mountain foothills to 2350 masl elevation.
Scabiosa georgica	Endemic to the Caucasus. Originally described in Georgia. The EOO: Racha-Lechkhumi, Imereti, Kartli, Kakheti, Trialeti in Georgia, the North Caucasus (Dagestan), Transcaucasia (Azerbaijan, Armenia). Grows in forest zone, on dry and stony slopes, in shrublands, forest edges, pebbly terrain.
Onobrychis cyri	Endemic to the Caucasus. Originally described in Georgia. The EOO: Kartli, Kakheti, Trialeti in Georgia, North Caucasus (Dagestan), Transcaucasia (Azerbaijan). Grows on stony slopes in the lower mountain zone.
Jurinea cartaliniana	Endemic to the Caucasus. Originally described in Georgia. The EOO: Kartli, Meskheti in Georgia, the North Caucasus (central). Grows in the middle mountain zone, on rocks.

The total area of the Caucasus ecoregion is about 586,800 km^2[12], and the species of concern are quite widely distributed in this ecoregion, as described above. The EOO of each species comprises many regions of Georgia, as well as several regions in other countries. Based on this, it could be concluded that the EOO of all five endemic species is larger than the established threshold. **Thus, the recorded endemic species do not qualify for the “range-restricted” according to the given definition, and further assessment against this criterion is not required.**

5.4.3.4.4 Assessment against CH criterion (iv) and PBF criterion (ii) – Migratory and congregatory species

This criterion does not apply to plant community, and will be respectively addressed in the fauna section.

5.4.3.4.5 Assessment against PBF criterion (iii) “significant biodiversity features identified by a broad set of stakeholders or governments”

The ESIA scoping and baseline studies included consultation with the relevant department of the Ministry of the Environmental Protection and Agriculture, as well as comprehensive review of all

[12] Ecoregional Conservation Plan for the Caucasus, 2020 edition, WWF, German Cooperation, KfW

publically available literature to identify all significant features of biodiversity in the Project area and the Project region in overall. The scoping phase also included disclosure of the Scoping Report and public consultations where various stakeholder groups, among them public authorities at different levels, local population, NGOs and especially those targeted at environmental protection, etc. were engaged. Neither consultations nor desktop study have identified within the limits of the EAAA any significant biodiversity features of flora and habitats other than discussed above that may fall under this criterion.

5.4.3.4.6 Assessment against PBF criterion (iv) "ecological structure and functions needed to maintain the viability of priority biodiversity features"

This criterion does not apply in the context of flora and habitats as the assessment against PBF criteria (i), (ii) and (iii) does not identified any PBFs of these categories within the EAAA.

5.4.3.4.7 Assessment against CHs' criterion (v) "areas associated with key evolutionary processes"

The Project is located in the geobotanical district of Shida Kartli, where some areas of Mtskheta and Kaspi districts are characterized by halophilic phytocenoses which is mainly developed in badland areas. These phytocenoses are comparable with desert vegetation by the structure of vegetation cover and species composition. The described type of flora of edaphogenetic deserts and semi-deserts includes endemic species of relatively narrow extent of occurrence together with widespread plants characterized with rather specific disjunctive distribution area the latter being of high importance for identification of geographical linkages, and for comprehension of evolution history of flora and vegetation in Georgia.

The species having distinctly disjunctive distribution area and represented in isolated patches are of higher importance for the solution of some evolutionary aspects of flora and vegetation in Georgia than endemic species. Migration of species which have wide disjunctive distribution area should occur from various districts of Afro-Asian region by different pathways during different epochs of the Tertiary Period.

The EAAA defined for flora and habitats does not comprises the described vegetation of edaphogenetic deserts and semi-deserts, and respectively population of plant species that might be significant for identification of geographical linkages and understanding of formation history of flora and vegetation in Georgia. Thus, the EAAA does not encompass any vegetation type that includes populations of the plant species that would be important for the establishment of geographic linkages and understanding of evolution history of flora and vegetation in Georgia. Respectively, it can be concluded that **the EAAA defined for flora and habitats is not associated with territories connected to key evolutionary processes, and it does not represent a CH under CHs' criterion (v).**

5.4.3.4.8 Conclusion

The assessment of the flora and habitats of the EAAA according to the CHs and PBFs criteria and conditions defined by the EBRD PR6 (2019) and Guidance Note 6 (2022) does not identified any critical habitats or priority biodiversity features of flora and habitats within the studied territory.

5.4.4 Fauna

5.4.4.1 Introduction

Comprehensive description of fauna in the project area is given in ESIA Volume 2, Annexes 3, 4 and 5, which include reports of seasonal field surveys of birds and bats. This section contains general characteristics of the Georgian fauna for the project area and enumerates the animal species, which are protected by Georgian or international legal acts (e.g. Conventions, Agreements etc.), and those of them that could be thought as the species, which are affected by the impact factors of the construction works and/or of operation of the Ruisi WPP project. Territories where important sites are located for the conservation of the animal biodiversity, in particular, key sites for endemic and rare species to the Caucasus that could be affected by the Ruisi WPP project, are noted in the text and shown on the maps.

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5.4.4.2 Legal framework

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

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

- the Environmental Protection Law of Georgia (the Frame Law for nature conservation);
- the Wildlife Law of Georgia;
- the Law on Red Data List of Georgia
- Decree #303 of 2 May 2006, of the President of Georgia, "On Approval of the Red List of Georgia" (Endangered Species List).
- the Law of Georgia on the System of Protected Areas

as well as:

- Law on State Ecological Expertise, January 1, 1997
- Law on Environmental Permits, January 1, 1997
- Law on State Control of Nature Protection, June 6, 2003

According to Georgian legislation, 135 species and 4 subspecies of animals are protected (Red Data list of Georgia, 2006). Taking into consideration the species which are protected by the international agreements, the whole number of protected species can reach up to 250. Most of these species are listed on the Red Data List of Georgia, Red Data List of IUCN, and in Attachments to different conventions.

International Conventions

The following list gives an overview of multilateral international conventions related to nature conservation and biodiversity protection, enforced in Georgia, which are relevant to this report.

- *Convention on Biological Diversity* (CBD), 1992, accepted at 02/06/1994.
- *Convention on the Conservation of Natural Habitats and of Wild Fauna and Flora* (the Bern Convention) - ratified in 30/12/2008.
- *Convention on the Conservation of Migratory Species of Wild Animals* (CMS), Bonn, 1979, date of entry into force 01/06/2000.

- *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES 1975; universal)
- *Agreement on the Conservation of African-Eurasian Migratory Waterbirds* (AEWA) - ratified in April 2001. This Agreement increased the number of the bird species that are protected by the law (up to 98 species listed in the Agreement occur in Georgia, most of them are not mentioned in Georgian Red Data List.
- *Agreement on the Conservation of Bats in Europe* (EUROBATS) – ratified on 21/12/2001. This agreement protects 28 bat species occurring in Georgia.

Bats are under special conservation in Europe. Bats are objects of protection under the Habitat Directive in the European Union. Furthermore, there is the special Agreement on the Conservation of Populations of European Bats / EUROBATS under the Convention on the Conservation of Migratory Species of Wild Animals. The CMS Convention recognizes that migratory species have to be protected through the entire migratory range of the species. The EUROBATS "aims to protect all 53 European bat species through legislation, education, conservation measures, and international cooperation." Georgia is a contracting party to both the CMS Convention and EUROBATS. To mitigate the negative impact on bats populations from the wind turbines in Europe, EUROBATS approved the Resolution #4.7 – *"Wind Turbines and Bat Populations"* (4th Session of the Meeting of the Parties, UNEP/EUROBATS, September 2003). Through this Resolution #4.7, the Agreement emphasizes that "the Parties and Range States should take full account of the precautionary principle in the development of wind turbine plants and take account of bats in planning processes relating to the siting of wind turbines, especially along migration routes and in areas of particular value to bat populations." Moreover, the special guidelines were elaborated by the EUROBATS to consider bats in wind farm projects – *"Guidelines for consideration of bats in wind farm projects, Revision 2014"*.

5.4.4.3 General Approach to Fauna Surveys

The fauna surveys have been planned and implemented according to the requirement of EBRD PR6 (2019). One of the main objectives of the baseline studies was to define species that occur within the study area, which are in need protection and of mitigation measures. Another important objective was to define wildlife features that can be considered as Critical Habitats (CH) or Priority Biodiversity Features (PBF) according to the EBRD definition. For the given Project, the identification of priority biodiversity features and critical habitats has been based on the criteria given in the Guidance Note - PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (September 2022).

All endangered species, which are protected by Georgian law or international conventions, should be considered as of the same importance without regard to taxonomy, size, or other features.

To evaluate the consequences of the realization of the project and estimate the impacts on all the environmental receptors, all the sensitive receptors, which could be affected, should be identified. The ecosystems, habitats and animals' populations that could be affected by the construction and operation of the Ruisi WPP project should be identified in the report. Therefore, during the environmental assessment, the possible impacts of the project on all the identified populations of protected species and all key biotopes and ecosystems, which might be affected by the project, should be considered.

5.4.4.4 Methodological approach

To define the impacts on the animal biodiversity, it is necessary to know, which species and in which numbers are really using the project territory. According to Betty Marriot (1997), it is necessary, using all kinds of accessible source of information, find out the following:

1 Whether there is evidence of the presence of those or other species within the impact area;

2 Whether there are habitats within the Impact Area, which are crucial for the species;

3 Whether the realization of the project will have a negative impact on these species and their crucial habitats.

Full-value data on the distribution of animal species (protected by the law) within the studied territory are absent. Data on numbers of these species either are absent or are outdated. There is no possibility to do a census of these species within the construction area in reasonable terms. To extrapolate the known habitat preferences of species to the landscape cover of the studied area, it is only possible to estimate a probability of the presence of species in the study area. It is possible to define the species that could be found within the impact zone of the project by estimating the features of the area (fodder supplies of the habitat, affinity of habitation of the human, presence of water sources and shelters, etc.) that limit the use of territory by animals. Knowing the requirement of species to the living space and their need in resources, there is a possibility to estimate (presumably) a total number of the affected individuals of this species. As it is stated in Chapter 3 "How to interpret biodiversity: the broad view" of Voluntary Guidelines on Biodiversity-Inclusive Impact Assessment (2006): "It is important to realize that potential impacts on biodiversity can be identified without having a complete description of that biodiversity. If an intervention is expected to result in changes in the composition, structure or key processes, there is a serious reason to expect that ecosystems and related ecosystem services will be affected. Further studies can focus on the aspect of biodiversity that is expected to be affected and on the resulting impacts on associated ecosystem services. Especially for areas where available data on biodiversity are limited, this approach has the advantage of focusing costly data collection efforts on the relevant aspect of biodiversity (thus avoiding lengthy descriptive studies of all biodiversity aspects in the intervention area)." That is exactly the case of our situation.

The basic method of the work is the use of checklists of species and overlap (superposition) of several respective maps: maps of distribution ranges, the map of landscapes, land cover map, land use map, map of land tenure and map of economic infrastructure, etc. Such a method could be named as a «method of simple matrixes» in the understanding of L. Canter (1996).

Data on species occurring within the Ruisi WPP project area were collected from the scientific literature (Kutubidze, 1966; Muskhelishvili & Chkhikvadze, 2000; Bukhnikashvili & Kandaurov, 2001; Muskhelishvili, 2002; Tarknishvili, 2002; Darchiashvili et al., 2004; Bukhnikashvili 2004; Bukhnikashvili et al., 2004; Bukhnikashvili et al., 2008; Pokryszko et al., 2011). The collected data were verified during the fieldworks, based on the existing habitats, finding of the animals traces (footprints, excrements, fur, feather etc.) on the predetermined sites of the project area and surrounding territories.

5.4.4.5 Zoological Field Survey Methods

Faunal field surveys for Ruisi WPP project included:

- General zoological field surveys that covered mammals except but bats, amphibians and reptiles;
- Bat field surveys; and
- Ornithological field surveys.

The methods used for each survey are described below.

5.4.4.5.1 General zoological field surveys

The general zoological field surveys were carried out by Dr. A Bukhnikashvili in April (27-29), June (23), July (4 and 7), September (17) and October (5) in the 2022 year, and separately by Dr. T. Arabuli in July (2-8).

During the zoological field surveys, the zoologists visited 48 of 58 WTG construction sites of first layout of WTG locations. Ten WTG sites were inaccessible because of private ownership on land, fencing and ban on entrance on the private lands. However, among the not visited WTG three was rejected in second design of Ruisi WPP layout. Thus only seven proposed locations were not inspected by zoologist Dr. T.Arabuli. 15 surveys on foot were executed within the project area. Some of WTG sites were surveyed by group of zoologists under leadership of Dr. A. Bukhnikashvili. All observation points within the study area of the Ruisi WPP project were fixed with GPS and described in the field diary. The investigated WTG sites and routes of the zoological field surveys are shown in Figure 5-18.

Time of observations on each observation point was depending on the terrain, of an area location and of evidence of animal presence on it. Generally, it took from 10 minutes up to one hour of the working time. Length of surveys varies from 2 km up to of 10 km during a day. Most of the zoological investigations were carried out in favorable weather conditions. During all working days, weather was sunny, sometimes windy. It was quite optimal and favorable for direct visual observations of reptiles, and amphibians and for tracking of mammals.

The general zoological surveys included the following observation methods:

Amphibians and Reptiles - Foot-survey along banks of water bodies (canals, ponds, and streams) within the impact zone of the Project. The direct visual observations of the adult animals on construction sites of WTG-s and at all of the potential spawning sites close to wind turbines construction sites, recording occurrence of the adult individuals and fixation of evidence of spawning (a lay of eggs etc.) etc.

Small Mammals - Registration of signs of activity within the WTG construction sites and construction corridor of the power line and internal roads – a combination of the various methods: dens and burrows search, registration of footprints and droppings, visual observation during the survey on foot etc.

Large mammals - Registration of signs of activity within the study area (footprints, droppings, direct visual findings during the survey on foot and from the high watching points). The aim is to find all possible evidence of the large mammals' presence on the study area, to have an idea on the usage of the territory of Project by these species.

The survey was done during daylight hours and in the dusk; any evidence observed were recorded by GPS.

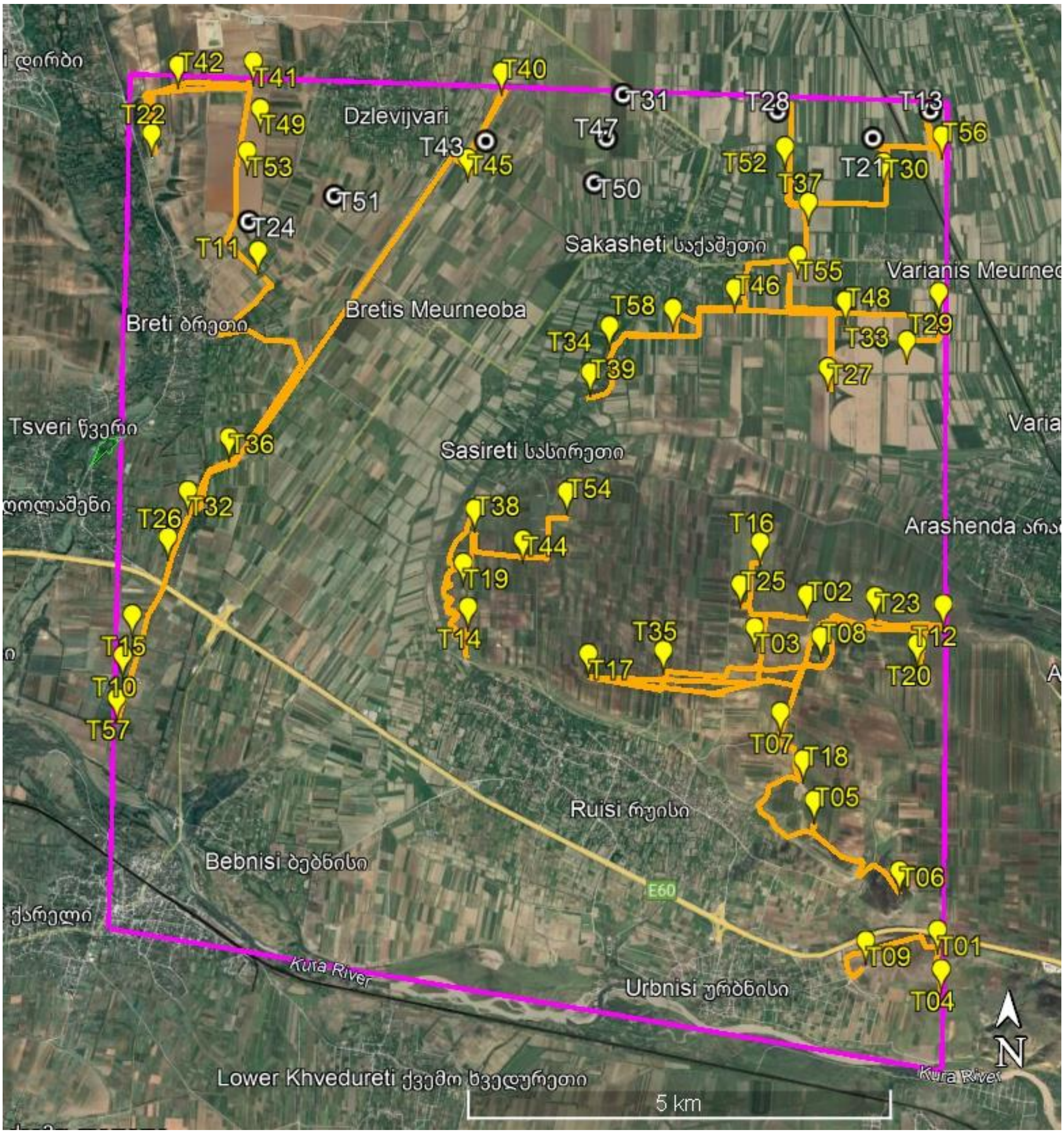

Figure 5-18 Routes of all field-surveys of zoologists in 2022

Yellow markers – surveyed WTG, White circles with black point in the center – not accessed WTG, orange lines – routes of zoological surveys, Magenta line – border of Ruisi WPP project area.

5.4.4.5.2 Ornithological Field Surveys

The study of ornithological situation within the 206 MV Ruisi WPP Project Area was carried out by Dr. A. Abuladze with assistance of invited professional ornithologists MS Arthur Green (US), Dr. Vladimir Melnikov (Russia), Oxana Zubkova, MS Denis Kitel (Belarus) and experienced amateurs-birdwatchers Ludmila Gritsenko (Estonia).

► **Objectives of the Ornithological Monitoring**

The main objectives of the bird survey were to collect baseline data on patterns of the transit migration of birds within the limits of Ruisi WPP Project Area and in adjacent areas, as well as their breeding and wintering there.

The specific objective of the study was to obtain information on the composition of passage visitors, their status of presence, territorial distribution, habitat selection, numbers of presented individuals, or densities, of solitary bird species, flight activity during wintering in the study area, dates of the presence and some other aspects of avifauna of area under consideration.

The special attention was paid to the target species. Traditionally, these bird species types are species listed in the EU Bird Directive Annex 1, Red Data List of Georgia and Red Data list of IUCN, and all large-sized soaring birds. From very beginning of the ornithological study, all birds of prey, owls and quail were chosen as targets species – 23 target bird species: 19 raptor species, 3 owl species and quail.

► **Bird Survey Methods**

The following four bird monitoring methods were used in different combination in different seasons of year:

- Observation from vantage points
- Survey on foot
- Road-car Survey
- Using of Playbacks for nocturnal birds survey

Observation from vantage points was accepted as base method. Several vantage points were selected for direct visual observations during field work – two in the autumn 2021, one in the winter 2022, four in the spring 2022, three in the summer 2022 and three in the autumn 2022. The location of all vantage points with coordinates is shown on maps in the seasonal/quarterly reports (see the ESIA Volume 2, Annex 5 “Bird Survey Reports”).

All vantage points were located at high points of relief with optimal conditions for direct visual observations. From the all vantage points, a very good view of the main parts of project area and some sides of the adjoining territories opened up. In good weather, visibility from the vantage points was up to the horizon, which allowed us to see flying birds from a distance of 3 – 5 km and more.

The total duration of direct visual observations carried from vantage points was more than 495 hours: 42 hours and 50 minutes in the autumn 2021; about 17 hours in the winter 2022; 178 hours and 30 minutes in the spring 2022; 118 hours and 25 minutes in the summer 2022.

Surveys on foot across all parts of the Project Area and in adjacent areas were carried out by two surveyors – expert and assistant, in some cases together with assistant/driver. These surveys on foot conducted during daylight hours, in favorable weather conditions, optimal for visual observations.

The road-car surveys in open habitats with field glasses from a moving car across and around study area. Road-car surveys were carried out with a series of frequent short stops from 5 to 30 minutes, around hours in total. Stops were made mostly in high points or relief with optimal conditions for visual observations with binoculars or telescope.

The total duration of survey on foot and road-car survey was more than 213 hours (213 hours and 20 minutes.

The monitoring of nocturnal bird species or species with night activity was conducted using of playbacks. Nocturnal bird surveys were done in good weather conditions on calm nights. A total of 23 hours and 20 minutes of night surveys were carried out in 2022 during breeding of owls:

- June 3/4, 2022; from 22:10 to 02:30 (4 h and 20 min);
- June 27/28, 2022; from 20:45 (June 27) to 03:15 (June 28); (6 h and 30 min);
- July 10/11, 2022; from 21:30 (July 10) to 03:45 (July 15); (6 h and 15 min);
- July 14/15, 2022; from 22:30 (July 14) to 04:45 (July 15); (6 h and 15 min).

Direct visual observations from high located watching points (vantage points) and land-based survey were conducted using binoculars (magnitude up to 12x). All records were documented with details of observation (dates, time, location of watching site, weather conditions, number of observed individuals and flocks, age, if possible, of observed birds, distance from observers, directions and height of flight, etc.). Special attention was paid to find nests of large birds of prey in proximity of the construction sites.

More details on the ornithological monitoring methods is provided in the ESIA Volume 2, Annex 5 “Bird Survey Reports”.

► **Survey Schedule**

The complex study of ornithological situation within the limits of Ruisi WPP Project Area covered all seasons of years 2021 – 2022 between October 6, 2021 and September 27, 2022. Field work were carried in all parts of area under consideration as well as in adjacent areas. Data were collected in all periods of year – during breeding of birds, their seasonal migrations in autumn and spring and wintering. The total duration of field work during 69 calendar/working days was 708 hours and 25 minutes, which is quite enough for such a relatively small area as the Ruisi WPP Project Area (about 104 km2). But it should be noted that the real time of direct observations is much longer and amounts to more than 794 hours (794 h 25 min). This is explained by fact that on some days the observations were carried out from two different vantage points (watching posts) by two or in some cases by three observers, the total duration was more.

Below, in the form of a list, data on the dates and duration of field work for individual seasons of the year are presented:

1. Autumn 2021 - nine calendar/ working days from October 6 and October 26, 2021 (79 hours)
2. Winter 2022 - eight calendar/ working days between January 20, 2022 and February 14, 2022 (about 66 hours).
3. Spring 2022 - 20 calendar/working days between April 1, 2022 and May 26, 2022 (212 hours and 40 minutes).
4. Summer 2022 – 21 calendar/ working days between June 5, 2022 and July 15, 2022 (255 hours and 20 minutes).
5. Autumn 2022 - 12 calendar/ working days between September 11 and September 27, 2022 (181 hours and 20 minutes).

► **Collection data for Collision Risk Assessment**

There are several methodologies and models of bird collision risk that could be used during the assessment of risks associated with the wind power plants. For the data collection we used the oblique collision risk method proposed by the Band, W. at al., 2007[13]. This method is very popular among

[13] Band, W., Madders, M. & Whitfield, D.P. 2007. Developing field and analytical methods to assess avian collision risk at wind farms. https://www.natural-research.org/ecological-consultancy-company/ornithology/collision-risk-modelling

specialists and has been used in similar projects in other countries. To match it to local conditions, in addition to vintage point observations, the observations from mobile sources was used to better track the flight within the project zone in conditions when the bird number is not so high. In addition, the necessary information about the biometric parameters (body length and wingspan) of the target bird species, their flight speed in different winds, daily activity, heights and directions of flight during seasonal migrations and local movements, numbers and density of breeding species, location of breeding, feeding and resting habitats, etc was collected from relevant sources. The risk assessment results are presented in the bird survey reports (see ESIA Volume 2, Annex 5).

5.4.4.5.3 Bats Survey

The study of bat (*Chiroptera*) population within the project area was carried out by I. Natradze with assistance of Dr. A.Bukhnikashvili, A.Kandaurov and G.Sheklashvili in 2022 year. The presented by experts report covers both - data from the field surveys conducted from 05.04.2022 through 02.11.2022 and results of processing of acoustic data recorded by passive bat detectors from 30.03.2022 through 05.11.2022.

► **Objectives of the surveys**

Considering the fact that wind power plants have an impact caused by collision and/or barotrauma on bats living close to WTG sites, the relevant research was planned with the following two main goals:

- Assessment of impact of the Ruisi wind power plants construction on the *Chiroptera* (bats) occurred in the project area.
- Assessment of importance of the study area for the bat population in the region.

The study was divided into three phases with the following particular objectives:

1. Spring observations covering the period from March through the end of May with the main objective to assess the extent to which the target area is used by bats for seasonal movements in spring.
2. Summer observations covering the period from June through the first decade of August with the main objective to identify: a) bat species diversity of the target area, b) existence of maternity colonies within the target area and in the potential shelters found within a 2-4 km from the target area; c) whether the target area is used by bats as feeding territory.
3. Autumn observations covering the period from the end of August through October with the main objective to assess whether bats use the target area for swarming and/or seasonal movements.

It is well known that bats are hibernating in the winter. Thus they cannot be suffered in result of Ruisi WPP operation from November till March, and respectively bat surveys was not planned during this period.

► **Methods of the bat survey**

The Agreement on the Conservation of Populations of European Bats (EUROBATS) under the Convention on Migratory Species (CMS) provides the special „Guidelines for consideration of bats in wind farm projects" (2014). The guidelines give recommendations about methods of the assessment of potential impact from the wind farms construction/operation on the bat species. Considering the fact that these guidelines have been developed for whole Europe, it is recommended to adapt the given methods to local conditions of the target country and/or territory.

Taken into account guidelines recommendations we used following methods of bat monitoring:

- Survey on foot using handheld ultrasound bat detectors.

- Collecting data using static/passive ultrasound bat detectors.
- Bats mist-netting

The following equipment were used during the field observations - ultrasound bat detectors Pettersson D240 and Pettersson D240x, Song Meter SM4BAT FS from Wildlife Acoustics, and also, special Ecotone bat nets. Bat sounds were recorded using portable voice recorders - Sony ICD-1000 and TASCAM DR-07MKII. For identification of the bat species, recorded sounds were processed by Kaleidoscope pro software.

► **Survey Schedule**

Considering weather conditions active field surveys were started on April 5 and finished on November 2, 2022. The field-routs were conducted around the construction sites of WTGs of the Ruisi WPP.

Spring 2022, since April 5 till May 9, field surveys were done by two groups of zoologists during three nights with ten-day intervals. Field research started before sunset and finished at the lowest rate of bats activity when we were not able to record bats activity during recent 2 hours and/or after 4-6 hours from sunset, and/or when the whole project area was covered by field routes.

Summer 2022, from May 19 till September 24, each field-survey visit included four nights (one night mist-nets and field routes in adjacent areas where mist-nets were installed and three nights of field routes covering the whole project area twice during each night) with recommended 14-day interval between each visit to the project area. During surveys the bats observation started 30 minutes before the sunset and continued throughout the night finishing 30 minutes after the sunrise.

Autumn 2022, since September 24 till November 2, the field surveys were done during three nights with ten days interval covering the whole project area. Field research started 30 minutes ahead of sunset and finished at the lowest rate of bats activity when we were not able to record bats activity during recent 2 hours. The field-works were finished at the earliest after 4-6 hours from sunset.

The routes passed during the bat surveys are shown in Figure 5-19, which also shows the location of mist netting areas and location of passive bat detectors.

The mist netting was carried out ten times: on May 25, June 9, June 21, July 7, July 22, August 4, August 13, August 24, September 2, and September 15. The mist nets 6 -12 meters of length were installed on the preselected sites where relatively higher possibility of bats catching was expected.

Five passive bat detectors were installed in the project area on 2th of March (see Figure 5-19):

- The first two detectors (BRETI#1 and BRETI#2) were installed at the coordinates 42.09388°N/43. 90227°E. BRETI#1 was installed on the met mast at about 55-60 meters height, BRETI#1 was installed on the met mast at about 20 meters height.
- The third detector (Ruisi #2) was installed at the coordinates 42.06025°N/43.94561°E, on the met mast at about 50 meters height.
- The fourth detector (Ruisi #3) was installed at the coordinates 42.04969°N/43.98080°E, on the met mast at about 50 meters height.
- The fifth detector (Tree) was installed at the coordinates 42.09476 °N/43.98746°E, on the tree at about 10 meters height, over the canopies.

Considering weather conditions active field surveys were started on 05.04.2022 and finished on 02.11.2022. In total, more than 1500 kilometers long field-route was covered during this period.

It should be mentioned that those areas where at least two species and/or several individuals are recorded simultaneously are considered as the areas with relatively high bat activity.

For more details on bat survey methods see the ESIA Volume 2, Annex 4 “Bat Survey Reports”.

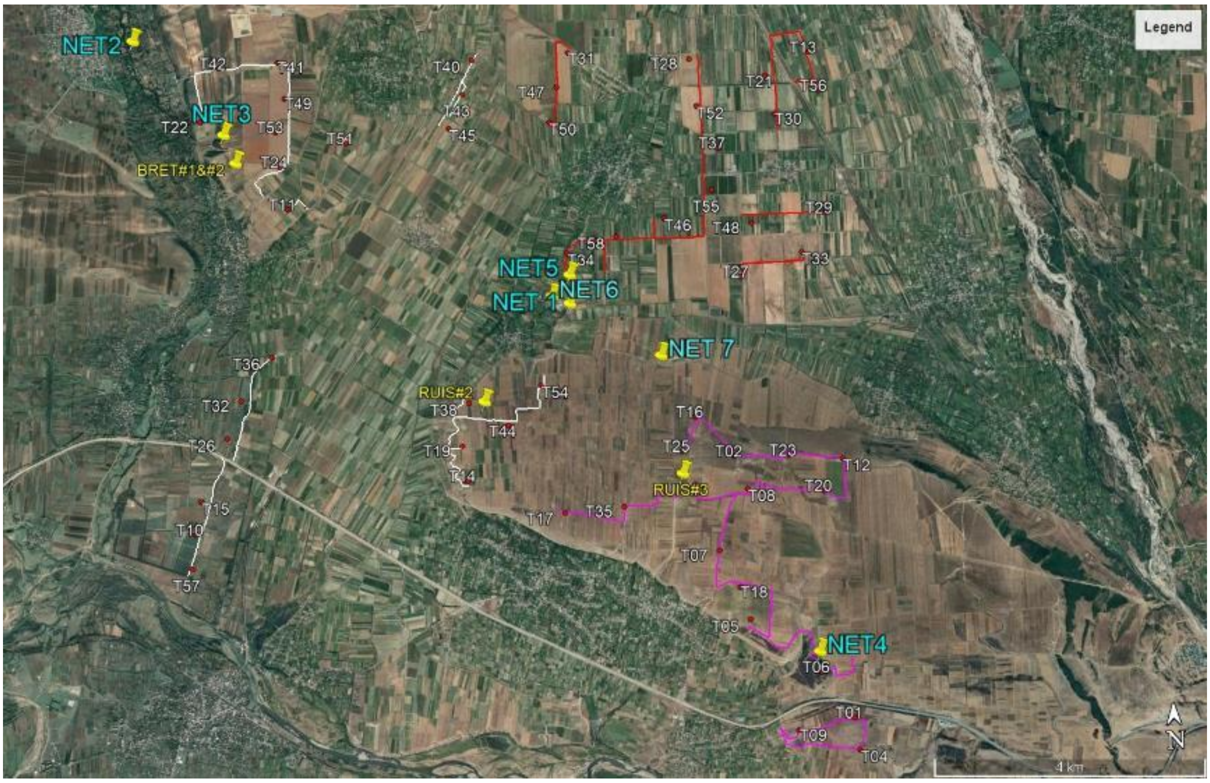

Figure 5-19 Bat survey map - field routes, mist netting areas and location of passive bat detectors

Field routs for the first night is given in red color, field routes for the second night is given in purple color, and field routes for the third night is given in white color. NET demarks mist netting areas, Yellow markers – passive bat detector installation place; White numbers – WTGs.

5.4.4.6 Species selection

The general principle for species selection is that each species, considered in the report, must have a forceful argument to include it in the list for consideration. We have to consider as the species that are already protected by law (e.g. listed in the national Red Data List, 2006), as well as species of any special interest of local community (e.g. a game species, or the species - attractive for tourists, etc.). Construction, operation and maintenance of the Ruisi WPP should not cause damage to the animals that occur in Georgia, especially endangered species. Some of the species included in the Georgian Red Data List (2006) are not threatened behind the Georgian border, in other parts of their distribution ranges. However, if any species will extinct on Georgian territory our fauna will become poor and our ecosystem will be less stable. Other species have numerous populations and stable distribution ranges on the Georgian territory, but are rare or are threatened abroad. In this case, the populations on our territory are the reserves or refuges of these species. Without the reserve populations, those species may become endangered or even extinct in other parts of their worldwide range and, in future in Georgia, too.

However, all species, which can be included in the list for consideration in this report, should be presumed to be the species impacted by the project, especially if a part of the population, significant for the survival of a species as a whole on the territory of Georgia, could be adversely affected by the construction and/or operation of the project.

5.4.4.7 Key-site selection

A key-site selection has two aspects. On the one hand, the site should be selected that is important for the sustainability of the populations of animals: breeding or nesting habitat, feeding (foraging) site, stopover site during migration, wintering or hibernation place, etc. On the other hand, we should select sites within the impact area of the Ruisi WPP where the impact of construction, operation, and repair works will result in damage to fauna.

All "sensitive" sites should be described in the report. All sites, that are requiring extra cares during construction and/or operation of the project infrastructure and all sites where biodiversity preservation is of concern should be mapped.

The sites that may require additional study to evaluate adverse effects of the Ruisi WPP project on the fauna should be also described.

The distribution, within the Ruisi WPP project impact area, of the ecosystems and of the animal complexes, which are requiring mitigation measures should be shown in tables or maps.

5.4.4.8 Geographical Aspects of Study Area in Georgia

Geographically, the Caucasus isthmus is recognized as a land from the southern borders of Armenia, Azerbaijan, and Georgia in the south to the Kuma-Manych depression in the north. It borders upon the Black and Azov Seas in the west and the Caspian Sea in the east. Close neighborhood of areas with different natural conditions is typical for the Caucasus. Distances between high mountains and coastal lowland or between humid or arid subtropics and coniferous forests are rarely more than dozens of kilometers. The isthmus has historically served as the area of transit for many species in the process of exploring new areas and as a migration corridor for many animals.

Georgia is situated in the western part of the Caucasus isthmus on the Black Sea coast. The area of Georgia is about 69700 km. Georgia occupies the south macroslope of the Greater Caucasus range, the western part of the intermountain Transcaucasian depression divided by the Likhi Ridge into the Colchis Lowland in the west of the country and the Kura River Valley in the east of the country, the western part of mountain ranges of the Lesser Caucasus and the northern extremity of the Middle East Uplands, the Armenian Highlands, to the south from the Lesser Caucasus. From the climatic and landscape standpoint, the territory of Georgia is quite uneven.

The western part of the Transcaucasian depression covers the Colchic province (Kolkheti), including two sub-provinces - of Colchic (Kolkheti) lowland and Colchic (Kolkheti) foothills. All rivers and streams here belong to the basin of the Black Sea. The central part of the Transcaucasian depression, situated in the eastern and central parts of Georgia, belong to the Kura physical-geographic province, Kura-Alazani sub-province (another sub-province of this province, Kura-Arax lowland, is located in Azerbaijan). All rivers and streams, located on the territory of this region, belong to the basin of the river Mtkvari (Kura) and, thus, to the basin of the Caspian Sea.

The Middle East physical-geographic province situated to the south from the Transcaucasian depression and consists of the Lesser Caucasus and Javakheti Plateau (Upland). One can divide Lesser Caucasus into three sections. Western part - Meskheti ridge and western slopes of Trialeti ridge are quite humid and high, covered with coniferous and broad-leaved forest. Hard rocks form mountain relief. Eastern part – Trialeti ridge is more arid and low, than western part, covered with deciduous forest. The south part consists of the Javakheti Plateau (Upland), Javakheti, Samsari, and Erusheti ridges. Relief is leveled (smoothed), rocks volcanic and deluvium. This part mainly is covered with the tree-less, open grassy landscape. Only on the Erusheti ridge, one can see the forest. All rivers and streams, located on this territory, except rivers on northern slopes of Meskheti ridge, belong to the basin of the river Mtkvari and, thus, to the basin of the Caspian Sea. Rivers on northern slopes of Meskheti ridge belong to the basin of the river Rioni and the Black Sea.

The project area is located on the left bank of the Mtkvari River within the central part of the Transcaucasian depression. From the physical-geographic point of view, the Ruisi WPP project is planned within the Middle East physical-geographic province.

5.4.4.9 Zoogeographic Characteristics of the Caucasus

From the standpoint of zoogeography, the entire Caucasus is located in the Holarctic or Palaearctic realm (kingdom) or zone. We use the zoning of the World Geographic Atlas of 1964 published in Moscow[14]. According to Vereshchagin's map (1964), the Caucasus includes several zoogeographic sub-zones. Figure 5-20 illustrates that in some locations the boundaries of the zoogeographic sub-zones come very close to each other.

Figure 5-20 Boundaries of Zoogeographic Sub-zones[15]

1. Central-Asian 2. Circumboreal 3. Mediterranean; Solid line is the zoogeographic sub-zone boundary; Dash line is the state border; Red oval – Ruisi WPP Project Area

In the north of the region, there are two districts of the Kazakhstan-Mongolian province of the Central Asian sub-zone. The middle of the Caucasus is mountains of the Greater and Lesser Caucasus and Talysh that belong to the Caucasus district of the Circumboreal sub-zone isolated from the main part of the sub-zone by steppes. The Circumboreal sub-zone is sometimes referred to as the sub-zone of

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

[15] Source: Regional Bat Conservation Plan for Caucasus, 2008.

Western Eurasia, which in principle does not change its characteristics and boundaries in the Caucasus (The World of Geography, 1984). Southern boundaries of the Caucasus Ecoregion lie within the Anterior Asia district of the Mediterranean province and Kura district (almost entire Azerbaijan) of the Iran-Turan province. Both these provinces belong to the Mediterranean sub-zone. Thus, three zoogeographic sub-zones and four zoogeographic provinces neighbor in the Caucasus. The Caucasus is home to species typical for all the three sub-zones resulting in the rich diversity of flora and fauna.

According to modern map of the biogeographical regions in Europe (Cervellini et al. 2020), the Alpine, Black Sea, Anatolian and Steppic regions reach into the territory of Georgia. All these regions belong to the Eurasian or Palearctic realm according to the updated "An updated Wallace's zoogeographic regions of the World" (Olson et al. 2001; Holt et al. 2013). However, a certain part of Georgian territory, namely the northern slopes of Trialeti Ridge and part of the southern slopes of the Great Caucasus in eastern Georgia, is covered with forest areas with communities including Colchis elements of the Black Sea Region, East European elements belonging to Alpine Region, Middle East elements of the Anatolian Region and elements of the Steppic fauna. Therefore, these areas cannot be referred to as the above-named biogeographic regions with certainty. It is rather difficult to outline the correct border between the faunistic regions represented throughout Georgia due to the mutual penetration of species between them. The complicated, sometimes mosaic, spatial structure of biological communities representing different biogeographic regions is specific to Georgia, as well as to the entire Caucasus. A refuge of Tertiary flora is situated in Georgia, the Colchis refugium in the catchment basin of the Black Sea (Tarkhnishvili et al. 2011).

5.4.4.10 Zoogeographic district of Ruisi WPP project

The Project Area is situated at the western limits the Kura district (Kura-Alazani sub-district) of the Iran-Turan province, which belong of the Mediterranean sub-zone. The Project area is covered with grassland with sparse derivates of forest and secondary meadows with communities including elements East-European, Middle East, and Turanian fauna. Terrestrial fauna of the Project area is quite degraded because of dense human population and in a result of long time usage for agriculture and for livestock breeding.

From the hydrobiological and ichthyological standpoint, presented on the website Freshwater Regions of the World[16], the Project area is situated within the intermountain plain – belongs to the ecoregion “434: Kura – South Caspian Drainages”. This freshwater ecoregion covers the largest area in the Caucasus River system that represents all possible ecological zones from mountains to the plain. The northern border of the ecoregion lies along the Main Caucasus Range. The western border follows the slopes of the Likhi Ridge and the divides of the Meskheti and Arsiani mountain ranges. This ecoregion encompasses the whole Kura-Aras catchment. All small rivers in surroundings of construction sites belong to this ecoregion. Gully and rivulets network on the project area is quite developed, however larger part of them transformed into irrigation canals and ditches of the Saltvis Irrigation System.

5.4.4.11 Landscapes (ecosystems) within the territory of Ruisi WPP project

According to N.Beruchashvili et al. (1988), historically the project territory and neighborhoods were characterized by three main landscapes (natural ecosystems) (see landscape map on Figure 5-21 below). Historically, the largest portion of this area was occupied by open habitats of grasslands with sparse bushes, which generally matches the description of Landscape 19 according to N.Beruchashvili classification - South-East Caucasian sub-Mediterranean (transitional to moderate-thermophilic semi-humid, foothill landscapes with derivates of the oriental hornbeam-oak forest, arid light forest in some places, and with beardgrass steppes (*Botriochloa sp.*)) and, in rivulets gorges and in dry gullies,

[16] http://www.feow.org/ecoregions/details/kura_south_caspian_drainages

derivates of the xerophilous forest of oak and oriental hornbeam-oak forest. Long time ago this ecosystem was totally transformed into irrigated agricultural land. Secondary grassland, steppe-like habitat appears on small land plots abandoned by owners for a few years. Of course, the animal community characteristic of the steppe cannot be fully restored here. Moreover, these areas are again involved in agricultural circulation every few years.

A lesser hilly part of the area in south-east was occupied by landscape 23 - East Georgian hilly and foothill landscapes with beardgrass steppes (*Botriochloa sp*.) and feather grass (*Stipa sp.*) steppes, dry shrubland (shibliak), dwarf-shrub (phrygana) vegetation and semi-desert vegetation. This ecosystem was developed on the elevations above 720 m a.s.l.. This ecosystem is totally transformed into agricultural land a long time ago, also. The secondary steppe-like habitat appears on land plots abandoned by owners and disappears in case of continue treatment. No sustainable natural steppe animal community exists on this territory. All species of rodents, carnivores and reptiles are adapted to life on arable lands.

The floodplain forest, landscape 51, was spread along the main rivers of the region. Currently a narrow line of bushes with solitary trees and the degraded meadows remain in these places instead of a wide strip of floodplain forest. Edges of the villages Bebnisi and Urbnisi are in less than one hundred meters from river waterbed.

The spatial distribution of the described landscape types within and around the project territory is shown on Figure 5-21.

The study area is densely populated. The residential areas and home gardens of nine villages occupy up to 12% of the territory of the Ruisi WPP project. The main highway Tbilisi-Batumi crosses the entire area in latitudinal direction in the south part of it. Two small railway sites are going through the area in the north east and in south-western corners. The dense network of unpaved field roads is developed within the project area and neighborhood in addition to the well developed network of the municipal asphalt roads.

Most of the territory is cut by irrigation canals and ditches, presented by main channels of Zemo (Upper) Ru, Didi Ru and Sadedoru, and numerous small distribution channels. All water courses within the study area are integrated into Saltvisi Irrigation System (See Figure 5-12). The Mtkvari River and two other large permanent rivers – Didi Liakhvi and Eastern Prone are outside the Ruisi WPP project area. The Didi Liakhvi River lies in more than 3.5 km to the east outside the borders of the project area. There are a few remnants of the smaller rivers Bretula and Bebiula. They are entering the project area via irrigation canals and are ending in the irrigation canals and ditches. The water current there is fully being regulated by farmers. The permanent presence of the water can be expected in large irrigation channels. However, level of water, speed of current, and therefore oxygen content in their water greatly varies in different seasons. Smaller irrigation canals and ditches, shown on Figure 5-12, contain water only during irrigation season (April-September). Therefore, they provide spawning habitat for amphibians and some invertebrates, but not form permanent aquatic habitat for fish and for true aquatic species. The stagnant waters are presented within the area of the Ruisi WPP as four artificial ponds and many puddles. Ponds are small less than 5 ha. All ponds are integrated into the irrigation system and are used as reservoirs for watering in case of water shortage. The water level varies in seasons and in different seasons and years. One can say that ponds are temporary water storage and thus temporary aquatic habitats.

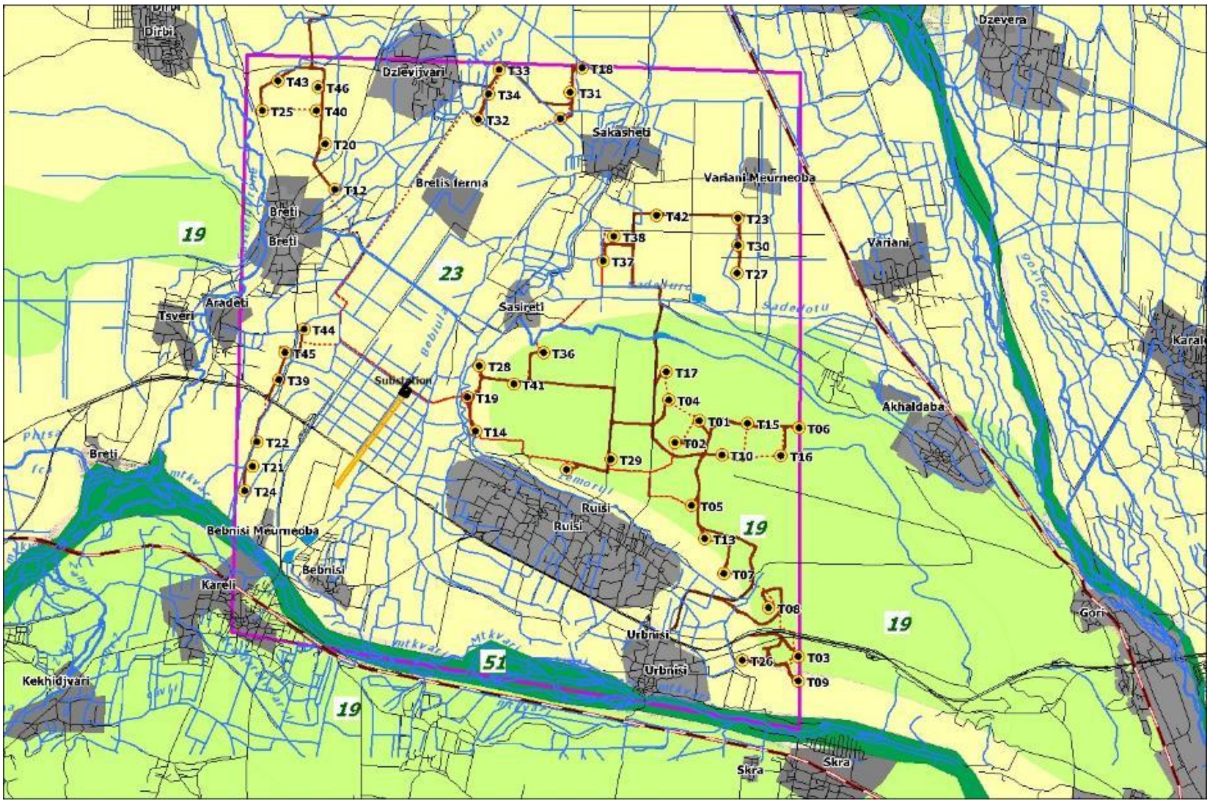


Figure 5-21 Landscapes within the Ruisi WPP project area and immediate neighborhoods

Light green 19 – Foothills with derivates of the oriental hornbeam-oak forest with beardgrass steppes (*Botriochloa*); Light yellow 23 - foothill landscapes with beardgrass steppes (*Botriochloa sp*.) and feather grass (*Stipa sp*.) steppes, dry shrubland (shibliak), dwarf-shrub (phrygana) vegetation; Dark green 51 - Floodplain forest with meadows; Project area - magenta line, WGT - red circles with black points in the centers; the projected internal roads - dark red lines, the internal roads with the power cables in the ground - red dashed lines, the residential areas - grey polygons, the existed internal ground-roads - grey lines, watercourses - blue lines.

Actually, there are two kinds of agriculture lands – the irrigated fruit gardens and vegetables plantations, and the non-irrigated arable land occupied by cereal fields (mainly wheat and maize) and fields of a sunflower. Lesser part of the area is used as pastureland for cattle of locals. In addition, small plots of artificial pine groves, remnants of former windbreaks are situated near the Ruisi and Breti villages. The agriculture lands are fragmented in not large parcels of different ownership and occupied with different crops.

There are none natural habitats within the project area. The narrow strips of bushes and trees along the canals and unpaved roads, as well as the degraded and partially cut-down windbreaks, are under great pressure of human activity and can be characterised as having a high level of a disturbance to animals. Wide usage of pesticides and herbicides leads to the pollution in watercourses and ponds.

According to EUNIS classification, four habitat types have been described in the project area during the botanical surveys, which are comprehensively described in flora sections. These habitats include:

I. Cultivated agricultural habitats
E1. – Dry grasslands
G1.1 – Riparian and gallery woodland
G3.4. – Pine forest (this is in fact the artificial pine grove – remnants of the windbreaks)

The major portion of the project area is occupied by habitat I - Cultivated agricultural habitats. Under code I - Cultivated agricultural habitats here are considered lands occupied with annual crops and permanent plantations. 37 WTG-s are placed within this habitat. That are WTG-s 02, 05, 06, 07, 10, 11, 12, 13, 14, 16, 18, 19, 20, 21, 22, 23, 24, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45 46.

Lesser part of the area is covered by habitat E1. – Dry grasslands. These areas are used as pasturelands. They have secondary semi-natural grass vegetation. Eight WTG-s are placed within this habitat. Those are WTG-s: 01, 03, 04, 09, 15, 17, 25, 26. Totally, area of this habitat within the project area is approximately 350 ha. The area is to small to support any sustainable population even of small mammal or reptile species.

Small artificial pine grove (habitat G3.4) occupies approximately 35 ha. Only one WTG 08 is placed within this area.

EUNIS habitats and major landscape types described within the Ruisi WPP project area are shown in Figure 5-22.

According to IUCN Habitat Classification scheme (version 3.1) one can find within the area under consideration following habitats:

14. Artificial – terrestrial
14.1 Arable land
14.2 Pastureland
14.3 Plantations
14.4 Rural Gardens

Aquatic habitats can be designated as:

15. Artificial – Aquatic
15.2 Ponds [below 8 ha]
15.7 Irrigated Land [includes irrigation channels]
15.9 Canals and Drainage Channels, Ditches

All these water bodies are situated within the areas occupied by cultivated agricultural habitats. None of above noted habitats are designated as habitat in need of special measures for protection.

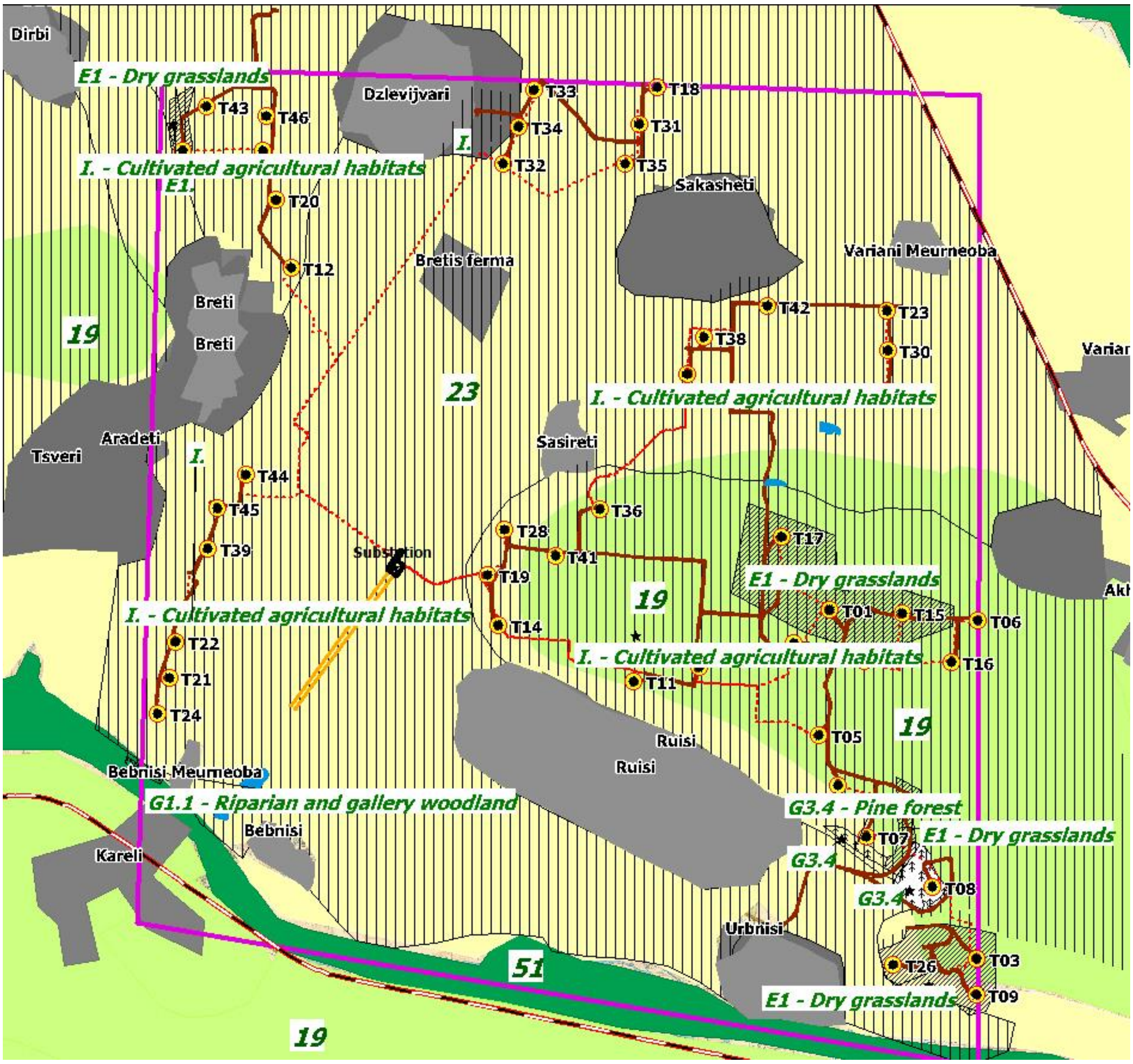


Figure 5-22 Habitats and Landscapes within the Ruisi WPP project area

Light green 19 – Foothills with derivates of the oriental hornbeam-oak forest, with beardgrass steppes (*Botriochloa*); Light yellow 23 - foothill landscapes with beardgrass steppes (*Botriochloa sp*.) and feather grass (*Stipa sp*.) steppes, dry shrubland (shibliak), dwarf-shrub (phrygana) vegetation Dark green 51 - Floodplain forest with meadows; Vertical hatching - I. Cultivated agricultural habitats; Oblique hatching - E1. – Dry grasslands; G3.4 – pine grove. Dark green - G1.1 – Riparian and gallery woodland; The limits of the project area – magenta line, WGT – red circles with black points in the centers; the projected internal roads – dark red lines, the internal roads with the power cables in the ground – red dashed lines, the residential areas – grey polygons, the existed internal ground-roads – grey lines, the railway – red and black dashed line. The watercourses (rivers and irrigation canals – blue lines.

5.4.4.12 Mammals

110 species of mammals are occurring in Georgia. These species are associated in 61 genera of 25 families that belong to eight orders. From this amount, six species were acclimatized in Georgia, or they have penetrated there after acclimatization on the adjacent territories (Bukhnikashvili, Kandaurov 1998, 2002; Gurielidze, 1997).

42 species of mammals, belonging to 25 genera of 11 families of six orders, are noted in documents or can be supposed, according to their requirements to habitat, as those that occur within the area of the Ruisi WPP construction. Among them are three species that are listed in the Georgian Red List (2006) as Vulnerable (VU), and one more added in result of assessment done in 2020. Two are listed in the IUCN Red List as Near Threatened (NT) and only one as Vulnerable – the bat Giant Noctule (*Nyctalus lasiopterus*). Presence of this species is confirmed during the field surveys.

No one mammal species is strictly endemic to Georgia or the Caucasus. Four species can be conventionally considered as endemic to the Caucasus and Asia Minor. The presence of these species within the study area is supported by authors' observations. The occurrence of the eight species is confirmed by expert zoologists during the field surveys, based on direct observations (two species) and tracks of animals (six species). The presence of 13 species of bats is confirmed using ultrasound bat detectors (passive and handheld.

There is only one protected by law mammal species, part of the key-habitat of which lies within the construction area - Brandt's Hamster (*Mesocricetus brandti*). This species occurs there at the westernmost edge of the its distribution range and has well adapted to live in the arable lands (See Table 5-58 Mammals occurring within the project area).

Parts of populations or some individuals of the protected by law species can be affected during construction and operation of the Ruisi WPP within the zone of impact or on the remote ecological receptors. Some of them can be affected in results of vehicle accidents within the construction zone (the feeding strategy of some medium-sized carnivore species, picking up dead animals from the road, leads in increased mortality).

Table 5-58 Mammals occurring within the project area

Red Data List of Georgia and **IUCN Red Data List** categories: *NT* – Near Threatened, **VU** – Vulnerable, **EN** – Endangered; **CR** – Critical Endangered; **Status on territory** : **YR-R** - Year Round Resident, **SB** – Summer Breeder, **PM** – Passage Migrant, **YR-V -** Year Round Visitor**, OV** – Occasional Visitor, **H** – home range of the species lies within the Project Impact area, **F** – Feeding area; **Data Source and Presence Confirmation** – **DO** – Direct Observation during the field surveys, **USD** - recorded by the Ultrasound Bat detector, **T** – tracks or footprints observed during the field surveys, **L** – noted in scientific literature, **E** – presence is expected because of habitat requirement of the species known from published issues.

	Family	Latin name	Georgian Name	English name	Endemic	Red List of Georgia	2020 Assessment	IUCN Red Data List	CITES	Bern Convention Annex	Bonn Convention	Emerald Network Species	Resolution #6	Presence Status within Project area	Source
		ERINACEOMORPHA													
1.	*Erinaceidae*	*Erinaceus concolor*	აღმოსავლეთევროპული ზღარბი	Southern White-breasted Hedgehog			LC	LC						HR	DO
		SORICOMORPHA													
2.	*Soricidae*	*Crocidura suaveolens*	გრძელკუდა კბილთეთრა	Gueldenstaedt'sShrew			LC	LC		III				HR	L
3.		*Crocidura leucodon*	თეთრმუცელა კბილთეთრა	Bicoloured White-toothed Shrew			LC	LC		III		1	1	HR	L
4.	*Talpidae*	*Talpa levantis*	მცირე თხუნელა	Levant Mole	**?**		LC	LC						HR	T
		CHIROPTERA													
5.	*Rhinolophidae*	*Rhinolophus ferrumequinum*	დიდი ცხვირნალა	Greater Horseshoe Bat			LC	LC			EUROBATS	1	1	HR	DO
6.		*Rhinolophus hipposideros*	მცირე ცხვირნალა	Lesser Horseshoe Bat			LC	LC			EUROBATS	1	1	HR	L
7.	*Vespertilionidae*	*Barbastella barbastellus*	ევროპული მაჩქათელა	Western Barbastelle		**VU**	**VU**	*NT*			EUROBATS	1	1	SV	UBD
8.	Molosidae	*Tadarida teniotis*	გრეძელკუდა ნაკეცტუჩა	European Free-tailed Bat			DD	LC						SV	UBD
9.		*Eptesicus serotinus*	ჩვეულებრივი მეგვიანე	Serotine			LC	LC		II	EUROBATS			SV	UBD
10.		*Myotis blythii*	ყურწვეტა მღამიობი	lesser mouse-eared bat			LC	LC		II	EUROBATS	1	1	SV	UBD
11.		*Myotis davidii*		Steppe Whiskered Bat			DD	LC			EUROBATS			?	UBD
12.		*Myotis mystacinus*	ულვაშა მღამიობი	Whiskered Myotis			LC	LC		II	EUROBATS			SV	UBD
13.		*Myotis nattereri*	ნატრერის მღამიობი	Natterer's Bat			DD	LC		II	EUROBATS			SV	UBD
14.		*Nyctalus leisleri*	მცირე მეღამურა	Lesser Noctule			LC	LC		II	EUROBATS			SV	UBD
15.		*Nyctalus noctula*	წითური მეღამურა	Noctule			LC	LC		II	EUROBATS			SV	UBD
16.		*Nyctalus lasiopterus*	გიგანტური მეღამურა	Giant Noctule			**VU**	**VU**		II	EUROBATS			SV	UBD
17.		*Pipistrellus nathusii*	ტყის ღამორი	Nathusius'Pipistrelle			LC	LC		II	EUROBATS			?	UBD
18.		*Pipistrellus kuhlii*	ხმელთაშუაზღვის ღამორი	Kuhl's Pipistrelle			LC	LC		II	EUROBATS			SV	UBD

WEG ENVI CONSULTING

	Family	Latin name	Georgian Name	English name	Endemic	Red List of Georgia	2020 Assessment	IUCN Red Data List	CITES	Bern Convention Annex	Bonn Convention	Emerald Network Species	Resolution #6	Presence Status within Project area	Source
19.		*Pipistrellus pipistrellus*	ჯუჯა ღამორი	Common Pipistrelle			LC	LC		III	EUROBATS			HR	UBD
20.		*Pipistrellus pygmaeus*	პაწია ღამორი	Pygmy Pipistrelle			LC	LC		II	EUROBATS			?	UBD
21.		*Plecotus auritus*	რუხი ყურა	Brown Long-eared Bat			LC	LC		II	EUROBATS			?	UBD
22.		*Vespertilio murinus*	ჩვეულებრივი ღამურა	Particoloured Bat			DD	LC			EUROBATS			SV	UBD
		LAGOMORPHA													
23.	*Leporidae*	*Lepus europaeus*	ევროპული კურდღელი	European Brown Hare			LC	LC						HR	L
		RODENTIA													
24.	*Gliridae*	*Glis glis*	ჩვეულებრივი ძილგუდა	Fat dormouse			LC	LC		III				HR	L
25.		*Dryomys nitedula*	ტყის ძილგუდა	Forest Dormouse			LC	LC		III				HR	L
26.	Cricetidae	*Microtus obscurus*	ჩვეულებრივი მემინდვრია	Common Vole			LC	LC						HR	L
27.		*Microtus socialis*	საზოგადოებრივი მემინდვრია	Social Vole			LC	LC						HR	DO
28.		*Mesocricetus brandti*	ამიერკავკასიური ზაზუნა	Brandt's Hamster	**?**	**VU**	**VU**	*NT*						HR	DO
29.		*Cricetulus migratorius*	ნაცრისფერი ზაზუნა	Grey Dwarf Hamster		**VU**	**VU**	LC						HR	L
30.	Muridae	*Mus musculus*	სახლის თაგვი	House Mouse			LC	LC						HR	DO
31.		*Mus macedonicus*	ველის თაგვი	Macedonian Mouse	**?**		LC	LC						HR	DO
32.		*Apodemus witherbyi*	კავკასიური ტყის თაგვი	Steppe mouse	**?**		LC	LC						HR	DO
33.		*Apodemus uralensis*	მცირე ტყის თაგვი	Little mouse			LC	LC						HR	L
34.		*Rattus norvegicus*	რუხი ვირთაგვა	Brown Rat			LC	LC						HR	L
35.		*Rattus rattus*	შავი ვირთაგვა	Black Rat			LC	LC						HR	L
		CARNIVORA													
36.	*Canidae*	*Canis aureus*	ტურა	Golden Jackal			LC	LC	III					HR	DO
37.		*Vulpes vulpes*	მელა	Red Fox			LC	LC	III					HR	T
38.	*Mustelidae*	*Martes foina*	კლდის კვერნა	Stone Marten, Beech Marten			LC	LC	III	III				HR	T
39.		*Meles meles*	მაჩვი	Eurasian Badger			LC	LC		III				HR	DO
40.		*Mustela nivalis*	დედოფალა	Least Weasel			LC	LC		III				HR	L
41.	*Felidae*	*Felis silvestris/F. catus*	ტყის კატა	Wild Cat			LC	LC	II	II				HR	DO
					4-?	**3 VU**	**4 VU**	**1VU**	**1-II, 3-III**	**12-II, 8-III**	**17-EUROBATS**	**5**	**5**	**25-HR, 11-SV, 4-?**	**10-DO, 12-L, 3-T, 16-USD**

5.4.4.12.1 Bats (Chiroptera)

As regards mammals within the area of the Ruisi WPP project - bats (*Chiroptera*) are one of the most sensitive groups of the species as wind turbines can kill and harm bats during their operation (*"Guidelines for consideration of bats in wind farm projects, Revision 2014"*). All bats that occur in Georgia are included in Appendix II of the Bonn Convention and protected under EUROBATS Agreement signed by Georgia in 2002 (Convention on the Conservation of Migratory Species of Wild Animals or CMS)[17].

According to the bat survey carried out for Ruisi WPP project, 19 species of the bat occurring in the project area according to the field surveys and literature sources (see ESIA Volume 2, Annex 4 "Bat Survey Reports"). They are listed in Table 5-59 below. Of them, the presence of 17 bat species has been confirmed during field surveys carried out by direct observation via mist-netting, using handheld ultrasound bat detectors Pettersson D240 and Pettersson D240x and portable voice recorders - Sony ICD-1000 and TASCAM DR-07MKII and Passive Bat Detectors (Song Meter SM4BAT Ultrasonic Recorder and Anabat Swift Passive Bat Detector). One species - Steppe Whiskered Bat (*Myotis davidii*) was caught in the mist nets. Others recorded by Passive Bat Detectors (ten species) and by handheld Ultrasounds Bat Detectors (seven species).

One species of Chiroptera fixed within the project area, the Western Barbastelle (*Barbastella barbastellus*) is included in the Georgian Red Data list (2006) and in the IUCN Red Data List as Near Threatened (NT). The Giant Noctule (*Nyctalus lasiopterus*) is listed in the IUCN Red List under the category vulnerable and assessed as vulnerable in result of assessment done in 2020.

The presence of four species: Lesser Mouse-eared Bat (*Myotis blythii*), Whiskered Bat (*Myotis mystacinus*), Geoffroy's Bat (*Myotis emarginatus*), Natterer's Bat (*Myotis nattereri*) was not confirmed on the species level by direct observation during the field surveys. Moreover, more or less extensive areas of the habitats suitable for them (forest and caves) do not exist within the project area.

The Bat Activity Indices (BAI) has been calculated for the project area for each month of the period of 30.03.2022 - 05.11.2022 using data obtained from the passive bat detectors (see ESIA Volume 2, Annex 4 "Bat Survey Reports"). According to the estimates, the average BAIs are quite low (less than four) and demonstrate similar dynamic in all locations where passive bat detectors were installed. Only at the WTG 53 and WTG 37 (according to first layout of the Ruisi WPP) close to the coordinates 42.09476°N/43.98746°E, at the windbreakers with matured trees and fruit gardens, were fixed high indices with maximum of 17.59. Fortunately, all WTGs in this part of the project area were rejected in second layout of Ruisi WPP project.

Table 5-59 Bat species occurring within the Ruisi WPP project area

Red Data List of Georgia and **IUCN Red Data List** categories: **NT** – Near Threatened, **VU** – Vulnerable, **LC** – Least Concern; **Confirmation status** – **C** – presence Confirmed by Direct Observation during the field surveys (recorded via handheld Ultrasound Bat Detector, caught in mist net and/or recorded by the Passive Bat detector, **L** – noted in scientific literature

	Latin name	Georgian Name	English name	Red List of Georgia	IUCN Red List	Bern Convention	Base Line Study	Field Study Report	Passive USB detectors	Project Area	Data Source
1.	*Rhinolophus ferrumequinum*	დიდი ცხვირნალა	Greater Horseshoe Bat		LC		+			+	L
2.	*Rhinolophus hipposideros*	მცირე ცხვირნალა	Lesser Horseshoe Bat		LC		+			+	L

[17] The Convention on the Conservation of Migratory Species of Wild Animals / CMS Convention (http://www.cms.int/).

	Latin name	Georgian Name	English name	Red List of Georgia	IUCN Red List	Bern Convention	Base Line Study	Field Study Report	Passive USB detectors	Project Area	Data Source
3.	*Barbastella barbastellus*	ევროპული მაჩქათელა	Western Barbastelle	**VU**	**NT**		+	+	+		C, L
4.	*Eptesicus serotinus*	ჩვეულებრივი მეგვიანე	Serotine		LC	II	+	+	+	+	C, L
5.	*Myotis blythii*	ყურწვეტა მღამიობი	Lesser Mouse-eared Bat		LC	II	+			+	L
6.	*Myotis davidii*	ველის მღამიობი	Steppe Whiskered Bat		LC		+	+		+	C, L
7.	*Myotis emarginatus*	სამფერი მღამიობი	Geoffroy's Bat		LC	II	+				L
8.	*Myotis mystacinus*	ულვაშა მღამიობი	Whiskered Myotis		LC	II	+			+	L
9.	*Myotis nattereri*	ნატრერის მღამიობი	Natterer's Bat		LC	II	+			+	L
10.	*Nyctalus leisleri*	მცირე მეღამურა	Lesser Noctule		LC	II	+	+	+	+	C, L
11.	*Nyctalus noctula*	წითური მეღამურა	Noctule		LC	II	+	+	+	+	C,L
12.	*Nyctalus lasiopterus*	გიგანტური მეღამურა	Giant Noctule	VU	**VU**	II	+	+	+	+	C, L
13.	*Pipistrellus nathusii*	ტყის ღამორი	Nathusius' Pipistrelle		LC	II	+	+	+	+	C, L
14.	*Pipistrellus kuhlii*	ხმელთაშუაზღვის ღამორი	Kuhl's Pipistrelle		LC	II	+	+	+	+	C, L
15.	*Pipistrellus pipistrellus*	ჯუჯა ღამორი	Common Pipistrelle		LC	III	+	+	+	+	C, L
16.	*Pipistrellus pygmaeus*	პაწია ღამორი	Pygmy Pipistrelle		LC	II	+	+	+	+	C, L
17.	*Plecotus auritus*	რუხი ყურა	Brown Long-eared Bat		LC	II	+			+	C, L
18.	*Vespertilio murinus*	ჩვეულებრივი ღამურა	Particoloured Bat		LC		+	+	+	+	C, L
19.	*Tadarida teniotis*	გრძელკუდა ნაკეცტუჩა	European Free-tailed Bat				+	+	+	+	*C*
			Number of species				**19**	**12**	**11**	**17**	

5.4.4.12.2 Mammals of middle and large size

It should be noted that the project area lies within the ranges of distribution of eight mammals of middle and large size, which are listed in Table 5-60. Of them, the badger (*Meles meles*) was seen during night surveys. Footprints of the wolf (*Canis lupus*) were not seen within the project area. We had heard voice of family groups of jackals. Scent marks of marten are recorded along the internal roads in many places. Footprints of fox (*Vulpes vulpes*) recorded in different places.

All records of mammal species within the project area are summarized below, while detailed information is provided in the ESIA Volume 2, Annex 3 “Fauna Survey Report”:

- Hedgehog (*Erinaceus concolor*) was recorded at WTG 43
- Molehills were found in ten locations at WTG 08, WTG 11, WTG 26, WTG 32, WTG 40, WTG 41, WTG 49, WTG 51, WTG 53, WTG 56.
- Rodent burrows (*Microtus sp. = M. socialis or M. arvalis*) found at the 46 WTGs construction sites (See Table 5 below), six large colonies of the Social vole (*Microtus socialis*) are seen at

WTG 03, WTG 14, WTG 20, WTG 38, WTG 40, WTG 44 – at the west edge of the not irrigated arable lands occupied by wheat.

- Brandt's hamsters (*Mesocricetus brandtii*) burrow recorded at WTG 03 and WTG 08 and between them in the arable land.
- Among large mammals most numerous was Red fox (*Vulpes vulpes*). Tracks of this species was fixed at 19 construction sites of Ruisi WPP project (see Table 5-61).
- Eurasian Badger (*Meles meles*) was seen in three points WTG 21, WTG 30 and WTG 37. At WTG 21 one adult badger and three young were fixed 4 July 2022.
- Golden Jackals (*Canis aureus*) was recorded in four places. Faeces of jackals found at WTG 28 (this WTG is rejected). Voice of jackal packs heard at WTG 22 (one pack), WTG 43 (two packs), and WTG 52 (one pack).
- One cat (*Felis sp.*), undefined up to species level, was seen at WTG 43.

More details about recorded mammal species (as well as other species encountered during general zoological field surveys) and habitats where they were found are provided in Table 5-61.

According to the results of the zoological field surveys, there are not sites of the Ruisi WPP project which can be considered as potentially important from mammals' biodiversity preservation standpoint.

Hunting on mammals is prohibited outside the hunting farms. None of the wild mammal species are used in economic activities.

Table 5-60 Large mammals occurring within the project area

Red Data List of Georgia and **IUCN Red Data List** categories: **LC** – Least Concern; **Status on territory**: **OV** – Occasional Visitor, **H** – home range of the species lies within the Project Impact area; **Confirmation status** – **D** – Direct Observation during the field surveys, **T** – tracks or footprints observed during the field surveys, **L** – noted in scientific literature.

Latin name	Georgian Name	English name	IUCN Red List	CITES	Bern Convention	Base Line Study	Project Area	Access Road route	Power Line route	Data Source
	Canidae									
Canis lupus	მგელი	Grey Wolf	LC	II	II	+	OV			L
Canis aureus	ტურა	Golden Jackal	LC	III		+	H	H	H	D, L
Vulpes vulpes	მელა	Red Fox	LC	III		+	H	H	H	D, L
	Mustelidae									
Martes foina	კლდის კვერნა	Stone Marten	LC	III	III	+	H	H	H	T, L
Meles meles	მაჩვი	Eurasian Badger	LC		III	+	H	H		D, L
Mustela nivalis	დედოფალა	Least Weasel	LC		III	+	H	H	H	L
			6	4	4	6	5 H	4	4	

Table 5-61 Results of zoologists field surveys

#	Map # in report	WTG old numbers (first layout)	WTG new numbers (second layout)	Location	Coordinates	Habitats	Species
33	39	**ALT.T39**	**N**	**rejected** 790 m to west (at Ruisi pond) from T37	412917.56 4662251.69 730m.a.s.l.	Agricultural land bordering with apple orchard	Rodents, Red fox (Vulpes vulpes), Marsh Frog (Pelophylax ridibundus)
35	41	**T01**	**T03**	170 m to NNW from T03	418021.3 4652219.65 608m.a.s.l.	Secondary meadow with shrubs	**nothing**
10	16	**T02**	**T01**	110 to east from T01	416221.89 4656151.42 815 m.a.s.l.	Pasture, degraded secondary meadow	Rodents
9	15	**T03**	**T02**	T02	416147.68 4656021.81 820 m.a.s.l.	Agricultural land with wheat	Rodents, Social voles colony (*Microtus socialis*), Brandt's hamster (*Mesocricetus brandtii*)
36	42	**T04**	**T09**	110 m to N fromT09	418136.44 4651995.14 747 m.a.s.l.	Secondary meadow with shrubs	Rodents, Three-lined Lizard (*Lacerta media*)
2	8	**T05**	**T07**	between T07 and T13	416479.04 4653661.11 744 m.a.s.l.	Agricultural land with sunflowers	Rodents
1	7	**T06**	**T08**	T08	417575.47 4652925.48 753 m.a.s.l.	Artificial forest with coniferous	Red fox (*Vulpes vulpes*), Rodents
4	10	**T07**	**T05**	110 to SSE from T05	416151.06 4654791.76 775 m.a.s.l.	Agricultural land with beans	Rodents
5	11	**T08**	**T10**	130 to NW from T10	416644.78 4655589.38 800m.a.s.l.	Agricultural land with wheat, harvested	Rodents. Brandt's hamster *(Mesocricetus brandtii*), Molehills of *Talpa sp.*
34	40	**T09**	**T26**	110 m to NE fromT26	417196.77 4652107.02 709m.a.s.l.	Secondary meadow with shrubs	Three-lined Lizard (*Lacerta media*)
37	43	**T10**	**T21**	200 m to WNW from T21	408526.03 4655428.26 659m.a.s.l.	Apple orchard	Rodents, Red fox, (*Vulpes vulpes*), Marsh Frog (*Pelophylax ridibundus*), Grass snake (*Natrix natrix*), Schmidt's Whip Snake (*Dolichophis schmidti*)
40	46	**Between T10 and T15**	**T22**	230 m SW from T22	408614.22 4655644.01 668m.a.s.l.	Agricultural land	Schmidt's Whip Snake (*Dolichophis schmidti*)
44	50	**T11**	**T12**	T12	410045.54 4660163.82 718m.a.s.l.	Agricultural fields with corn	Rodents, Red fox (*Vulpes vulpes*), Molehills (*Talpa sp.*)
7	13	**T12**	**T06**	T06	418082.92 4656054.78 785 m.a.s.l.	Pasture, degraded secondary meadow	Rodents
19	25	**T14**	**T14**	T14	412463.1 4655938.91 732m.a.s.l.	Agricultural land with onions	Rodents, Social voles colony (*Microtus socialis*)
39	45	**T15**	**T22**	200 m to NW from T22	408569 4655828 663m.a.s.l.	Agricultural land with corn	Rodents, Red fox (*Vulpes vulpes*), Marsh Frog (*Pelophylax ridibundus*), Grass snake (*Natrix natrix*), Schmidt's Whip Snake (*Dolichophis schmidti*)
12	18	**T16**	**T17**	280 m to SSE from T17	415815.78 4656759.1 804m.a.s.l.	Pasture, degraded secondary meadow	Rodents

#	Map # in report	WTG old numbers (first layout)	WTG new numbers (second layout)	Location	Coordinates	Habitats	Species
14	20	**T17**	**T11**	200 m to NW from T11	413908.31 4655479.39 860 m.a.s.l.	Agricultural land with wheat	Rodents
3	9	**T18**	**T13**	110 to NNW from T13	416431.31 4654244.13 753 m.a.s.l.	Agricultural land with sunflowers	Rodents
18	24	**T19**	**T19**	120 m to SE from T19	412427.78 4656529.69 725 m.a.s.l.	Agricultural land with vegetable	Rodents
8	14	**T20**	**T16**	T16	417805.22 4656035.79 782 m.a.s.l.	Agricultural land with wheat	Rodents. Social voles colony (*Microtus socialis*)
		T21	**rejected**			Agricultural land	Badger (*Meles meles*) 1 adult and 3 youngs
49	55	**T22**	**T25**	T25	408830.02 4661593.34 731 m.a.s.l.	Secondary meadow	Rodents, Golden jackal (*Canis aureus*) voice of one pack
6	12	**T23**	**T15**	T15	417153.32 4656074.71 805 m.a.s.l.	Pasture, degraded secondary meadow	Rodents
11	17	**T25**	**T04**	300 m to NNE from T04	415835.23 4656488.01 807 m.a.s.l.	Pasture, degraded secondary meadow	Rodents
41	47	**T26**	**T39**	130 m to SW from T39	408928.3 4656841.26 672m.a.s.l.	Agricultural field with vegetable	Rodents, Molehills (*Talpa sp.*), Marsh Frog (*Pelophylax ridibundus*).
23	29	**T27**	**T27**	300 m to west from T27	416764.95 4658951.01 715 m.a.s.l.	Agricultural land	Rodents
		T28	**rejected**			Agricultural land	Golden jackal (*Canis aureus*) faeces
26	32	**T29**	**N**	**rejected**	418031.89 4659708.53 702 m.a.s.l.	Agricultural land	Rodents,
28	34	**T30**	**N**	**rejected** NW corner	417420.26 4661246.77 714 m.a.s.l.	Orchard with white and black cherries	Rodents, Red fox (*Vulpes vulpes*), Badger (*Meles meles*)
42	48	**T32**	**T45**	T45	409213.08 4657236.94 676 m.a.s.l.	Agricultural field with whea	Rodents, Red fox, (*Vulpes vulpes*), Marsh Frog (*Pelophylax ridibundus*), Molehills (*Talpa sp.*)
27	33	**T33**	**N**	620 m to east from T30	418031.89 4659708.53 702 m.a.s.l.	Agricultural land	Rodents
20	26	**T34**		630 m to NW from T37	414716 4659024 710 m.a.s.l.	Agricultural land, near the canal	Rodents
13	19	**T35**	**T29**	T29	414815.84 4655492.83 750 m.a.s.l.	Agricultural land with wheat and vegetables	Rodents
43	49	**T36**	**T44**	280 m to SW from T44	409755.5 4658002.31 682m.a.s.l.	Agricultural fields with potatoes and peppers	Rodents, Marsh Frog (*Pelophylax ridibundus*).
29	35	**T37**	**N**	**rejected** NW corner	416476.95 4660728.90 721 m.a.s.l.	Agricultural land with corn	Rodents, Red fox (*Vulpes vulpes*), Marsh Frog (*Pelophylax ridibundus*), Badger (*Meles meles*) feaces
17	23	**T38**	**T28**	T28	412551.17 4657054.34 735 m.a.s.l.	Agricultural land with vegetable	Rodents, Social voles colony (*Microtus socialis*)
32	38	**T32**	**T45**	T45	412522.23 4661414.32 717 m.a.s.l.	Agricultural land with corn	Rodents, Red fox (*Vulpes vulpes*), Marsh Frog (*Pelophylax ridibundus*)

#	Map # in report	WTG old numbers (first layout)	WTG new numbers (second layout)	Location	Coordinates	Habitats	Species
31	37	**T40**	**T33**	T33	412744.92 4661817.23 724 m.a.s.l.	Agricultural land with cabbage	Rodents, Social voles colony (*Microtus socialis*), Red fox (*Vulpes vulpes*), Molehills (*Talpa sp.*), Marsh Frog (*Pelophylax ridibundus*). Shelkovnikov's treefrog I*Hyla orientalis*)
45	51	**T41**	**T46**	460 m to SSW from T46	410623.03 4660956.01 723 m.a.s.l.	Secondary meadow	Rodents, Molehills (*Talpa sp.*)
48	54	**T42**	**T43**	280 m to N from T43	408950.37 4662291.84 739 m.a.s.l.	Agricultural land with wheat	Rodents
		T43	**T34**	90 m to S from T34		Agricultural land	Hedgehog *(Erinaceus concolor*), Cat (*Felis sp*.), Golden jackal (*Canis aureus*) voice of two packs
16	22	**T44**	**T41**	T41	413118.58 4656858.28 730 m.a.s.l.	Agricultural land with wheat	Rodents Social voles colony (*Microtus socialis*)
22	28	**T46**	**T42**	T42	415656.27 4659501.34 710 m.a.s.l.	Agricultural land with corn	Rodents, Red fox (*Vulpes vulpes*), Green Toad (*Bufotes variabilis*)
25	31	**T48**	**T23**	120 m to SW from T23	416904.81 4659723.95 705 m.a.s.l.	Apple orchard	Rodents, Red fox (*Vulpes vulpes*)
46	52	**T49**	**T46**	330 m to SE from T49	409849.63 4661879.23 734 m.a.s.	Agricultural land with wheat	Rodents, Red fox, (*Vulpes vulpes*), Marsh Frog (*Pelophylax ridibundus*), Molehills (*Talpa sp.*)
		T51	**rejected**			Agricultural land	Molehills (*Talpa sp.*)
30	36	**T52**	**N**	**rejected** NW corner	416480.12 4660973.2 716m.a.s.l.	Agricultural land with wheat	Rodents, Red fox (*Vulpes vulpes*), Golden jackal (*Canis aureus*) voice of one pack
47	53	**T53**	**T40**	270 m to SE from T40	409818.23 4661413.98 727 m.a.s.l.	Agricultural land with wheat	Rodents, Red fox, (*Vulpes vulpes*), Marsh Frog (*Pelophylax ridibundus*), Molehills (*Talpa sp.*)
15	21	**T54**	**T36**	T36	413641 4657454.91 742m.a.s.l.	Agricultural land with wheat	Rodents
24	30	**T55**	**N**	**rejected**	416251.55 4660097.52 711 m.a.s.l.	Agricultural land with corn Apple orchard	Rodents, Red fox (*Vulpes vulpes*).
50	56	**T56**	**N**	**rejected** NW corner	418062.34 4661586.54 716 m.a.s.l.	Agricultural field with vegetable	Rodents, Red fox, (*Vulpes vulpes*), Marsh Frog (*Pelophylax ridibundus*), Molehills (*Talpa sp.*)
38	44	**T57**	**T24**	140 m to W from T24	408342.73 4654941.27 655 m.a.s.l.	Apple orchard	Rodents, Red fox, (*Vulpes vulpes*), Marsh Frog (*Pelophylax ridibundus*), Grass snake (*Natrix natrix*), Schmidt's Whip Snake (*Dolichophis schmidti*).
21	27	**T58**	**T38**	130 m to N from T38	414886.97 4659453.81 711 m.a.s.l.	Apple orchard	Rodents, Red fox (*Vulpes vulpes*)

5.4.4.13 Birds

There are approximately 385 bird species recorded for Georgian avifauna. (A. Abuladze, personal communication, 2013, Boehme *et al*, 1987; Kutubidze, M., 1985, Zhordania R.,1979). Today, these species are associated in 191 genera of 68 families that belong to 24 orders. 172 species are breeding regularly in Georgia. 154 appear in the country only during migrations or wintering. 47 species are occasional visitors. Status of the presence of other 12 species is unknown. The territory of Georgia is important to Western Palaearctic birds' migration. The diversity of the bird species and numbers of each species greatly increase in spring and in autumn during seasonal transit migrations and on lowlands in winter. One of the migration routes is going along the valley of the river Mtkvari (Kura River).

For the study area, 96 species of birds are noted in documents or can be supposed, according to their requirements to habitat, as those that occur within the Ruisi WPP project area and immediate vicinity. These species are associated in 58 genera of 29 families that belong to 11 orders. Four species among them are listed in the Georgian Red List. All are passage migrants. Of them, one species – Lesser Kestrel (*Falco naumanni*) is listed as a Critically Endangered (CR), three species Imperial Eagle (*Aquila heliacal),* Levant Sparrowhawk (*Accipiter brevipes*) and Long-legged Buzzard (*Buteo rufinus*) as a Vulnerable (VU). According to 2020-year assessment, one species - Steppe Eagle (*Aquila nipalensis*) is noted as an Endangered (EN), and one - European Turtle-dove (*Streptopelia turtur*) as a Vulnerable (VU). Two species are listed as Near Threatened (NT) - Pallid Harrier (*Circus macrourus*) and Meadow Pipit (*Anthus pratensis*).

It should be highlighted that the Egyptian Vulture (*Neophron percnopterus*), which is listed in the IUCN Red List and in the Georgian Red Data List as an Endangered (EN), have not been registered during the field studies in 2022 and 2023. There are neither habitat preferred by this vulture within the Ruisi WPP project area and immediate neighborhoods, nor feeding ground of this species in this side of the Transcaucasian lowland. However, occasional visits of the Egyptian vulture cannot be excluded for sure, while nearest nest of it is known on Kvernaki ridge in about 20 km from the border of the project area. For more details see Table 5-62 “Birds occurring within the project area” at the end of this sub-section.

From 96 species of birds recorded in the project area and immediate neighborhoods (the study area) by the ornithologist, 22 are year-round residents, which are nesting in the study area and present throughout of all seasons of the year. Among them, no one species is listed in the Red Data Lists (Georgian or IUCN). 57 species are breeding species, including year-round residents and summer breeders. None of them is listed in the Red Data Lists as threatened (CR, EN or VU). The Project Area is used by various species of birds-of-prey and passerines as a stopover site on passage. 74 species pass through the study area during migration, 23 species appear there only during migrations and 14 species are winter visitors. Presence of these species within the study area is supported by direct observations and by published scientific issues. The full list of the birds recorded in the study area is given in Table 5-62.

During field work breeding was confirmed for about 50 bird species. 35 species were recorded in winter. The Long-legged Buzzard was only one species among wintering birds that is noted in the Georgian Red Data List (2006) as Vulnerable (VU).

The breeding avifauna of the project area can be classified as a poor by breeding species and is presented in general by common, widely distributed and numerous bird species. The dominating group of breeding birds is small passerines. From the 36 non-passerine bird species occurring there, just 5 species are local breeders. In the same time, from 60 passerine birds – 46 breeds within the study area.

From very beginning of study, all birds of prey, owls and quail were chosen as targets species – total 23 target bird species, including 19 raptor species, 3 owl species and quail. However, in result of field surveys, presence on the project territory of the following 16 species of birds of prey Black Kite (*Milvus migrans*), Short-toed Eagle (*Circaetus gallicus*), Common Buzzard (*Buteo buteo*), Long-legged Buzzard (*Buteo rufinus),* Rough-legged Buzzard (Buteo lagopus), Western Marsh-harrier (*Circus aeruginosus*), Hen Harrier (*Circus cyaneus*), Pallid Harrier (*Circus macrourus*), Montagu's Harrier (*Circus pygargus*), Goshawk (*Accipiter gentilis*), Sparrowhawk (*Accipiter nisus*), Booted Eagle *(Hieraaetus pennatus)*, Common Kestrel (*Falco tinnunculus*), Lesser Kestrel

(*Falco naumanni),* and Hobby (*Falco subbuteo)*. Merlin (*Falco columbarius*), and two owls Little Owl (*Athene noctua),* Long-eared Owl (*Asio otus*) was confirmed. All these species are passage transit migrants, besides Long-legged Buzzard and Rough-legged Buzzard are year-round visitors. The Hen Harrier, Sparrowhawk, Goshawk, Rough-legged Buzzard are known as winter visitors. The Sparrowhawk and Common Kestrel are summer visitors. Among these 16 target species Black Kite, Common Buzzard, Sparrowhawk Montagu's Harrier and Common Kestrel are fixed in numbers above ten individuals for full season of observation. All other are recorded as rare solitary visitors in the project area. Noteworthy, breeding sites of these birds-of-prey were not fixed within the study area during the field surveys.

The territory of Georgia is important to Western Palaearctic birds' migration. East Georgia, Mtkvari River valley, has a certain importance for various species of birds-of-prey and passerine, as well as for the Common Quail (*Coturnix coturnix*) as a stopover site on passage and as wintering habitat. The diversity of the bird species and numbers of each species greatly increase in spring and in autumn during seasonal transit migrations and in winter.

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

Hunting on migratory birds in autumn is not prohibited. Actually, only Common Quail (*Coturnix coturnix*) can be considered as game species occurring in the project area. No one wild bird species is used in economic activities.

Based on the results of the ornithological surveys, the importance of the study area from the ornithological point of view should be classified as “low”. Breeding and wintering avifauna of the Ruisi WPP Project Area may be considered as a poor because it is presented mainly by widely distributed, quite common and numerous bird species which are typical elements to the fauna of this region of Georgia – Shida Kartli. Especially, the community of the breeding birds presented by widespread and common species.

More-or-less significant breeding habitats for local year-round residents and migratory summer breeders are floodplain forest along the Mtkvari and Eastern Prone rivers, and, in less extent, in the wind-breaking strips.

Table 5-62 Birds occurring within the project area

The legend of the categories of the status of birds at the
YR-R: year-round resident; breeding species, present throughout of all seasons of the year;
YR-V: year-round visitor; non-breeding species, present throughout of all seasons of the year;
SB: Summer breeding birds – species present in summer and absent all the rest seasons;
WV: winter visitor – non-breeding species, present in late autumn, winter and early spring;
PM: passage visitor (transit migrant) – bird on passage, present primarily in autumn and spring;
OV: vagrant – recorded only several times; unexpected because normal distribution range is very distant from Georgia.

	Family	Latin name	Georgian Name	English name	Endemic	Red List of Georgia	2020 Assessment	IUCN Red Data List	CITES	Bern Convention	Bonn Convention (AEWA, Annex 2 - II)	Emerald Network	Resolution #6	Target species	Presence Status within Project area	Source
		GALLIFORMES														
1.	*Phasianidae*	*Coturnix coturnix*	მწყერი	Common Quail			LC	LC							SB, PM	DO
		ACCIPIRIFORMES														
2.	*Accipitridae*	*Pernis apivorus*	ბოლოკარკაზი	European Honey-buzzard			LC	LC	II	II		1	1	**1**	PM	DO
3.		*Circaetus gallicus*	გველიჭამია არწივი	Short-toed Snake-eagle			LC	LC	II	II		1	1	**1**	PM	DO
4.		*Aquila pomarina*	მცირე არწივი	Lesser Spotted Eagle			LC	LC	II	II		1	1	**1**	PM	DO
5.		*Hieraaetus pennatus*	ჩია არწივი	Booted Eagle			LC	LC	II	II		1	1	**1**	PM	DO
6.		*Aquila heliaca*	ბეგობის არწივი	Imperial Eagle		**VU**	**EN**	**VU**	I	II		1	1		PM r	L
7.		*Circus aeruginosus*	ჭაობის ბოლობეჭედა	Western Marsh-harrier			LC	LC	II	II		1	1	**1**	PM	DO
8.		*Circus cyaneus*	მინდვრის ბოლობეჭედა	Northern (Hen) Harrier			LC	LC	II	II		1	1	**1**	PM,WV	DO
9.		*Circus macrourus*	ველის ბოლობეჭედა	Pallid Harrier			*NT*	*NT*	II	II		1	1	**1**	PM	DO
10.		*Circus pygargus*	მდელოს ბოლობეჭედა	Montagu's Harrier			LC	LC	II	II		1	1	**1**	PM	DO
11.		*Accipiter brevipes*	ქორცქვიტა	Levant Sparrowhawk		**VU**	LC	LC	II	II		1	1		PM	DO
12.		*Accipiter nisus*	მიმინო	Eurasian Sparrowhawk			LC	LC	II	II				**1**	PM, WV,SV	DO
13.		*Accipiter gentilis*	ქორი	Northern Goshawk			LC	LC	II	II				**1**	PM, WV	DO
14.		*Milvus migrans*	ძერა	Black Kite			LC	LC	II	II		1	1	**1**	PM	DO
15.		*Buteo lagopus*	ფეხბანჯგვლიანი კაკაჩა	Rough-legged Buzzard			LC	LC	II	II				**1**	PM, WV	DO
16.		*Buteo buteo*	კაკაჩა	Common Buzzard			LC	LC	II	II				**1**	YR-V, PM, WV	DO
17.		*Buteo rufinus*	ველის კაკაჩა	Long-legged Buzzard		**VU**	LC	LC	II	II		1	1	**1**	YR-V, PM	DO
		COLUMBIFORMES														DO
18.	*Columbidae*	*Columba livia*	გარეული მტრედი	Rock Dove			LC	LC							YR-V	DO
19.		*Columba palumbus*	ქედანი	Common Woodpigeon			LC	LC		III					PM	DO
20.		*Streptopelia turtur*	ჩვეულებრივი გვრიტი	European Turtle-dove			**VU**	**VU**							PM	DO

	Family	Latin name	Georgian Name	English name	Endemic	Red List of Georgia	2020 Assessment	IUCN Red Data List	CITES	Bern Convention	Bonn Convention (AEWA, Annex 2 - II)	Emerald Network	Resolution #6	Target species	Presence Status within Project area	Source
21.		*Streptopelia decaocto*	საყელოიანი გვრიტი	Eurasian Collared-Dove			LC	LC							YR-R	DO
		CUCULIFORMES														DO
22.	*Cuculidae*	*Cuculus canorus*	გუგული	Common Cuckoo			LC	LC							SB, PM	DO
		STRIGIFORMES														DO
23.	*Strigidae*	*Otus scops*	წყრომი	Common Scops-owl			LC	LC	II	II					SB, PM	DO
24.		*Athene noctua*	ჭოტი	Little Owl			LC	LC	II	II					YR-R	DO
25.		*Asio otus*	ყურებიანი ბუ	Long-eared Owl			LC	LC	II	II					YR-R	DO
		CAPRIMULGIFORMES														DO
26.	*Caprimulgidae*	*Caprimulgus europaeus*	უფეხურა	European Nightjar			LC	LC		II		1	1		SB, PM	DO
		APODIFORMES														DO
27.	*Apodidae*	*Apus apus*	ნამგალა	Common Swift			LC	LC							SB, PM	DO
		CORACIIFORMES														DO
28.	*Meropidae*	*Merops apiaster*	კვირიონი	European Bee-eater			LC	LC		II					SB, PM	DO
29.	*Coraciidae*	*Coracias garrulus*	ყაპყაპი	European Roller			LC	*NT*		II		1	1		PM	DO
30.	*Bucerotiformes*	*Upupa epops*	ოფოფი	Eurasian Hoopoe			LC	LC		II					SB, PM	DO
		PICIFORMES														DO
31.	*Picidae*	*Dendrocopos minor*	მცირე ჭრელი კოდალა	Lesser Spotted Woodpecker			LC	LC		II					YR-R	DO
32.		*Dendrocopos major*	დიდი ჭრელი კოდალა	Great Spotted Woodpecker			LC	LC		II					YR-R	DO
		FALCONIFORMES														DO
33.	*Falconidae*	*Falco naumanni*	ველის კირკიტა	Lesser Kestrel		***CR***	***CR***	LC	II	II		1	1	**1**	PM	DO
34.		*Falco tinnunculus*	ჩვეულებრივი კირკიტა	Common Kestrel			LC	LC	II	II				**1**	SV, PM	DO
35.		*Falco columbarius*	ალალი	Merlin			LC	LC	II	II			1		PM,WV	DO
36.		*Falco subbuteo*	მარჯანი	Eurasian Hobby			LC	LC	II	II				**1**	PM	DO
		PASSERIFORMES														DO
37.	*Laniidae*	*Lanius collurio*	ღაჟო	Red-backed Shrike			LC	LC		II		1	1		SB, PM	DO
38.		*Lanius minor*	შავშუბლა ღაჟო	Lesser Grey Shrike			LC	LC		II		1	1		SB, PM	DO
39.		*Lanius senator*	წითელთავა ღაჟო	Woodchat Shrike			LC	LC							SB	DO
40.	*Oriolidae*	*Oriolus oriolus*	მოლაღური	Eurasian Golden-oriole			LC	LC		II					SB, PM	DO
41.	*Corvidae*	*Garrulus glandarius*	ჩხიკვი	Eurasian Jay			LC	LC		III					YR-R	DO
42.		*Pica pica*	კაჭკაჭი	Black-billed Magpie			LC	LC		III					YR-R	DO
43.		*Corvus frugilegus*	ჭილყვავი	Rook			LC	LC		III					PM,WV	DO

	Family	Latin name	Georgian Name	English name	Endemic	Red List of Georgia	2020 Assessment	IUCN Red Data List	CITES	Bern Convention	Bonn Convention (AEWA, Annex 2 - II)	Emerald Network	Resolution #6	Target species	Presence Status within Project area	Source
44.		*Corvus cornix*	რუხი ყვავი	Hooded Crow			LC	LC							YR-R	DO
45.		*Corvus corax*	ყორანი	Common Raven			LC	LC							YR-R	DO
46.	*Alaudidae*	*Melanocorypha calandra*	ველის ტოროლა	Calandra Lark			LC	LC		II		1	1		SB, PM	DO
47.		*Calandrella brachydactyla*	მცირე ტოროლა	Greater Short-toed Lark			NE	LC		II		1	1		SB, PM	DO
48.		*Calandrella rufescens*	რუხი ტოროლა	Lesser Short-toed Lark			LC	LC		II					SB, PM	DO
49.		*Galerida cristata*	ქოჩორა ტოროლა	Crested Lark			LC	LC							SB, PM	DO
50.		*Alauda arvensis*	მინდვრის ტოროლა	Eurasian Skylark			LC	LC							SB, PM	DO
51.		*Lullula arborea*	ტყის ტოროლა	Wood Lark			LC	LC				1	1		SB, PM	DO
52.	*Hirundinidae*	*Hirundo rustica*	სოფლის მერცხალი	Barn Swallow			LC	LC		II					SB, PM, SV	DO
53.		*Delichon urbica*	ქალაქის მერცხალი	Northern House-martin			LC	LC		II					SB, PM, SV	DO
54.	*Paridae*	*Parus major*	დიდი წივწივა	Great Tit			LC	LC		II					YR-R	DO
55.		*Parus caeruleus*	ლურჯთავა წიწკანა	Eurasian Blue Tit			LC	LC		II					YR-R	DO
56.	*Aegithalidae*	*Aegithalos caudatus*	თოხიტარა	Long-tailed Tit			LC	LC							YR-R	DO
57.	*Troglodytidae*	*Troglodytes troglodytes*	ჭინჭრაქა	Winter Wren			LC	LC		II			1		YR-R	DO
58.	*Phylloscopidae*	*Phylloscopus collybita*	ჭედია ყარანა	Common Chiffchaff			LC	LC		II					SB, PM	DO
59.		*Phylloscopus trochiloides*	მწვანე ყარანა	Greenish Warbler			LC	LC		II					PM	DO
60.	*Sylviidae*	*Sylvia atricapilla*	შავთავა ასპუჭაკა	Blackcap			LC	LC		II					SB, PM	DO
61.		*Sylvia communis*	რუხი ასპუჭაკა	Common Whitethroat			LC	LC		II					SB, PM	DO
62.	*Muscicapidae*	*Muscicapa striata*	რუხი მემატლია	Spotted Flycatcher			LC	LC		II					SB, PM	DO
63.		*Erithacus rubecula*	გულწითელა	European Robin			LC	LC		II					YR-R	DO
64.		*Ficedula semitorquata*	საყელოიანი მემატლია	Semicollared Flycatcher	?		LC	LC		II		1	1		PM	L
65.		*Phoenicurus phoenicurus*	ჩვეულებრივი ბოლოცეცხლა	Common Redstart			LC	LC		II					SB, PM	DO
66.		*Saxicola torquata*	შავთავა ოვსადი	Common Stonechat			LC	LC		II					SB, PM	DO
67.		*Saxicola rubetra*	მდელოს ოვსადი	Whinchat			LC	LC		II					SB, PM	DO
68.		*Oenanthe oenanthe*	ჩვეულებრივი მეღორღია	Northern Wheatear			LC	LC		II					PM	DO
69.		*Oenanthe pleschanka*	მელოტჩიტა	Pied Wheatear			LC	LC		II		1	1		SB, PM	DO
70.		*Oenanthe hispanica*	შავამლაყი მეღორღია	Black-eared Wheatear			LC	LC		II					SB, PM	DO
71.		*Oenanthe isabellina*	ბუქნია მეღორღია	Isabelline Wheatear			LC	LC		II					SB, PM	DO

	Family	Latin name	Georgian Name	English name	Endemic	Red List of Georgia	2020 Assessment	IUCN Red Data List	CITES	Bern Convention	Bonn Convention (AEWA, Annex 2 - II)	Emerald Network	Resolution #6	Target species	Presence Status within Project area	Source
72.	*Turdidae*	*Turdus merula*	შავი შაშვი	Eurasian Blackbird			LC	LC							YR-R	DO
73.		*Turdus pilaris*	ბოლოშავა	Fieldfare			LC	LC							PM, WV	DO
74.		*Turdus philomelos*	წრიპა	Song Thrush			LC	LC							SB? PM	DO
75.		*Turdus viscivorus*	ჩხართვი	Mistle Thrush			LC	LC							SB? PM, WV	DO
76.	*Sturnidae*	*Sturnus vulgaris*	შოშია	Common Starling			LC	LC		III					SB? PM, WV	DO
77.	*Motacillidae*	*Motacilla flava*	ყვითელი ბოლოქანქარა	Yellow Wagtail			LC	LC		II					PM	DO
78.		*Motacilla cinerea*	მთის ბოლოქანქარა	Grey Wagtail			LC	LC		II					PM	DO
79.		*Motacilla alba*	თეთრი ბოლოქანქარა	White Wagtail			LC	LC		II					YR-V, SB, PM	DO
80.		*Anthus campestris*	მინდვრის მწყერჩიტა	Tawny Pipit			LC	LC		II		1	1		SB, PM	DO
81.		*Anthus pratensis*	მდელოს მწყერჩიტა	Meadow Pipit			*NT*	*NT*		II					PM	L
82.		*Anthus trivialis*	ტყის მწყერჩიტა	Tree Pipit			LC	LC		II					SB, PM	DO
83.		*Anthus cervinus*	წითელჩიჩახვა მწყერჩიტა	Red-throated Pipit			LC	LC		II					PM	L
84.		*Anthus spinoletta*	მთის მწყერჩიტა	Water Pipit			LC	LC		II					PM, WV	DO
85.	*Emberizidae*	*Emberiza citrinella*	ჩვეულებრივი გრატა	Yellowhammer			LC	LC		II					PM	DO
86.		*Emberiza hortulana*	ბაღის გრატა	Ortolan Bunting			LC	LC				1	1		SB, PM	DO
87.		*Emberiza melanocephala*	შავთავა გრატა	Black-headed Bunting			LC	LC		II					SB, PM	DO
88.		*Emberiza calandra*	მეფეტვია	Corn Bunting			LC	LC							SB, PM	DO
89.	*Fringillidae*	*Fringilla coelebs*	სკვინჩა	Chaffinch			LC	LC							YR-R	DO
90.		*Fringilla montifringilla*	მთიულა	Brambling			LC	LC							PM, WV	DO
91.		*Chloris chloris*	მწვანულა	European Greenfinch			LC	LC		II					YR-R	DO
92.		*Carduelis carduelis*	ჩიტბატონა	European Goldfinch			LC	LC		II					YR-R, PM, WV	DO
93.		*Carduelis cannabina*	ჭვინტა	Eurasian Linnet			LC	LC		II					SB,PM	DO
94.	*Passeridae*	*Passer domesticus*	სახლის ბეღურა	House Sparrow			LC	LC		III					YR-R	DO
95.		*Passer montanus*	მინდვრის ბეღურა	Eurasian Tree Sparrow			LC	LC							YR-R	DO
96.		*Petronia petronia*	კლდის ბეღურა	Rock Sparrow			LC	LC							YR-R	DO
					1-?	**3-VU, 1-CR**	**1-CR, 1-EN,1-VU**	**2-VU**	**1-I, 22-II**	**67-II, 6-III**		**24**	**26**	**17**	**22-YR-R, 5-YR-V, 35-SB, 74-PM, 14-WV, 7-SV, 1-OV**	**92-DO, 4-L**

5.4.4.13.1 Bird migration routes across the project area

Bird migration and nomadic movements take place in Georgia for the whole year. However, there are sharply seen two migratory periods – spring and autumn passage. The important Euro-African and Euro-Asian flyways of many bird species cross the territory of Georgia. Not less than 215 species, or more than half of bird species of Georgia, are migratory birds, which are absent in the winter. Not less than 230 species are regularly noted at the period of seasonal migrations in the spring and autumn. Among them, 154 species appear in the country only during migrations or wintering. The flyways of migratory birds on the territory of Georgia are linked with natural "guiding" lines – with the outlines of the Black Sea coastline, valleys of the large rivers (Enguri, Khobistskali, Rioni, Mtkvari and with their tributaries), mountain ranges, mainly with the Greater Caucasus Chain and its off spurs, and less with the Surami ridge and with ranges of the Lesser Caucasus.

There are known primary, secondary and additional flyways, as well as concentration places of migratory flocks, so-called "migratory bottle-necks" and stopover sites (places of their stay for the resting). The "bottle-necks" are situated on the passes in mountains (especially passes of the Great Caucasus) and in valleys of large rivers – Mtkvari, Rioni, Tergi (Terek), Alazani, and in valleys of some tributaries of them. The most important bottleneck is located in the southwestern part of Kolkheti Lowland, on the coastal lowlands of Kolkheti and Adjara. Bird migration ways through the territory of Georgia are shown on Figure 5-23.

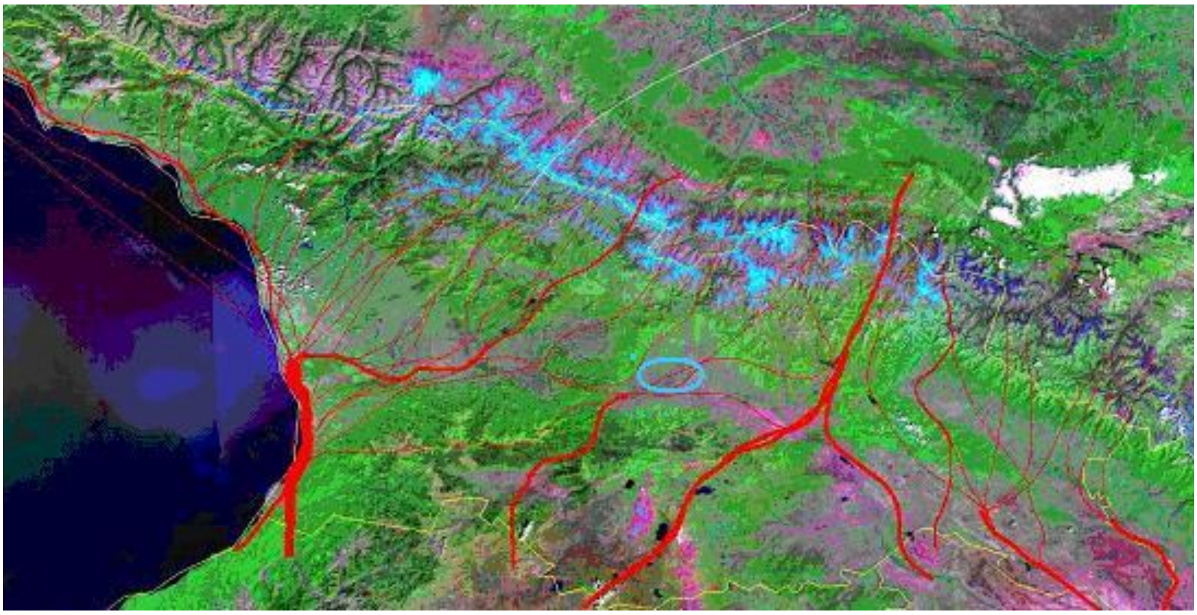


Figure 5-23 Bird migration ways in Georgia

Red lines – migration direction, light blue polygons – glaciers in mountains; blue oval - Ruisi WPP

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

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

From a bird safety standpoint, the first wave (1-20 March) and second wave (second half of March) are noticeable. In this time many cranes, birds-of-prey, waterfowls and corvids (*Corvidae*) are migrating. These species are sensitive to accidents on linear obstacles (e.g. wires) and to electrocution when perching. Third wave – (7-10 April until 1 May) is the most intensive migration wave. More than half of the spring migrants migrate in this time. The last fourth wave (May) is of less importance for the Ruisi WPP project because this is a time of migration of small birds (cuckoo, oriole, swift and some species of small passerines).

Arrivals of the migrant birds, which are nesting in Georgia, continue from 5-10 May to 20-25 May, with a peak between 10 and 20 May.

The most important factors of intensification of spring migration are the meteorological conditions on the plains of the North Caucasus. The soaring birds (e.g. large birds of prey) are in need of the thermals - good warmed grounds, places with the ascending flows of air.

The migration of some species (e.g. ducks, waders and cranes) have a place at night. Main flight altitude for most of the migrants is around 20-50 m.; some of the small bird species (Passeriformes) prefer the 5-20 m. The large bird species (waterfowl, birds of prey, cranes, gulls, etc) on the contrary usually fly higher (100-250 m).

The project area is lying on the periphery of the main ways of birds' migration, where general flyway lies along the Mtkvari River. In spring, within the project area, most migratory birds are flying across the Mtkvari River valley from south-west to north-east, lesser part are flying from the west to the east. Mainly, birds migrate in dispersed flocks or solitary.

In autumn, the general direction of the migration is from the North to the South. The birds' flocks cross the Main Caucasus Ridge through the passes in the gorges of the main rivers and go down to the intermountain plains. They do not follow the bends of these riverbeds. The main part of birds flies along the coastline of the Black Sea and above the sea. Birds gather in large flocks in the Kolkheti/Colchis Lowlands.

Transit migrants are dominating. Their species composition and numbers vary largely, sometimes in a very short time.

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

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

The migration is going in the daytime and in the night. Four peaks are noted in the diurnal activity of the migrants. Among sensitive to WTGs and power line presence species at dusk migrate some species of the waterfowls and birds-of-prey, at night fly some species of ducks, geese, and cranes. Main flight altitude for most of the migrants is around 20-50 m.

The project area is lying on the secondary way of birds' migration. In autumn, within the project area, part of the migratory birds are flying along the Mtkvari River valley from east to west, and part is flying from north to south crossing the rever. Mainly, birds migrate in dense and dispersed flocks, seldom as solitary individuals. The WPP poses more danger for those moving along the latitudinal axis – from east to west, and in a lesser extent for birds moving from north to south.

Winter (December – February). This period is characterized by poor species structure, by the limited territorial distribution of large aggregations of birds, by high numbers of some wintering species' and by essential fluctuations of birds number from year to year. At the later period of the winter (the last weeks of February), it is noted increasing of the diurnal activity of all species and some revival of activity in the movements of both flocks of wintering species and resident breeders. The territory of Georgia is of important significance for wintering birds. More than 130 species are wintering there and more than 40 of them are gathered in numerous flocks. Birds are distributed irregularly in the places of wintering. Mostly, they prefer the open and semi-open areas on the plains in the regions with generally warm and snowless winters. The most important wintering area is Colchis Lowland, at coastal lowlands, in floodplains of large rivers of Black Sea basin and of their inflows (See Figure 5-24).

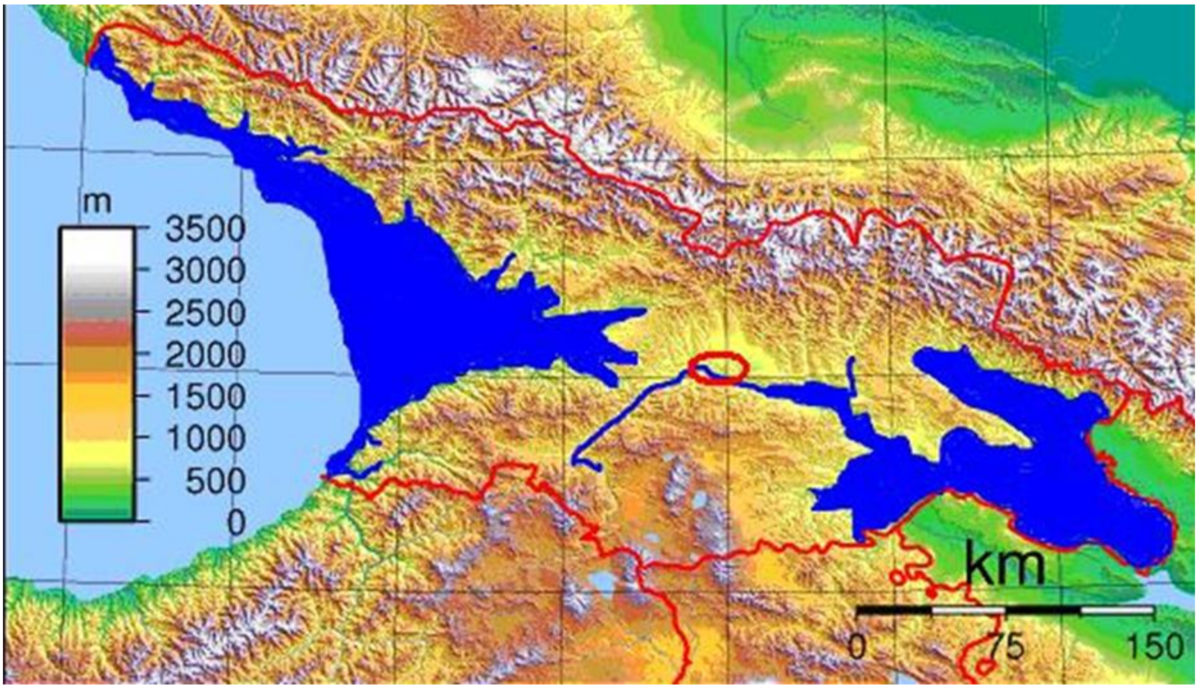


Figure 5-24 Bird wintering areas in Georgia

Red lines – state borders, Dark blue polygons – birds wintering areas, Red oval - the project area of Ruisi WPP

A number of the migrants varies noticeably from year to year. Unfortunately, the available data does not allow defining an exact number of the birds, which are flying during the seasonal migrations through the territory of Georgia.

Noteworthy that the open areas within the project area "(arable lands, kitchen gardens,, pastures, tree-less slopes) are used by some species of migrating raptors (harriers, buzzards, hawks) and other birds for halting and hunting on small rodents, small-sized passerine birds and other prey" (Abuladze, 2023).

5.4.4.14 Reptiles

57 species of reptiles were ever recorded for Georgia (Bakradze & Chkhikvadze, 1992; Tarkhnishvili et al., 2002). Today, these species are associated in 27 genera of 12 families that belong to 2 orders. The area of Ruisi WPP project is situated at the westernmost edge of Intermountain plain of the Transcaucasia. The major part of reptile species is restricted in their distribution to the south-eastern part of Georgia.

Nine species of reptiles are noted in documents or can be supposed, according to their requirements to habitat, as those that occur within the Ruisi WPP project area. These species together their status are listed in Table 5-63. One species among them - Mediterranean Tortoise (*Testudo graeca*) - is included into the Georgian Red List and IUCN Red List as Vulnerable (VU). The presence of this species within the study area is supported by published scientific issues and by experts' opinions. However, we have not fixed these species during regular observation in 2022-2023 years.

Following records of reptile species have been made during the zoological surveys for the Ruisi WPP Project:

- Three-lined Lizard (*Lacerta media*) recorded at two WTGs – WTG 04 and WTG 09.
- Grass snake (*Natrix natrix*) recorded at three points WTG 10, WTG 15 and WTG 57 on the left bank of the Eastern Prone River.
- Schmidt's Whip Snake (*Dolichophis schmidti*) was seen in the same places at WTG 10, WTG 15 and WTG 57, and between WTG 10 and WTG 15.

More information on these records, among them habitats where reptiles were noted is provided in Table 5-61.

No one reptile species is used in economic activities. There are no sites of the Ruisi WPP project area those can be considered as potentially important for reptilian fauna.

5.4.4.15 Amphibians

There are 12 species of amphibians found in Georgia (Tarkhnishvili, 1995, 1996). Today, these species are associated in 10 genera of six families that belong to two orders. All amphibian species are in need of stagnant, or of very slowly current, freshwater bodies for reproduction.

Three species of amphibians are noted in documents or can be supposed, according to their requirements to habitat, as those that occur within the Ruisi WPP project area (see Table 5-64). They are belonging to one order (*Anura*), three families, and three genera. Among them no one species is listed in the Georgian Red List. European Green Toad (*Bufotes variabilis*) is listed in the IUCN Red List as a Data deficiency (DD) and Shelkovnikov's treefrog (*Hyla orientalis* former *Hyla arborea*) is not evaluated (NE) in the IUCN Red Data List. Presence of these species within the study area is supported by published scientific issues and by direct observation. The species are not endemic to Caucasus. All amphibian species are in need of stagnant fresh water – small water pools with stagnate water or low current water, which are present in the project area. Following records of amphibian species have been made during the zoological surveys for the Ruisi WPP Project:

- Marsh Frog (*Pelophylax ridibundus*) was recorded in 13 points.
- Shelkovnikov's treefrog (Hyla orientalis) voice of this frog was heard many places, but self treefrog was seen at the WTG 40.
- Green Toad (*Bufotes variabilis*) was seen at WGT 46.

More information on these records, among them habitats where amphibians were noted is provided in Table 5-61.

No one amphibian species is used in economic activities.

Table 5-63 Reptiles occurring within the project area

	Family	Genera	Georgian Name	English name	Endemic	Red List of Georgia	2020 Assessment	IUCN Red list	CITES	Bern Convention	Bonn Convention	Emerald Network Species	Resolution #6	Presence Status within Project area	Source
		SQUAMATA													
1.	Lacertidae	*Lacerta strigata*	ზოლიანი ხვლიკი	Striped Lizard			LC	LC		III				HR	**L**
2.		*Lacerta media*	საშუალო ხვლიკი	Three-lined Lizard			LC	LC						HR	**DO**
3.	Colubridae	*Platyceps najadum*	წენგოსფერი მცურავი	Dahl's Wipe Snake			LC	LC		II				HR	**L**
4.		*Coronella austriaca*	სპილენძა	Smooth Snake			LC	LC		II				HR	**L**
5.		*Dolichophis schmidti*	წითელმუცელა მცურავი	Red-Bellied Racer			LC	LC		III				HR	**DO**
6.		*Natrix natrix*	ჩვეულიბრივი ანკარა	Ring Snake, Grass Snake			LC	LC		III				HR	**DO**
7.		*Natrix tessellata*	წყლის ანკარა	Dice Snake			LC	LC						HR	**L**
8.	Typhlopidae	*Xerotyphlops vermicularis*	ბრუცა გველი	Eurasian Blind Snake			LC	LC		III				HR	**L**
		TESTUDINES													
9.	Testudinae	*Testudo graeca*	ხმელთაშუაზღვის კუ	Mediterranean Tortoise		**VU**	*NT*	**VU**	II	II		**1**	**1**	HR	**L**
						1-VU	**1-NT**	**1-VU**	**1-II**	**3-II, 4-III**		**1**	**1**	**9-HR**	**3-DO, 6-L**

Table 5-64 Amphibians occurring within the project area

	Family	Latin name	Georgian Name	English name	Endemic	Red List of Georgia	2020 Assessment	IUCN Red list	CITES	Bern Convention	Bonn Convention	Emerald Network	Resolution #6	Presence Status within Project area	Source of Data
		ANURA													
1	Bufonidae	*Bufotes variabilis (former Bufo viridis)*	მწვანე გომბეშო	European Green Toad			LC	DD		II				HR	DO
2	Hylidae	*Hyla orientalis*	აღმოსავლური ვასაკა	Shelkovnikov's treefrog			LC	NE		II				HR	DO
3	Ranidae	*Pelophylax ridibundus*	ტბორის ბაყაყი	Marsh frog			LC	LC						HR	DO
										2-II				**3-HR**	**3-DO**

5.4.4.16 Aquatic Fauna - Freshwater Fish

The present ichthyofauna of Georgia comprises 167 species, 109 genera, 57 families, 25 orders and 3 classes. Among them 61 are freshwater inhabitants, 76 species occur in marine water and 30 species are anadromous (Ninua N., Japoshvili B., 2008).

There are 25-26 species of fish in the Mtkvari River basin within the Georgian borders. About 16 of them could be found in the Mtkvari River within the impact zone of the Project. They belong to three orders, five families and 14 genera. Among them are seven endemic species to the River Mtkvari basin - Kura nase (*Chondrostoma cyri*), Mursa *(Barbus mursa*), Kura bleak (*Alburnus filippii*), Blackbrow bleak (*Acanthobrama microlepis*), Kura stone loach (*Oxynoemacheilus brandti*), Kura gudgeon (*Romanogobio persus*), and Caspian freshwater goby (*Planticola cyris),* formerly known as *Neogobius constructor* (See Table 5-65).

Eight species are used for the subsistence fishery: Caucasian Chub (*Squalius cephalus*), Kura nase (*Chondrostoma cyri),* Kura barbel (*Barbus lacerta),* Mursa (*Barbus mursa),* Bulatmai barbel (*Barbus capito),* Khramulya (*Capoeta capoeta),* Crucian carp (*Carassius carassius),* Common carp (*Cyprinus carpio).* These species are found in downstream of the Prone River and in Didi Liakhvi River (near Gori town). The spawning grounds of the Caucasian Chub and Kura barbel are found in the Mtkvari River to the west of Mtskheta in Mtkvari River (Ninua N., Japoshvili B., 2008, Elanidze R., 1983, Dr. T. Kokosadze personal communication, 2013).

One fish species, the Golden spined loach (*Sabanejewia aurata*) is listed in the Red Data List of Georgia as Vulnerable (VU). Two species, the Bulatmai barbel (*Barbus capito*) and Common carp (*Cyprinus carpio*) are listed in the IUCN Red Data List as Vulnerable (VU), and were assessed as Vulnerable in 2020 year. Moreover, two another species were assessed as Vulnerable (VU) - Kura nase (*Chondrostoma cyri*) and Blackbrow bleak (*Acanthobrama microlepis).*

It can be presumed that four fish species can be found in small rivers and in canals and ponds of irrigation system within the Ruisi WPP project area. They include: Kura bleak (*Alburnus filippii*), Riffle minnow (*Alburnoides bipunctatus*), Caspian freshwater goby (*Planticola cyris)* and Mosquito fish (*Gambusia affinis*). The presence of the same species and Crucian carp (*Carassius carassius*) can be expected in the artificial ponds. All these species are not listed in the Georgian Red Data List and in the IUCN Red Data List as threatened category (CR, EN, and VU). Kura bleak and Caspian freshwater goby are endemic to the River Mtkvari basin.

The most important areas for fish habitat conservation are the spawning grounds between Mtskheta and Gori. Which species and in which numbers spawns within there is unknown and needs involving of the ichthyologist in the pre-construction surveys.

Table 5-65 Fish species occurring close to the study area

Status of presence: + – occurrence is known; ? - an occurrence of the species is suspected

#	Family	*Latin name*	*Latin name by old classification*	Georgian Name	English name	Endemic	Red List of Georgia	2020 Assessment	IUCN Red list	CITES	Bern Convention	Bonn Convention	Emerald Network Species	Resolution #6	Mtkvar, Liakhvi, Prone	Canals, ponds	ISSUES
		CYPRINIFORMES															
1.	Cyprinidae	*Squalius cephalus*	*Leuciscus cephalus orientalis*	კავკასიური ქაშაპი	European chub				LC						**1**		L
2.		*Barbus lacerta*	*Barbus lacerta cyri*	მტკვრის წვერა	Kura barbel				LC						**1**		L
3.		*Barbus capito*	*Barbus capito*	ჭანარი	Bulatmai barbel			**VU**	**VU**					**1**	**1**		L
4.		*Barbus mursa*		მურწა	Mursa	Y			LC						**1**		L
5.		*Capoeta capoeta*	*Varicorhinus capoeta*	ხრამული	Khramulya				LC						**1**		L
6.		*Carassius carassius*		ჩვეულებრივი კარჩხანა	Crucian carp				LC						**1**	**1 ?**	L
7.		*Cyprinus carpio*		კობრი (გოჭა)	Common carp			**VU**	**VU**						**1**		L
8.		*Romanogobio persus*	*Gobio persa*	მტკვრის ციმორი	Kura gudgeon	Y		*NE*	*NE*						**1**		L
9.		*Alburnoides bipunctatus*		სამხრეთული ფრიტა	South minnow				LC						**1**		L
10.		*Alburnus filippii*		მტკვრის თაღლითა	Kura bleak	Y			LC						**1**	**1**	L
11.		*Acanthalburnus microlepis*		შავწარბა	Blackbrow bleak	Y		**VU**							**1**	**1**	L
12.		*Chondrostoma cyri*		მტკვრის ტობი	Kura nase	Y		**VU**	LC						**1**		L
13.	Cobitidae	*Sabanejewia aurata*	*Cobitis aurata*	წინააზიური გველანა	Golden Spined Loach		**VU**		LC		III			**1**	1		L
14.	Gobiidae	*Planticola cyris*	*Neogobius constructor*	კავკასიური მდინარის ღორჯო	Caucasian freshwater goby	Y			LC						**1**		L
15.	Nemacheilidae	*Oxynoemacheilus brandtii*	*Nemachilus brandti*	მტკვრის გოჭალა	Kura loach	Y			LC						**1**	1	L
		CYPRINODONTIFORMES															
16.	*Poeciliidae*	*Gambusia affinis / G.holbrooki*		გამბუზია	Mosquito fish			Lc	LC						**0**	**1**	L
		PERCIFORMES															
17.	Gobiidae	*Planticola cyris*	*Neogobius constructor*	კავკასიური მდინარის ღორჯო	Caucasian freshwater goby	Y		LC	LC						**1**	**1**	L
						8	**1**	**4- VU**	**2 VU**		**1**	**0**	**0**	**2**	**16**	**5+1?**	**17-L**

5.4.4.17 Invertebrates

Thousands of invertebrate species occur in Georgia and most of them are very poorly studied (Foster-Turley P., Gokhelashvili R., 2009). Nine invertebrate species, which occur in Georgia, are listed as Critically Endangered, Endangered or Vulnerable in the 2008 IUCN Red Data Book. 43 species of invertebrates are listed in the Georgian National Red Data list (2006). Conservation status of most of the other species can be characterized as DD (Data Deficient). There is only fragmentary bibliography on the spatial distribution of most of them in the region under consideration. In Georgia, we have not State Register of fauna, as an officially accepted document for the use in the EIA. Such a document is prepared only for Adjara - the Register of the Fauna of Adjara (Bukhnikashvili A., ed., 2011). That is an obstacle to consider the whole spectrum of invertebrates in this report.

Invertebrate species listed in the Georgian Red Data List will be noted below in Table 5-66, among animal species of the Red Data List of Georgia (2006), which are occurring within the impact area of the Project.

5.4.4.18 Endemic wildlife species within the project area

The Caucasus has a high concentration of endemic species, exceeding those in the vast majority of non-tropical regions. The total number of regional endemic species varies between 20-30% for fish, amphibians, reptiles, and mammals (Tarkhnishvili & Kikodze, 1996; Chatwin et al., 1996) and is possibly even higher for some groups of invertebrates. Largely, this is explained by presence of Pliocene forest refugia in the western Caucasus, where many species currently absent from the rest of the Planet survived both sharp decrease of humidity 5 millions of years before present and the Ice Age (Tuniyev, 1995; Tarkhnishvili, 1996; Tarkhnishvili et al., 2000, 2001). 21 vertebrate taxa, considered endemic to the Caucasus, are listed in the IUCN Red Data Book under categories DD, LR(nt), VU, EN, and CR. Those include eight mammals, one bird, ten reptiles, and two amphibians. There are at least five mammals, one bird, 17 reptiles, 18 fish and hundreds of invertebrates (insects, snails, crustaceans) endemic to the Caucasus but not included in either national or international Red Lists. For instance, some of the sixteen narrow ranged lizards of genus *Darevskia*, several unisexual taxa among them, have the area of occupancy so little that they obviously fall under the IUCN Red List criteria but little attention is paid to the conservation of these species.

Within the territory of Georgia the region of the Western Lesser Caucasus, with its extremely high humidity level and landscapes, has the highest diversity of forest plants and animals throughout the South Caucasus and harbors a high proportion of the regional endemics, including Pliocene relict species (nearly 50% of the vertebrate species endemic to the Caucasus). Another area, which is a reach with endemic to Caucasus species, is sub-alpine and alpine belts of the Greater Caucasus.

Fortunately, the Ruisi WPP project area is situated outside of both the rich on endemism sites. No one species of vertebrates occurring within the project area can be considered as endemic to Caucasus. Within the Impact area of the Ruisi WPP project one can find among mammals the Levant Mole (*Talpa levantis*), Brandt's Hamster (*Mesocricetus brandti*), Macedonian Mouse (*Mus macedonicus*) and Steppe mouse (*Apodemus witherbyi*). Both these species are inhabitant of Caucasus isthmus, Asia Minor peninsula, south coast of the Caspian Sea, and partly of the Balkan Peninsula. The estimated extent of occurrence (EOO) of these species exceeds the area of the Transcaucasia about eight - ten times. E.g. estimated extent of occurrence (EOO) of the Levant Mole is 1628100 km^2 and estimated extent of occurrence (EOO) of the Macedonian Mouse (*Mus macedonicus*) is 2161431 km^2, while the territory of all three countries (Georgia, Azerbaijan and Armenia) occupies 186701 km^2.

No endemic bird, reptile and amphibian species are known for the Ruisi WPP project area and immediate neighborhoods.

There are six fish species endemic to Caucasus, specifically for Kura (Mtkvari) and Aras rivers and Caspian Sea basin: Kura nase (*Chondrostoma cyri*), Mursa (*Barbus mursa*), Blackbrow bleak (*Acanthobrama microlepis* former *Acanthalburnus microlepis*), Kura stone loach (*Oxynoemacheilus brandtii*), Kura gudgeon (*Romanogobio persus*), and Caspian freshwater goby (*Planticola cyris*). One can expect that among them only Caspian freshwater goby can be found in canals and small rivers within the Ruisi WPP.

5.4.4.19 Species protected by Law in Georgia - Red Data List of Georgia

The existing law, devoted to the biodiversity protection, is the Law on the Red Data List of Georgia. The current tool of the implementation this Law is the Red Data List of Georgia, which was enforced by the Decree #303 of the President of Georgia "On the Approval of the Red List of Georgia" (May 2, 2006). These law and decree were reinforced by Prime Minister of Georgia without any modifications in 2013 year. In 2020, the reassessment of the conservation statuses of all animal species occurring in Georgia was done by the large scientific community of zoologists. The conservation statuses of some species were changed. The results of this reassessment are transferred to Ministry of Environmental Protection and Agriculture of Georgia. However, they have not resulted in changes in the law and official Red Data List or to new list of the species protected by law.

18 redlisted species are recorded within the Ruisi WPP project area and one species can probably visit the project area.

According to Criteria of Georgian Red List (2006) out of mammals – three species are listed as Vulnerable (VU) in the Georgian Red data List, but do not belong to the threatened category (CR, EN and VU) according to the IUCN Red Data List. One mammal species the Giant Noctule (*Nyctalus lasiopterus*) is assessed as Vulnerable during reassessment in 2020 year. Only this species is listed in the IUCN Red Data List as Vulnerable. There is only one, protected by law, mammal species, small part of the key-habitat of which lies within the construction area - Brandt's Hamster (*Mesocricetus brandti*). This species occurs there at the westernmost edge of the distribution range and is well adapted to live in the arable lands.

Two hamsters are year-round residents on the project area. Presence of one of them Brandt's Hamster (*Mesocricetus brandti*) is confirmed by found burrows and collections vouchers. The Grey Dwarf Hamster (*Cricetulus migratorius*) is presumed according to habitat requirements. To bats are summer visitors or breeders in vicinities of the Ruisi WPP project. Presence of the wintering shelters of the Western Barbastelle (*Barbastella barbastellus*) and Giant noctule should be excluded according to the habitat within the project area.

Among five bird species, one - Lesser Kestrel (*Falco naumanni*) is Critical Endangered according to Georgian Red Data List (2006), but is listed as Least Concern species (LC) in IUCN Red Data List. Two species: the Imperial Eagle (*Aquila heliaca)* and the European Turtle-dove (*Streptopelia turtur)* are assessed as Endangered (EN) in 2020 year. They both are listed in the IUCN Red Data list as a Vulnerable (VU). The Imperial Eagle is listed as Vulnerable in the Georgian Red Data List (2006), while European Turtle-dove is not included in this document. Next two birds, Levant Sparrowhawk (*Accipiter brevipes*) and Long-legged Buzzard (*Buteo rufinus*) are listed in the Red Data List of Georgia as Vulnerable (VU), but are listed in the IUCN Red Data List as species of Least Concern. All these birds are passage migrants on the Ruisi WPP project area. Their presence on this territory as rule lasts a few weeks in spring and in autumn.

The occasional visits of the Egyptian Vulture (*Neophron percnopterus*) cannot be excluded for sure, while nearest nest of it is known on Kvernaki ridge in about 20 km east of the Ruisi WPP project area. The Egyptian Vulture is listed the IUCN Red List and in the Georgian Red Data List as an Endangered (EN). However, there are neither habitat preferred by this vulture within the project area, nor feeding ground of this species in this side of the Transcaucasian lowland. This species is not registered during the field studies in 2022 and 2023.

The Levant Sparrowhawk, Long-legged Buzzard, Lesser Kestrel and European Turtle-dove were seen in the project area during migration seasons. No nest of these species was found during breeding season. Presence of Imperial Eagle confirmed by published sources. This species can be considered as rare passage migrant and occasional visitor. Among the listed in the Red Data List of Georgia birds, no one species has the nests within the project area.

One species of reptile the Mediterranean Tortoise (*Testudo graeca*) is listed in the Red Data List of Georgia as Vulnerable. The Mediterranean Tortoise is included into the IUCN Red Data List as belonging to the category of Vulnerable. This species is not registered during the field studies in 2022 and 2023.

Presence of the Mediterranean Tortoise is confirmed by published sources (Muskhelishvili, 1970). It occur in open grassy habitat, rather in the natural grass than dry gullies than within the arable lands and watered orchards. Some individuals of the Mediterranean Tortoise can be killed in vicinity of WTG-s, transformer substation and along the power line, as well as along the access roads. On the level of local population, this species can be impacted, if the nesting sites (egg-laying or oviposition places) will be destroyed during construction. Fortunately, such places are not situated within the construction sites.

No protected amphibian species are recorded within the project territory.

Only one fish - the Golden Spined Loach (*Sabanejewia aurata*) is listed in the IUCN Red Data List as belonging to the category of Vulnerable (VU). Two species: Bulatmai barbel (*Barbus capito)* and the Common carp (*Cyprinus carpio)* are assessed as Vulnerable (VU) in 2020 year. They both are listed in the IUCN Red Data list as a Vulnerable (VU). Next two fish, Blackbrow bleak (*Acanthobrama microlepis*) and Kura nase (*Chondrostoma cyri*) are not listed in the Red Data List of Georgia, but they are assessed as Vulnerable (VU) in 2020 year. They both are listed in the IUCN Red Data List as species of Least Concern.

One vulnerable fish species - Golden Spined Loach (*Sabanejewia aurata*) is expected in the Mtkvari, Didi Liakhvi and Eastern Prone rivers. These rivers will be not crossed during the construction. It is unlikely that the construction and operation of the Ruisi WPP will affect this species.

Four insects occurring in the Ruisi WPP project area are listed in the Red Data List of Georgia. Among them one species the Death's Head Sphinx (*Acherontia atrops)* is listed as Endangered (EN). This species formerly was known as *Manduca atropos*. Other three species are listed as Vulnerable (VU). All four insects are not included in the UCN Red Data List.

The occurrence of the all four insect species is suspected, based on their habitat preferences and known habitat peculiarities. There are no known sites of the key-habitats of the endangered invertebrates within the Project area. Thus, the Project cannot be considered as one, which will have a significant adverse impact on invertebrate species protected by law.

For details, see Table 4. Animal species, included in the Red Data List of Georgia (2006), which are occurring within the impact area of the Project.

Table 5-66 Animal species, included in the Red Data List of Georgia (2006), which are occurring within the impact area of the Project.

Red Data List of Georgia and **IUCN Red Data List** categories: **NT** – Near Threatened, **VU** – Vulnerable, **EN** – Endangered; **CR** – Critical Endangered; **Status on territory** : **YR-R** - Year Round Resident, **SB** – Summer Breeder, **SV** – Summer Visitor, **PM** – Passage Migrant, **OV** – Occasional Visitor, **H** – home range of the species lies within the Project Impact area; **Confirmation status** – **DO** – Direct Observation during the field surveys, **PD** - recorded by the Passive Bat detector, **TO** – tracks or footprints observed during the field surveys, **L** – noted in scientific literature, **I** – data obtained in results of interview of colleagues and locals, **S** – presence is expected because of habitat requirement of the species known from published issues.

	Latin name	Georgian name	English name	Red Data List of Georgia	Assessment 2020	IUCN Red Data List	Convention	Emerald Network	Resolution #6	Status on territory	Confirmation status	CITES
	Mammalia	**ძუძუმწოვრები**										
1.	*Barbastella barbastellus*	ევროპული მაჩქათელა	Western Barbastelle	**VU**	**VU**	*NT*	EUROBATS	Yes	Yes	YRR	PD	
2.	*Nyctalus lasiopterus*	გიგანტური მეღამურა	Giant Noctule		**VU**	**VU**	EUROBATS Bern II			SV	PD	
3.	*Mesocricetus brandti*	ამიერკავკასიური ზაზუნა	Brandt's Hamster	**VU**	**VU**	*NT*				YR-R	DO	
4.	*Cricetulus migratorius*	ნაცრისფერი ზაზუნა	Grey Dwarf Hamster	**VU**	**VU**	LC				YR-R	L	
	Aves	**ფრინველები**										
1.	*Neophron percnopterus*	ფასკუნჯი	Egyptian Vulture	**VU**		**EN**				OV rare	L	
2.	*Aquila heliaca*	ბეგობის არწივი	Imperial Eagle	**VU**	**EN**	**VU**	Bern II	Yes	Yes	PM rare	L	I
3.	*Accipiter brevipes*	ქორცქვიტა	Levant Sparrowhawk	**VU**	LC	LC	Bern II	Yes	Yes	PM	DO	II
4.	*Buteo rufinus*	ველის კაკაჩა	Long-legged Buzzard	**VU**	LC	LC	Bern II	Yes	Yes	PM, YR-V	DO	II
5.	*Streptopelia turtur*	ჩვეულებრივი გვრიტი	European Turtle-dove		**EN**	**VU**				PM	DO	
6.	*Falco naumanni*	ველის კირკიტა	Lesser Kestrel	***CR***	***CR***	LC	Bern II	Yes	Yes	PM	L	II
	Reptilia	**ქვეწარმავლები**										
1.	*Testudo graeca*	ხმელთაშუაზღვის კუ	Mediterranean Tortoise	**VU**	*NT*	**VU**	Bern II	Yes	Yes	YR-R	L, I	II
	Osteichtyes	**ძვლოვანი თევზები**										
1.	*Barbus capito*	ჭანარი	Bulatmai barbel		**VU**	**VU**				YR-R	L	
2.	*Cyprinus carpio*	კობრი (გოჭა)	Common carp		**VU**	**VU**				YR-R	L	
3.	*Acanthobrama microlepis (former Acanthalburnus microlepis)*	შავწარბა	Blackbrow bleak		**VU**	LC				YR-R	L	
4.	*Chondrostoma cyri*	მტკვრის ტობი	Kura nase		**VU**	LC				YR-R	L	
5	*Sabanejewia aurata*	წინააზიური გველანა	Golden Spined Loach	**VU**		LC				YR-R	S	
	Insecta	**მწერები**										
1.	*Acherontia atrops (former Manduca atropos)*	სფინქსი მკვდართავა	Death's Head Sphinx	**EN**	NE	NE				SB	S	
2.	*Callimorpha dominula*	დათუნელა ჰერა	Scarlet Tiger Moth	**VU**	NE	NE				SB	S	
3.	*Polyommatus daphnis*	ცისფერა მელეაგრი	Meleager's Blue	**VU**	NE	LC				SB	S	
4.	*Xylocopa violacea*	იისფერი ქსილოკოპა	Violet Carpenter bee	**VU**	NE	LC				SB	S	

5.4.5 Ecosystem Services

5.4.5.1 Introduction

Maintenance of the core ecosystem services is one of the key objectives of the EBRD PR6 (2019), which defines ecosystem services as "the benefits that people, including businesses, derive from ecosystems", and organizes them into four types, including:

(i) provisioning services, which are the products people obtain from ecosystems;

(ii) regulating services, which are the benefits people obtain from the regulation of ecosystem processes;

(iii) cultural services, which are the non-material benefits people obtain from ecosystems; and

(iv) supporting services, which are the natural processes that maintain the other services.

The EBRD Guidance Note 6 (2022) recommends to identify ecosystem services with potential to have both high importance to relevant stakeholders and limited substitutes. Besides, it requires to scope ecosystem services in coordination with the social assessment team and in consultation with key stakeholders to verify information regarding ecosystem services generated within the area of concern and their beneficiaries.

Ecosystem services that are present in the study area have been described as recommended by EBRD PR6 (2019), specifically according:

- the use of, and dependence on, these ecosystem services by potentially affected communities; and
- the project's dependence on these ecosystem services.

5.4.5.2 Methodology

The identification of ecosystem services and assessment of the dependence of affected communities and the Project on them have included the following steps:

- identification of ecosystem types presented in the study area
- definition of ecosystem condition and identification of the ecosystem services they may deliver
- definition which ecosystem services are significant to local communities and have limited substitutes
- definition of dependence of local communities on the ecosystem services identified as important for them
- engagement of the social assessment team in the above described process
- definition of the Project's dependence on the ecosystem services identified in the study area

The main literature sources used for identification and assessment of ecosystem services present in the Project's impact zone as well as dependence of affected communities and the Project on these services include:

- Ecosystem Services Review for Impact Assessment, Introduction and Guide to Scoping, Working Paper, World Resources Institute

- Waving Ecosystem Services into Impact Assessment, A Step-by-Step Method, version 1.0, World Resources Institute
- Methods of Environmental Impact Assessment, 2009, 3rd Edition, editors Peter Morris and Riki Therivel
- Qinghua Liu, Xiao Sun, Wenbin Wu, Zhenhuan Liu, Guangji Fang, Peng Yang, Agroecosystem services: A review of concepts, indicators, assessment methods and future research perspectives, Ecological Indicators 142 (2022) 109218
- Paula Rendon, Bastian Steinhoff-Knopp, Benjamin Burkhard, Linking ecosystem condition and ecosystem services: A methodological approach applied to European agroecosystems, Ecosystem Services 53 (2022) 101387

5.4.5.3 Description of Ecosystem Services

The Project area and neighborhood mainly include by terrestrial habitats, with limited representation of freshwater ecosystems. The ecosystems of the study area can be divided into three major types, including:

- Agroecosystem which is presented by agricultural lands and surrounding dry meadows used for grazing
- River ecosystem and associated riparian forest
- Forest ecosystem which is presented by artificial pine forest

All three ecosystems can provide number of services, which are often interconnected. Services that these ecosystems provide, as well as the assessment of their importance for and dependence on by local communities are described in Table 5-67. The ecosystem services are organized into four types (provisioning, regulating, cultural and supporting), in line with the EBRD PR6 (2019).

It should be highlighted that the baseline studies have identified limited dependence of the Project on local ecosystem services. Respectively, Table 5-67 majorly describes ecosystems according to services they provide to local population and businesses.

Table 5-67 Identification of ecosystem services and dependence of local communities on them

Ecosystem Services	Importance of ecosystem services for local communities/ Project	Dependence
Provisioning Services: goods or products obtained from ecosystems		
Food (crop growing, livestock breeding)	Agroecosystem of agricultural lands and dry meadows enable local population to grow various annual and permanent croups, as well as provide grazing and hay lands for cattle breeding. Population of all affected villages are engaged in agriculture – both crop growing and cattle breeding. Agriculture provides them food for self-consumption, and is one of the main sources of their income. Respectively, the affected communities notably depend on agriculture, and food provisioning service is important for affected communities. This ecosystem is also important for agri-business companies operating in the study area and immediate neighborhoods as they generate income from food production.	High

Ecosystem Services	Importance of ecosystem services for local communities/ Project	Dependence
Surface water	Surface water bodies present in the study area are used for irrigation, watering of cattle and fish farming. They are not used as drinking water sources. The dependence of local communities on this ecosystem service is significant considering the role of agriculture for their livelihoods. Fresh water provisioning is also important for local fish farms, which take water from the irrigation canals crossing the study area.	High
Groundwater	Water supply of four affected villages (Bebnisi, Ruisi, Sagholasheni and Urbnisi, Kareli Municipality) virtually fully depend on groundwater obtained from deep aquifer. In some areas water wells are artesian. The engineering-geological baseline study has found shallow groundwater at some locations of the Project Area, where water table rises up to 1-3 and 3-6 m depths.	High
Natural medicines	Usually vegetation of rural areas includes certain species of medicinal plants that could be used in natural medicine by local population. On the other hand, the study area is not characterized by abundance of such plant species. According to social baseline survey, income of local residents does not depend on the collection of medicinal plants. Though, it is likely that some households gather medicinal plants for own use, in small amounts.	Low
Forest products	Forested territories are rather limited in the study area. Forests are mainly represented by artificial pine grove and small fragment of riparian woodland. The social survey does not identify any dependence of local population on forest products.	Low
Regulating Services: benefits obtained from the regulation of ecosystem processes		
Air quality	Vegetation of the study area improves air quality at local level, which supports well-being of local population. On the other hand, air quality does not depend only on local factors and notably influenced by movement of air masses over large areas, and dependence of beneficiaries on the service provided by local ecosystem could be assessed as moderate.	Medium
Climate (local)	Vegetation, water bodies and terrain determine micro-climatic conditions, and thus are important for well-being of local population.	Medium

Ecosystem Services	Importance of ecosystem services for local communities/ Project	Dependence
Regulation of water timing and flows	Usually vegetation cover helps with infiltration of rain water and thus controls timing and flows surface runoffs. This reduces flooding risk for residential and agricultural lands during heavy rains, as well as soil erosion in the area. Riparian forests along the East Prone River and Mtkvari River is especially important for flood control. It should be mentioned that the riparian forests are already notably modified due to anthropogenic pressure and are likely to partly loss inherent regulation capacity. The population of Bereti and Sagholasheni villages are the closest to the mentioned rivers, and respectively most dependent on the water regulation by ecosystems.	Medium
Water quality	Riparian forests present in the vicinity of the Project is important for water purification and ensuring water quality in the river. In other sections of the study area, vegetation cover controls erosion and limits transport of suspended solids into the surface water bodies, and thus plays important role in maintaining water quality in surface water bodies as well. Local population uses river water for irrigation and watering of cattle only.	Medium
Regulation of geohazards	Vegetation protects terrain from water and wind erosion, and is important to control landslide development. Erosion control is beneficiary for local population to avoid degradation of their pastures and crop lands, as well as threats that landslide development may impose to their property and safety. According to the engineering-geological survey, large areas in the northern section of Urbnisi village are especially sensitive to erosion due to local geological conditions. Riparian forest protects river banks from erosion, and thus secures adjoining lands, private properties and public infrastructure. Erosion control service of the ecosystem is equally important for the Project to avoid erosion and eventually landslide development in the Project area that may jeopardize the Project infrastructure.	High
Cultural Services: non-material benefits obtained from ecosystems		
Recreation	Local population may use local water bodies for armature fishing. Besides, some sections of the study area may have aesthetic value and could be used for relaxation.	Low
Supporting services: natural processes that maintain the other ecosystem services		
Pollination	Pollination is important to ensure stable production of crops by local population. It is also necessary to maintain vegetation cover and diversity of plant species in semi-natural habitats present in the study area, which deliver various services to locals, as described above.	High

Potential impact of the Project on these ecosystem services and relevant mitigation measures are discussed in Section 6.7.4.

6 Assessment of Potential Environmental and Social Impacts

6.1 Methodology Used for EIA Process

This chapter includes the assessment of impacts anticipated for the construction and operation of Ruisi WPP. Baseline data were collected and analysed for the Project's Area of Influence in order to estimate environmental and social changes that may occur there. Field surveys and desk studies were used to identify receptors of potential impacts, assess their sensitivity and predict potential changes in the environment so that significance of impact could be determined.

The following scheme was applied to environmental and social impact assessment for the planned project:

Step I: Identification of main impact types and scope of surveys

To identify impacts that could be significant for the projects of the given type based on the project's baseline conditions and overall analysis of the planned activities.

Step II: Baseline survey - collection and analysis of information

To fulfil detailed survey of physical, biological and social environment, to identify receptors that could be influenced by the planned activity and to establish sensitivity of impact receptors.

Step III: Characterization and assessment of impacts

To establish nature, likelihood, significance and other quantitative characteristics of identified impacts based on sensitivity of receptors, and to describe changes anticipated in the environment and assessment of their significance.

Step IV: Identification of mitigation measures

To identify measures for avoidance, mitigation or compensation of significant impacts.

Step V: Assessment of residual impacts

To anticipate changes that may have place in the environment after implementation of mitigation measures.

Step VI: Elaboration of monitoring and management strategies

The efficiency of mitigation measures should be monitored to ensure that impacts do not exceed established valued, to verify efficiency of mitigation measures, or to identify the need for corrective actions.

6.2 Impact Receptors and Their Sensitivity

The following impacts are anticipated during the implementation of the Project:

- Deterioration of the quality of ambient air;
- Noise Propagation;
- Impact on geology;
- Impact on biological environment;

- Impacts anticipated during waste management process;
- Impact on topsoil;
- Landscape and visual changes;
- Impact on local socio-economic environment;
- Impact on human health and safety risks;
- Impact on monuments of historical and cultural heritage
- Impacts of wind turbines operation.

6.3 Impact on surface water bodies and ground waters

6.3.1 Surface waters

One of the most important rivers near the project area is the Mtkvari River. The distance between the main and alternative sites of the project and the Mtkvari River usually much exceeds 1 km. Turbine #10 is located closest to the Mtkvari (943 m). In addition, the Mtkvari River is bordered by various topographic and infrastructure barriers (hills, road infrastructure, settlements). Closer to construction sites, but still outside the impact zone, is the River East Frone: distance between the main and alternative sites of the project and the River East Frone is generally more than 1 km. The Turbine River No. 22 and Turbine River No. 42 are located closest to the East Frone River (356 m and 796 m, respectively). Zemo Ruisi main channel is also at a considerable distance from the project sites: only one site in the turbine plan is found closer than 100 m (tower #14 at 79 m), while four sites are located further than 100 m, but closer than 200 m. As for other facilities, they are more than 200 m away from the main channel. As for the alternative location plan of turbines, two sites 27 (Alt) and -39 (Alt) are 73 m and 58 m from the main channel, respectively, and 38 (Alt) and 40 (Alt) are 110 m and 148 m from the Bretula Channel, respectively.

The table below shows the distance from the above-mentioned surface water bodies to the nearest construction sites of the project in question.

Table 6-1 Distance of the surface water bodies from the nearest construction sites

Surface water bodies	Closest facilities	Distance (m)
River Mtkvari	WGT 24	703
East Prone River	WGT 25	356
	WGT 43	789
River/brook Bretula	WGT 32	110
	WGT 33	58
	WGT 34	148
	WGT 12	279
Zemo Ru Canal	WGT 18	73
	WGT 14	69
	WGT 19	86
	WGT 28	97
	WGT 38	518
Artificial lake/Pool	WGT 27	693

As the Table shows, none of the construction sites are located less than 50 m from surface water bodies. The alternative turbine sites (WGT 27 Alt, WGT 38alt, WGT 39, WGT 40alt alt) are the closest to surface water bodies - their distance from the main channels varies from 58m to 148m. Relative proximity to water bodies was viewed as one of the reasons for not prioritizing the mentioned alternatives. However, as even in this case, the distance from the water bodies exceeds 50 m, the final decision to exploit alternative sites will be made at the EIA stage based on a more thorough analysis.

Besides the fact that the given surface water bodies are at a sufficient distance from the construction sites, the complex terrain and infrastructural obstacles (roads, rural settlements, etc.) make it impossible for any type of pollution to spread over long distances from the construction sites. The project impact is expected only on the irrigation network sites. Such pollution will not spread against the water current, i.e. towards the main channels and then into the rivers, and will be localized to a limited area. Nevertheless, during the construction of turbine foundations and road widening, particular special attention will be paid to the pollution preventive measures:

- In accordance with the Emergency Response Plan, the construction company will be equipped with fuel spill prevention and containment appliances (sorbents).
- The existing roads will be used as access roads, and when they are widened, the drainage channels provided along the roads will not be directed towards the main channels.
- Extremely strict control will be applied for the trouble-free operation of the construction machinery to prevent even minor fuel or oil spills. This applies both to the construction works (mainly) and to operation of the machinery used for maintenance and repairs in the operation phase.

6.3.2 Ground waters

The turbine generator sites are mainly located on ridges and construction sites where no significant groundwater horizons are encountered. Groundwater levels at specific turbine sites will be determined during the further planned detailed engineering and geological works. However, as early as at the stage of preliminary surveys, it can be said that the groundwaters in the project area are deep enough. Dredging during the construction works is done to a maximum depth of 3-4 m and during the construction of turbine foundations. Dredging depth is less with access roads, camps or substation grounds.

The groundwaters on the sites where the established groundwater table is less than 3 m are referred to as surface groundwaters, which are localized, do not form significant horizons and are not associated with drinking water sources. During the construction works the ground will be dredged to a depth of 3m. So, no impact on groundwater is expected on most construction sites, while on the few areas where groundwater levels may be less than 3m, it can be said that, first, it is local receptors, insignificant in terms of resources, and second, the impact will be temporary, reversible, localized and less intense. No special mitigation measures are needed to protect these objects. It is sufficient to comply with the construction norms and standards and waste management according to the plan.

Usually, groundwater control will be necessary during the construction to prevent groundwater flow into the foundation basin of the turbine tower. Groundwater control is necessary both, for the purposes of the construction process and protection of groundwater from contamination with concrete mortar. Pumped groundwater will be diverted into adjacent channels (small network channels) or dry ravines. This measure is temporary during the construction period. After the construction is complete, groundwater will not pose any threat to the facility (the selected cement grade is adequate for the degree of groundwater aggressiveness), and the object will not impact groundwater either as the groundwater in the area is local surface groundwater accumulated in the rocks weathered under the rain impact, without extensive horizons and discharging into the nearby dry ravines.

In addition, when considering alternatives, the decision was made to raise the foundations by 1 m what will reduce the depth of the foundation in the ground and thereby reduce the already little risk of contamination of the local groundwaters.

6.4 Impact on the atmospheric air quality

Most of the planned facilities and construction grounds of the Wind Farm are quite far from the residential buildings. The site of the substation and the site allocated for the construction camp is more than 1.5 km away from the nearest residential buildings (village Ruisi). As for the turbines, their vast majority (31 turbines) will be distanced from the nearest residential buildings by more than 700 m. 15 of the 50 turbine sites are more than 500 m away, but less than 700 m from the nearest residential buildings. Only 4 turbine sites (#58, 55, 37, and 22) are located less than 500 m away. The smallest recorded distance refers to turbine No. 37 and is 326 m from Variani Farm premises.

6.4.1 Construction Phase

The degree of possible pollution of the atmospheric air is assessed by an approach, which takes into account the operation of typical construction machinery.

Based on the above, the following main sources of pollution were identified: two diesel generator, parking lot, excavator, dump truck and bulldozer. These machines run on fuel, and their emissions are estimated according to the operation capacity based on the effective regulatory and reference documentation.

The single and average maximum daily permissible concentrations of harmful substances emitted during the construction works will be specified in the EIA Report.

To assess the atmospheric air background pollution, it is necessary to use the recommendations given in paragraph 8, Article 5 of the Decree №408 of the Government of Georgia dated December 31, 2013 ("On approval of technical regulations for the calculation of maximum allowable emissions of harmful substances into the atmospheric air") – (see Table 6-2):

Table 6-2 Recommended background values for pollutants depending on the population size

Population (1,000 people)	Background pollution, mg/m^3			
	NO_2	SO_2	CO	Dust
250-125	0,03	0,05	1,5	0,2
125-50	0,015	0,05	0,8	0,15
50-10	0,008	0,02	0,4	0,1
<10	0	0	0	0

To simulate the dispersion of harmful substances in the atmospheric air, the emissions recorded during the construction works of the wind turbine foundation located the closest to the settled area and during the operation of the construction camp will be taken.

The analysis of the calculation results must confirm that in the construction phase, the quality of the atmospheric air in the adjacent areas, both for 500-meter rated zone and the nearest settlement zone, will not exceed the legally established standards.

6.4.2 Operation

The atmospheric air quality will not deteriorate in the operation phase. During the operation phase, only the vehicles of the service personnel may be driven around the area, and the operation of the diesel generator will not be necessary, as the substation will be supplied directly with the power generated by the turbines.

It is planned to use grounding transformers as the main source of power for 0,4 kV own circuits. It is planned to use 160 kV grounding transformers to supply power for own consumption. The parameters of grounding transformers are to be specified in the "Grid connection training course". The project envisages the use of diesel generators only as reserve units during the unforeseen events - the generator capacity should be confirmed based on the calculation of the power balance of the substation equipment. 200 kW capacity generators are assumed to be used as reserve units.

The generator emissions in the operational phase will not exceed the emissions in the construction phase, when the operation of two diesel generators at a higher frequency is considered, and, therefore, the emissions during the operational phase will be less than the ZDG standard emissions.

The generator emissions of the operational phase will not exceed the emissions of the construction phase envisaging a more intense operation of two diesel generators. Consequently, the emissions in the operational phase will be less than the maximum permissible emission standard.

6.4.3 Mitigation measures

As mentioned above, the risks of impact on the atmospheric air quality exist only in the construction phase and during the repairs that will be less intense compared to the construction phase.

Below are measures to mitigate the expected impacts in the construction phase, namely:

- Ensuring that machines are technically in a good condition;
- Turning off vehicle engines or operating at minimum speeds when not in use;
- Always driving the vehicles at optimum speeds (especially through the populated areas on unpaved roads);
- Limiting the use of roads across the populated areas as much as possible;
- Taking precautions (e.g., avoiding dropping materials from heights during loading/unloading);
- Watering working areas and road surfaces in dry weather;
- Appropriately covering vehicle bodies when transporting dusty materials;
- Using special covering or watering the storage area of the dusty materials to prevent the wind from carrying them away.
- Placing generators and other machinery and equipment away from sensitive receptors (residential houses), if any;
- Instruction of personnel;
- Recording/registering and responding to the complaints.

6.5 Noise Impacts

6.5.1 Introduction

Noise is any unwanted sounds or a combination of sounds of different frequencies and intensities that have an undesirable influence on a human body.

With its physics, noise is the mechanical oscillations of particles of an elastic environment (gas, liquid, organic matter) within the scope of a human auditory analyzer (16 Hz-20 kHz) arising under the influence of a certain force. At the same time, the sound is called regular periodic (sinusoidal) oscillations, and the noise is called an irregular set of sounds, non-periodic, random oscillation processes. Thus, from a hygienic point of view, noise is a combination of sounds of different frequencies and levels of sounds, which hampers the perception of useful audible signals (music, conversation, etc.) and triggers an unwanted, irritating effect on the human body. Noise is classified depending on the nature of spectrum and time characteristics.

6.5.1.1 Noise Sources

Depending on the place of origin, the noise sources are classified as follows:

- The main source of noise in the houses in the urban areas is mainly the traffic with the highest share in noise pollution. The number of cars, their speed, urban development and motor system are the main parameters that impact the noise distribution. Besides, a great share of heavy vehicles in the common car park is noteworthy;

- Engineering, technological and household equipment, as well as human activities are the internal noise sources in the houses;

- Sources related to human life activities, such as playing sports, cleaning the area, etc., within the framework of the micro-district (quarter);

- The external sources are industrial and energy infrastructure.

6.5.1.2 Time Characteristics of noise

Depending on time characteristics, the following types of noise can be identified:

A. Permanent noise: with its sound level changing by no more than 5 dB during an 8-gour working day in the working zone or in the rooms of residential and public buildings, as measured by a “slow” time property of the noise meter;

B. Non-permanent noise: with its level during an 8-gour working day in the working zone, or during the working shift or on the territory of the settled areas changes by more than 5 dB, as measured by a “slow” time property of the noise meter.

Non-permanent noise is classified as:

a. Noise varying in time, with its sound level continuously changing in time;

b. Intermittent noise, with its sound level changing gradually (by 5 dB or more). Besides, the duration of intervals, during which the noise level is permanent, is 1 second and more;

c. Pulse noise, which is made up of several sound signals with the duration of less than 1 sec. besides, the sound levels as measured by relevant time characteristic “impulse” and “slow” differ by no less than 7 dB.

6.5.1.3 Regulatory Requirements for Admissible Noise Impacts and Impact Assessment

As per the state standards, the admissible noise levels are specified by Decree # 297/N of the Ministry of Health, Labor and Social Affairs of Georgia. This Decree sets both admissible noise levels and maximum admissible levels for different territories (State Registration Code 470.230.000.11.119.004.920).

The noise levels in the buildings and premises and adjoining areas are also regulated by Technical Regulation no. 398 of the Government of Georgia on August 15, 2017 “On the levels of acoustic noise in the rooms of the residential houses and public establishments and their accommodation areas”. The given technical regulation, which is based on the requirements of the international standards (e.g. ISO 1996-1: 2003. “Acoustics, Description, measurement and assessment of environmental noise”, Part 1: “Main assessment values and procedures”; ISO 1996-2: 2007“Acoustics, description and measurement of environmental noise”, Part 2) sets the admissible levels of acoustic noise in the rooms of residential, buildings and buildings of public and in the settled areas to protect people against the unfavorable impact of noise.

The requirements of the Georgian and international legislations are identical except some minor changes.

Table 6-3 Georgian Standards for Noise Levels

Receptor	Time interval	Average admissible noise level (dB)	Maximum admissible noise level (dB)
Residential	7:00-23:00	55	70
Residential	23:00- 7:00	45	60
Commercial	24 hours	60	75

Table 6-4 IFC Noise Level Guidelines

Receptor	One hour Laeq (dB)	
	During the day 07.00-22.00	At night 22.00 – 07.00
Residential; Institutional; Educational	55	45
Industrial; commercial	70	70

For the technical regulation purposes (expert assessment of noise level), the rated parameter of continuous noise is the sound level measured by noise meter LAdBA with weighting A, and the equivalent sound level LAeqvdBA for non-continuous (variable) noise.

As per the given technical regulation, the admissible noise levels are given in Table 6-5.

Table 6-5 Admissible levels of acoustic noise in the rooms of residential and public buildings and their settled areas

№	Purpose/use of area and premises	Allowable limits		
		L_{Day} (dBA)		L_{Night} (dBA)
		Day	Night	
1	Educational facilities and library halls	35	35	35
2	Medical facilities/chambers of medical institutions	40	40	40
3	Living quarters and dormitories	35	30	30
4	Hospital chambers	35	30	30
5	Hotel/motel rooms	40	35	35
6	Trading halls and reception facilities	55	55	55
7	Restaurant, bar, cafe halls	50	50	50
8	Theatre/concert halls and sacred premises	30	30	30
9	Sport halls and pools	55	55	55
10	Small offices (≤100m3) – working rooms and premises without office equipment	40	40	40
11	Big offices (≥100 m3) working rooms and premises without office equipment	45	45	45
12	Conference halls /meeting rooms	35	35	35
13	areas bordering with houses residential, medical establishments, social service and children facilities(<6 storey buildings)	50	45	40
14	Areas bordering with houses residential, medical establishments, social service and children facilities(>6 storey buildings)	55	50	45
15	The areas bordering with hotels, trade, service, sport and public organizations	60	55	50

Note:

1. *In case noise generated by indoor or outdoor sources is impulse or tonal, the limit must be 5dBA less than indicated in the table.*
2. *Acoustic noise limits given above are set for routine operation conditions of the 'space', i.e. windows and door are closed (exception – built-in ventilation canals), ventilation, air conditioning, lighting (in case available) are on; functional (baseline) noise (such as music, speech) not considered.*

The results of noise measurements are documented in accordance with the rules established by the effective law. The noise level value of is calculated with 1 dBA accuracy, by considering generally accepted rounding of the value.

For workplace noise the following IFC standards are applicable.

Table 6-6 IFC Work Environment Noise limits

Type of Work, workplace	IFC General EHS Guidelines
Heavy Industry (no demand for oral communication)	85 Equivalent level Laeq, 8h
Light industry (decreasing demand for oral communication)	50 - 65 Equivalent level Laeq, 8h

► **IFC Requirements for noise impact assessment: ENVIRONMENTAL, HEALTH, AND SAFETY GUIDELINES FOR WIND ENERGY August 7, 2015**:

Noise impact should be assessed in accordance with the following principles:

- Receptors should be chosen according to their environmental sensitivity (human, livestock, or wildlife).
- Preliminary modeling should be carried out to determine whether more detailed investigation is warranted. The preliminary modeling can be as simple as assuming hemispherical propagation (i.e., the radiation of sound, in all directions, from a source point). Preliminary modeling should focus on sensitive receptors within 2,000 meters (m) of any of the turbines in a wind energy facility.
- If the preliminary model suggests that turbine noise at all sensitive receptors is likely to be below an LA90 of 35 decibels (dB) (A) at a wind speed of 10 meters/second (m/s) at 10 m height during day and night times, then this preliminary modeling is likely to be sufficient to assess noise impact; otherwise it is recommended that more detailed modeling be carried out, which may include background ambient noise measurements.
- All modeling should take account of the cumulative noise from all wind energy facilities in the vicinity having the potential to increase noise levels.
- If noise criteria based on ambient noise are to be used, it is necessary to measure the background noise in the absence of any wind turbines. **This should be done at one or more noise-sensitive receptors.** Often the critical receptors will be those closest to the wind energy facility, but if the nearest receptor is also close to other significant noise sources, an alternative receptor may need to be chosen.
- The background noise should be measured over a series of 10-minute intervals, using appropriate wind screens. At least five of these 10-minute measurements should be taken for each integer wind speed from cut-in speed to 12 m/s

6.5.2 Noise 3D Modelling: Methodology

To identify the degree of environmental impact and to subsequently manage it in the design and construction phases of the infrastructural facility, a swift study of the environmental characteristics as well as the identification of the capacity and levels of such impacts is important. Noise modeling allows evaluating the noise distribution characteristics in the construction and operation phases of the Turbines and noise impact levels in the study area and nearest settlement before the project is implemented.

Based on the received data, the implementing agency will have an opportunity to take noise preventive measures what will have a positive impact on the population of nearby settlements, as well as on the turbines efficiency.

Noise modeling is a complex job giving a great importance to the modeling data. Consequently, the obtained results immediately depend on the complete input data. Below we give a brief description of noise modeling:

- A detailed study of the turbine noise characteristics is done at the initial stage;
- The data on the characteristics of the environment adjacent to the turbines are collected (Relief, landscaping, settlements, sensitive receptors, etc.);
- The initial modeling data are retrieved and processed according to the characteristics of a concrete study object;

- The compliance of the technical requirements and instructions for noise propagation with respect to a specific source is determined;
- The noise level is calculated at any study point by using relevant computer software;
- The efficiency of the obtained results and modeling is examined;
- A report on the obtained results is developed for further assessment of the noise impact level.

6.5.2.1 Used Computer Software

Noise modeling was performed using a German-made “CadnaA” computer program.

“CadnaA” (Computer Aided Noise Abatement) is the leading software for calculation, presentation, assessment and prediction of environmental noise. Whether your objective is to study the noise emission of an industrial plant, of a mart including a parking lot, of a new road or railway scheme or even of entire towns and urbanized areas: “CadnaA” is designed to handle all these tasks.

With more than 30 implemented standards and guidelines, powerful calculation algorithms, extensive tools for object handling, outstanding 3D visualization and the very user-friendly interface “CadnaA” is the perfect software to handle national and international noise calculation and noise mapping projects of any size.

With its technical capabilities and its ease of use “CadnaA” represents state-of-the-art technology. “CadnaA” is developed in C/C++ and communicates perfectly with other Windows applications like word processors, spreadsheet calculators, CAD software and GIS-databases. “CadnaA” includes a multi-lingual user interface and is successfully applied in more than 60 countries all over the world.

6.5.2.2 Resources used in modeling

The following works were accomplished within the scope of noise modeling:

- The noise sources and characteristics were identified;
- The design points were selected along the border of the area to protect;
- The direction of noise propagation was specified from the sources of noise to the design points was specified and the acoustic calculations of the environment were done which have an impact on noise propagation (natural screens, green plantings, etc.);
- The expected noise levels were identified at the design points and compared to the admissible noise level.

Modeling configuration:

- Distances of the modeled sections 12000 x 11500 m.
- Area Coordinates (UTM/WGS84/Meridian 38):
  - Bottom left corner X - 407396, Y - 4651046;
  - Upper right corner X - 419527, Y - 4662883;
- Receiver Interval 10x10 m.
- Max search radius 2000 m.

The following information was used for modeling:

1. Project location plan (ShapeFiles);
2. Project turbine characteristics (height, work schedule, etc.);
3. Typical noise levels (dBA) for each source (source - technical specifications of the equipment and literature materials);
4. Digital Terrain Model (ASTER GDEM);
5. Environmental conditions of the study area (green plants, noise-suppressing structures, barriers, etc.);
6. Attributes of the nearest buildings;
7. Meteorological properties;
8. Calculation standard - „ISO 9613 - Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation“;
9. Standard for noise source characteristics - „ISO 11203:1995 - Acoustics - Noise emitted by machinery and equipment - Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level“;
10. Noise norms provided by the legislation of Georgia.

6.5.2.3 Calculation standard - „ISO 9613”

This noise modeling is based on ISO 9613, regarding Attenuation of Sound during Propagation Outdoors. The standard contains calculation methods of sound attenuation during propagation outdoors. The purpose is to estimate noise level of environment at a point generated from various noise sources.

Attenuation occurring when noise waves are propagated outdoor may be in the form of attenuation due to distances (divergence) from sound sources to observation points, attenuation due to atmospheric absorption, attenuation due to ground effects, attenuation due to objects blocking the propagation of sounds, etc.

Basic equation of noise pressure on the receiver point is:

$$L_{ft} = L_w + D_c - A$$

$$A = A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{misc}$$

where:

L_w - Power level of noise source;

D_c - Directivity factor of noise source;

A - Attenuation (octave band);

A_{div} - Attenuation due to distance (divergence);

A_{atm} - Attenuation due to atmospheric absorption;

A_{gr} - Attenuation due to ground effects;

A_{bar} - Attenuation due to barriers;

A_{misc} - Attenuation due to other effects, such as the presence of trees, (forests), the presence of industrial areas or residential areas.

► **Attenuation due to distance (Geometrical divergence A_{div})**

Attenuation due to distance is calculated by using the following equation:

$$A_{div} = [20Log(\frac{d}{d_o}) + 11] \ dB$$

where:

d - the distance from the source to the observation point;

d_o - reference distance (in general = 1 meter).

► **Attenuation due to atmospheric absorption A_{atm}**

Attenuation due to atmospheric absorption is calculated by using the following equation:

$$A_{atm} = \frac{\alpha d}{1000}$$

α is the coefficient of atmospheric attenuation (in dB/km units), for every octave band. Examples of α coefficient is presented in Table 6-7.

Table 6-7 Example of atmospheric attenuation coefficient

Temperature	Relative Humidity	Atmospheric attenuation coefficient α, dB/km							
		Frequency, Hz							
ºC	%	63	125	250	500	1000	2000	4000	8000
10	70	0.1	0.4	1.0	1.9	3.7	9.7	32.8	117
20	70	0.1	0.3	101	2.8	5.0	9.0	22.9	76.6
30	70	0.1	0.3	1.0	3.1	7.4	12.7	23.1	59.3
15	20	0.3	0.6	1.2	2.7	8.2	28.2	88.8	202
15	50	0.1	0.5	1.2	2.2	4.2	10.8	36.2	129
15	80	0.1	0.3	1.1	2.4	4.1	8.3	23.7	82.8

► **Attenuation due to ground effects (Agr)**

Attenuation due to the largest ground effect is caused by sound reflections from the ground surface experiencing interference with sound directly propagating from the source to the receiver.

To calculate the attenuation, three areas are defined at the sound propagation track, namely:

- The source area, is the area located between the source to a distance of $30h_s$ with a maximum distance of d_p. h_s is the source height and d_p is the propagation distance from the source to the receiver.
- The receiver area, is the area located between the receiver to a distance of $30h_r$ with a maximum distance of d_p. h_r is the receiver height and d_p is the propagation distance from the source to the receiver.

– The middle area, is the area located between the source area and the receiver area. If $d_p < (30h_s + 30h_r)$, the source area and receiver area will overlap, accordingly there is no middle area.

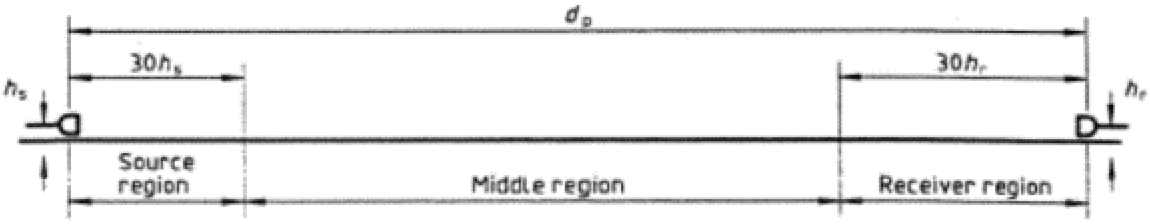


Figure 6-1 Division of areas to determine attenuation due to ground effects

Apart from that, the ground surface of each area is categorized into:

- **Hard ground**, including cement covered surfaces, tiles, water, ice, concrete and other surfaces with low porosities. For hard surfaces, G=0.
- **Porous ground or porous surfaces,** including grass covered surfaces, trees and other vegetation, and soil surfaces that are usually used for the growth of vegetation, such as rice fields. For porous surfaces, G=1.
- **Mixed ground**. If the ground surface is a combination of hard surfaces and porous surfaces, then the G value varies from 0 to 1.

To calculate the surface attenuation, the attenuation in the A_s source should be calculated by calculating the G_s surface factor, the attenuation in the A_p receiver area by calculating the G_p surface factor and the attenuation in the A_m middle area by calculating the G_m surface factor by using Table 6-8. Then the attenuation due to the ground effect is calculated by using the following equation:

$$A_{gr} = A_s + A_r + A_m$$

Table 6-8 Equation to calculate the ground effect attenuation at the source, receiver and middle areas

Frequency Hz	A_s or A_r [1)] dB	A_m dB
63	-1,5	$-3q$ [2)]
125	-1.5 + G x $a'(h)$	$-3q(1-G_m)$
250	-1.5 + G x $a'(h)$	
500	-1.5 + G x $a'(h)$	
1000	-1.5 + G x $a'(h)$	
2000	-1.5 + (1-G)	
4000	-1.5 + (1-G)	
8000	-1.5 + (1-G)	

Notes

$a'(h)$=1.5 + 3.0 x $e^{-0.12(h-5)^2}(1-e^{-dp/50})$ + 5.7 x $e^{-0.09h^2}(1-e^{-2.8\times10^{6} \times dp^2})$

$b'(h)$=1.5 + 8.6 x $e^{-0.09h^2}(1-e^{-dp/50})$

$c'(h)$=1.5 + 14.0 x $e^{-0.46h^2}(1-e^{-dp/50})$

$d'(h)$=1.5 + 5.0 x $e^{-0.9h^2}(1-e^{-dp/50})$

1) To calculate A_s, $G=G_s$ and $h=h_s$ are used. To calculate A_r, $G=G_r$ and $h=h_r$ are used.
2) $q=0$, if d_pO $(30h_s + 30h_r)$
   $q=1-(30*(h_s+h_r)/d_p)$,if $d_p > (30h_s + 30h_r)$

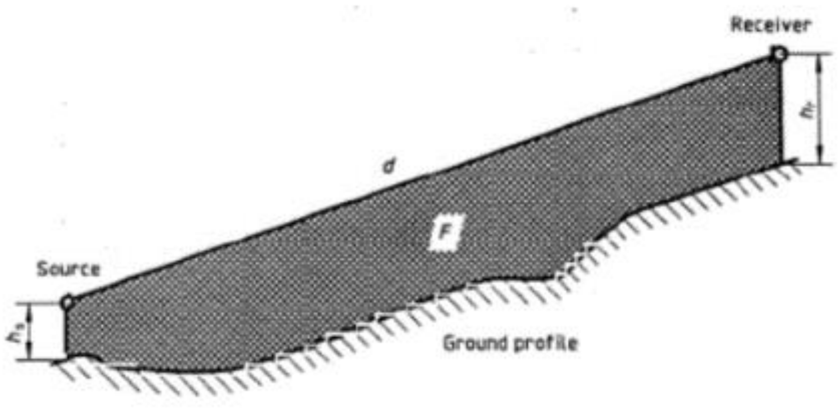
In specific conditions, namely:

- If only the sound pressure at the receiver position is calculated;
- If the sound propagation occurs in areas with porous surfaces or mixed ground that are mostly porous surfaces;
- If propagated sounds are not pure tones.

Then the attenuation is calculated by using the following equation:

$$A_{gr} = 4.8 - (2h_m / d)\left[17 + (300 / d)\right] \geq 0 \quad dB$$

h_m is the average height of the propagation track on the ground surface (meter) and *d* is the distance between the source and the receiver position (see Figure 6-2).



$h_m = F/d$, where F is the area

Figure 6-2 Method to evaluate h_m

In the calculation of attenuation due to ground effect, the ground surface in the surroundings of project zone is considered to be a porous surface as the ground surface is covered by grass, trees and other vegetation. The impedance effect due to the ground surface is calculated by using the following equation:

$$P \sim R^{-b}$$

R is the propagation distance, while b is the impedance effect factor of the ground surface. For ground surfaces covered with grass, the b=1,2 value is used.

► **Attenuation due to barriers (Abar)**

An object is referred to as a barrier if:

- The surface density is at least 10 kg/m^2;
- The object surface is covered without any cracks or gaps;
- The object height from the propagation surface is greater than the octave band (l_l+l_r >λ) wavelength as indicated in Figure 6-3.

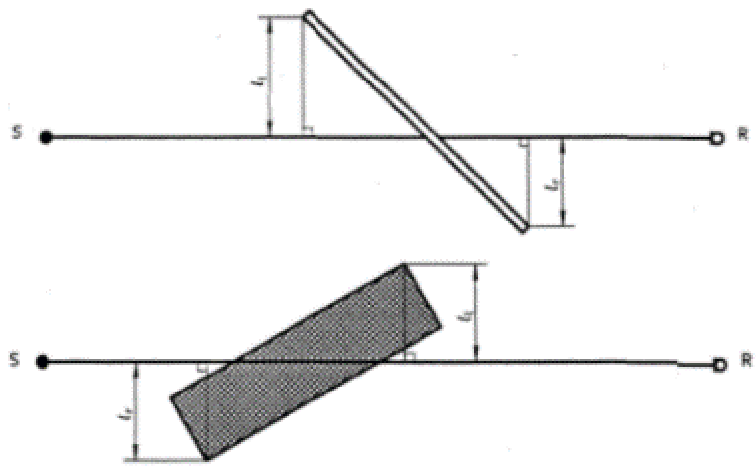


Figure 6-3 Cross-section of two objects/barriers in the propagation track

Diffraction effects occurring at the upper end of the barrier is calculated by using the following equation:

$$A_{bar} = D_z - A_{gr} > 0$$

While diffraction effects that occur around the vertical ends are calculated by using the following equation:

$$A_{bar} = D_z > 0$$

D_z is the attenuation barrier for each octave band frequency, that is calculated with the following equation:

$$D_z = 10Log\left[3 + (C_2/\lambda)C_3 z K_{met}\right] \ dB$$

where:

C2 = 20, inclusive the reflection factor due to the ground effect. If the reflection factor due to the ground effect is calculated separately, C2 = 40.

C3 = 1 for a single diffraction. For a double diffraction, C3 = $[1+(5\lambda/e)^2]/[(1/3)+(5\lambda/e)^2]$

λ - wavelength for each octave band;

z - difference between the propagation track length of direct sounds and diffracted sounds;

K_{met} - correction factor for meteorology effects;

e - distance between two diffraction ends when double diffraction occur.

► **Meteorological correction**

Meteorological corrections are calculated by using the following equation:

$$C_{met} = 0, \ jika \ d_p \le 10(h_s + h_r)$$
$$C_{met} = C_0\left[1 - 10(h_s + h_r)/d_p\right], \ jika \ d_p > 10(h_s + h_r)$$

► **Other attenuations (Amisc)**

Other attenuations calculated are attenuations due to the presence of trees, attenuations due to industrial areas and attenuations due to housing areas.

Attenuations due to the presence of forests A_{fol}

The presence of trees can cause attenuation if the density of the trees actually blocks the propagation track. The attenuation size due to the trees is indicated in Table 6-9. Attenuation due to the presence of forests can also be calculated by using the following equation:

$$A_{fol} = [8.5 + 0.12d] \ dB$$

d is the diameter of the forest/foliage.

Table 6-9 Sound attenuation during propagation at d_f distance, through trees

Propagation distance d_f, meter	Frequency, Hz							
	63	125	250	500	1000	2000	4000	8000
10 O df O 20	Attenuation , dB:							
	0	0	1	1	1	1	2	3
20 O df O 200	Attenuation , dB/m:							
	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.12

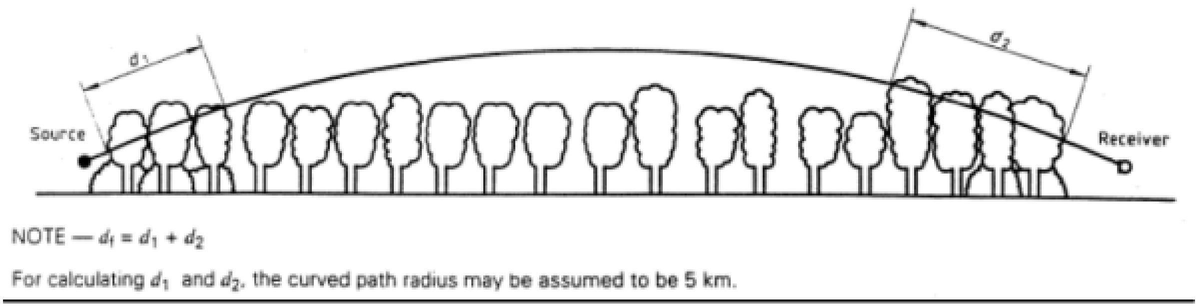


Figure 6-4 Attenuation A_{fol} increases linear towards the d curve length, passing trees/forests

► **Attenuation due to the presence of industrial areas A_{site}**

In industrial areas, attenuation may occur due to the scattering of the installation of equipment and other objects in industrial areas. The attenuation size highly depends on the type of the site and the equipment, therefore accurate attenuation is largely determined by measuring. Table 6-10 is an estimate of the attenuation size due to the presence of industries. The attenuation size increases linear against the d curve, along the equipment (see Figure 6-5), with a maximum attenuation of 10 dB.

Table 6-10 Estimated sound attenuation size due to the presence of industrial areas

Frequency, Hz	63	125	250	500	1000	2000	4000	8000
A_{site}, dB/m	0	0.015	0.025	0.025	0.02	0.02	0.015	0.015

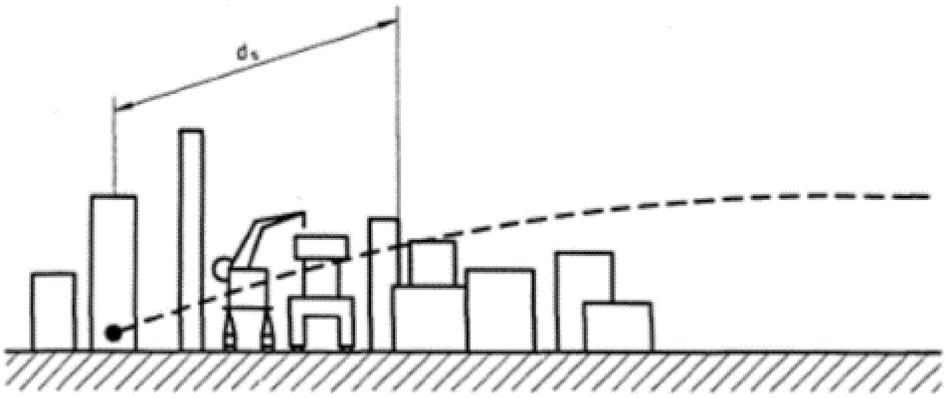


Figure 6-5 Attenuation A_{site} increases linear against the d curve length in industrial areas

► **Attenuation due to housing areas (A_{hous})**

The presence of housing areas in the surroundings of the source, receiver and the sound propagation track may contribute to cause attenuation due to the blocked propagation of the sound source. The size of the attenuation A_{hous} is highly dependent on the actual condition, therefore the calculation of A_{hous} is basically an estimated value. Mathematical equations used to calculate A_{hous} are:

$$A_{hous} = A_{hous,1} + A_{hous,2}$$

$$A_{hous,1} = 0.1Bd_b \quad dB$$

$$A_{hous,2} = -10Log\left[1-(p/100)\right] \quad dB$$

Where:

$A_{hous,2}$ - is calculated when there are rows of buildings near roads, railways and other corridors;

B - density of buildings or housings along the propagation track, i.e. the area with buildings divided by the total outer area;

d_b - the total length of the propagation track is calculated similarly to the procedure in Figure 8.3.6.2;

p - the percentage of the façade length is relative against the total length of the roads or railways.

6.5.3 Noise Receptors

The project area is located in Gori and Kareli Municipalities. There are villages near the locations of the project turbines. Therefore, the major sensitive receptors found near the study area are buildings and facilities used temporarily or permanently by the local population.

Villages adjacent to the project area are as follows:

- Vill. Ruisi;
- Vill. Sagolasheni;
- Vill. Breti;
- Vill Bretis Meurneoba

- Vill. Sasireti;
- Vill. Dirbi;
- Vill. Dzvelijvari;
- Vill. Sakasheti;
- Vill. Variani;
- Vill. Varianis Meurneoba
- Vill. Arashenda.
- Vill. Urbnisi;
- Vill. Bebnisi;
- Kareli.

Of the listed villages, Ruisi is outstanding in terms of population (5139 people based on 2014 census).

Figure 6-6 below shows the locations of the turbines and adjacent villages.

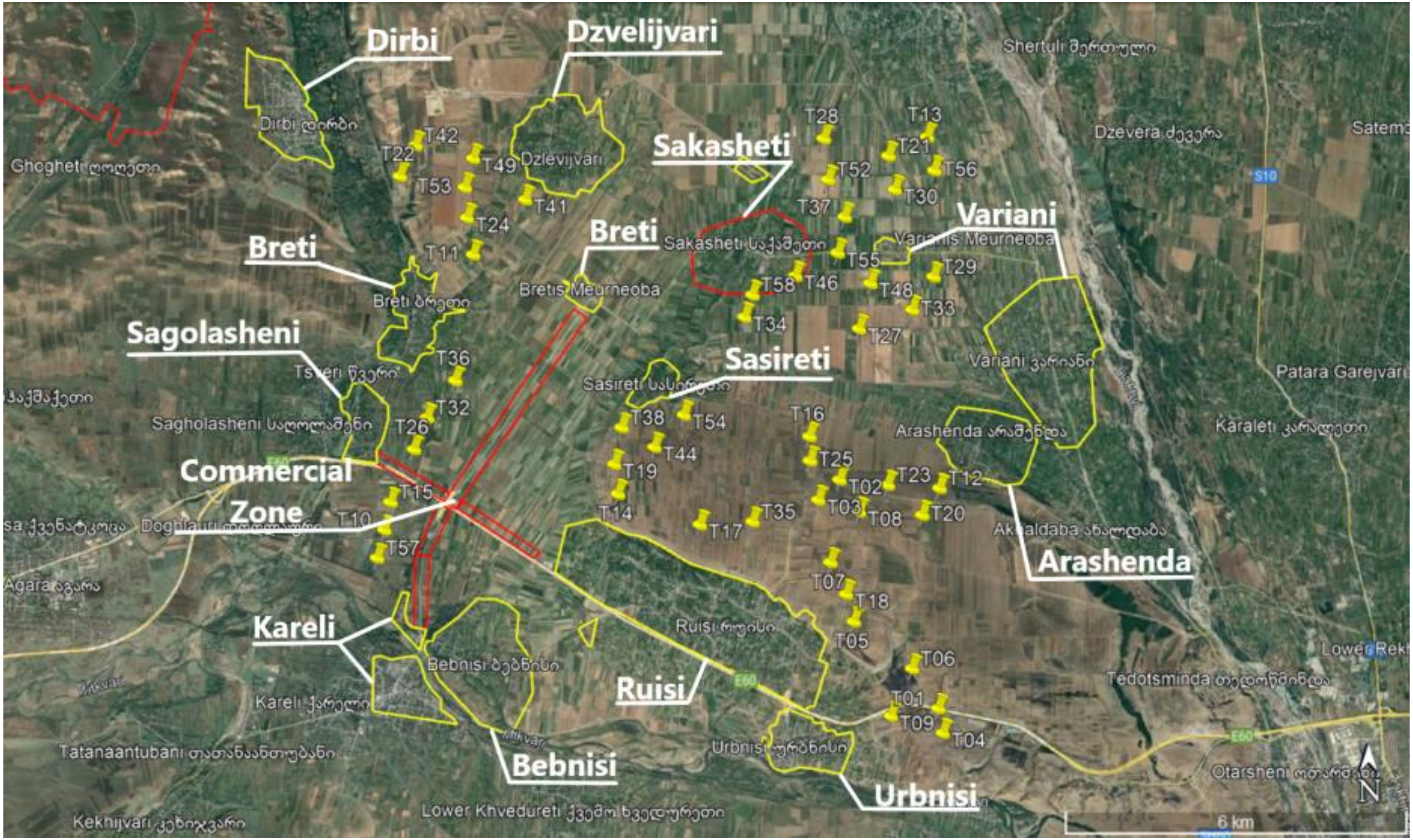


Figure 6-6 **Settlements adjacent to the project area**

6.5.4 Noise Modeling Scenarios

6.5.4.1 Construction Phase

The dominant source of noise from most construction equipment is the engine, usually a diesel, without sufficient muffling. Only in a few cases noise generated by the process dominates (for example, impact pile driving, pavement breaking).

The internal combustion engines of different power are used to provide propulsion for the wheels of trucks and/or operating power for the working mechanisms such as buckets, dozers, etc. Exhaust noise is usually the most important component of internal combustion engine noise. However, noise associated with the air intake, cooling fans, and the mechanical and hydraulic transmission and control systems may also be significant, depending upon the type and size of specific pieces of equipment.

Noise levels during construction will vary depending on the activity, type and number of equipment, work schedule, duration of use and the distance from receptor. Construction in this analysis, first the noise level due to each piece of equipment, which is likely to be used in the construction, is calculated.

Noise levels induced by the main road construction equipment considered in assessment are presented in Table below (Note: the values indicated in the table may differ depending on the brand of machinery provided/used by contractor). The list includes all equipment except vehicles and some minor pieces of equipment.

Construction Equipment	Typical noise level (dBA)[18]
Mobile crane	73 - 79
Bulldozer	81.7
Excavator	80.7
Grader	85
Roller	80.0
Rock Drill	81.0
Dump Truck	76.5
Concrete Mixer Truck	78.8
Dump Truck	76.5
Dump Truck	76.5
Paver	77.2
Boring Jack Power Unit	83.0

Noise modeling for the construction phase admits that 2 neighboring wind turbines will be installed at the same time. Modeling assumes that during the construction, two construction machines, each with the noise level of 95 dB, will work at each location simultaneously.

Noise modeling for construction phase was done for the worst case scenario, with all sources (four macines at two neighboring sites) operating simultaneously.

In sound modeling, at construction phase, area source is used as noise source.

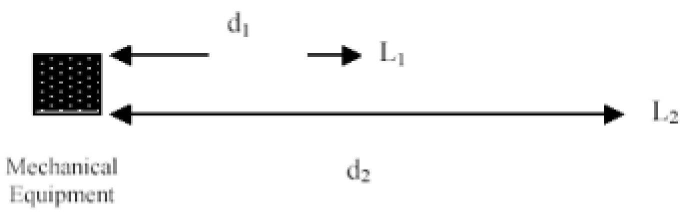
[18] The noise levels is given near the source of noise.

Area sources are modelled as closed polygons. They are noise sources extending in two dimensions while the third dimension perpendicular to its area is small in relation to the receiver distance. CadnaA subdivides upon calculation the area sources into sufficiently small sub-areas. In the centre of each sub-source a point source with the appropri-ate partial sound power is placed. This procedure results in a fine grid ofpoint sources, the total emission of which represents the area source.

Horizontal area sources are inserted by entering their horizontal projection. Examples of area sources are construction sites, parking lots, sports facilities, and even entire industrial or commercial areas.

The noise level L_2 (in dBA) at distance d_2 can be computed from the noise level L_1 (in dBA) measured at distance d_1 by the equation:

$$L_2 = L_1 - 20 \log (d_2 / d_1)$$



6.5.4.2 Operation Phase

Noise modeling was done for the turbine construction and operation scenario and for the worst case scenario with simultaneous operation of all turbines. A total of 50 wind turbines will be operating simultaneously in the operation phase.

Noise modeling for the construction phase admits that 2 wind turbines will be installed at the same time. Modeling assumes that during the construction, two construction machines, each with the noise level of 95 dB, will work at each location.

Below we give all noise modeling scenarios:

- Scenario N1 - wind turbine construction scenario;
- Scenario N2 - wind turbine operation scenario:
    - Turbine cabin height - 105 m;
    - Turbine cabin height - 150 m.

The point source of noise in the operation phase is the turbine cabin, which is, in first case 105-meter high and in second case 150-meter high. The spectral levels of the wind turbine noise source in the operation phase are given in Table 6-11.

Table 6-11 Noise Levels of Wind Turbines

Turbine Model	Noise Level L_{WAf} [dB]								
	31.5	63	125	250	500	1000	2000	4000	8000
Generic WTG of similar size and class to 4.5 MW	73.1	84.3	92.9	98.5	102.4	102.6	98.1	95.7	80.8

Noise modeling for both, the construction and operation phases, was done for the worst case scenario, with all sources operating simultaneously. A vertical grid with the height of 500 meters was used to demonstrate spherical noise propagation. Consequently, it is possible to determine the noise impact level on birds.

The calculation was done for the option of operating of noise sources with a maximum load. For noise suppression, the computer software considered the possibility of noise loss by considering sound absorption of the atmosphere (under the influence of temperature, humidity and atmospheric pressure) and distance to the source. This method is based on the noise propagation characteristics and guidelines given in ISO 9613 (Acoustics - Attenuation of sound during propagation outdoors — Part 2: General method of calculation).

The air temperature during the modeling is 20°C, while the relative humidity is 70%. The turbines operate 24 hours a day.

6.5.5 Noise Modeling Results

As the obtained results evidence, in the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 40 dBA at the nearest building found in village Arashenda (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia.

In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 40 dBA at the nearest building found in village Breti (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia.

In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 42 dBA at the nearest building found in village Variani (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia.

In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 42 dBA at the nearest building found in village Ruisi (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia.

In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 40 dBA at the nearest building found in village Sasireti (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia.

In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 41 dBA at the nearest building found in village Sagholasheni (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia.

In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 40 dBA at the nearest building found in village Dzvelijvari (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia.

In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 43 dBA at the nearest building found in village Sakasheti (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia.

Noise modeling results for the wind turbines construction phase are given for the nearest residential houses in village Sakasheti, which are located closest the two turbines. The noise level at the nearest building in case of simultaneous installation of two turbines will not exceed 40 dBA. This noise level is lower than the day and night noise standards established by the legislation of Georgia.

Overall, as the modeling results have evidenced, the noise level generated in the construction and operation phases of the wind turbines at the nearest residential buildings does not exceed the day and night noise standards established by the legislation of Georgia.

It should be considered that all calculations above were made for the case of simultaneous operation of all noise sources.

Table 6-12 Noise impact levels at a vertical height of 105 meters

Distance From The Turbine	Noise Level (dBA)
50 m.	63.2
100 m.	56.1
200 m.	50
500 m.	41.6

Table 6-13 Noise impact levels at a vertical height of 150 meters

Distance From The Turbine	Noise Level (dBA)
50 m.	63.5
100 m.	56.3
200 m.	50.3
500 m.	41.8

Table 6-14 below shows the expected noise levels for buildings in the nearest settlements. Noise levels are presented for two scenarios: Turbine cabin height - 105 m. and Turbine cabin height – 150 m.

Table 6-14 Noise levels at nearest receptors

Settlement	Building N	Building Coordinates		Noise Levels (dBA)	
		X	Y	Turbine cabin height - 105 m.	Turbine cabin height - 150 m.
Arashenda	1	418539	4656529	37.8	38.1
	2	418510	4656543	37.9	38
Breti	1	411970	4659983	30.2	30.1
	2	411826	4659789	30.1	30
Variani	1	417182	4660427	41.3	41.2
	2	417629	4660222	40.8	40.7
Ruisi	1	413630	4655011	40	40.1
	2	415896	4653996	41.8	41.7

Settlement	Building N	Building Coordinates		Noise Levels (dBA)	
		X	Y	Turbine cabin height - 105 m.	Turbine cabin height - 150 m.
Sasireti	1	413402	4657947	39.7	39.6
	2	413232	4657925	39.6	39.5
Sagolasheni	1	408508	4657331	40.8	40.7
Dzvelijvari	1	411319	4661676	39.2	39.1
	2	410821	4662101	39.1	39
Sakasheti	1	414975	4659905	42.8	42.7
	2	415192	4660090	42.4	42.2
Kareli	1	408805	4654484	39.2	39.1
	2	408777	4654394	38.5	38.4
Bebnisi	1	409525	4653893	29.8	29.7
	2	409495	4653841	29.7	29.6
Urbnisi	1	416427	4651982	37.8	37.7
	2	416477	4651887	38	37.9

As the result of the change in the height of the turbines (105 m. and 150 m.), the noise levels on the nearest residential buildings change insignificantly. The maximum difference observed as a result of modeling is 0.3 dBA.

Noise modeling is also performed in the commercial zone adjacent to the project area (See figure N8.4.1). As the modeling results showed, as a result of the operation of the WPP (under both scenarios), the noise levels within the commercial zone do not exceed 55 dBA. In the section of the commercial zone, which is closest to the area where the stations are located, the noise level is 52 dBA. In all other cases, noise levels are much lower (ranging from about 40-45 dBA).

Since the permissible norm of noise for commercial / industrial purpose buildings is 60 dBA according to the national legislation, exceeding the permissible norm of noise in the mentioned area is not fixed as a result of modeling.

Figure 6-7 - Figure 6-33 below show the visual modeling results of noise propagation caused by the WPP construction and operation (for all scenarios). The borders of the villages are shown as the contours were confirmed by the municipal authorities and they include all residential houses and areas, which could be used as residential in future (e.g. the development zone in Sakasheti village). Thus modeling covers all residential houses and areas, which are under the potential noise impact.

Figure 6-7 Initial view of the project area

Figure 6-8 Initial view of the project area

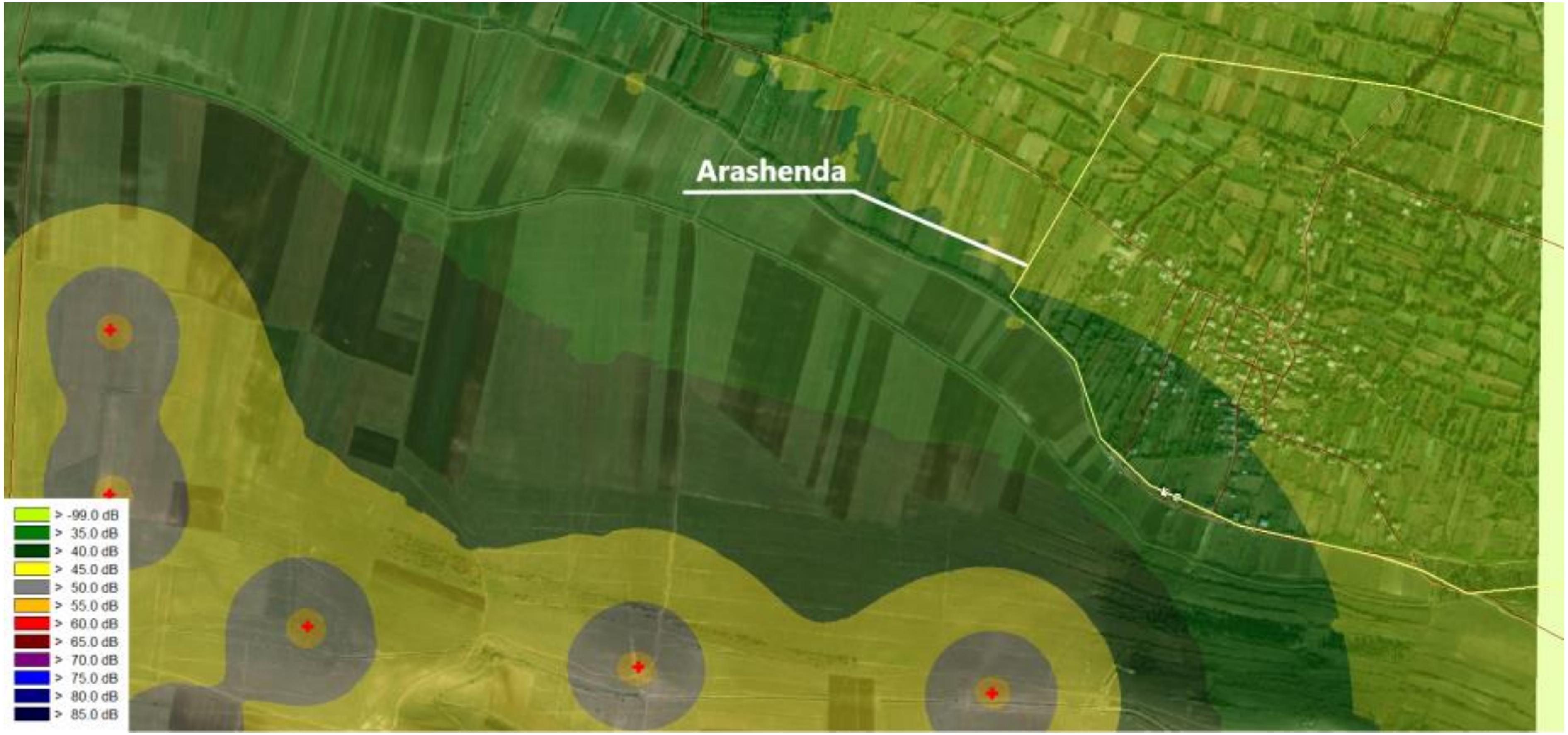


Figure 6-9 Propagation of noise in the vicinity of Arashenda village - Turbine Height - 105 m.

Figure 6-10 Propagation of noise in the vicinity of Breti village and Breti Meurneoba - Turbine Height - 105 m.

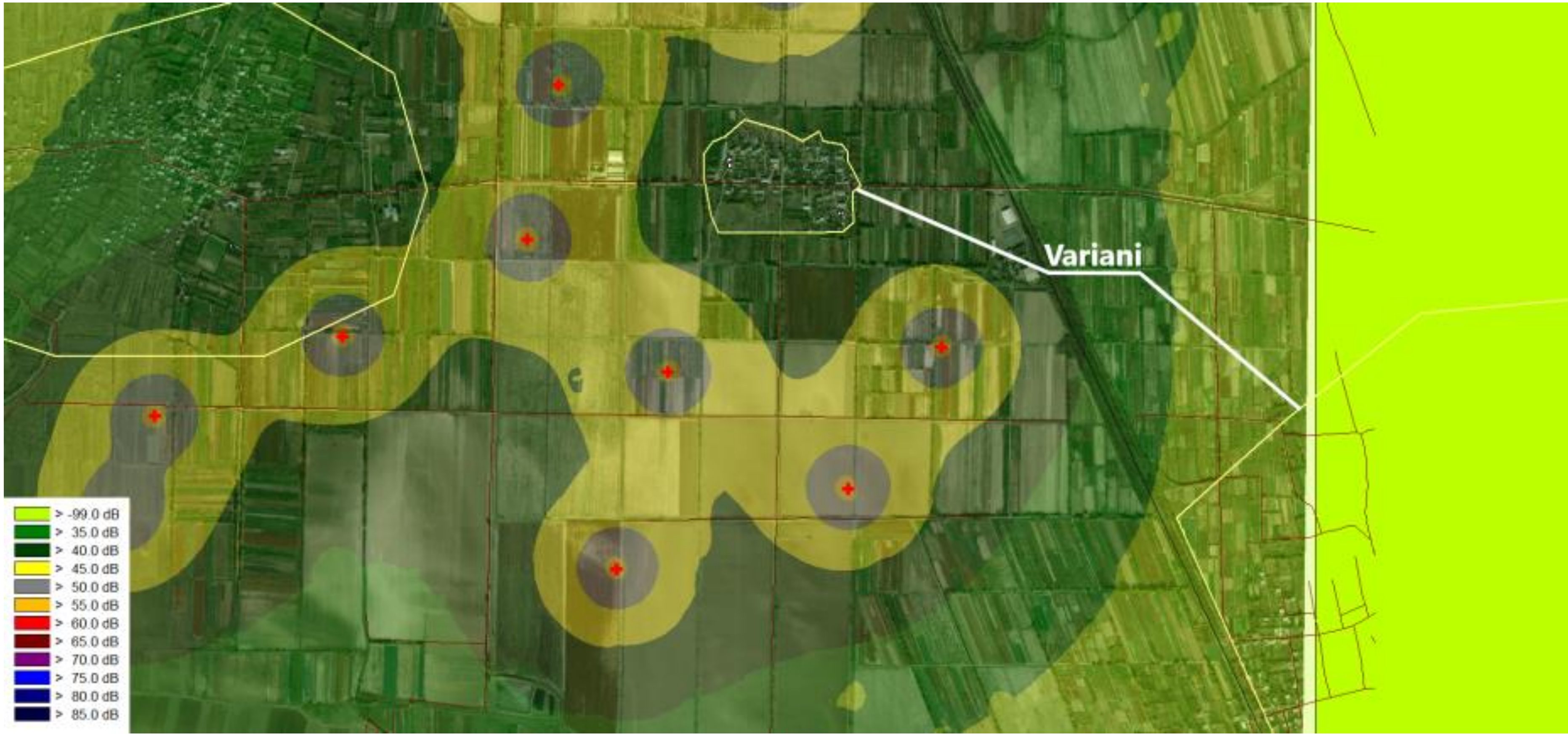


Figure 6-11 Propagation of noise in the vicinity of Variani village and Variani Meurneoba - Turbine Height - 105 m.

Figure 6-12 Propagation of noise in the vicinity of Ruisi village - Turbine Height - 105 m.

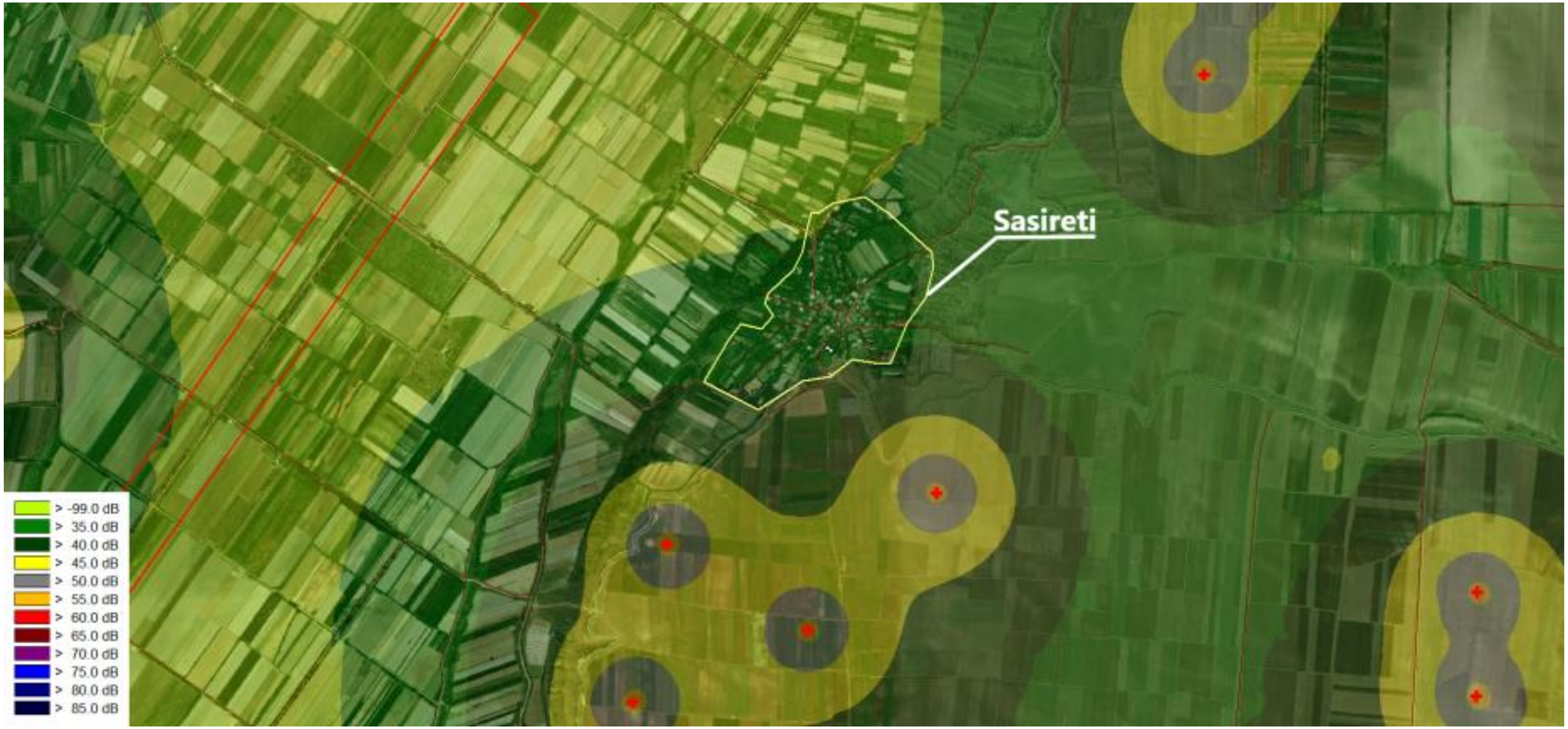


Figure 6-13 Propagation of noise in the vicinity of Sasireti village - Turbine Height - 105 m.

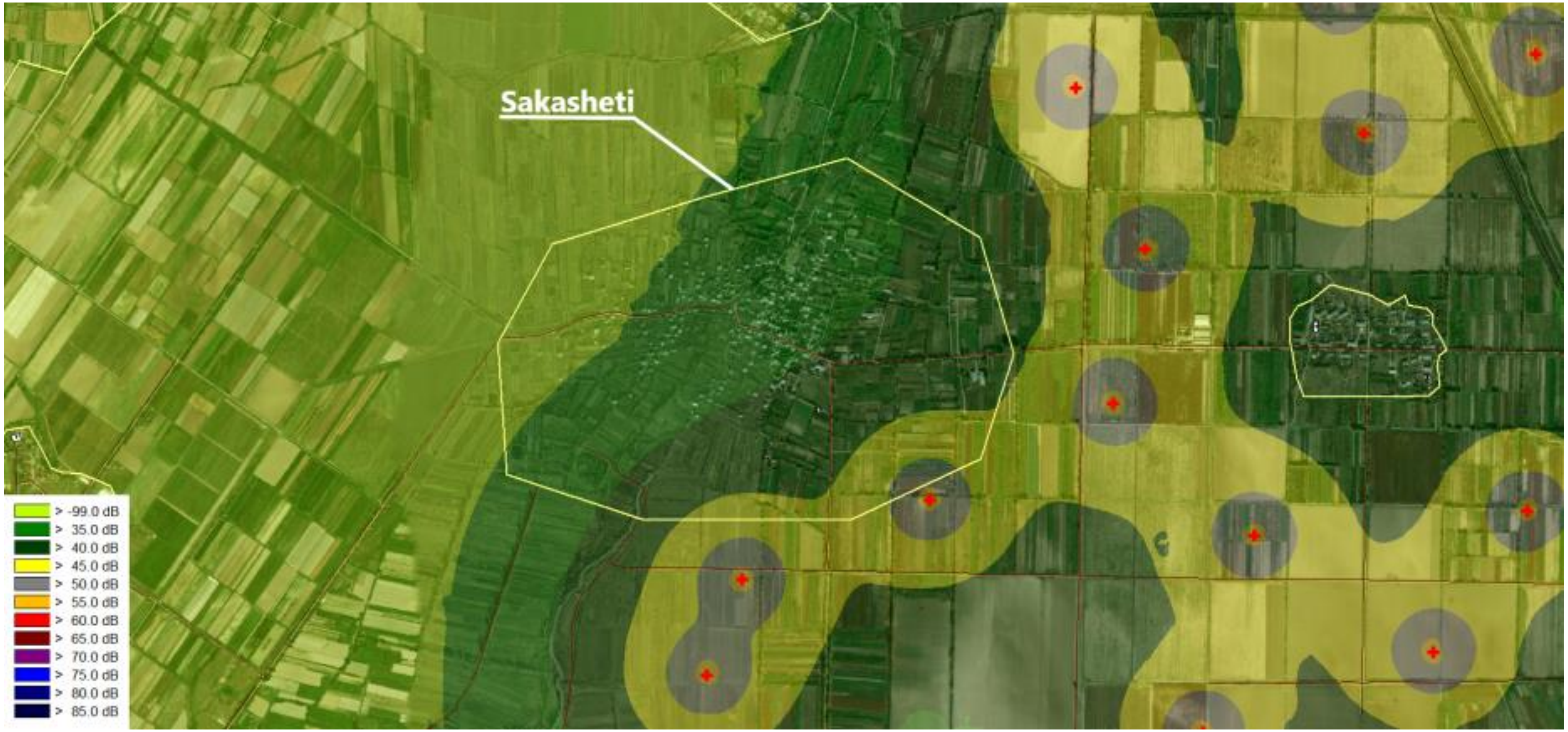


Figure 6-14 Propagation of noise in the vicinity of Sakasheti village - Turbine Height - 105 m.

Figure 6-15 Propagation of noise in the vicinity of Sagolasheni village - Turbine Height - 105 m.

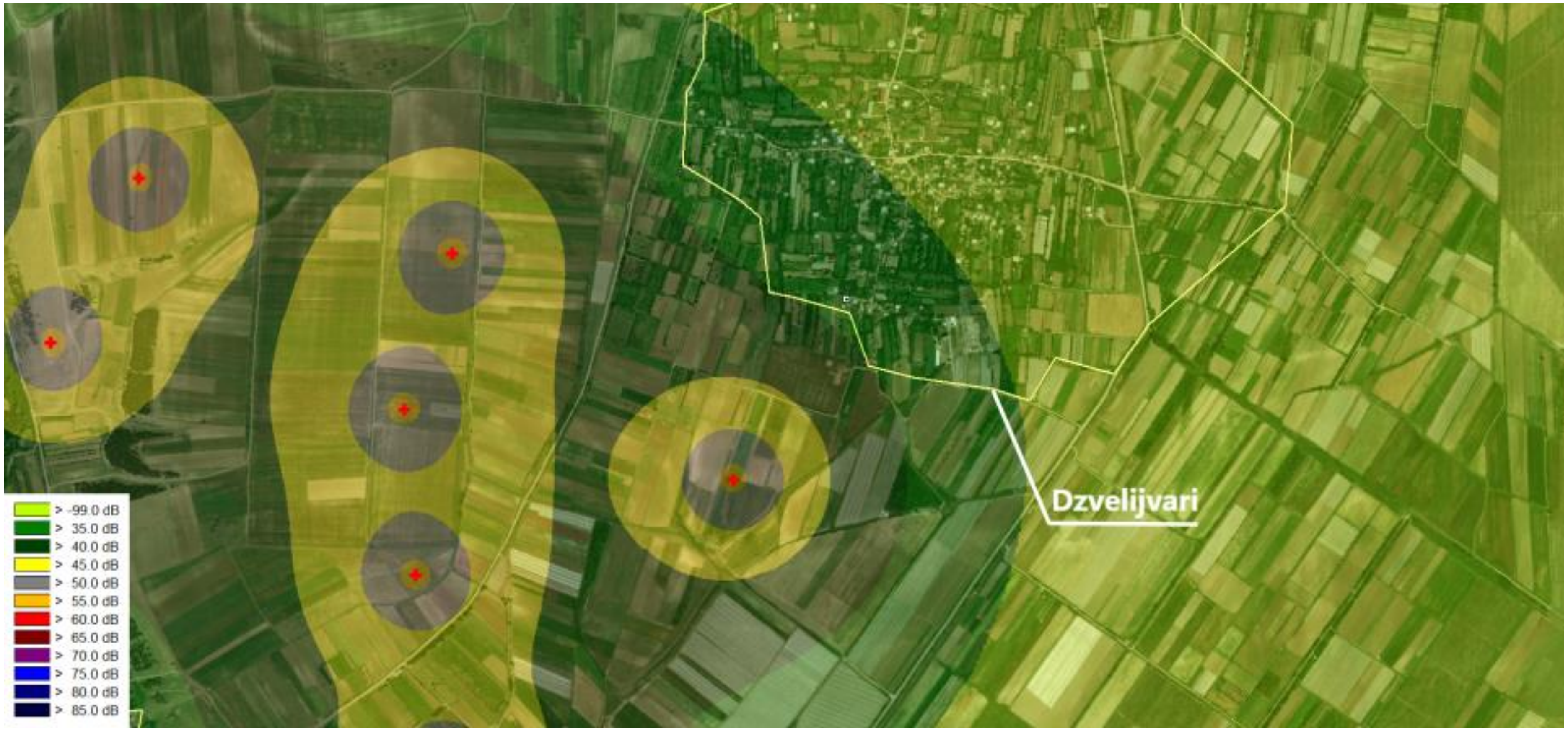


Figure 6-16 Propagation of noise in the vicinity of Dzvelijvari village - Turbine Height - 105 m.

Figure 6-17 Propagation of noise in the vicinity of Bebnisi village - Turbine Height - 105 m.

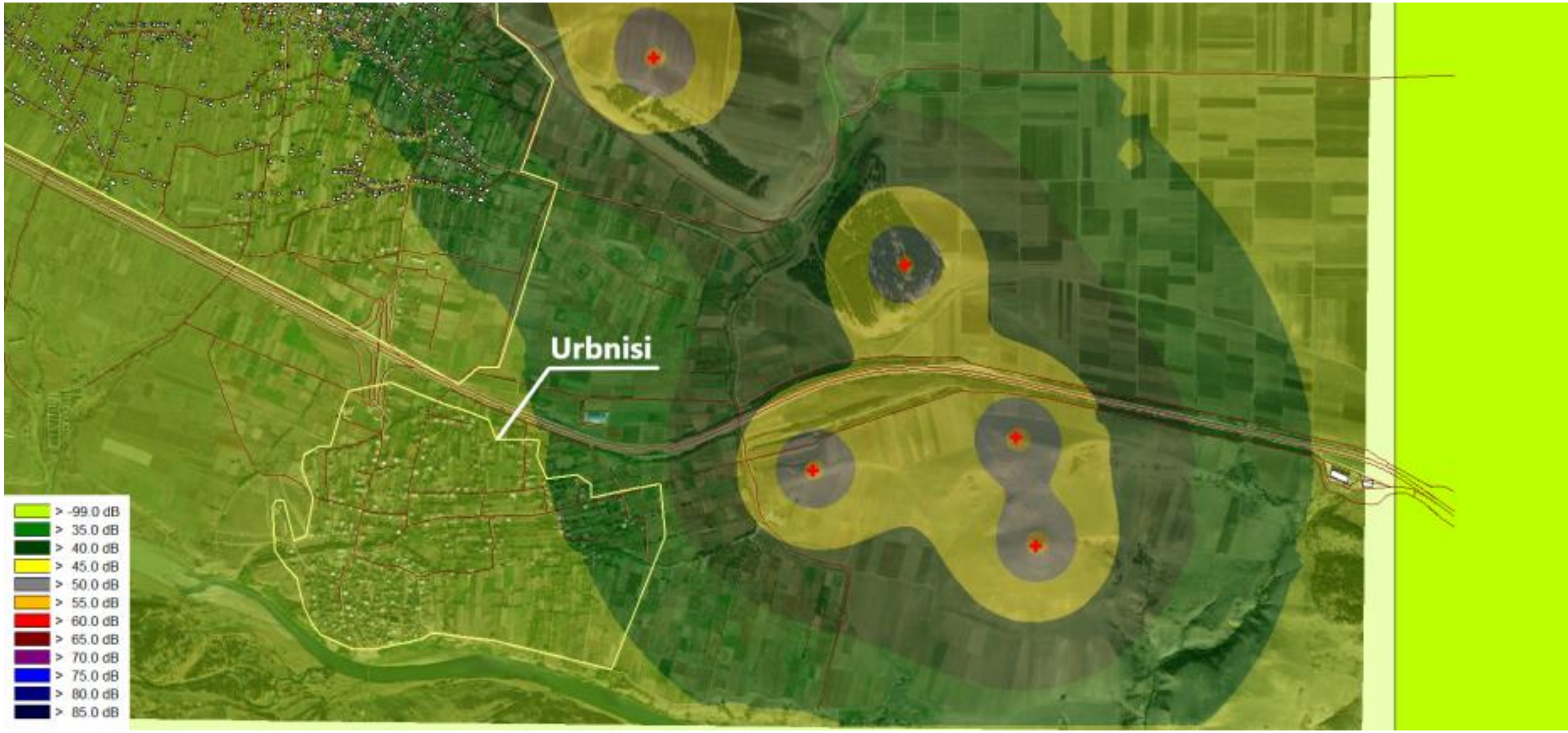


Figure 6-18 Propagation of noise in the vicinity of Urbnisi village - Turbine Height - 105 m.

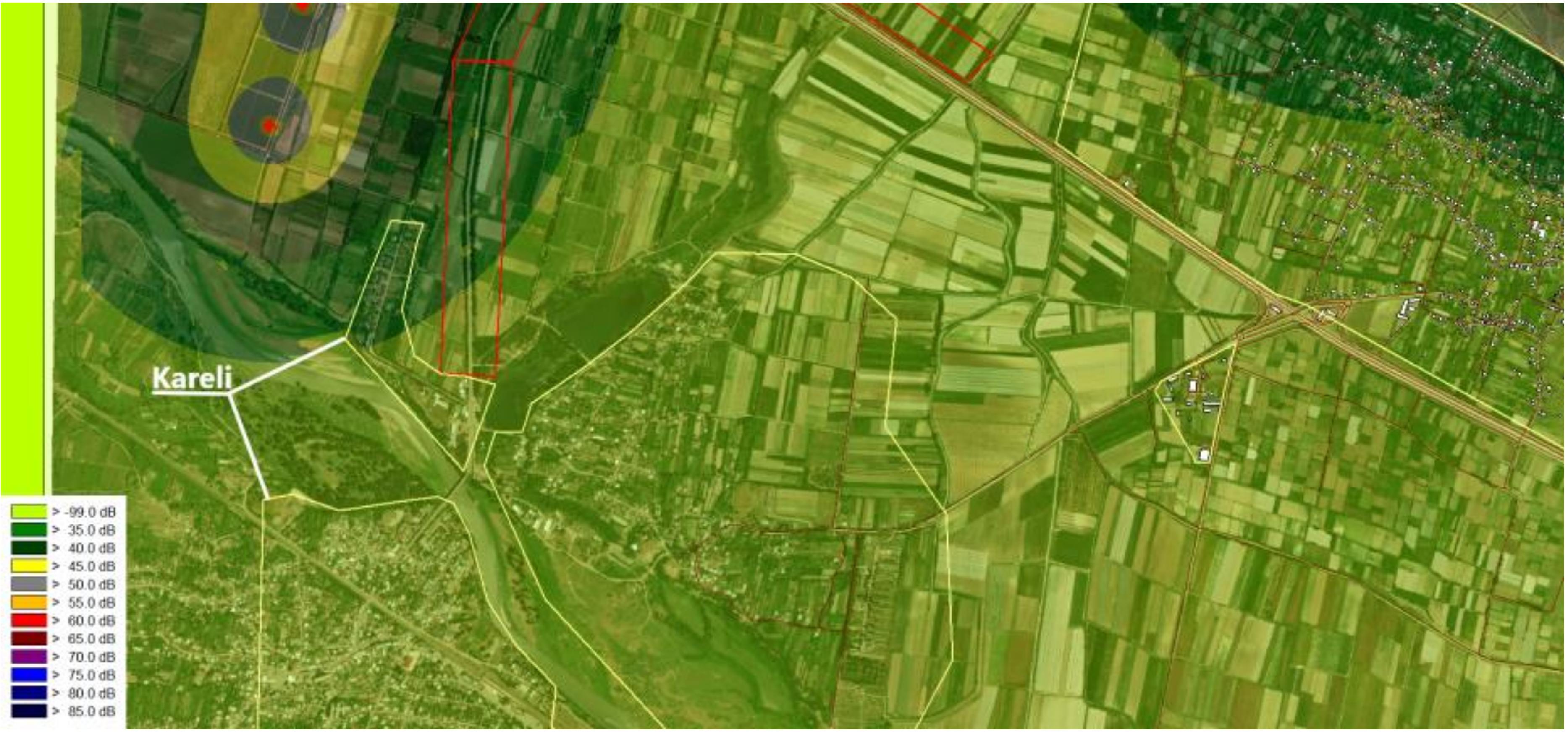


Figure 6-19 Propagation of noise in the vicinity of Kareli - Turbine Height - 105 m.

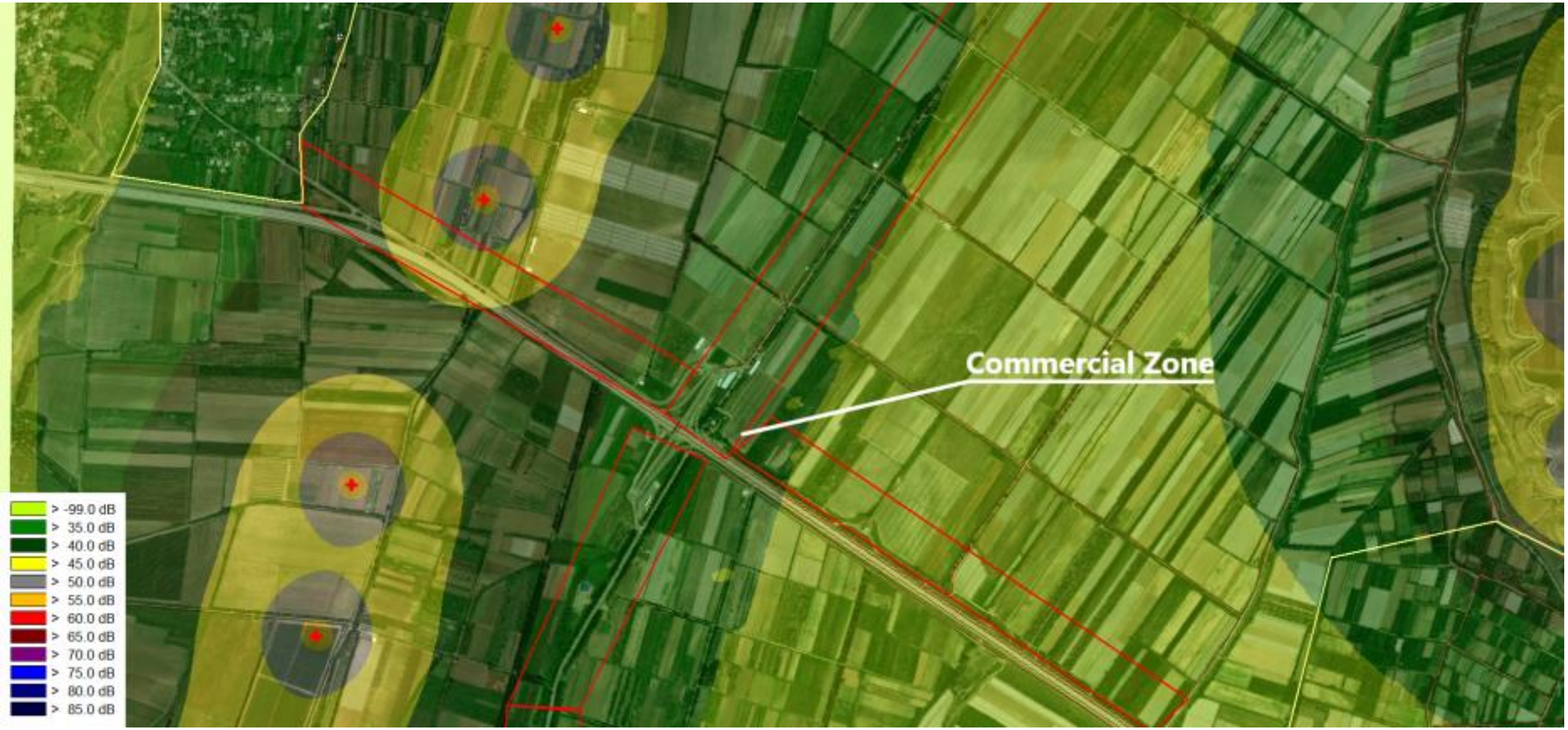


Figure 6-20 Propagation of noise in the vicinity of Commercial zone - Turbine Height - 105 m.

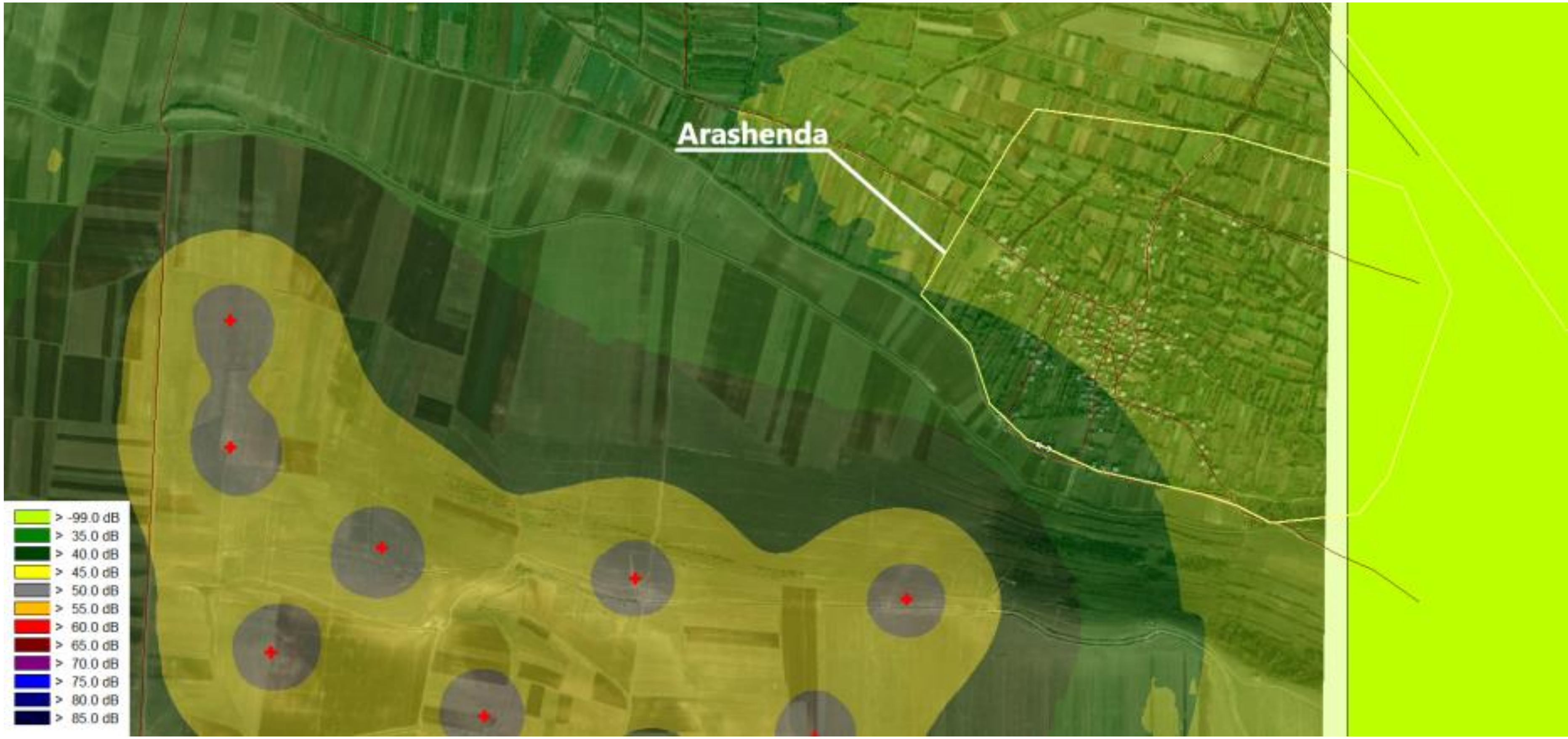


Figure 6-21 Propagation of noise in the vicinity of Arashenda village - Turbine Height - 150 m.

Figure 6-22 Propagation of noise in the vicinity of Breti village and Breti Meurneoba - Turbine Height - 150 m.

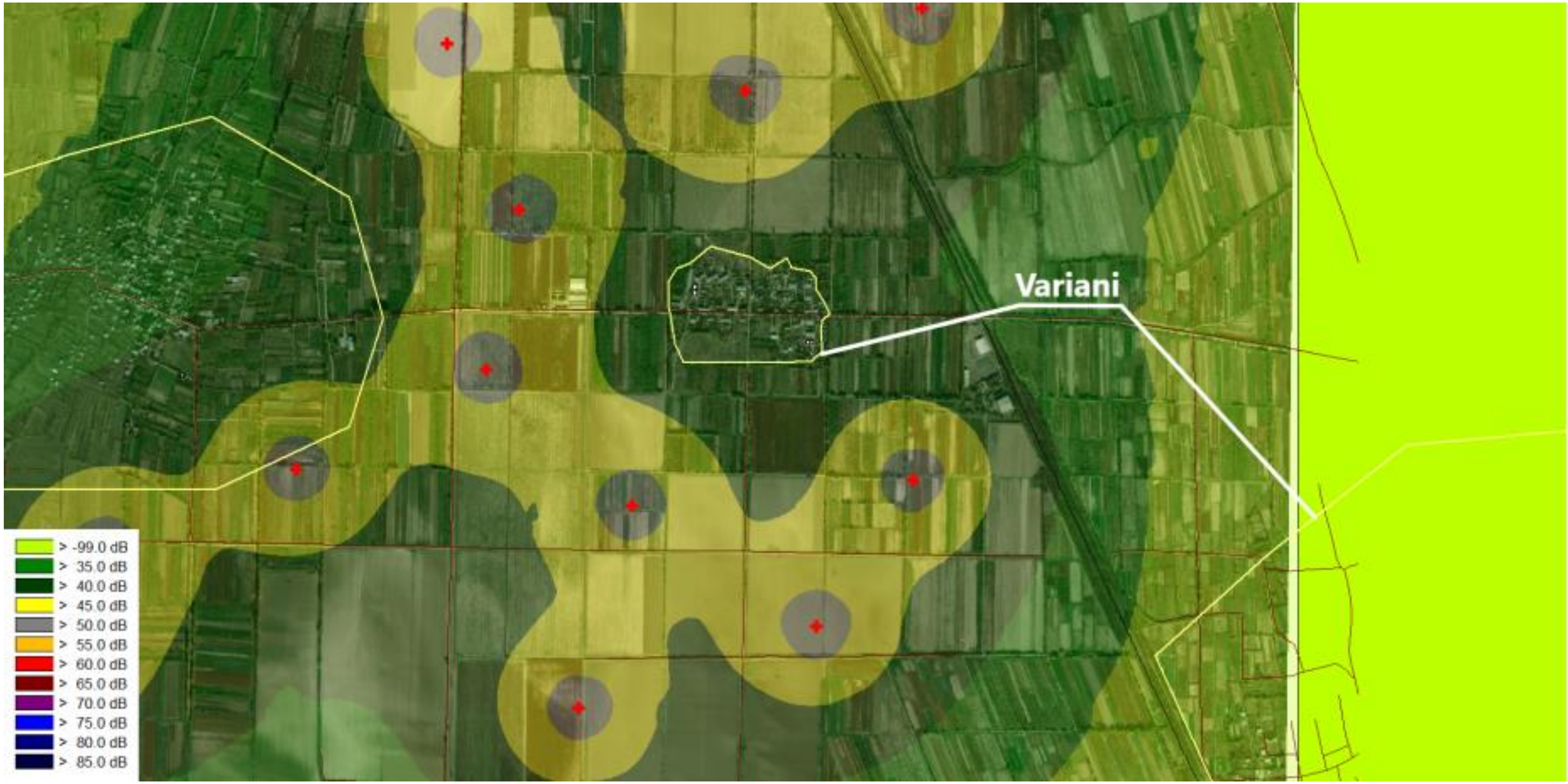


Figure 6-23 Propagation of noise in the vicinity of Variani village and Variani Meurneoba - Turbine Height - 150 m.

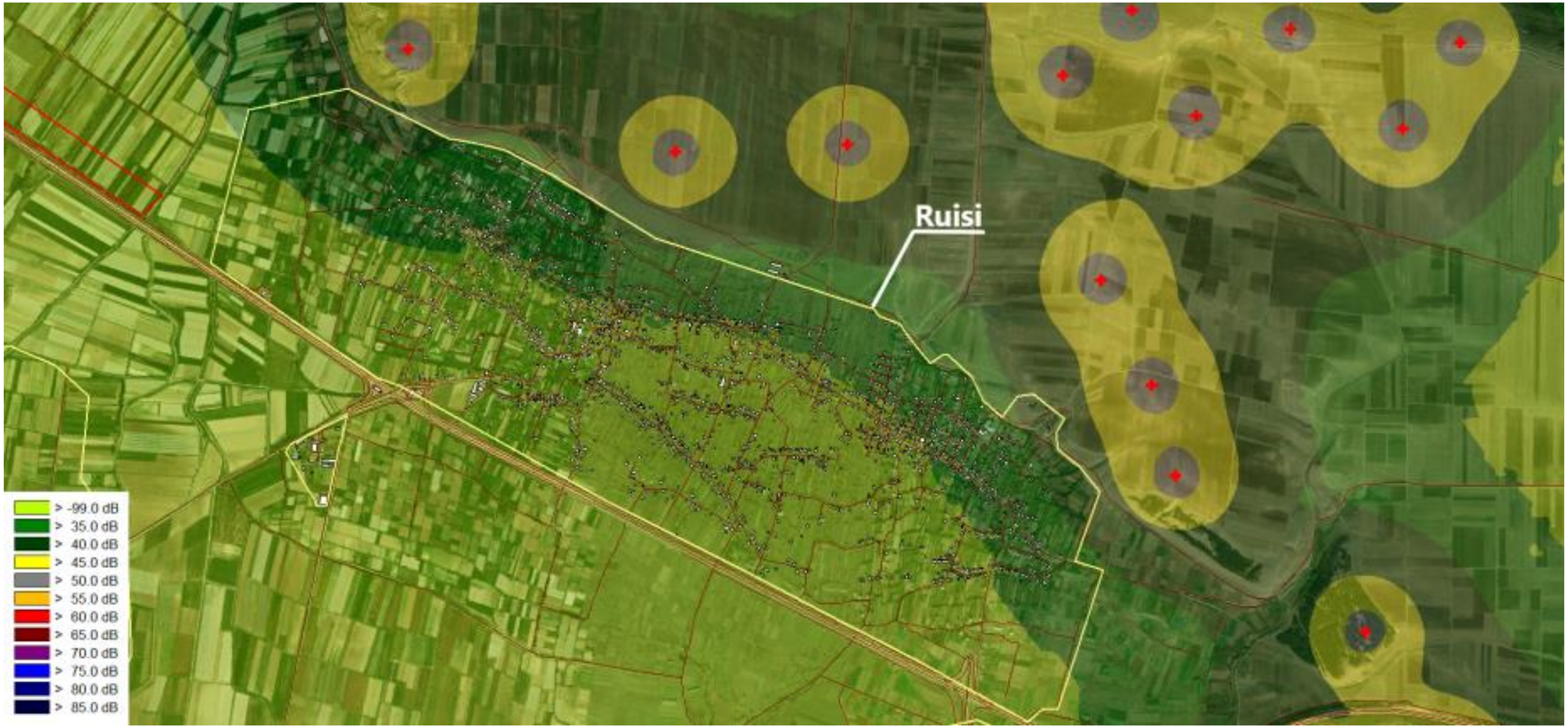


Figure 6-24 Propagation of noise in the vicinity of Ruisi village - Turbine Height - 150 m.

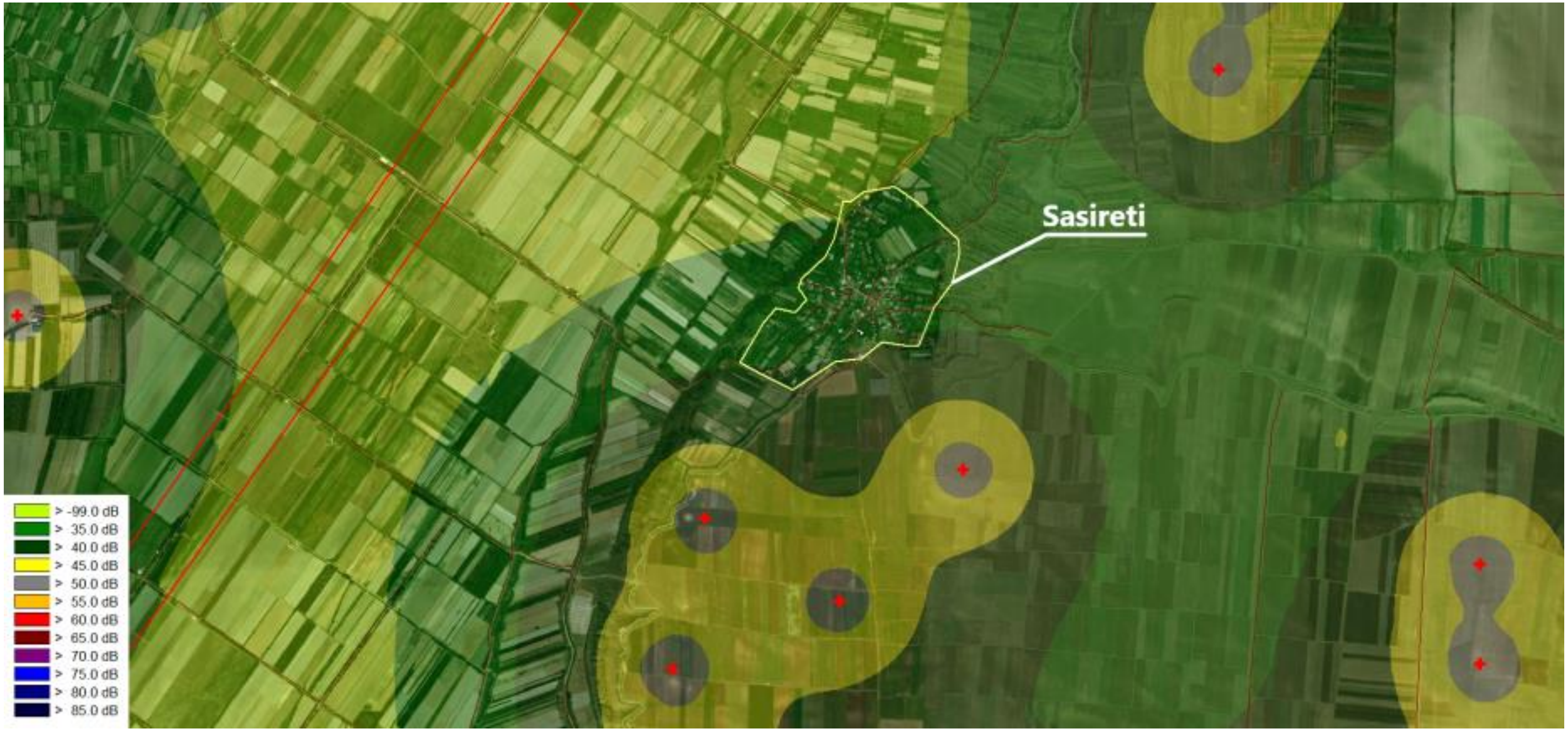


Figure 6-25 Propagation of noise in the vicinity of Sasireti village - Turbine Height - 150 m.

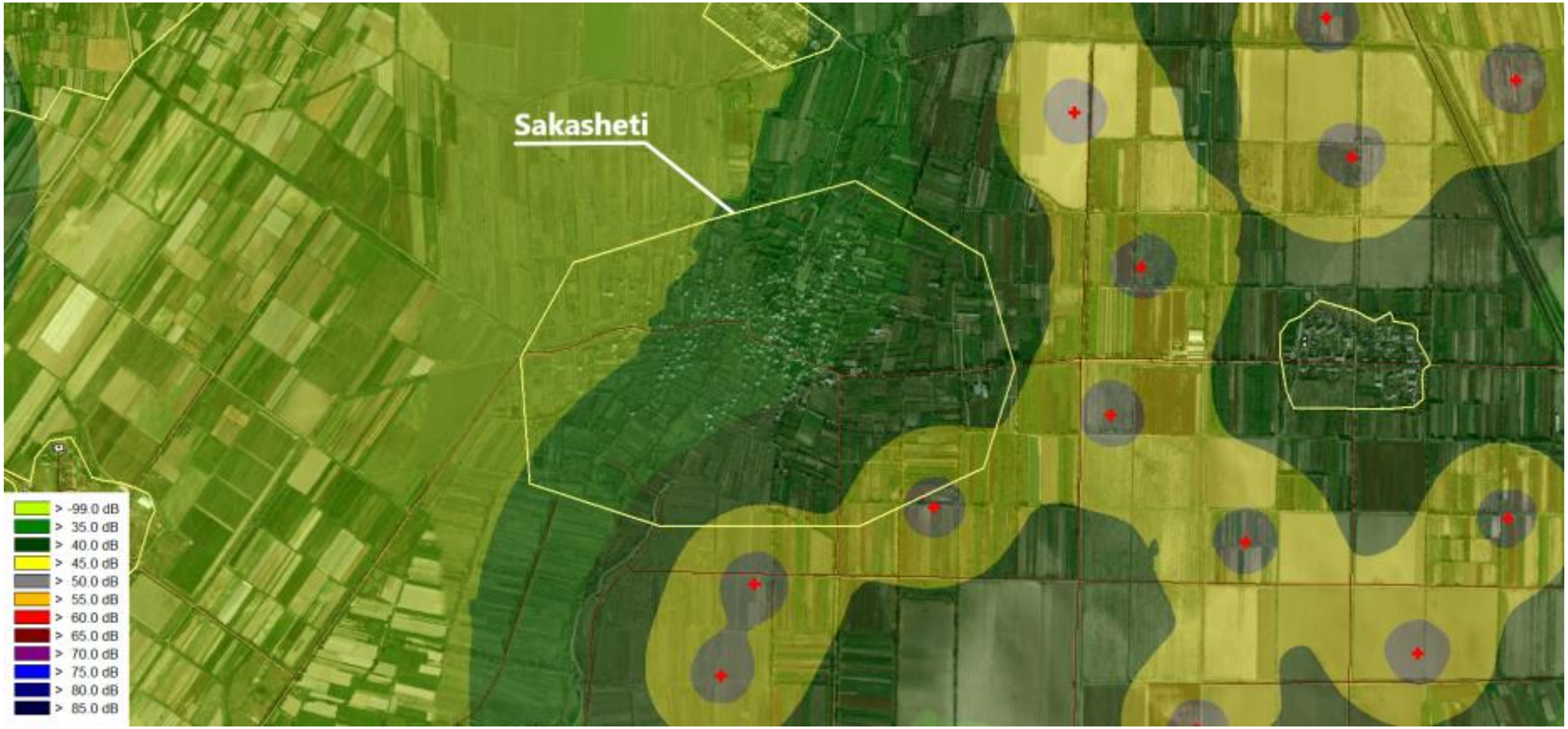


Figure 6-26 Propagation of noise in the vicinity of Sakasheti village - Turbine Height - 150 m.

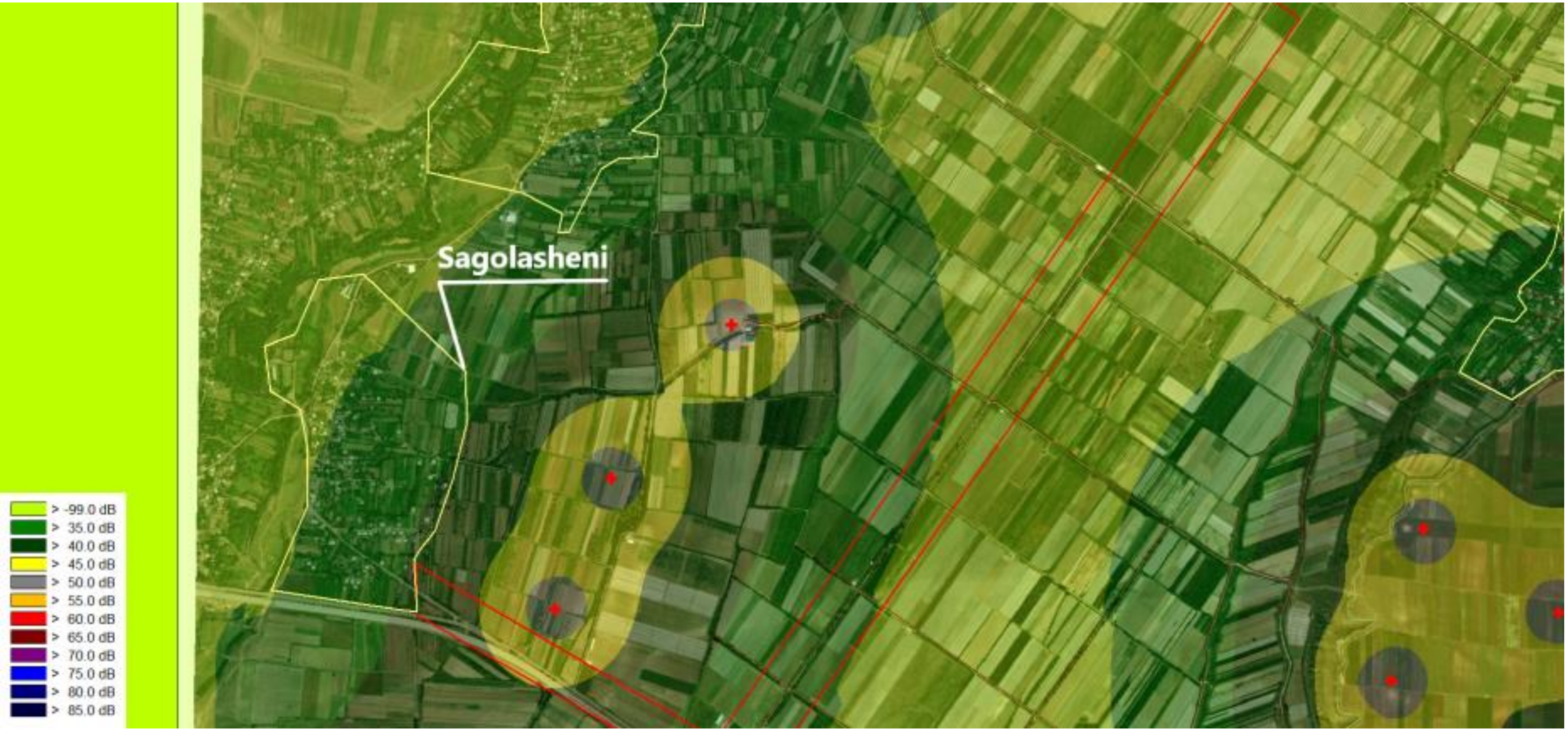


Figure 6-27 Propagation of noise in the vicinity of Sagolasheni village - Turbine Height - 150 m.

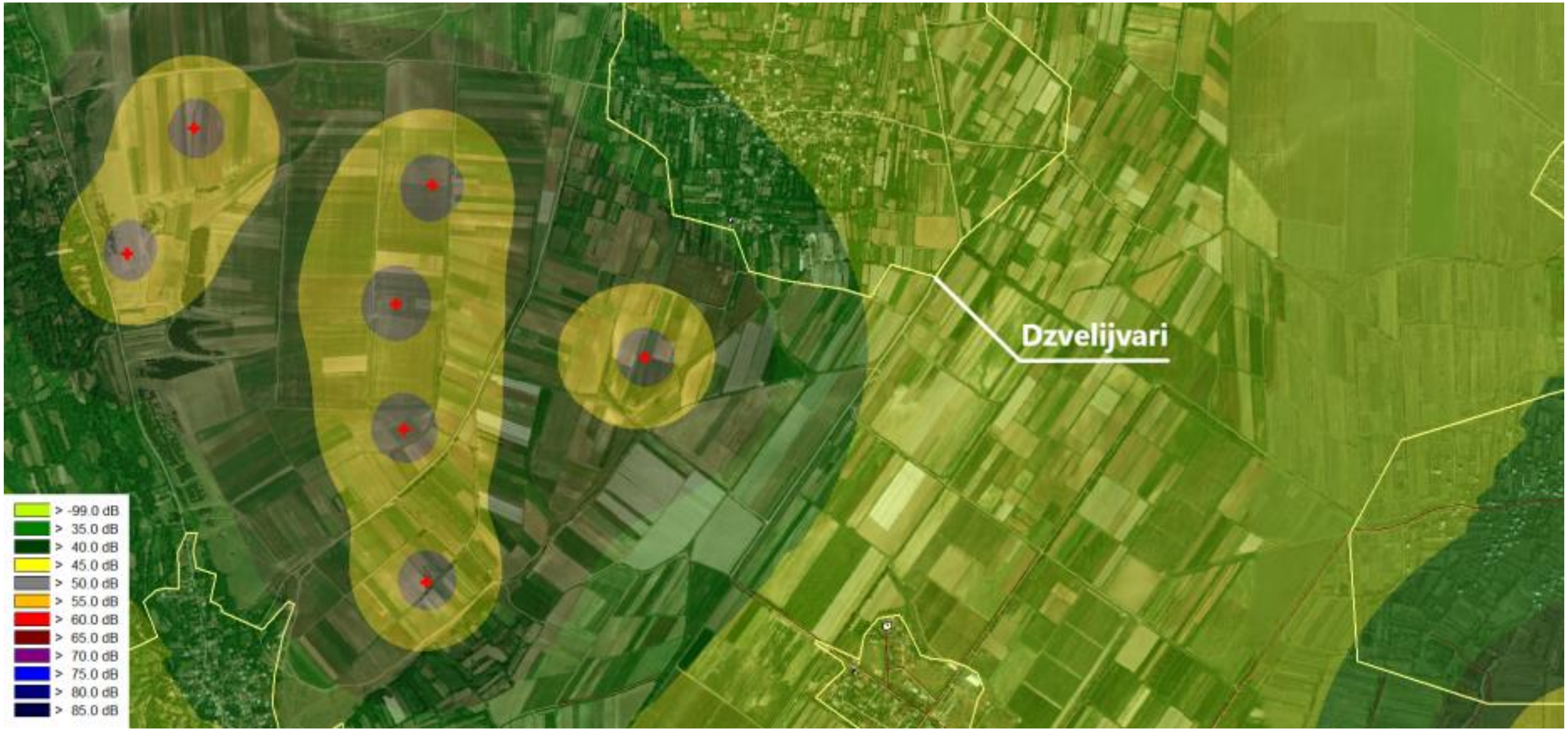


Figure 6-28 Propagation of noise in the vicinity of Dzvelijvari village - Turbine Height - 150 m.

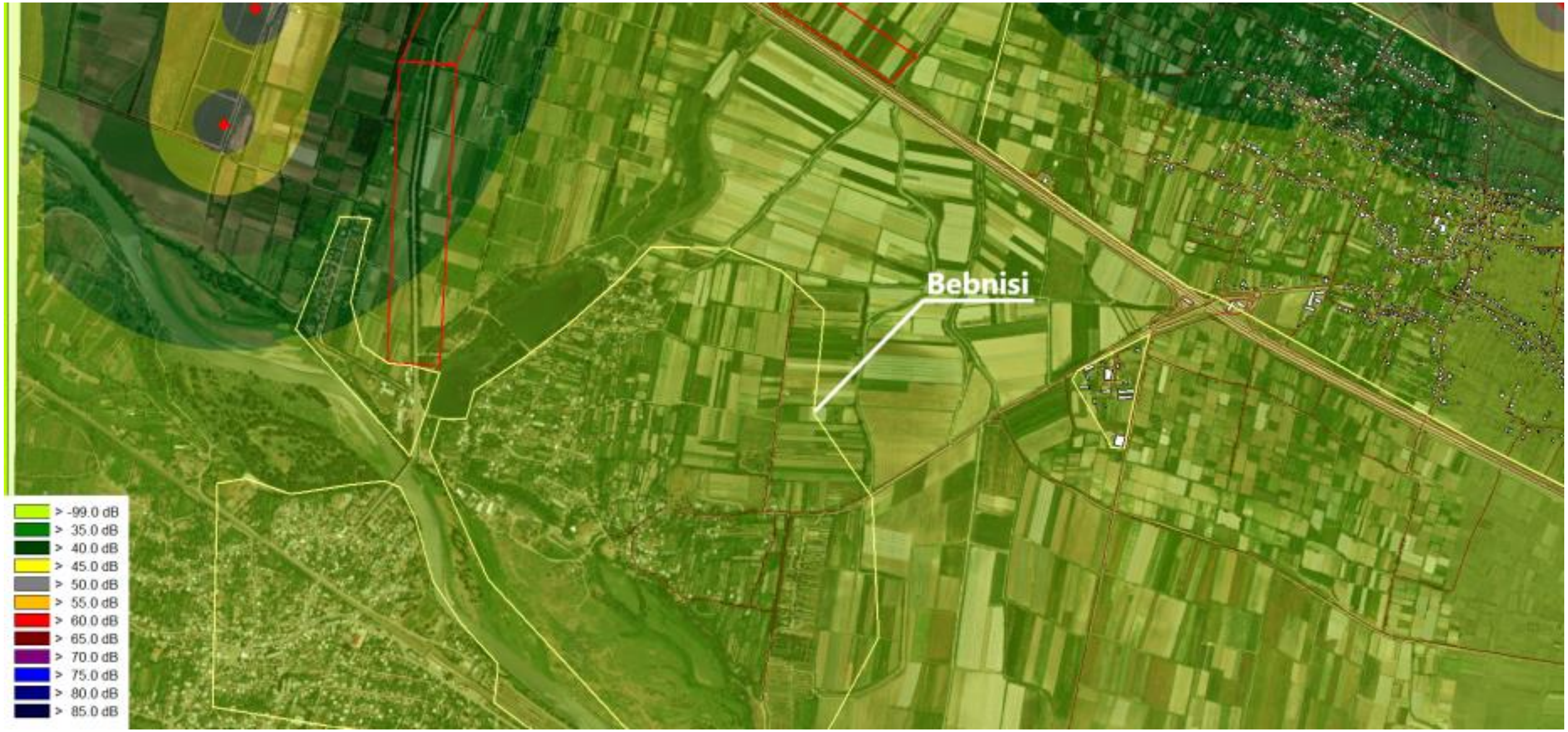


Figure 6-29 Propagation of noise in the vicinity of Bebnisi village - Turbine Height - 150 m.

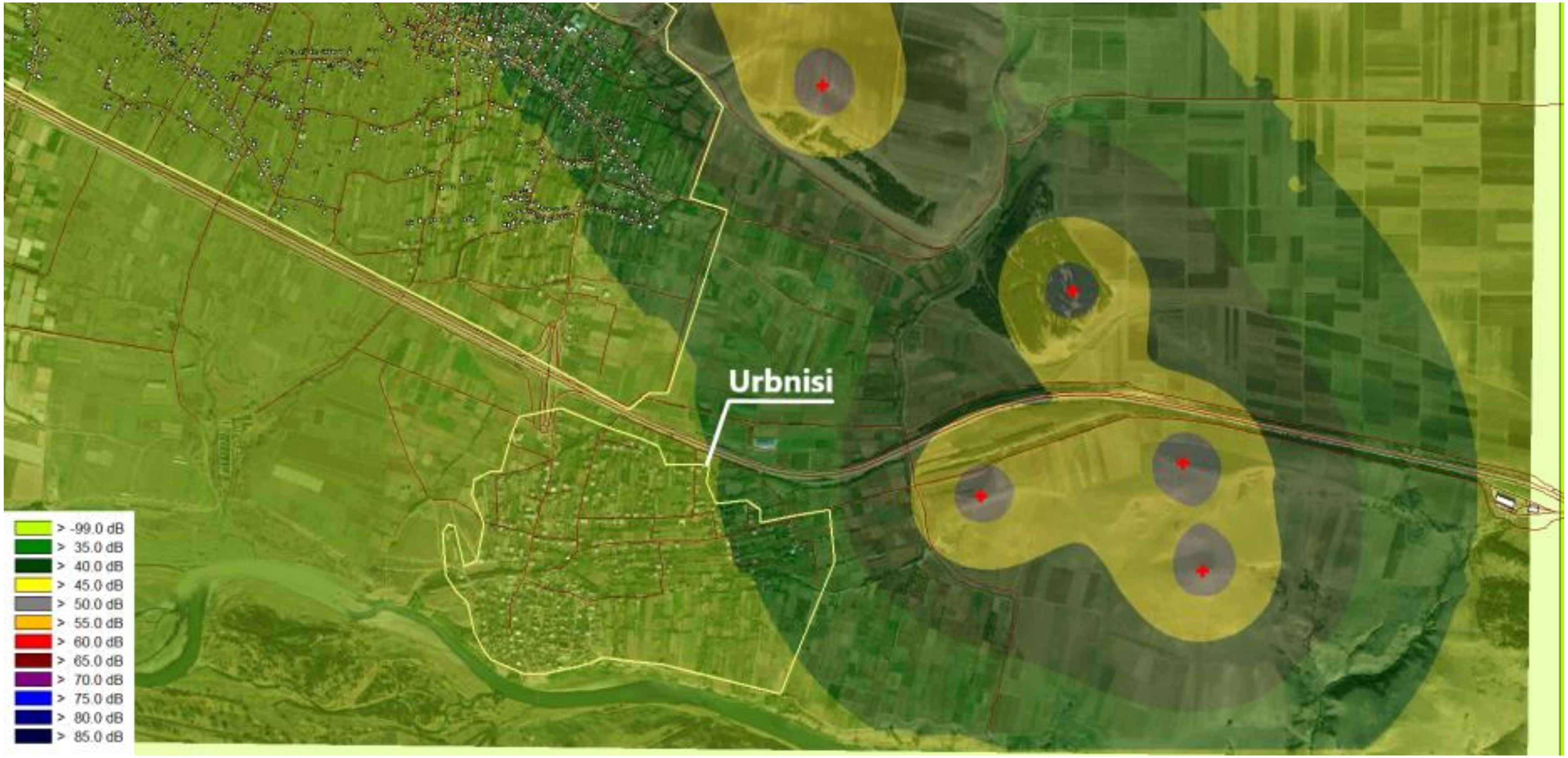


Figure 6-30 Propagation of noise in the vicinity of Urbnisi village - Turbine Height - 150 m.

Figure 6-31 Propagation of noise in the vicinity of Kareli - Turbine Height - 150 m.

Figure 6-32 Propagation of noise in the vicinity of Commercial zone - Turbine Height - 150 m.

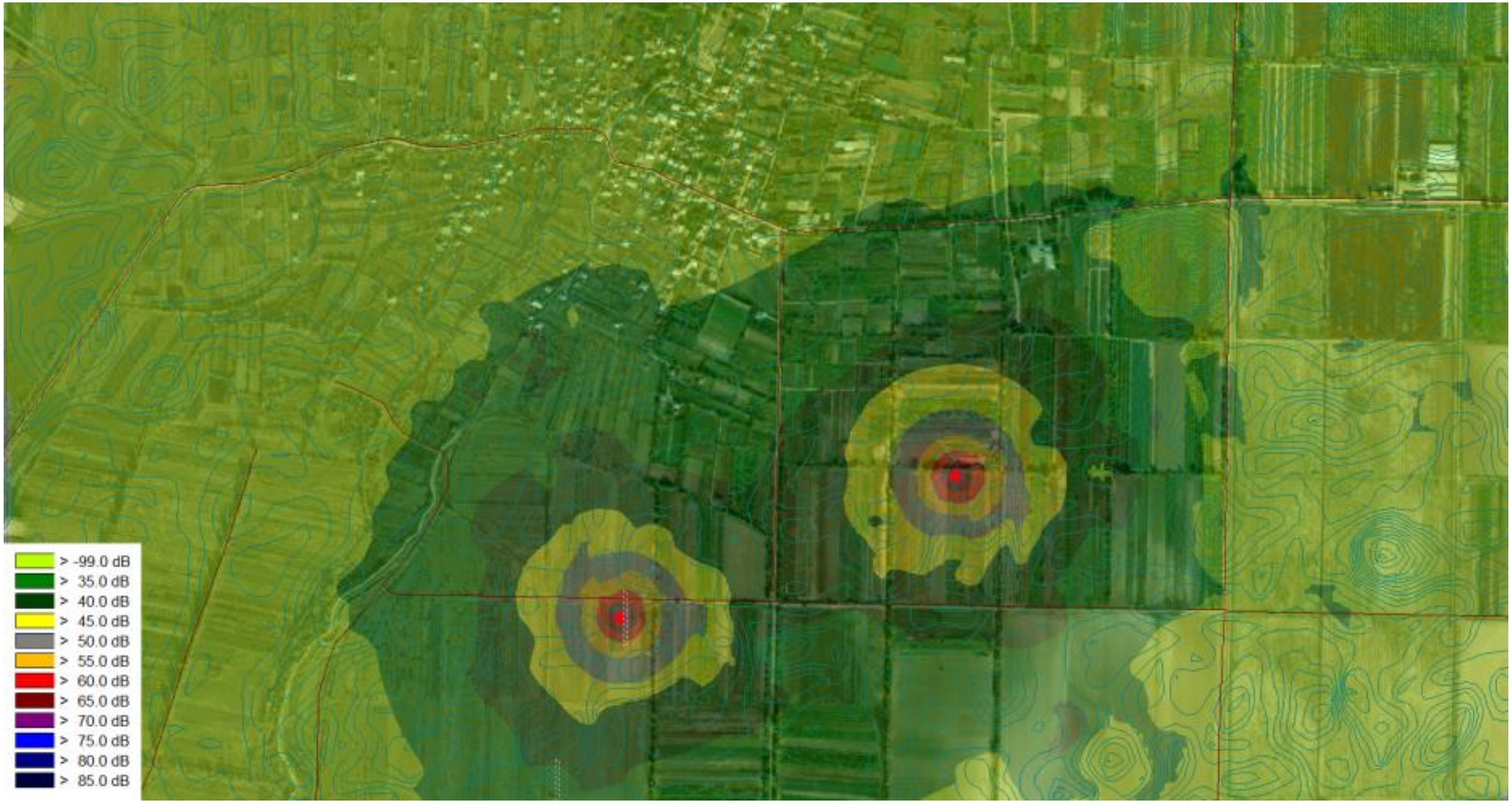


Figure 6-33 Noise propagation for the construction stage, in the vicinity of Sakasheti village (the closest location of construction sites to the settlements and residential houses)

6.5.6 Conclusion

- The noise study (modeling) was done within the scope of Ruisi wind power plant construction project;
- Noise modeling was carried out with worldwide accepted German CadnaA software;
- Works to obtain the input information were provided within the scope of noise modeling, used for modeling.
- The baseline measurements were performed on the area of the residential buildings adjacent to the project wind farm. The measurement was performed from 2022/09/17 to 2022/09/18. The noise measurement was performed continuously for 24 hours. Baseline noise measurements were performed at 5 locations adjacent to the project wind farm;
- As the obtained results evidence, in the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 40 dBA at the nearest building found in village Arashenda (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia;
- In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 40 dBA at the nearest building found in village Breti (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia;
- In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 42 dBA at the nearest building found in village Variani (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia;
- In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 42 dBA at the nearest building found in village Ruisi (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia;
- In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 40 dBA at the nearest building found in village Sasireti (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia;
- In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 41 dBA at the nearest building found in village Sagholasheni (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia;
- In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 40 dBA at the nearest building found in village Dzvelijvari (in both scenario (105 m. and 150 m.)). This noise level is lower than the day and night noise standards established by the legislation of Georgia;
- In the wind turbines operation phase, the level of noise caused by the wind turbine operation will not exceed 43 dBA at the nearest building found in village Sakasheti (in both scenario (105 m. and 150 m.). This noise level is lower than the day and night noise standards established by the legislation of Georgia;
- Noise modeling results for the wind turbines construction phase are given for the nearest residential houses in village Sakasheti, which are located closest the two turbines. The noise level at the nearest building in case of simultaneous installation of two turbines will not exceed

40 dBA. This noise level is lower than the day and night noise standards established by the legislation of Georgia;

- Overall, as the modeling results have evidenced, the noise level generated in the construction and operation phases of the wind turbines at the nearest residential buildings does not exceed the day and night noise standards established by the legislation of Georgia;
- It should be considered that all calculations above were made for the case of simultaneous operation of all noise sources;
- Noise modeling is also performed in the commercial zone adjacent to the project area. As the modeling results showed, as a result of the operation of the WPP (under both scenarios), the noise levels within the commercial zone do not exceed 55 dBA. In the section of the commercial zone, which is closest to the area where the stations are located, the noise level is 52 dBA. In all other cases, noise levels are much lower (ranging from about 40-45 dBA);
- Since the permissible norm of noise for commercial / industrial purpose buildings is 60 dBA according to the national legislation, exceeding the permissible norm of noise in the mentioned area is not fixed as a result of modeling.

Overall, as the modeling results have evidenced, the noise level generated in the construction and operation phases of the wind turbines at the nearest residential buildings does not exceed the day and night noise standards established by the legislation of Georgia.

6.6 Impact on geodynamic processes

6.6.1 Expected impacts on geodynamic processes during the construction and operation stages

6.6.1.1 Impacts

For the scoping stage, Geoengineering Ltd. carried out a visual survey of the territory, recognition of dangerous geological processes and camera study of archival materials. A plan has been prepared for a detailed engineering geological survey to be carried out at all sites selected for the turbines to determine appropriate design parameters. The results of the preliminary visual survey will also be verified on the basis of additional engineering geological studies. For the scoping stage, based on field reconnaissance and camera works, geologists give the following conclusion:

Directly on the project area, In terms of the development of geological processes and events, no significant threats are fixed in the study area. The rocks forming the slopes are mostly in a stable state. Their development is mainly expected on the deeply cut river slopes as erosion processes and related landslide phenomena, mainly in the erosion valleys of the Mtkvari River and its tributaries. Therefore, the study of landslide phenomena in the study area involves immediately studying erosion processes.

As for the general geological conditions of the region and the surrounding area of the project area: Most of landslides are on the left bank of the Mtkvari River, where lateral erosion develops quite intensely. Often they break off the shoreline as large clumps built with slightly bound alluvial deposits

As for the left small tributaries of the Mtkvari River developed in molassa rocks of Miocene-Pliocene age, they totally depend on the intensity of atmospheric and surface runoff and participate in the regime of erosion processes occurring in the valleys. Therefore, they are activated with spring floods and periods of rainy weather, especially heavy rainfalls. It should be noted that the said landslide bodies are not only locally spread near the valley. Rather, they often extend and occupy adjacent areas, what is once again due to the development of erosion processes, especially lateral erosion.

Erosion processes, as mentioned above, are associated with the left tributaries of the Mtkvari River. The erosion network has dense branches and covers large areas in the northern areas of Urbnisi village taking place due to easily erodible constituent rocks.

Another type of erosion to distinguish among the erosion processes occurring in the study area is plane erosion, more related to the crests and other positive relief forms in the area, especially in areas devoid of the tree and grass cover.

As for the hazardous geological processes and phenomena developed within the study area (following the project goals), attention should be paid to suffosive phenomena, which may develop in the clay-sandy rocks of Pliocene age. It should also be noted that suffosive forms are not characterized by mass distribution, although they often develop in a latent form, and it requires some effort for researchers to identify them.

In addition to the above-mentioned, we can note bogging of some areas caused by the failure of irrigation systems or improper use of the irrigation water

There are also rock avalanches over the steep sections of high slopes, which mostly appear in the area of Pliocene conglomerates

Landslides occupy limited areas within the study area and are mostly associated with the same valleys where landslide and erosion processes occur, although their occurrence is less dangerous and they flow into the valley bed only as small streams.

The hazardous geological processes and phenomena described above develop in places remote from the study areas (7 areas) and therefore, do not pose any threat to the construction of the design tower-turbines.

6.6.1.2 Conclusions and Recommendations

The analysis and evaluation of the data of the office and field reconnaissance studies of the engineering and geological conditions of the Ruisi Wind Farm area allow drawing the following conclusions

- According to the building and climatic zoning, the study area belongs to the II^b region and is a part of a hot sub-region of a moderately humid region of East Georgia with an average air temperature of +21-26 to -1+2°C.
- In terms of geomorphology, the area is a part of Shida Kartli Plain with low and medium-high hilly plateaus, gentle slopes and terraced accumulative relief.
- According to the tectonic zoning map of Georgia, the study area is a part of Mukhranti-Tiriponi subzone of the eastern subsidence of the Georgian Block, the geological structure of which is presented by marine molassa deposits of Neogene Meotic-Pontic, Sarmatian, Karagan-Concian and Chokrak stages - the conglomerates, sandstones, gravelites and argillite-like clays. These main rocks are covered by Quaternary aluvial, aluvial-proluvial, deluvial-proluvial, eluvial and artificial grounds.
- In a hydrogeological view, the territory belongs to Kartli subregion of porous-fissure waters, which is a part of the artesian basin of the Georgian Block. Three (III, IV and V) of the conditionally selected 7 sites in the area deserve special attention, where groundwaters may outcrop at the depths of 1-3 and 3-6 m. In other four sites (I, II, VI and VII) groundwater is not expected to expose.

- According to the macroseismic intensity map of Georgia, all 7 sites of the study area belong to the 8-point seismic zone with a non-dimensional seismicity coefficient of 0.20-0.21.
- Depending on the geological, hydrogeological, engineering-petrological and engineering-geodynamic conditions, according to Annex 10 of Building Norms and Rules 1.02.07-87 (Engineering Surveys for Construction), with the complexity of the engineering-geological conditions, the design sites of the tower-turbines of Ruisi Wind Farm are of a medium complexity and belong to the II category.
- With further detailed studies, we should obviously expect to identify much more engineering-petrological units instead of 12 lithostratigraphic complexes identified in the attached schematic engineering-geological map (scale 1:25 000).
- The study area is characterized by plain engineering and geodynamic conditions. No hazardous geological processes and phenomena are recorded in it.
- Based on the analysis and assessment of the engineering-geological information obtained from the preliminary studies, it can be concluded that the conditions for the construction of Ruisi tower-turbines are favorable and, with a high probability, no geological complications are expected. Obviously, this assumption needs to be appropriately confirmed in the next phase with detailed engineering and geological surveys.
- The program of engineering-geological surveys, which must be realized to develop the detailed design, must be based on the exact coordinates of the location of individual design objects of the WPP (Wind Farm) (tower-turbine, power transformer unit, access road, etc.) and static and dynamic loads transmitted from them to the grounds of the foundation base.
- The program of engineering-geological surveys necessary to develop the detailed design of Ruisi tower-turbine, power unit and access roads to them is given below (**Table 6-15**.). The program can be specified by agreement with the **JSC Wind Power** taking into account the above recommendations.

Table 6-15 The program of engineering-geological surveys necessary to develop the detailed design of Ruisi tower-turbine

№	Description	Unit of measurement	Number in different study sites								Total
			Site I	Site II	Site III	Site IV	Site V	Site VI	Site VII	Voltage substation	
1	**Field survey works**										
1.1	Layout of survey points (boreholes, pits, VES), identifying their coordinates and levels at the towers locations.	1 tower	11	7	15	7	6	1	3	1	**51**
1.2	Layout of survey points (boreholes, pits, VES), identifying their coordinates and levels along the access roads and cable lines.	1 point									**0**
1.3	Drilling vertical boreholes up to 10 m deep by sampling and detailed engineering-geological documentation	Borehole	11	7	_	7	_	1	3		**29**
		Lin. M.	110	70	_	70	_	10	30		**290**

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№	Description	Unit of measurement	Number in different study sites								Total
			Site I	Site II	Site III	Site IV	Site V	Site VI	Site VII	Voltage substation	
1.4	Drilling vertical boreholes up to 15 m deep by sampling and detailed engineering-geological documentation.	Borehole	_	_	15	_	6	_	_	1	**22**
		Lin. M.	_	_	225	_	90	_	_	15	**330**
1.5	Standard dynamic penetration test (SPT) in boreholes with 1.5 m intervals	1 Borehole	11	7	15	7	6	1	3	1	**51**
1.6	Drilling holes up to 3 m deep by sampling and detailed engineering-geological documentation on the tower-turbine grounds	1 Hole	11	7	15	7	6	1	3	1	**51**
1.7	Drilling holes up to 3 m deep by sampling and detailed engineering-geological documentation along the access roads and cable lines, with the length of 50-53 km	1 hole	30	30	32	16	10	12	5	_	**135**
1.8	Vertical electrical sounding (VES)	Pc.	37	29	46	22	17	8	9	3	**171**
2	**Laboratory works**										
2.1	Study of the physical properties of grounds	1 set	33	21	45	21	18	5	15	5	**163**
2.2	Study of the mechanical properties of grounds	1 set	33	21	45	21	18	5	15	5	**163**
2.3	Standard ground cimpaction	1 trial	11	7	15	7	6	1	3	1	**51**
2.4	Chemical analysis of grounds (pH, chlorides, sulphates)	1 analysis	22	14	30	14	12	2	6	2	**102**
2.5	Chemical analysis of ground waters (pH , content of sulphates, content of chlorides)	1 analysis			15		6			1	**22**
3	**Office works**										
3.1	Desk processing of the results of field and laboratory studies, drafting engineering-geological sections, defining the rated and estimate values of the physical and mechanical properties of grounds.	1 set	1	1	1	1	1	1	1	1	**8**
3.2	Drafting the geological-engineering report	1 report	1	1	1	1	1	1	1	1	**8**

► **General measures for all construction sites:**

- In order to prevent the development of erosive and landslide processes related to the construction of roads, ditches for the drainage of atmospheric waters should be arranged along the road surface
- After the completion of the construction works, it is necessary to carry out the recultivation works of the areas adjacent to the road corridors and the places where the wind turbines are located, which should take into account the introduction of a fertile layer of soil and the sowing of perennial grasses
- During the ongoing construction works of the wind power station and during the operation phase, it is necessary to monitor erosion processes and, if necessary, take appropriate measures.

6.6.2 Impact on soils

6.6.2.1 Impact

Turbines of Wind Farms and other facilities are planned to place mainly on watershed ridges, as well as on agricultural plots. Main characteristics of mountain-valley terrain on watershed ridges are erosion and denudation processes. Soil layer is shallow. Usually, humus layer is less than 15 cm thick. As for the plateau-like terrain complex, it typically has hilly-erosion and areas, while the soil layer in the adjacent plain areas with agricultural plots is rich and the humus layer is as thick as 30-50 cm.

In terms of impact on soil and landscape, the project area is divided into areas of permanent and temporary impact. Areas of permanent impact are areas containing turbine generator towers, substation, as well as expansions or new sections of access roads. These areas are not subject to reclamation.

The humus layer of the stripped soil in these areas should be used for reclamation of other construction sites, while the bottom layer of the stripped soil should be used for preparation of roads and construction sites.

Temporary impact areas include, first of all, areas of tower installation (areas adjacent to the sites of about 50 turbine-generator towers), where the cranes will be placed. The temporary impact areas also include construction camps and 3 sites allocated for temporary storage of fill.

► Permanent impact areas:

Foundations of turbine towers

- Diameter of the foundation of a turbine tower: 21.0m
- Area: 346.2 m^2
- Humus layer thickness: 0.3m;
- Volume of humus layer stripped for each turbine foundation: 104m^3
- Total volume of humus layer stripped for 46 towers of turbines is: 4784m^3 ;

► Ruisi Substation:

- Area of the substation site: 20 000m^2

   - Average 30 cm of humus layer will be stripped. Consequently, the volume of the stripped humus layer is **6000m^3;**

- Access roads:

   - The total length of the permanent access roads is: 52 187.80 m
   - The area of the access roads and hard platforms is: 336 713.86 m^2
   - Existing roads of at least 2.5 m width are used as access roads. There is no humus layer on the existing roads. The total area of the existing road is approximately 130470m^2. To build roads and platforms, the humus layer will be necessary to strip from the area of 206,243.5 m^2. **The volume of humus layer to strip is 61 873m^3.**

The humus layer, with the volume of 73,073 m^3, will be completely stripped in the areas of permanent impact. This portion of humus layer will be temporarily stored in the adjacent area and used for the reclamation of temporarily occupied areas or will be distributed over adjacent agricultural land in agreement with the landowners.

- Sites with temporary impact:

Construction grounds for turbine installation

The area of each construction ground is approximately 8,500 m^2. 346.2 m^2 of this area will be permanently occupied by the turbines. Accordingly, the additional area occupied by the temporary construction site is approximately 8,154 m^2, while the thickness of the humus layer to strip from each construction site is 8 154m^2 x 0.3 = 2.446 m^3. No ground except for the humus layer will be stripped. Rather, it will be simply levelled locally with graders.

A total of **112 516 m^3** of humus layer will be stripped from 46 sites, which will be stored separately and used for reclamation of the construction sites after the construction is complete.

Construction camp:

The area of the camp with 1 main crane is: 30 m x 55 m (1,650 m²); The project needs a camp with 2 main cranes: 30 m x 110 m with a total area of 3300 m²; A plot adjacent to the substation area (30m x 110m) is allocated for the camp.

The volume of the humus layer stripped during the camp construction is 3300 x 0,3 = 990 m^3;

The volume of humus layer excavated from the cable trenches is 10,000 m^3. This layer will be temporarily stored on the area adjacent to the trenches and used to cover the trenches.

Temporary landfills

Maximum total volume of the soil humus layer allowed to strip from the temporary landfills is 31 560 m^3 . It will be used for reclamation.

A total of no more than 164,860 m^3 of humus will be stripped from the temporary impact areas. The humus layer of the stripped soil will be stored on the adjacent territory and will be used for the reclamation of the temporarily occupied construction sites (camps, construction grounds, landfills) and to cover cable trenches after the construction is complete.

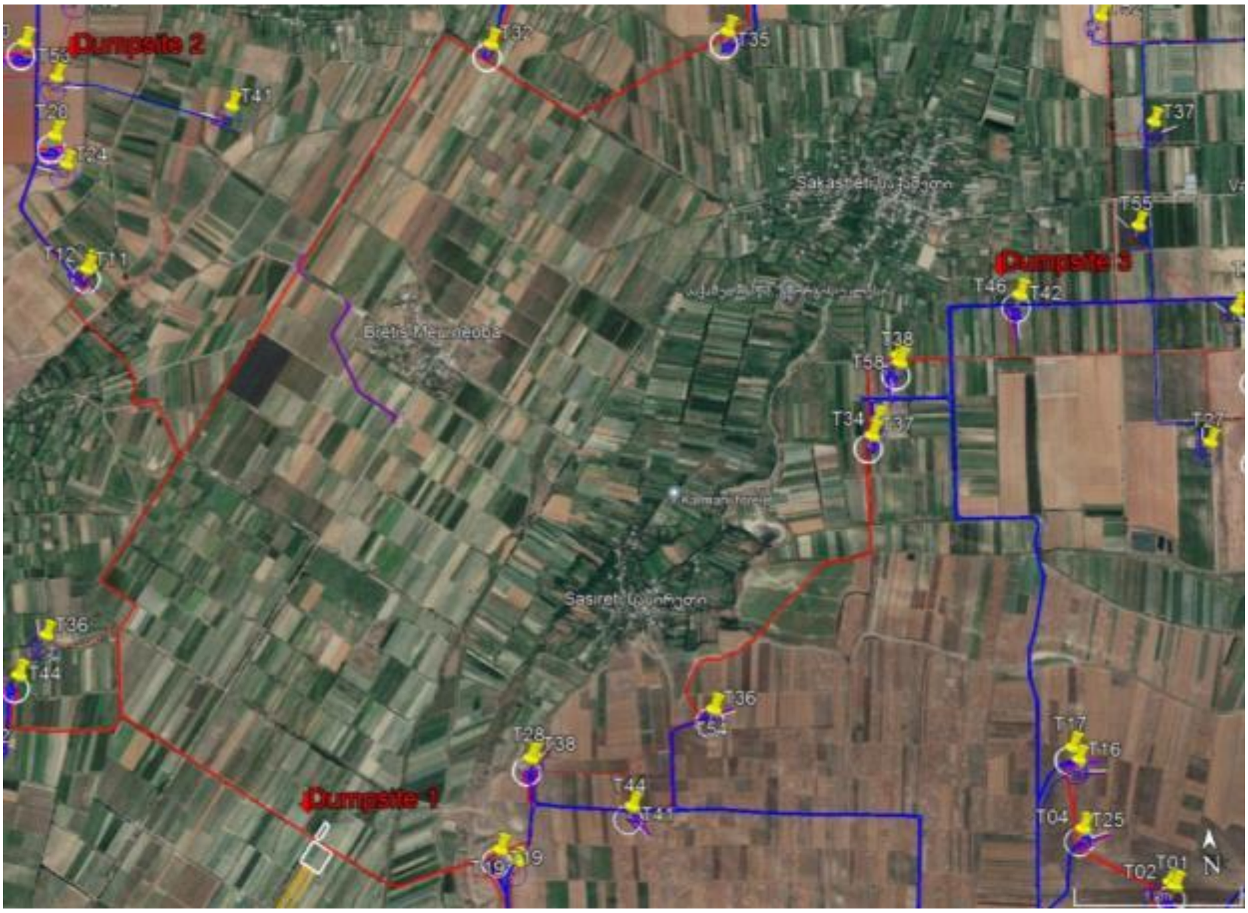


Figure 6-34 Sites of temporary landfills

6.6.2.2 Mitigation measures

Topsoil damage and reduction in soil stability is mainly expected during preparatory and construction works, which will be related to vehicle movement within the project area and earth works, as well as arrangement of temporary and permanent infrastructure and final disposal of waste rock.

However, in the construction phase, topsoil will be stripped, which will be later stored based on relevant technical regulations, and the reclamation works will be accomplished in the area after the works are completed. The humus layer of the stripped soil will be fully used for the reclamation of the temporary construction sites and for anti-erosion measures. The humus layer will be temporarily stored (separately from the waste rock) as 2 m high cone-shaped piles near the construction sites subject to reclamation and in the 3 designated landfills.

Soil quality may be affected by improper management of waste (both solid and liquid), violation of rules for fuel and lubricants and construction materials storage, as well as accidental spill of fuel/lubricants from construction machinery and vehicles. in the construction phase higher risks of soil contamination are expected in the vicinity of the construction camp, as the parking lot and other potential sources of soil contamination, such as a diesel generator, will be provided there.

Removal and recultivation of topsoil will be done in accordance with the requirements of technical regulations approved by Decree N424 of the Government of Georgia of December 31, 2013 "On removal, storage, use and recultivation of the topsoil layer";

The impact on the topsoil will be minimal in the operational phase, as the vehicles will only move in the roads that have already been paved. In addition, it will no longer be necessary to use a diesel generator and store diesel fuel. The main impact can be caused by improper waste management.

Appropriate mitigation measures must be taken to prevent soil damage and contamination, including:

- Stripping surface soil layer and temporarily storing in the pre-selected areas prior to the construction works. Earthworks shall be carried out in in accordance with the requirements of technical regulations approved by Decree N424 of the Government of Georgia of December 31, 2013 "On removal, storage, use and recultivation of the topsoil layer";
- Topsoil landfills must be provided in accordance with relevant rules: the fill height shall not exceed 2 m; the pile slopes shall have an appropriate slope angle (45^0); If necessary, drainage channels along the perimeter shall be arranged; After completion of the construction works, the stored soil shall be used for reclamation;
- Strict protection of the boundaries of the working grounds to prevent possible contamination of the "neighboring" areas, damage to the fertile layer and compaction;
- Using only the allocated routes for vehicles and machinery (prohibiting off-road driving) to reduce the likelihood of soil compaction;
- Machinery and equipment should be inspected regularly. Any damage or fuel/oil leaks must be repaired immediately. Damaged vehicles will not be allowed to enter the site;
- Collection and storage of waste in a designated area;
- Storing materials/waste in such a way as to avoid erosion and their movement from the construction site with surface runoff;
- In case of pollutant spills, containment of the spilled material and immediate cleanup of the contaminated area;
- In case of significant contamination, the contaminated soil and ground shall be removed from the area for further remediation by the duly licensed contractor.
- Instructing personnel before the onset of work;
- Cleaning and reclamation of the area after the work is completed.

Non-humus lower soil layer

The volume of the ground to dispose on the landfill from the turbines is 20 000 m^3.

The volume of non-humus soil stripped on the substation area to dispose on the landfill, does not exceed 6000 m^3, and 1000 m^3 on the campsite.

The construction of the access roads will not produce ground to dispose on the landfill. On the contrary, the construction of access roads will need 82,000 m^3 of inert aggregate (sand, gravel, grit). Some of the material disposed on the temporary landfills can be used as inert aggregate for the roads.

Most of non-humus soil layer excavated from the cable trenches will be completely returned into the trench and covered with the stripped and temporarily stored humus layer (10,000 m^3 (40,000 m^3 x 25%) of the excavated mass). The same amount will be needed to dispose on the temporary landfills, i.e. 10 000 m^3.

The total volume of soil to dispose on the temporary landfills does not exceed 37,000 m^3. In reality, this volume will be much less, since it is assumed that at least half of the excavated soil can be used for paving the access roads what will require a total of 82,000 m^3 of inert material. Some of this material (gravel and sand) will be supplied from the quarries, but some material placed on the temporary landfills will also be used.

The areas of the proposed temporary landfills:

- Landfill 1 (near the camp) – 10 400m^2
- Landfill 2 (between towers 49 and 53)– 28 800m^2
- Landfill 3 (at tower 46)– 66 000m^2

Ballast soil will be temporarily deposited in 3 separate landfills (isolated from the humus soil layer) in 3 m high cone-shaped piles. During construction, the ballast soil from these temporary storage sites will be distributed to the construction sites where additional aggregate will be needed to apply.

6.7 Impact on biological environment

6.7.1 Protected areas

Territory selected for the implementation of the Project is located at far distance from all nationally designated territories. Within the Ruisi Wind Farm construction area or immediate vicinity, there are no protected territories as well as areas included into “Emerald Zone Network” system, habitats of international importance, migration corridors of birds of passage or Special Protection Areas (SPAs) envisaged by European Union Directive 79/409/EEC (Avian Bird Directive).

As described in the baseline section, the nearest Special Protection Area to Project implementation territory is SPA 10 (Kvernaki) (see Figure 6-35), which overlaps with Emerald Site GE0000046 Kvernaki Ridge and IBA GEO20 “Kvernaki”. The distance between the Project implementation territory and this sensitive zone is more than 12 km. Any impact on fauna, flora and habitats of this SPA, either direct or indirect, is not anticipated considering the distance between the project area and the fact that there are the city of Gori and the Didi Liakhvi River between them.

The distance to other protected territories of the region is significantly larger. Besides, these protected areas are featured by different set of species than the project area comprising agricultural lands and rural habitats.

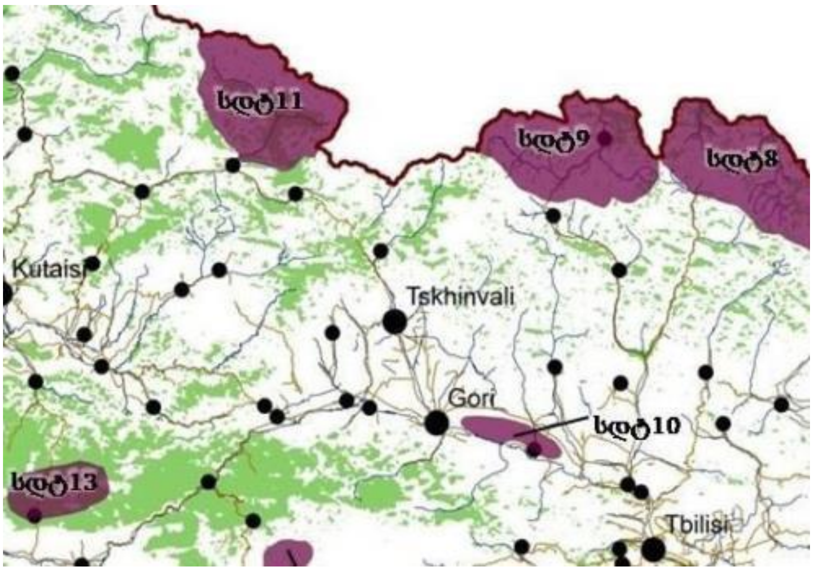


Figure 6-35 Location of Special Protected areas

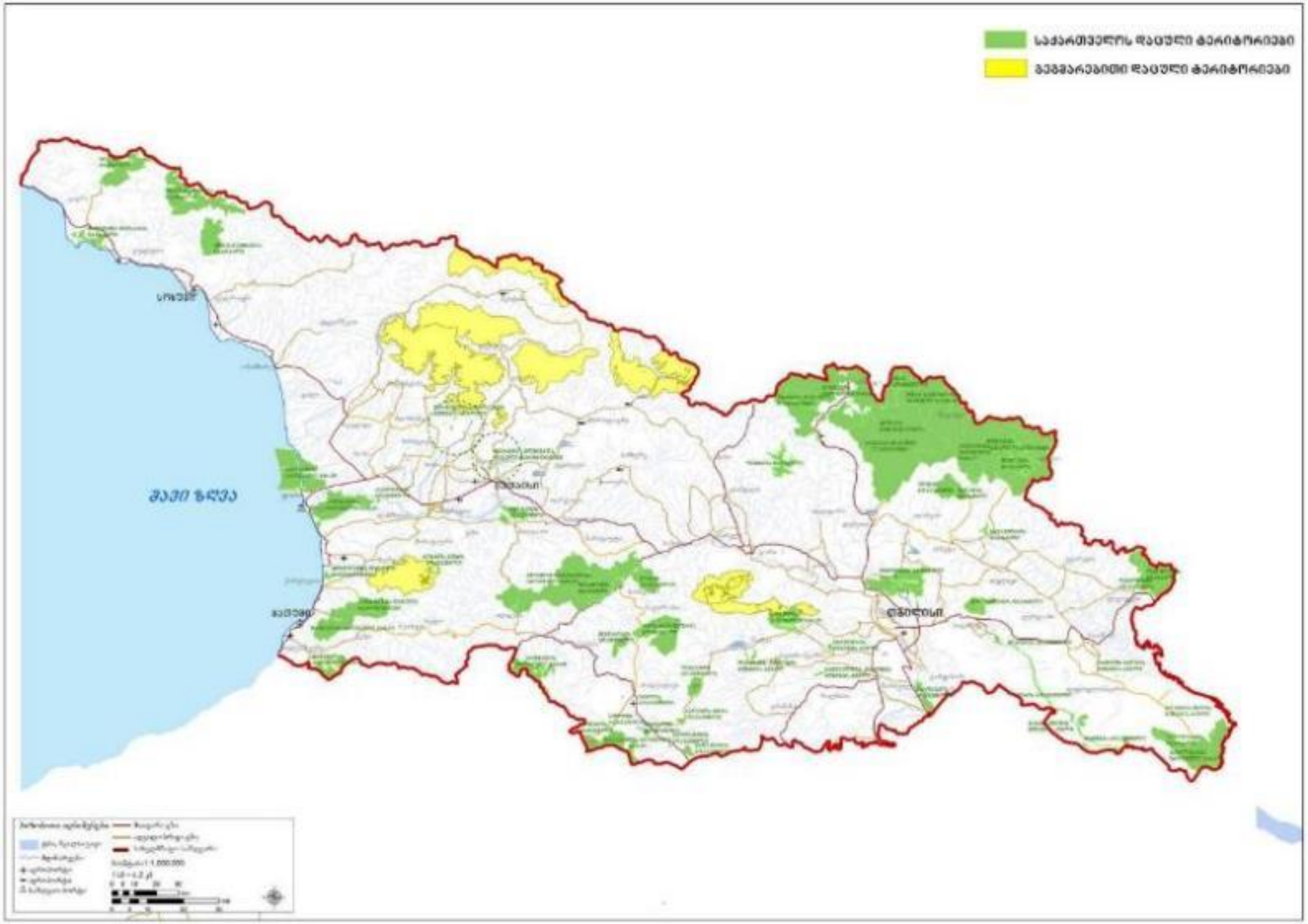


Figure 6-36 Existing and planned protected areas of Georgia

6.7.2 Flora – Impacts and Mitigation measures

6.7.2.1 Receptors and Impacts

Based on the results of detailed botanical research, following conclusions can be made:

- Most of the project area (over 90%) is occupied by agricultural fields. In terms of protection of rare plant species, these areas have no ecological value.
- No species of plants from the Red List of Georgia or globally threatened species of IUCN Red List are found in the project corridor.
- It should be also mentioned, that the species protected under the Bern Convention and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1975; universal) do not grow within the project corridor either.
- There are no high sensitivity habitats within the project corridor.
- One habitat of medium value is identified

► **Description of identified medium sensitivity habitat/area**

Plot 17. Wind Turbine #6. Pine forest (planted), EUNIS Category: **G3. 4. (Pine forests).** Ruisi Village. GPS coordinates X 417575.47/ Y 4652925.48. Altitude (m AMSL) 753. Of the tree species is recorded: Pinus nigra; shrublayer is not developed; and grass species are represented by: Festuca rubra, Stipa pulcherrima, Thymus tiflisiensis - endemic to the Caucasus, Dactylis glomerata, Phleum pratense, Medicago coerulea, Poa angustifolia, Euphorbia seguieriana, Teucrium polium, Achillea bieberstainii, Plantago lanceolata, Taraxacum officinalis, Achillea millefolium, Agropyron repens, Stachys atherocalyx, Carduus crispus, Artemisia caucasica, Galium tricornutum, Coronilla varia, Tripleurospermum nummularium, Galium verum, Allium atroviolaceum, Scabiosa georgica - endemic to the Caucasus, Teucrium nuchense - endemic to the Caucasus, Falcaria vulgaris, Achillea millefolium, Salvia verticillata, Tragopogon graminifolius, Lapulla squarrosa. Moss layer is not developed.

In case Turbine #8 will be retained in its final configuration, its installation and the construction of its access road will be associated with medium sensitivity impacts to this habitat. In particular, it will be necessary to cut a certain number of trees and plants (pine).

► **Impact on endemic species**

Five species endemic to the Caucasus have been found in the study area. These include:

1. Thymus tiflisiensis
2. Teucrium nuchense
3. Scabiosa georgica
4. Onobrychis cyri
5. Jurinea cartaliniana

During the construction phase, eradication of the mentioned endemic species of plants from the environment or significant damage to the population is not expected. It is possible to destroy individual specimens or individual groups of plants, but there will be no damage to significant populations. As discussed in Section 5.4.3.4.3, the listed endemic species are not range-restricted according to the EBRD Guidance Note 6, and destruction of some specimen would not reflect on their occurrence.

► **Distribution and introduction of invasive species**

As described in the flora baseline, an invasive species *Xanthium spinosum* has been found in dry grassland present in the Project Area in the environs of Arashenda Village (Turbine #15). The Project Area comprises only small population of this species (Sol (solitarie) - few individuals, coverage about to 10%). Therefore, there is a risk for the Project to further distribute this invasive species within the project area or outside its boundaries during construction works. Seeds of this plant could be incidentally introduced to other sites during site clearance works and earth moving operations on the construction phase.

It is known that *Xanthium spinosum* is already introduced almost in all regions of Georgia. It grows in wide variety of habitats among them at road sites, nearby residential areas, abandoned and cultivated fields, along irrigation canals, at the edges of vegetable gardens and crop fields. Therefore, though this plant has been recorded only at one location, it is highly likely that *Xanthium spinosum* is already present in other sections of the project area and its neighborhood as well.

Considering all the above mentioned, further distribution of this invasive species by the Project cannot be considered as high impact. But, still some preventive measures will be considered both for the construction and operation phases to avoid further distribution of this invasive plant.

There is also risk to introduce other invasive plants in the project area during site reinstatement works if non-native plants will be used for revegetation.

6.7.2.2 Mitigation Measures

The pine forest at Turbine #8 site is artificially planted. This small forest grove does not belong to the State Forestry Fund and the procedures for cutting trees here are not regulated by the Order №5 of February 15, 2010 of the Minister of Environmental Protection and Natural Resources of Georgia "On the procedure for assigning a special purpose category to the lands of the State Forestry Fund". However, before the completion of the EIA, after determining the exact coordinates of the turbine and access road, identification and cadastral description of the trees to be cut will be carried out. The cut wood will be handed over to the municipality. In exchange for cut trees, compensatory measures aimed at maintaining the damaged habitat will be planned:

- It should be noted that in forested areas it is practically impossible to restore and maintain the former natural groves in the state they were before construction (especially if the habitat is also affected by other factors). Therefore, in such cases, it is recommended and mandatory to implement offset or eco-compensation measures, which implies the restoration of equivalent forest habitats. The same approach is recommended for artificial pine forest. For each cut tree, 3 new saplings will be planted, in agreement with the municipality and the Ministry of Environment Protection and Agriculture.
- In the above-mentioned artificial pine grove, the trees are withering, which might be caused by the spread of parasites. As a compensatory measure, plant protection specialists will study the target habitat and develop a plan for rehabilitation measures. Immediately after the completion of the construction, the company will start implementing the rehabilitation plan developed by the specialists.

Due to the potential risk to spread existing and introduce new invasive species in the project area, mitigation measures will be employed to minimize their colonization and propagation, including:

- Visual check of each work site for the presence of *Xanthium spinosum* before site preparation works are started;

- Removal invasive plant species whenever possible before starting vegetation clearance and site preparation works to avoid their distribution and further collonization;
- Use native plants for revegetation of disturbed sites where the need for artificial revegetation is identified;
- Ensure proper topsoil storage to avoid seed loss and reduce the need for artificial revegetation.

In addition, a conservation programme before starting the construction shall be prepared for five rare plant species that are endemic to the Caucasus including: *Thymus tiflisiensis*, *Teucrium nuchense*, *Scabiosa georgica, Onobrychis cyri,* and *Jurinea cartaliniana*.

The detailed botanical surveys have identified populations of species of high and medium conservation value in the Project Corridor. Adverse impacts that the construction and operation of the planned project may have on botanical receptors (flora and vegetation) were assessed. Findings of the impact assessment will be used to develop and specify conservation/restoration and offset measures, and prepare respective biorestoration specifications, compensation plans and monitoring plan for the botanical component of the biodiversity.

Description of the background situation will facilitate to the post-project monitoring of botanical component of biodiversity and restoration measures implemented on territories identified to compensate for the project impacts.

The following measures are recommended to ensure conservation of endemic plants: translocation of live plants to conservation centers and reproduction of plants using seeds collected in the wild. The translocation of live plants is always associated with high risk and therefore target plants should be propagated with seeds to achieve higher success of conservation measures and grow enough seedlings for reintroduction into relevant habitats.

Plants translocated from their natural habitats, along with seed-reproduced plants will form living plant collections in their respective conservation centers. Reintroduction of translocated and seed-grown plants into the project corridor or their relevant natural habitats should be carried out after the completion of project construction.

6.7.3 Impact on Fauna

6.7.3.1 Project activities with possible adverse impacts

Project impacts include impacts caused by construction works, which will be eliminated within a certain period of time after the completion of construction works, and residual impacts, which will occur long after the completion of construction works. The main types of expected impact are as follows:

Impact of the construction works

- Disturbance of bird nesting sites - some birds may abandon their nests
- Destruction of mammal and reptile shelters and bird nests in the preparatory stage during the implementation of earth cleaning works and clearance from vegetation
- Poaching - illegal hunting by construction crews or local residents
- Accidents - Some animals may be accidentally killed by a person or a vehicle
- The Waste

Residual impacts:

- Death of birds due to wind turbine-generators
- Death of bats due to wind turbine generators
- Death of birds due to transmission lines, in particular electrocution and collisions with lines
- Disturbance of large mammals due to noise and vibration generated by the operation of wind turbine generators
- Disturbance of large mammals and birds due to human presence in the wind power plant area
- Modification of habitats due to presence of WTGs and other above-ground facilities
- Fragmentation of habitats – due to cutting tall trees along the construction corridor of turbine towers and 150m transmission line.
- Easier access to areas with less altered vegetation for tourists and potential poachers due to construction of new access roads.

Activities planned within the framework of the project may have harmful effects on ecosystems (mainly vegetation cover) and fauna: arrangement of wind turbine-generators, construction of access roads and transmission lines, as well as installation of power cables and technical service works.

- Cleaning and construction of the area. The construction of wind turbine generators, transmission lines and access roads leads to habitat modification, the extent of which depends on the characteristics of the existing vegetation cover, topographic conditions and the height of the transmission lines. Examples of habitat modification are: destruction or fragmentation of forest cover; Loss of animal habitats, including destruction of bird nesting and feeding sites. Additionally, animals may be injured or killed. Due to the noise and presence of construction equipment and workers in the area, animals might be frightened. Some types of impacts will be permanent (e.g. cutting of trees, occupation plots of land by wind turbine generators), while others will be temporary (e.g. removal of vegetation cover around construction sites, increased intensity of human activity).
- Installation of cables. The impact caused by the installation of power cables will be relatively short-term and temporary. Moving equipment used to move cables or unload materials at construction sites can cause physical effects such as injury or death to animals. Installation of energy transmitting cables will cause noise and visual impact along the electrical power line corridor, which may scare animals and birds away from the area.
- Technical service related work. Animals may be endangered due to the noise caused by the maintenance works carried out in the corridor of the electrical power line and at the wind power plant and due to presence of the labor force at the site. Particularly, animals might get frightened during labour work such as mowing, weeding, tree removal, corridor inspection, repair of masts and their foundations, as well as restoration of damaged cables.

6.7.3.2 Potential Impacts on Wildlife Habitats

During the construction process in the Ruisi wind farm short-term negative impacts on habitats, soil and air quality are expected in project area, which do not represent significant problems.

There are mainly two types of habitats present in the project area: 1. semi-natural and 2. anthropogenic. Semi-natural habitats in the Ruisi wind farm construction corridor includes artificial pine grove, windbreak remnants, shrublands, and grasslands; Habitats under anthropogenic influence are represented by agricultural fields, on which various types of vegetables are grown, or orchards are planted, as well as overgrazed and degraded secondary meadows.

The anthropogenic impact on habitats in the construction corridor is clearly defined and is represented by mechanical (tillage, construction of irrigation canals and roads, overgrazed and degraded meadows) and chemical (use of herbicides, insecticides, acaricides and fungicides) aspects. The potential significance of the project impact on habitats, existing within the project area, as it was assessed on the stage of scoping are presented in Table 6-16.

Table 6-16 Habitats within project construction area

N	**Habitat description**	**Impacts**
1	Artificial pine grove	**Medium**
2	Shrubland	**Medium**
3	Windbreaks	**Medium**
4	Overgrazed and degraded meadows	**Insignificant**
5	meadows	**Insignificant**
6	Agricultural lands with grain crops (maize, wheat), with sunflowers	**Insignificant**
7	Agricultural lands with vegetables (tomatoes, onions, peppers, cucumbers, potatoes)	**Insignificant**
8	Orchards (apples, berries, cherries, plums) and vineyards	**Insignificant**

The construction of a wind power plant might have an adverse impact on the above-mentioned semi-natural habitats, such as grasslands, shrubs and artificial pine grove. The types of expected impacts on habitats during the construction of a wind power plant are: 1. Direct loss of habitats, which may occur during the construction of infrastructure, including clearing the area for the foundation of turbines, construction of auxiliary buildings, warehouses and roads; 2. Degradation of habitats, or creating disturbing effect; 3. Fragmentation of habitats and creating edge effect; 4. Degradation and loss of existing habitats outside the project corridor, within the adjacent area, which might be caused by pollution as a result of construction works, or as a result of erosion.

Potential habitat loss for various species and at the population level (e.g. loss of potential foraging habitats for birds and bats) is discussed below, in relevant sections.

Fragmentation of wildlife habitats may have place due to the need to arrange a corridor of a certain width along the construction corridor of turbine towers and 150m transmission line on the top of the ridge, tall trees will be cut down if necessary. It should be noted, that taking into account the fact that the 10 km alternative option for transmission line corridor is replaced by 150 m long corridor, and the turbine connecting corridor (access roads and connecting cables) will be arranged mainly in the existing road corridor, the additional effect of habitat fragmentation will be insignificant.

Habitat loss outside the project area is not likely if construction works are properly planned and managed. To ensure this, relevant prevention/ mitigation measures (e.g. demarcation of work sites, etc.) are considered for the project.

6.7.3.3 Potential Impacts on Bats and Mitigation Measures

Bats (order *Chiroptera*) present one of the large group of fauna, which is sensitive to the impact of the WPP construction and operation.

► **Construction Impacts**

Bats are extremely restricted in finding shelters for breeding colonies. Suitable for the roosting shelters – trees hollows, caves and abandoned buildings are of great importance for their populations. Wintering and maternity roost can be destroyed if some trees with hollows will be felled during the clearing works (tree cutting) during preparation works in not proper time. In addition, a spill of fuel in wetlands can destroy the food resource of the maternal colony, which will substantially reduce the number of young.

All large trees on the construction sites that are subject to removal should be inspected on the presence of bats colonies, before the start of the clearing works within the Right-of-Way of the power line and within the construction sites. If the bat colony (despite whatever included or not this species into the Georgian Red Data List or not) will be found, the tree cannot be destroyed without consultation with MoEPA officials and bat experts.

► **Operational Impacts**

The most significant impact of operating wind turbines on bats is direct killing, caused due to collision and/or barotraumas. The outer extremities of the blades may reach speeds as high as 250-300 km/h, making them totally undetectable for echolocating bats. In addition to the risk of direct collision, the wake effect drastically modifies the air pressure near the rotating blades, enlarging the risk zone and causing fatal barotraumas to flying bats.

There are various reasons for bat presence, and resulting fatalities around wind turbines. Bats may use the nacelles of WTG as roosts. At low wind speeds, insect flight and bat activity occur at higher altitude, increasing the potential presence of bats near rotating blades. Security lights at the bottom of the tower, the color of wind turbines and acoustic effects are also suspected to attract flying insects and bats into the risk zone. Migrating bats and bats from local sedentary populations are often killed by wind turbines, sometimes in large numbers. This can reduce bat populations.

From the species recorded during field surveys - Pipistrellus spp, Hypsugo savii, Nyctalus spp, and Vespertilio murinus are known as species of high collision risk; Barbastella barbastellus and Eptesicus serotinus are known as species of the medium collision risk; and Rhinolophus spp, Myotis spp with Plecotus spp are known as low collision risk species.

Level of collision risk with wind turbines is different for different species. The probability of the fatality is greater for high flying species that forage or migrate above the forest canopy:

- Particoloured Bat (*Vespertilio murinus),* which presence confirmed by passive bat detectors.
- Noctule Bats (*Nyctalus* spp.) – Noctule (*Nyctalus noctula*), Giant Noctule (*Nyctalus lasiopterus*), Lesser Noctule (*Nyctalus leisleri*). The presence of all of them is confirmed by passive bat detectors.
- Pipistrelle bats (*Pipistrellus* spp.) - Kuhl's Pipistrelle (*Pipistrellus kuhlii*), Common Pipistrelle (*Pipistrellus pipistrellus*), Pygmy Pipistrelle (*Pipistrellus pygmaeus*). The presence of all of them is confirmed by passive bat detectors and during field surveys.
- Nathusius' Pipistrelle (*Pipistrellus nathusii*) – today not confirmed, but according to data collected via passive bat detectors cannot be excluded.

And for the tree roosting species like:

- Long-eared Bats (*Plecotus* spp.) - Brown Long-eared Bat (*Plecotus auritus*) – the presence today is confirmed by handheld ultrasound bat detector.

A few WTGs of the Ruisi WPP are located on the edge of the artificial pine grove and close to windbreak forest lines with large old trees, that significantly increases the collision risk for some forest dwelling species. Under the medium risk are:

- Serotine (*Eptesicus serotinus*) - the presence of it is confirmed
- Western Barbastelle (*Barbastella barbastellus*) - *the* presence of this species is confirmed

Thus, out of 19 bat species, known for the project area, 10 species are under high risk (the presence of nine species is confirmed) and one species under medium risk (presence is confirmed) to be killed by WTG blades.

Therefore:

- The bat protection module should be used to protect the bats in the vicinity of the WPP via the temporarily “shut down” the wind turbine generators.
- The construction should take place at appropriate times to minimize impacts of noise, vibrations, lighting and other related disturbance on bats. Construction activity should be clearly delineated in any plan to ensure operations are restricted to least sensitive times in that area.

Overall, during the surveys conducted on the project area and vicinities, no bat roosts were located. Based on the results of the surveys, we can assume that the project area is used by bats for foraging/feeding and movements.

Based on the results of field surveys, generally, the bat activity on most territories of the project area, except on single nights, is quite low. Also, bat activity is decreasing when wind speed is increasing. The increase of BAI during the selected night in June, July, and the beginning of August can be partially explained by the fact that during this period of time bats have youngsters and they are increasing feeding/foraging activity and cover longer distances for food. However, it should be mentioned that no maternity colony was recorded in abandoned buildings close to the project area.

Relatively high bat activities are recorded close to the wind turbines given in Table 6-17, where mitigation measures would be needed to minimize impact on bats.

Table 6-17 Turbines with need of mitigation measures

#	Old Numbers of WT	New Numbers of WT	Coordinates
1.	6	8	42.02399°N/44.00428°E
2.	32	45	42.06187°N/43.90395°E
3.	34	37	42.08097°N/43.96223°E
4.	35	29	42.04688°N/43.97047°E
5.	36	44	42.06870°N/43.90835°E
6.	37	removed from the final configuration	42.09427°N/ 43.99025°E
7.	43	34	42.10292°N/43.94450°E
8.	47	31	42.10336°N/43.96161°E
9.	50	35	42.09868°N/43.95999°E
10.	52	removed from the final configuration	42.10007°N/43.98677°E
11.	55	removed from the final configuration	42.08868°N/43.98879°E
12.	58	38	42.08291°N/43.97120°E

Close to these wind turbines, there are fruit gardens and windbreakers with mature trees, which create favorable conditions for bats.

Based on the results of the field works conducted through July, in the case of construction and operation of the wind farm, the most important recommendations at this stage are:

1. From the 10th of November through the beginning of March, wind turbines could operate without switching them off because during winter bats are not active.
2. Turbine #8 can operate without switching it of only if it is moved/relocated to the eastern direction, until the coordinates 42.02588°N/44.00978°E. It is important to consider that in such a mode of operation, the distance to the artificial pine forest should be at least 2000F[19] meters or more. Otherwise, when wind speed is below 7 m/s (measured at nacelle height) during nights without rain, it is recommended (i) increase cut-in wind speed; or (ii) feathering of blades; or (iii) shutting down. This recommendation should be also applied during drizzle weather conditions and after the period when the rain stops as bats are active during a drizzle and they start activity shortly after rain. These restrictions apply to the period 30 minutes before sunset through 30 minutes after sunrise. These turbines should be equipped with a passive bat detector as this is the recommendation for all turbines in order to observe bat activity in the surrounding areas of each turbine.
3. For the wind turbines #45, #37, #29, #44, #34, #31, #35, #24 and #38, given in Table 6-17, when wind speed is below 7 m/s (measured at nacelle height) during nights without rain, it is recommended (i) increase of cut-in wind speed; or (ii) feathering of blades; or (iii) shutting down. This recommendation should be also applied during drizzle weather conditions and after the period when the rain stops as bats are active during a drizzle and they start activity shortly after rain. These restrictions apply to the period 30 minutes before sunset through 30 minutes after sunrise. These turbines should be equipped with a passive bat detector as this is the recommendation for all turbines in order to observe bat activity in the surrounding areas of each turbine.
4. Turbines #37alt (removed); #52alt (removed), #55 (alt. removed) #52alt (removed), #55 (alt. removed), required the same measures as in p.3, but these turbines have been removed from the final configuration.
5. During the blooming season, the following limitations of operations apply to those wind turbines planned to be located in fruit gardens and in their close vicinities: when wind speed is below 7 m/s (measured at nacelle height) during nights without rain, it is recommended (i) increase of cut-in wind speed; or (ii) feathering of blades; or (iii) shutting down. This recommendation should be also applied during drizzle weather conditions and after the period when the rain stops as bats are active during a drizzle and they start activity shortly after rain. These restrictions apply to the period 30 minutes before sunset through 30 minutes after sunrise. These turbines should be equipped with a passive bat detector as this is the recommendation for all turbines in order to observe bat activity in surrounding areas of each turbine.
6. All other turbines can operate without switching them off due to almost no activity close to these turbines. However passive bat detectors should be installed on the wind turbines to measure BAI and develop relevant mitigation measures if/as needed.
7. Maximally avoid artificial lightening, use it where and when necessary. In the wind farm area should use lightings that do not attract insects (using lights with a reduced amount of blue and UV, increased amount of red in the spectrum) and direct downward light flux toward the area of need to

[19] This distance should be calculated as "the shortest straight line distance between a given point or line and the horizontal circle with a center at the wind turbine tower axis and a radius equal to the turbine blade length" (EUROBATS Publication Series No. 6, page 79).

light. Use a shielded lighting-unit that does not emit lights above the horizontal. Avoid lamps emitting wave-length below 540nm and with a correlated color temperature more than 2700K.

8. The nacelles should be made inaccessible for bats as much as technically possible and feasible.
9. It is recommended to avoid the development of bushes and wetlands under the wind power turbine.
10. Passive bat detectors should be installed on the wind turbines to measure BAI for each turbine and then, based on particular results, develop the relevant recommendations for the operation of each turbine on the project sites.
11. Maximally avoid or put limitations on cutting trees.
12. If cutting the trees is unavoidable and necessary for wind power plant construction and safe operation, the tree-cutting activity should be done according to the following steps: (i) to select those trees which should be cut; (ii) check these selected trees by bats-specialist on the potential roost-occurrence and mark those trees which will be considered as potential roosts for bats; (iii) Marked potential roost-trees are not allowed to cut from 20 May until 15 August and from 1 December until the end of February, and bats-specialist should attend cutting of marked potential roost-trees in the allowed period of time. If the roosting bats occur in the cut trees, immediate measures need to be taken to identify alternative roosts for these individuals or colonies; and (iv) non-marked trees can be cut any time during the year.
13. To consult with a bat specialist if during the tree-cutting process suddenly roosting bats occur in the cut trees.
14. Post-construction monitoring should be carried out as recommended by the Resolution 8.4 adopted at the 8th meeting of parties of the Agreement on the Conservation of Populations of European Bats (EUROBATS).
15. Continue post-construction monitoring and mitigation measures as long as needed to guarantee the effectiveness of mitigation measures.

These recommendations that are based on the bat surveys of the ESIA stage might be revised, further developed and/or adapted taking into consideration the results post-construction monitoring.

6.7.3.4 Potential impacts on Birds and Recommended Mitigation measures

To date, a huge number of scientific articles have been published on the problems of bird collisions with various technical structures, including wind turbines. Birds may collide with various parts of the wind turbine or with some associated technical structures such as power lines (electricity cables), meteorological masts, etc. The effects of wind farm on bird, especially collision risk level, depends on the wide range of various factors including the specification of the development, topography of area, habitat of the surrounding land, meteorological conditions, visibility factors and very much on the location of turbines, bird species present (Johnson et al. 2000 a,b, Percival 2000, Erickson et al. 2002, Langston & Pullan 2003, Barrios & Rodriguez 2004, Smallwood & Thelander 2004, Hoover & Morrison 2005, Madders & Whitfield 2006, etc.).

Avian collisions with WTGs and power lines can occur in large numbers if the project area is located within daily flyways and seasonal migration corridor. Some groups of bird species are flying at night and during low light conditions (e.g. at dusks and in fog). If conductors (wires) are not spaced far enough apart to prevent birds from touching two wires at once, or if “bird-proofing” measures are not implemented, large perching birds (particularly raptors) can be electrocuted. Based on migratory patterns and known species of concern, the Ruisi WPP lies within the area with a low of mass killing of birds.

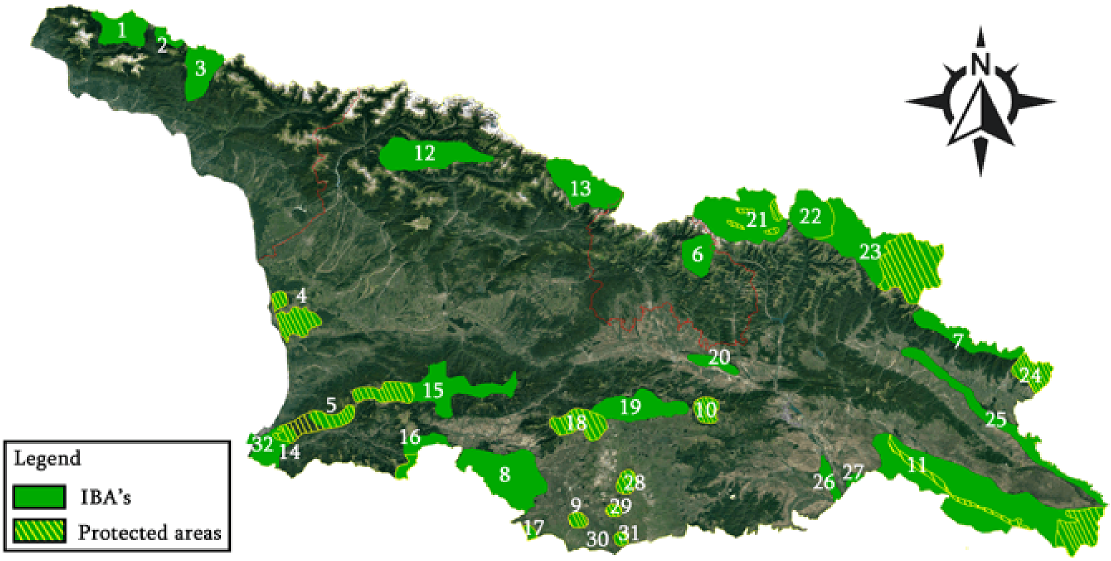
Bird species characterized by rapid flight and the combination of heavy body and relatively short wings run a high risk of colliding with the power line and WGT blades because of their restricted speed of reaction to unexpected obstacles. Onshore studies have suggested that raptors are more prone to collisions than other species. Among the birds that could be at risk from the collision with wires are the following:

- Galliformes – Quail (*Coturnix coturnix*) is an important game species in Georgia. Collisions of this species with wires are well known, but, unfortunately, this fact is not documented.
- Large raptors (*Accipitridae*) during migration and movements after nesting period.

Based on the results of complex ornithological studies for which large raptors were target species, carried out within the limits of Ruisi WPP Project Area as well as in adjacent areas and analysis of collected data, it is possible to conclude that:

- The species composition of birds in the area under consideration is very poor. The basis of the local Avifauna is represented by common widespread and numerous bird species that are typical for this region of Georgia. The species composition of nesting birds is especially poor. Only about 1/4 of the total number of bird species found in Georgia are recorded here. Most of these bird species are non-permanent elements in the local Avifauna, and are observed for a short time and in small numbers during seasonal migrations, wintering or occasional movements.
- There were not observed any more-or-less remarkable differences in compositions of bird species, their status and duration of presence, distribution by seasons of year, breeding and feeding/hunting habitat selection, numbers or densities between Ruisi WPP Project Area and adjacent parts of the Shida Kartli Region.
- According to the data collected during field work carried out in previous years and decades, the more-or-less visible changes in species composition, territorial distribution, habitat selection, numbers, density and behavior of breeding bird species, which are breeding year-round residents or migratory summer breeders to study areas, were not recorded during last several years.
- The whole territory or separate parts allocated for the planned establishment of the Ruisi WPP does not apply to the any IBA's or Important Bird Areas (Figure 6-37).
- Ruisi WPP Project Area and adjacent areas situated outside of both the rich on Caucasian endemism sites. No endemic bird species were recorded here.
- The level of human activities in Ruisi WPP Project Area and adjacent territories is very high. Absolutely all parts of study area are located in the part of Shida Kartli that was transformed several decades/centuries ago. There are no natural, primeval biotopes here. The entire study area is presented by typical anthropogenic landscape. According to the materials collected during numerous visits to the area under consideration in 2021 – 2022, among all negative, for birds and other animals, factors, the most alarming is human disturbance. This is due to the constant presence of a large number of local people, agricultural machinery, numerous flocks of sheep and cattle, dogs, heavy transport moving, etc. Besides that, solitary poachers and groups of poachers with dogs, illegally hunting in the study area, regularly were watched in area that should be considered as a very heavy impact factor on the local bird community and other fauna.

  In this regard, the level of anthropogenic load on the birds inhabiting this area should be assessed as a high, but in some sites of study area, especially in tree-less parts of study area as well in and around villages and along roads the level of human disturbance should be considered as very high.



1.Ritsa GE001
2.Pskhu GE002
3.Gumismta GE003
4.Kolkheti GE004
5.Kintrishi GE005
6.Liakhvi GE006
7.Eastern Caucasus Mountains GE007
8. Meskheti Ridge GE008
9. Khanchali Lake GE009
10.Algeti GE010
11.Iori Region GE011
12.Svaneti GE012
13.Racha GE013
14.Batumi GE014
15.Adjara-Imereti Ridge GE015
16.Savsheti Ridget GE016
17.Kartsakhi Lake GE017
18.Tabatskuri Lake GE018
19.Trialeti Ridge GE019
20.Kvernaki Ridge GE020
21.Kazbegi GE021
22.Khevsureti GE022
23.Tusheti GE023
24.Lagodekhi GE024
25.Alazani Valley GE025
26.Low Mtkvari Valey GE026
27.Jandari Lake GE027
28.Paravani Lake GE028
29.Sagamo Lake GE029
30.Bogdasheni Lake GE030
31.Madadapha Lake GE031
32.Chorokhi Delta GE032

Figure 6-37 Important Bird Areas of Georgia

- Large-sized/long-lived bird species have low reproductive rates and/or rare or are already in a vulnerable conservation state (such as cranes, pelicans, flamingos, geese, eagles, vultures, some other large-sized and medium-sized soaring birds) that may be particularly at collision risk. Evidence to date indicates that wind plants that are located away from areas harboring concentrations of threatened and endangered bird species during seasonal migrations and wintering or areas that are important for these birds during nesting periods have relatively low rates of mortality. In this regard, the territory where the 206 MV Ruisi WPP is supposed to be constructed should be chosen as more or less optimal in terms of the Avifauna safety. In this area, no significant accumulations of birds during the migration period, especially during wintering, were noted. The species composition of nesting bird species, that may become victims of collision with wind turbines, is very poor, and the number of these bird species is measured by solitary pairs.

- The importance of the Ruisi WPP Project Area from the ornithological point of view should be classified in general as "**LOW**" during breeding season, as "**LOW**" during post-breeding movements (MEDIUM for some species occurred in dry open habitats), as "**LOW/MEDIUM**" during seasonal migrations and as "**LOW or VERY LOW**" in winter (Table 6-18). This expert's opinion is mainly based on the fact that the Avifauna is represented by a very small number of bird species nesting within the limits of the area under consideration. Breeding and wintering Avifauna of the considered as a poor because it presented mainly by widely distributed, quite common and numerous bird species, which are typical elements to the Fauna of this part of Georgia – Shida Kartli Region. Especially, the community of year-round residents presented by widespread and quite common species, mostly by passerines, which are typical elements for the Ornitho-Complexes of anthropogenic landscapes. Although the number of bird species visiting this territory during seasonal migrations is large, the overwhelming majority of transit migrants visit Ruisi WPP Project

Area for a short time, practically without stopping for rest and feeding. Sometimes they make stops, but usually closer to the floodplain of the Mtkvari River 3-5 km south of study area.

Table 6-18 Ornithological Importance of separate parts of the 206 MW Ruisi WPP Project Area by seasons of year

Seasons of year	Ornithological importance of separate parts by seasons of year					
	Woodlands along western border	Artificial pine forests	Cultivated fields	Pastures	Gardens, orchards	Villages
Breeding season	Low	Low	Low	Low/ None	Low	Very Low
Post-breeding movements	Low	Low	Medium	Low	Low	None
Seasonal migrations	Low	Low	Medium	Low/ medium	Low	None
Winter	Low	Low	Low	Low	Very Low	Low

- The dominant systematical groups of the year-round resident, year-round non-breeding visitors, summer visitors without breeding, migratory breeders, transit migrants and wintering bird species, presented within the limits of study area are small-sized passerines. Some threatened bird species, listed in the "Georgia Red List 2006" may be recorded here, but mainly as an occasionally visitors usually for short time, mostly during seasonal transit migrations, and in very low numbers.

- More-or-less important feeding habitats for local year-round residents and migratory summer breeders as well as for year-round visitors without breeding and non-breeding summer visitors are cultivated fields and pastures in the central and eastern parts of study area.

- Ruisi WPP Project Area situated outside of the migratory corridors and so-called "bottle-necks" of long-distance migrating birds of prey such as Eastern Black Sea fly-way at the Black Sea coastlands, valleys of some large rivers of the Black Sea basin and flood-lands of large rivers in Eastern Georgia, i.e. in the Caspian Sea basin. The study area situated a few kilometers north of the secondary fly-way that runs along the Mtkvari River flood-land, southern macro-slopes of the Kvernaki Ridge and northern macro-slope of the Trialeti Ridge (Figure 6-38 and Figure 6-39). In addition, the open and habitats in the central and eastern parts of study area such as cultivated fields, pastures, tree-less gentle slopes, used by some species of migrating birds, including birds of prey - harriers, buzzards, hawks for halting and hunting on small rodents, small-sized passerine birds, large insects and other prey. Based on the data collected in the study area during ornithological surveys, carried out within the limits of Ruisi WPP Project Area and in adjacent areas, in 2021 – 2022 as well as in previous years/decades, it may be confirmed that the total numbers of transit migrants and flock size of migrating target bird species, or Birds of Prey (*Falconiformes*) is much smaller in contrast to the size of the migrating flocks observed at the main or secondary fly-ways, especially along migratory fly-ways located in the valley of large rivers in adjacent regions of Georgia – at the East Black Sea fly-way, in the Mtkvari River valley, at passes of the Trialeti Ridge, Javakheti Upland and south-eastern corner of the Iori Table-land – flood-lands of the Alazani and Iori rivers.

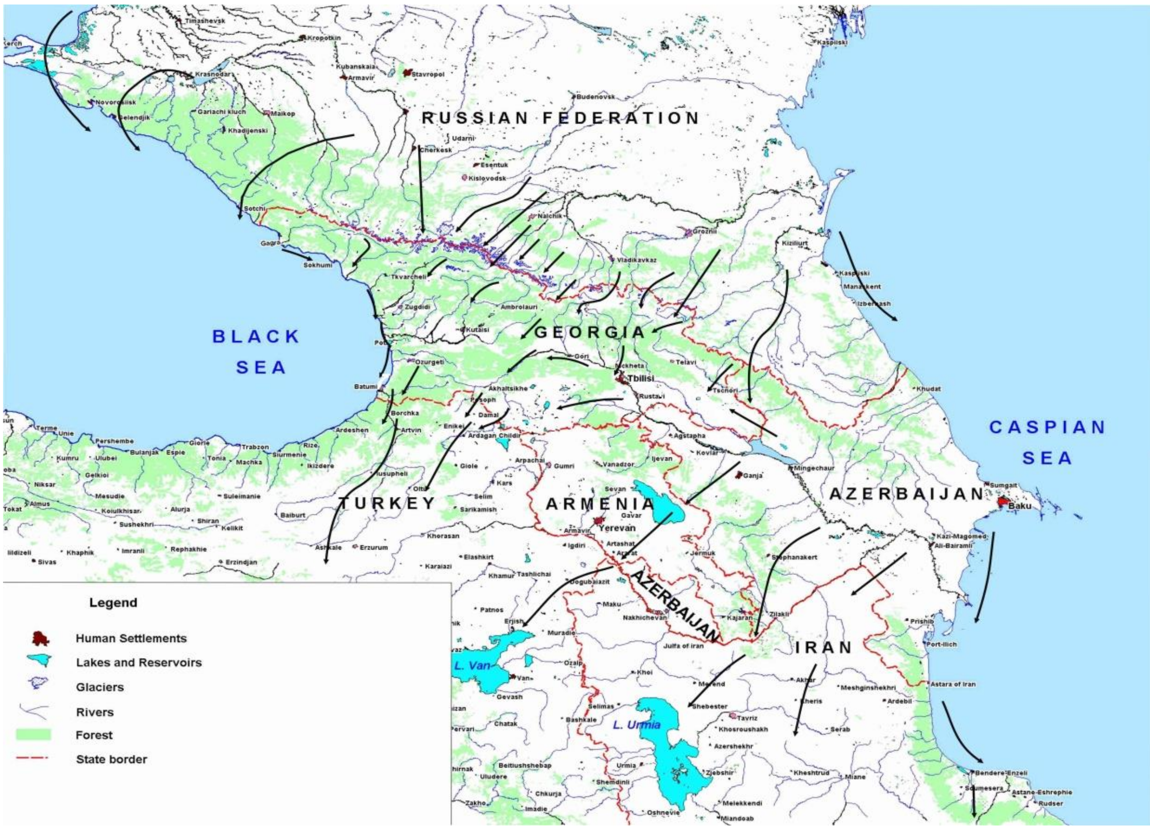


Figure 6-38 The main fly-ways of migrating birds across the Caucasus

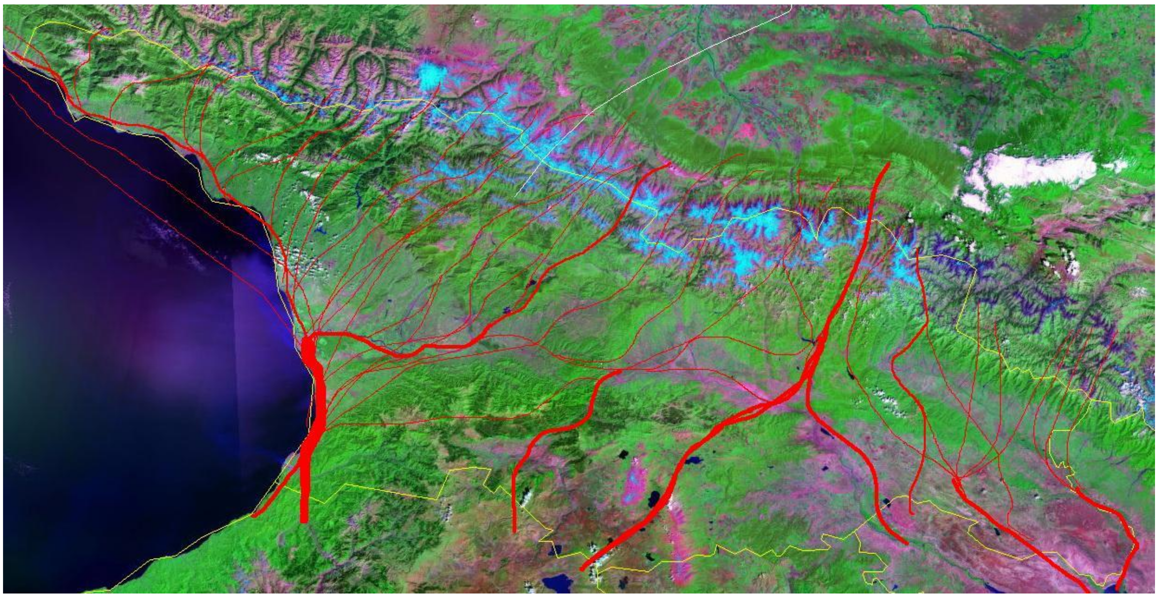


Figure 6-39 The most important fly-ways of Birds of Prey and some other groups of migrating birds at the territory of Georgia

- Transit migrants - target species, or Birds of Prey, flying across the territory of the Ruisi WPP Project Area, rare form large aggregations (flocks) and cross the study area always at fairly high altitudes above the relief. Migrating raptors, except common buzzard, some harriers and common kestrel, flying across the area under consideration practically without stopping for resting or feeding and are present here for a short time. Other raptor species are rare in small numbers visitors. Typically, solitary individuals or pairs, rarely small flocks were observed. The most common and regular transit migrants, such as the Honey Buzzard, Steppe Buzzard, Black Kite flying across study area were noted in flocks consisting up to 10 individuals, much rarely from 10 to 20 individuals and very rare more than 20 individuals, while at the main fly-ways in large aggregations can be up to several thousand individuals. In addition, it should be noted, the majority of transit migrants crossing the study area usually without stopping. If they do stop it occurs occasionally and in very small numbers.

- Particularly intensive is autumn transit passage of various birds across the Ruisi WPP Project Area and in adjacent areas. Autumn migration started in the middle of August. Between August 15 and 25 first transit migrants started to appear, their number increasing slightly during the last days of August. Intensive passage was observed from September 10 until middle of second of October. Extremely visible autumn migration dates for large- and medium-sized birds, especially for Birds of Prey (*Falconiformes*) are September 15 – October 10. During this period several waves of migration are observed with a peak in the late September – early October. From 150 ... 200 to 300 ... 400 individuals of birds of prey fly by daily are commonly observed flying across the Ruisi WPP Project Area and in adjacent areas, including 50 - 150 individuals flying directly into the risk zone, i.e. through those areas where it is planned to place wind turbines. Since mid-October, the number of migrants has been sharply reduced and no more than 50 individuals of raptors fly here daily, including 20 - 30 individuals flying across the risk zone. The latest solitary migrants, mostly Black Kite (*Milvus migrans*), Goshawks (*Accipiter gentilis*), Sparrowhawk (*Accipiter nisus*), Hen Harrier (*Circus cyaneus*), Rough-legged Buzzard (*Buteo lagopus*), Common Kestrel (*Falco tinnunculus*) were observed in the middle of November, occasionally later;

- Among large- and middle-sized transit migrants the most widespread, more-or-less common, numerous and regular passage visitors are the following species: Common Buzzard (*Buteo buteo*), Black Kite (*Milvus migrans*), Honey Buzzard (*Pernis apivorus*), Sparrowhak (*Accipiter nisus*), some harriers (*Circus* spp.), Common Kesterl (*Falco tinnunculus*), European Bee-eater (*Merops apiaster*), European Roller (*Coracias garrulous*), Rook (*Corvus frugilegus*), etc. Among small-sized passage visitors the most abundant are Common Swift (*Apus apus*), Eurasian Crag Martin (*Ptyonoprogne rupestris*), Barn Swallow (*Hirundo rustica*), House Martin (*Delichon urbica*), various larks, pipits, finches, buntings, some other passerine bird species.

- The majority long-distance transit migrants were observed flying at altitudes above 200 meters of the terrain. This primarily relates to the large- and medium-sized migrants, such as Honey Buzzard (*Pernis apivorus*), Black Kite (*Milvus migrans*), Common Buzzard (*Buteo buteo*), Lesser Spotted Eagle (*Aquila pomarina*), Booted Eagle (*Hierraetus pennatus*) as well as to some other transients - European Bee-eater (*Merops apiaster*), Common Swift (*Apus apus*), Rook (*Corvus frugilegus*), some other medium-sized bird species. Another group of large and medium-sized birds of prey flies within a height of 5 - 50 meters above the terrain. This species such as hawks (*Accipiter* spp.), all species of harriers (Circus spp.), European Roller (*Coracias garrulous*), Common Quail (*Coturnix coturnix*), Hoopoe (*Upupa epops*) during migrations were observed at low altitudes.

- It is well known, that the territory of Georgia is an important area for various groups of wintering birds - in first turn for species associated with wetlands, sea shore, coastal lowlands, birds of prey, passerines, some other groups of birds. The significance of Georgian wintering grounds is greatly increased when unfavorable weather conditions take place in northward regions (northern and eastern shores of the Black sea, basin of the Azov Sea, southern regions of Russia, Front-Caucasian area, Northern Caucasus, lower Don River valley, lower part of the Volga River valley, etc.). But the area under consideration, or Ruisi WPP Project Area as well as adjacent parts of the Kvernaki Ridge located outside of the main wintering grounds of birds in Georgia (see Figure 6-40) and the importance of the study area as a wintering ground should be classified as a very low for some bird species, mostly passerines, wintering in the study area. Number of wintering bird species in all years was less than 50m usually less than 40, and total numbers of each winterer species is very low. In general, this area has no any significance for wintering birds (Abuladze 2012; 2013);

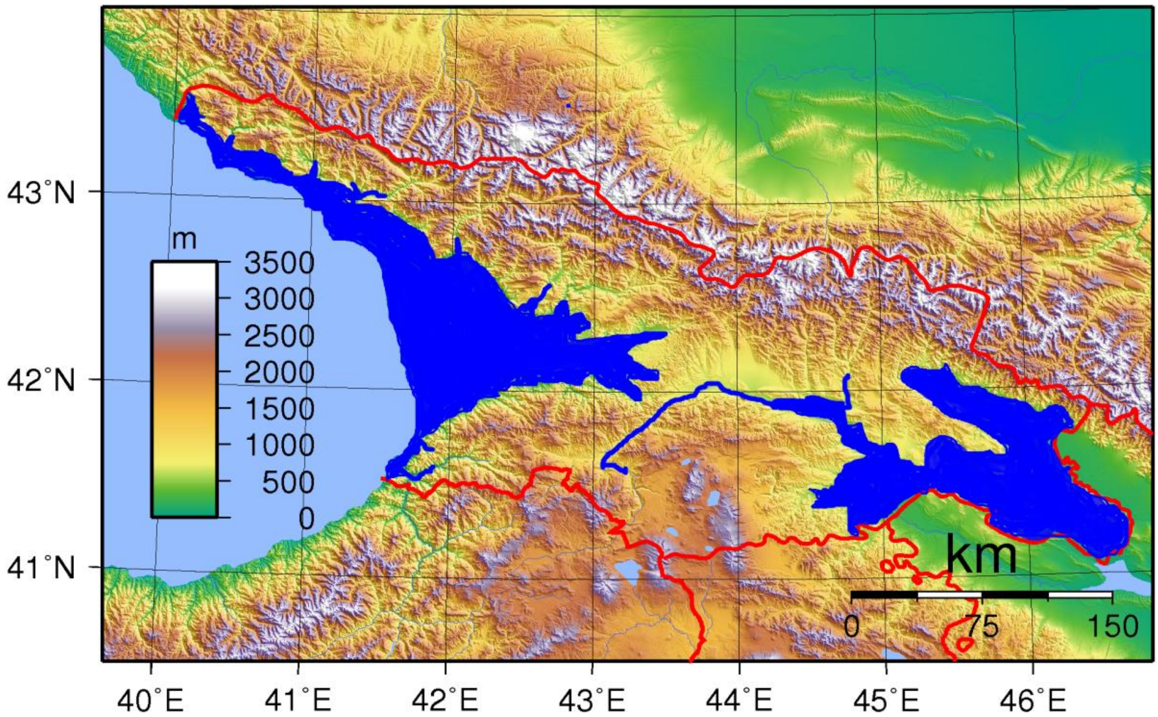


Figure 6-40 Wintering grounds of birds in Georgia (marked in blue)

6.7.3.4.1 Main Conclusion

Summarizing all the materials collected, we can draw the main conclusion - the construction and operation of the planned station should not have any serious negative impact on the avifauna. Both at the national level and, moreover, at the regional level.

Naturally, during the construction, and even more so during the subsequent operation of the wind power plant, all the requirements and standards that apply to the technical facilities of such a project must be applied and observed.

6.7.3.4.2 Collision Risk Assessment

There are several methodologies and models of bird collision risk that could be used during the asseesment of risks associated with the wind power plants. For the data collection we used the methodology proposed by the Scottish Natural Heritage and have matched it to local conditions increasing, in addition to vintage point observations, the observations from mobile sources enabling to better track the flight within the project zone in conditions when the bird number is not so high. At first glance, it seemed logical to use for collision risk assessment the approaches, methodology and models developed by the same Scottish Natural Heritage. However, there are several arguments, which support the idea that at ths stage of project development it is not feasible to use this methodology and it should be replaced by other approaches:

- First of all, the methodology developed by Scottish Natural Heritage is meaningful and efficient tool when the number of birds in the project area is high and their flight heights correspond to the location of the rotor blades and accordingly – the risk zones. In our case the number of birds in the project area is low and the flight heights are either much higher (for birds of pray) than the rotor location, or much lower (in case of quale).

- The development of a full collision risk assessment is possible only at the detailed design stage after determining the location of the turbines, their type, size, number, distance between them, orientation relative to the bird migration front, the nature of the surrounding habitats and other markers and parameters. This data is not available at present.
- In addition, it is necessary to have information about the biometric parameters (body length and wingspan) of the target bird species, their flight speed in different winds, daily activity, heights and directions of flight during seasonal migrations and local movements, numbers and density of breeding species, location of breeding, feeding and resting habitats, etc. All necessary materials were taken from special sources. In particular, data on the Birds of Prey biometrics was taken from the following sources:
    - http://europeanraptors.org/raptors-species/
    - http://www.oiseaux-birds.com/home-page.html
    - https://www.bto.org/understanding-birds/birdfacts
    - Information about flight speed data was taken from: Alerstam, T., Rosen M., Backman J., G P., Ericson P & Hellgren O. 2007. Flight Speeds among Bird Species: Allometric and Phylogenetic Effects PLoS Biol, 5, 1656-1662. DOI:10.1371/journal.pbio.0050197

Thus the main conclusion maid was that:

- For the specific conditions of the project area the methodology proposed for collision risk assessment by Scottish Natural Heritage is excessive and do not provide added value to general conclusions made earlier, which seem to be sufficient for the decision making
- The Collision Risk Assessment (CRA) in accordance with the Scottish Natural Heritage could not be conducted at present due to the lack of the technical information. CRA based on this model could be conducted later at the detailed design stage, when all the required technical details are available

Taking into account the aforementioned, it was recommended:

- to conduct the CRA repeatedly at the detailed design stage, using the Scottish Natural Heritage methodology.
- to conduct at present stage simplified CRA. For this purpose, the Band oblique collision risk method was used. This method is very popular among specialists and has been used in similar projects in other countries:
    - https://www.natural-research.org/ecological-consultancy-company/ornithology/collision-risk-modelling

The results are presented below. Calculations are presented separately for the most common target bird species.

Table 6-19 Summary of collision risk modelling parameters for some target bird species recorded at the Ruisi WPP

Raptor species	**Length:** min-max / average (cm)	**Wingspan** min-max / average (cm)	**Average speed** (m/sec)	**Bird observation time at 20-200m** (secs)
Honey Buzzard	51-60 / 55	135-150 / 142	10	~30
Black Kite	48-58 / 53	135-150 / 145	10	~170
Short-toed Eagle	62-67/65	170-185 / 180	15	~240
Hen Harrier	48-50	110	10	~80

Raptor species	Length: min-max / average (cm)	Wingspan min-max / average (cm)	Average speed (m/sec)	Bird observation time at 20-200m (secs)
Marsh Harrier	48-56 / 52	120-135 / 125	12	~320
Pallid Harrier	48-50	95-120 / 110	10	15
Montagu's Harrier	43-50 / 45	97-115 / 110	10	~480
Goshawk	46-63 / 55	89-122 / 110	15	12
Sparrowhawk, female	35-41 / 38	67-80 / 74	10	~360
Common Buzzard	50-57 / 55	113-128 / 120	14	~1400
Long-legged Buzzard	65	126-155 / 140	15	220
Rough-legged Buzzard	49-59 / 56	125-148 / 138	14	20
Lesser Spotted Eagle	55-65 / 60	153-177 / 165	18	~90
Booted Eagle	45-55 / 50	110-130 / 120	15	~140
Eurasian Hobby	32-36 / 35	68-84 / 75	15	7
Lesser Kestrel	29-32 / 30	58-72 / 65	10	2
Common Kestrel	32-39 / 35	68-85 / 75	10	~625

► **Black Kite (*Milvus migrans*)**

The collision risk is calculated with an angle to head wind 180 degree. The biometric and speed parameters of the species used for the calculation of the collision risk:

Length (m)	**0,53**
Wingspan (m)	**1,45**
Speed relative to air (m/s)	**10**
Flapping (0) or Gliding (1)	**0 and 1**

Table 6-20 The collision risk for Black Kite under condition of 0, 5 and 10 m/s wind speed.

Wind speed (m/s)	Angle	Risk	Wind speed (m/s)	Angle	Risk	Wind speed (m/s)	Angle	Risk
0	0	7,5%	5	0	13,6%	10	0	*
0	5	7,5%	5	5	13,6%	10	5	*
0	10	7,5%	5	10	13,5%	10	10	*
0	15	7,4%	5	15	13,4%	10	15	*
0	20	7,5%	5	20	13,1%	10	20	*
0	25	8,0%	5	25	12,8%	10	25	*
0	30	8,6%	5	30	12,5%	10	30	*
0	35	9,1%	5	35	12,1%	10	35	*
0	40	9,7%	5	40	12,1%	10	40	*
0	45	10,2%	5	45	12,3%	10	45	*
0	50	10,6%	5	50	12,6%	10	50	*
0	55	11,0%	5	55	12,8%	10	55	*
0	60	11,3%	5	60	12,9%	10	60	*
0	65	11,6%	5	65	13,0%	10	65	*
0	70	11,9%	5	70	13,1%	10	70	*
0	75	12,1%	5	75	13,1%	10	75	*
0	80	12,3%	5	80	13,1%	10	80	*
0	85	9,5%	5	85	9,5%	10	85	*
0	90	0,8%	5	90	0,8%	10	90	0,8%
0	95	9,5%	5	95	9,5%	10	95	9,6%
0	100	11,8%	5	100	12,0%	10	100	16,3%
0	105	11,4%	5	105	11,3%	10	105	14,2%
0	110	10,9%	5	110	10,8%	10	110	12,3%
0	115	10,5%	5	115	10,2%	10	115	11,0%
0	120	10,0%	5	120	9,6%	10	120	10,0%
0	125	9,5%	5	125	9,0%	10	125	9,1%
0	130	8,9%	5	130	8,4%	10	130	8,3%
0	135	8,3%	5	135	7,7%	10	135	7,5%
0	140	7,7%	5	140	7,0%	10	140	6,8%
0	145	7,0%	5	145	6,3%	10	145	6,0%
0	150	6,4%	5	150	5,6%	10	150	5,3%
0	155	5,7%	5	155	4,9%	10	155	4,6%
0	160	5,2%	5	160	4,1%	10	160	3,8%
0	165	5,0%	5	165	3,5%	10	165	3,1%
0	170	5,0%	5	170	3,2%	10	170	2,6%
0	175	5,0%	5	175	3,2%	10	175	2,4%
0	180	5,0%	5	180	3,2%	10	180	2,4%

► **Short-toed Eagle (*Circaetus gallicus*)**

The collision risk is calculated with an angle to head wind 180 degree.

The biometric and speed parameters of the species used for the calculation of the collision risk:

Length (m)	**0,65**
Wingspan (m)	**1,80**
Speed relative to air (m/s)	**15**
Flapping (0) or Gliding (1)	**1**

Table 6-21 The collision risk for Short-toed Eagle under condition of 0,5 and 10 m/s wind speed.

Wind speed (m/s)	Angle	Risk	Wind speed (m/s)	Angle	Risk	Wind speed (m/s)	Angle	Risk
0	0	6,0%	5	0	8,2%	10	0	15,1%
0	5	6,0%	5	5	8,2%	10	5	15,0%
0	10	5,9%	5	10	8,2%	10	10	14,9%
0	15	5,9%	5	15	8,1%	10	15	14,7%
0	20	6,1%	5	20	8,0%	10	20	14,4%
0	25	6,4%	5	25	7,9%	10	25	14,1%
0	30	6,8%	5	30	7,9%	10	30	13,6%
0	35	7,3%	5	35	8,2%	10	35	13,1%
0	40	7,7%	5	40	8,5%	10	40	12,6%
0	45	8,1%	5	45	8,8%	10	45	12,0%
0	50	8,5%	5	50	9,1%	10	50	11,4%
0	55	8,8%	5	55	9,4%	10	55	11,2%
0	60	9,0%	5	60	9,6%	10	60	11,2%
0	65	9,3%	5	65	9,7%	10	65	11,2%
0	70	9,5%	5	70	9,9%	10	70	11,1%
0	75	9,6%	5	75	10,0%	10	75	11,0%
0	80	9,8%	5	80	10,1%	10	80	11,0%
0	85	9,4%	5	85	9,4%	10	85	9,6%
0	90	1,0%	5	90	1,0%	10	90	1,0%
0	95	9,3%	5	95	9,3%	10	95	9,5%
0	100	9,3%	5	100	9,3%	10	100	9,6%
0	105	8,9%	5	105	8,9%	10	105	9,1%
0	110	8,6%	5	110	8,4%	10	110	8,5%
0	115	8,2%	5	115	8,0%	10	115	8,0%
0	120	7,8%	5	120	7,6%	10	120	7,5%
0	125	7,3%	5	125	7,1%	10	125	7,0%
0	130	6,9%	5	130	6,6%	10	130	6,5%
0	135	6,4%	5	135	6,1%	10	135	6,0%
0	140	5,9%	5	140	5,6%	10	140	5,4%
0	145	5,3%	5	145	5,0%	10	145	4,9%
0	150	4,8%	5	150	4,5%	10	150	4,3%
0	155	4,3%	5	155	3,9%	10	155	3,7%
0	160	3,9%	5	160	3,4%	10	160	3,2%
0	165	3,7%	5	165	3,0%	10	165	2,7%
0	170	3,7%	5	170	2,8%	10	170	2,4%
0	175	3,7%	5	175	2,8%	10	175	2,3%
0	180	3,7%	5	180	2,8%	10	180	2,3%

► **Honey Buzzard (*Pernis apivorus*)**

The collision risk is calculated with an angle to head wind 180 degree.

The biometric and speed parameters of the species used for the calculation of the collision risk:

Length (m)	**0,55**
Wingspan (m)	**1,42**
Speed relative to air (m/s)	**10**
Flapping (0) or Gliding (1)	**1**

Table 6-22 The collision risk for Honey Buzzard under condition of 0, 5 and 10 m/s wind speed.

Wind speed (m/s)	Angle	Risk
0	0	7,6%
0	5	7,6%
0	10	7,6%
0	15	7,5%
0	20	7,5%
0	25	7,9%
0	30	8,5%
0	35	9,0%
0	40	9,5%
0	45	10,0%
0	50	10,5%
0	55	10,8%
0	60	11,2%
0	65	11,4%
0	70	11,7%
0	75	11,9%
0	80	12,1%
0	85	9,5%
0	90	0,8%
0	95	9,5%
0	100	11,6%
0	105	11,2%
0	110	10,8%
0	115	10,3%
0	120	9,8%
0	125	9,3%
0	130	8,8%
0	135	8,2%
0	140	7,6%
0	145	6,9%
0	150	6,3%
0	155	5,6%
0	160	5,2%
0	165	5,1%
0	170	5,1%
0	175	5,2%
0	180	5,2%

Wind speed (m/s)	Angle	Risk
5	0	13,9%
5	5	13,8%
5	10	13,7%
5	15	13,6%
5	20	13,4%
5	25	13,1%
5	30	12,7%
5	35	12,3%
5	40	12,0%
5	45	12,2%
5	50	12,4%
5	55	12,6%
5	60	12,8%
5	65	12,9%
5	70	12,9%
5	75	12,9%
5	80	12,9%
5	85	9,5%
5	90	0,8%
5	95	9,5%
5	100	11,8%
5	105	11,2%
5	110	10,6%
5	115	10,0%
5	120	9,5%
5	125	8,9%
5	130	8,2%
5	135	7,6%
5	140	6,9%
5	145	6,2%
5	150	5,5%
5	155	4,8%
5	160	4,1%
5	165	3,5%
5	170	3,3%
5	175	3,3%
5	180	3,3%

Wind speed (m/s)	Angle	Risk
10	0	*
10	5	*
10	10	*
10	15	*
10	20	*
10	25	*
10	30	*
10	35	*
10	40	*
10	45	*
10	50	*
10	55	*
10	60	*
10	65	*
10	70	*
10	75	*
10	80	*
10	85	*
10	90	0,8%
10	95	9,5%
10	100	16,4%
10	105	14,0%
10	110	12,1%
10	115	10,9%
10	120	9,8%
10	125	9,0%
10	130	8,2%
10	135	7,4%
10	140	6,7%
10	145	5,9%
10	150	5,2%
10	155	4,5%
10	160	3,8%
10	165	3,1%
10	170	2,6%
10	175	2,4%
10	180	2,4%

► **Lesser Spotted Eagle** (***Aquila pomarina***)

The collision risk is calculated with an angle to head wind 180 degree.

The biometric and speed parameters of the species used for the calculation of the collision risk:

Length (m)	**0,60**
Wingspan (m)	**1,65**
Speed relative to air (m/s)	**18**
Flapping (0) or Gliding (1)	**0 and 1**

Table 6-23 The collision risk for Lesser Spotted Eagle under condition of 0,5 and 10 m/s wind speed

Wind speed (m/s)	Angle	Risk
0	0	5,9%
0	5	5,9%
0	10	5,9%
0	15	5,8%
0	20	5,9%
0	25	6,1%
0	30	6,5%
0	35	7,0%
0	40	7,3%
0	45	7,7%
0	50	8,0%
0	55	8,3%
0	60	8,5%
0	65	8,7%
0	70	8,9%
0	75	9,0%
0	80	9,2%
0	85	9,0%
0	90	0,9%
0	95	8,8%
0	100	8,7%
0	105	8,3%
0	110	8,0%
0	115	7,6%
0	120	7,2%
0	125	6,8%
0	130	6,4%
0	135	5,9%
0	140	5,5%
0	145	5,0%
0	150	4,5%
0	155	4,0%
0	160	3,7%
0	165	3,6%
0	170	3,6%
0	175	3,6%
0	180	3,6%

Wind speed (m/s)	Angle	Risk
5	0	8,1%
5	5	8,1%
5	10	8,1%
5	15	8,0%
5	20	7,8%
5	25	7,7%
5	30	7,7%
5	35	7,8%
5	40	8,1%
5	45	8,4%
5	50	8,7%
5	55	8,9%
5	60	9,0%
5	65	9,2%
5	70	9,3%
5	75	9,3%
5	80	9,4%
5	85	9,1%
5	90	0,9%
5	95	8,9%
5	100	8,7%
5	105	8,2%
5	110	7,8%
5	115	7,4%
5	120	7,0%
5	125	6,6%
5	130	6,1%
5	135	5,7%
5	140	5,2%
5	145	4,7%
5	150	4,2%
5	155	3,6%
5	160	3,2%
5	165	2,8%
5	170	2,7%
5	175	2,7%
5	180	2,7%

Wind speed (m/s)	Angle	Risk
10	0	14,8%
10	5	14,8%
10	10	14,7%
10	15	14,5%
10	20	14,2%
10	25	13,8%
10	30	13,4%
10	35	12,9%
10	40	12,4%
10	45	11,8%
10	50	11,1%
10	55	10,7%
10	60	10,7%
10	65	10,6%
10	70	10,5%
10	75	10,4%
10	80	10,3%
10	85	9,3%
10	90	0,9%
10	95	9,2%
10	100	9,0%
10	105	8,4%
10	110	7,9%
10	115	7,5%
10	120	7,0%
10	125	6,5%
10	130	6,0%
10	135	5,5%
10	140	5,0%
10	145	4,5%
10	150	4,0%
10	155	3,5%
10	160	3,0%
10	165	2,5%
10	170	2,3%
10	175	2,2%
10	180	2,2%

► **Western Marsh Harrier (*Circus aeruginosus*)**

Western Marsh Harrier (*Circus aeruginosus*), male

The collision risk is calculated with an angle to head wind 180 degree.

The biometric and speed parameters of the species used for the calculation of the collision risk:

Length (m)	**0,52**
Wingspan (m)	**1,25**
Speed relative to air (m/s)	**12**
Flapping (0) or Gliding (1)	**1**

Table 6-24 The collision risk for Marsh Harrier under condition of 0, 5 and 10 m/s wind speed

Wind speed (m/s)	Angle	Risk
0	0	6,4%
0	5	6,4%
0	10	6,4%
0	15	6,3%
0	20	6,3%
0	25	6,5%
0	30	6,8%
0	35	7,2%
0	40	7,6%
0	45	7,9%
0	50	8,2%
0	55	8,5%
0	60	8,7%
0	65	8,8%
0	70	9,0%
0	75	9,1%
0	80	9,2%
0	85	8,9%
0	90	0,8%
0	95	8,8%
0	100	8,8%
0	105	8,4%
0	110	8,1%
0	115	7,7%
0	120	7,4%
0	125	7,0%
0	130	6,6%
0	135	6,1%
0	140	5,7%
0	145	5,2%
0	150	4,7%
0	155	4,3%
0	160	4,0%
0	165	4,0%
0	170	4,0%
0	175	4,0%
0	180	4,0%

Wind speed (m/s)	Angle	Risk
5	0	10,0%
5	5	10,0%
5	10	10,0%
5	15	9,8%
5	20	9,7%
5	25	9,5%
5	30	9,2%
5	35	9,0%
5	40	9,0%
5	45	9,2%
5	50	9,4%
5	55	9,5%
5	60	9,6%
5	65	9,7%
5	70	9,7%
5	75	9,7%
5	80	9,7%
5	85	9,0%
5	90	0,8%
5	95	8,9%
5	100	8,8%
5	105	8,3%
5	110	7,9%
5	115	7,5%
5	120	7,1%
5	125	6,6%
5	130	6,2%
5	135	5,7%
5	140	5,2%
5	145	4,7%
5	150	4,2%
5	155	3,7%
5	160	3,2%
5	165	2,9%
5	170	2,7%
5	175	2,7%
5	180	2,7%

Wind speed (m/s)	Angle	Risk
10	0	31,7%
10	5	31,6%
10	10	31,3%
10	15	30,9%
10	20	30,2%
10	25	29,3%
10	30	28,2%
10	35	27,0%
10	40	25,6%
10	45	24,1%
10	50	22,5%
10	55	20,8%
10	60	19,0%
10	65	17,2%
10	70	15,4%
10	75	13,7%
10	80	12,6%
10	85	9,3%
10	90	0,8%
10	95	9,2%
10	100	9,8%
10	105	9,0%
10	110	8,3%
10	115	7,7%
10	120	7,1%
10	125	6,6%
10	130	6,0%
10	135	5,5%
10	140	5,0%
10	145	4,5%
10	150	3,9%
10	155	3,4%
10	160	2,9%
10	165	2,4%
10	170	2,2%
10	175	2,1%
10	180	2,1%

► **Northern (Hen) Harrier (*Circus cyaneus*)**

Northern Harrier (*Circus cyaneus*), adult male

Northern (Hen) Harrier (*Circus pygargus*), male

The collision risk is calculated with an angle to head wind 180 degree.

The biometric and speed parameters of the species used for the calculation of the collision risk:

Length (m)	**0,49**
Wingspan (m)	**1,10**
Speed relative to air (m/s)	**10**
Flapping (0) or Gliding (1)	**1**

Table 6-25 The collision risk for Hen Harrier under condition of 0, 5 and 10 m/s wind speed

Wind speed (m/s)	Angle	Risk
0	0	5,3%
0	5	5,3%
0	10	5,3%
0	15	5,2%
0	20	5,2%
0	25	5,3%
0	30	5,4%
0	35	5,7%
0	40	5,9%
0	45	6,1%
0	50	6,3%
0	55	6,4%
0	60	6,5%
0	65	6,6%
0	70	6,6%
0	75	6,6%
0	80	6,6%
0	85	6,7%
0	90	6,8%
0	95	6,3%
0	100	6,3%
0	105	6,1%
0	110	5,8%
0	115	5,5%
0	120	5,3%
0	125	5,0%
0	130	4,7%
0	135	4,4%
0	140	4,0%
0	145	3,7%
0	150	3,4%
0	155	3,1%
0	160	3,0%
0	165	3,0%
0	170	3,0%
0	175	3,0%
0	180	3,0%

Wind speed (m/s)	Angle	Risk
5	0	7,3%
5	5	7,3%
5	10	7,2%
5	15	7,1%
5	20	7,0%
5	25	6,9%
5	30	6,7%
5	35	6,6%
5	40	6,7%
5	45	6,8%
5	50	6,9%
5	55	7,0%
5	60	7,1%
5	65	7,1%
5	70	7,1%
5	75	7,1%
5	80	7,1%
5	85	7,1%
5	90	7,1%
5	95	6,73%
5	100	6,3%
5	105	6,0%
5	110	5,7%
5	115	5,4%
5	120	5,1%
5	125	4,7%
5	130	4,4%
5	135	4,1%
5	140	3,7%
5	145	3,4%
5	150	3,0%
5	155	2,7%
5	160	2,4%
5	165	2,3%
5	170	2,2%
5	175	2,2%
5	180	2,2%

Wind speed (m/s)	Angle	Risk
10	0	13,1%
10	5	13,1%
10	10	13,0%
10	15	12,8%
10	20	12,6%
10	25	12,3%
10	30	11,9%
10	35	11,4%
10	40	10,9%
10	45	10,4%
10	50	9,8%
10	55	9,2%
10	60	8,7%
10	65	8,5%
10	70	8,3%
10	75	8,3%
10	80	8,1%
10	85	8,1%
10	90	7,9%
10	95	7,2%
10	100	6,6%
10	105	6,2%
10	110	5,8%
10	115	5,4%
10	120	5,0%
10	125	4,7%
10	130	4,3%
10	135	3,9%
10	140	3,6%
10	145	3,2%
10	150	2,9%
10	155	2,5%
10	160	2,2%
10	165	2,0%
10	170	1,8%
10	175	1,8%
10	180	1,8%

► **Pallid Harrier (*Circus macrourus*)**

Pallid Harrier (*Circus macrourus*), male

The collision risk is calculated with an angle to head wind 180 degree.

The biometric and speed parameters of the species used for the calculation of the collision risk:

Length (m)	**0,48**
Wingspan (m)	**1,10**
Speed relative to air (m/s)	**10**
Flapping (0) or Gliding (1)	**1**

Table 6-26 The collision risk for Hen Harrier under condition of 0,5 and 10 m/s wind speed

Wind speed (m/s)	Angle	Risk
0	0	5,3%
0	5	5,3%
0	10	5,2%
0	15	5,2%
0	20	5,2%
0	25	5,2%
0	30	5,4%
0	35	5,7%
0	40	5,9%
0	45	6,1%
0	50	6,3%
0	55	6,4%
0	60	6,5%
0	65	6,6%
0	70	6,7%
0	75	6,7%
0	80	6,8%
0	85	6,9%
0	90	0,7%
0	95	6,7%
0	100	6,3%
0	105	6,1%
0	110	5,8%
0	115	5,5%
0	120	5,3%
0	125	5,0%
0	130	4,7%
0	135	4,4%
0	140	4,0%
0	145	3,7%
0	150	3,4%
0	155	3,1%
0	160	3,0%
0	165	3,0%
0	170	3,0%
0	175	3,0%
0	180	3,0%

Wind speed (m/s)	Angle	Risk
5	0	7,2%
5	5	7,2%
5	10	7,1%
5	15	7,1%
5	20	7,0%
5	25	6,8%
5	30	6,7%
5	35	6,6%
5	40	6,7%
5	45	6,8%
5	50	6,9%
5	55	7,0%
5	60	7,1%
5	65	7,1%
5	70	7,1%
5	75	7,1%
5	80	7,1%
5	85	7,1%
5	90	0,7%
5	95	6,7%
5	100	6,3%
5	105	6,0%
5	110	5,7%
5	115	5,4%
5	120	5,1%
5	125	4,7%
5	130	4,4%
5	135	4,1%
5	140	3,7%
5	145	3,4%
5	150	3,0%
5	155	2,7%
5	160	2,4%
5	165	2,2%
5	170	2,2%
5	175	2,2%
5	180	2,2%

Wind speed (m/s)	Angle	Risk
10	0	13,0%
10	5	13,0%
10	10	12,9%
10	15	12,7%
10	20	12,5%
10	25	12,2%
10	30	11,8%
10	35	11,3%
10	40	10,8%
10	45	10,3%
10	50	9,7%
10	55	9,1%
10	60	8,7%
10	65	8,5%
10	70	8,3%
10	75	8,1%
10	80	7,9%
10	85	7,7%
10	90	0,7%
10	95	7,2%
10	100	6,6%
10	105	6,2%
10	110	5,8%
10	115	5,4%
10	120	5,0%
10	125	4,7%
10	130	4,3%
10	135	3,9%
10	140	3,6%
10	145	3,2%
10	150	2,9%
10	155	2,5%
10	160	2,2%
10	165	2,0%
10	170	1,8%
10	175	1,8%
10	180	1,8%

► **Eurasian Hobby (*Falco subbuteo*)**

The collision risk is calculated with an angle to head wind 180 degree.

The biometric and speed parameters of the species used for the calculation of the collision risk:

Length (m)	**0,35**
Wingspan (m)	**0,75**
Speed relative to air (m/s)	**15**
Flapping (0) or Gliding (1)	**1**

Table 6-27 The collision risk for Eurasian Hobby under condition of 0, 5 and 10 m/s wind speed

Wind speed (m/s)	Angle	Risk	Wind speed (m/s)	Angle	Risk	Wind speed (m/s)	Angle	Risk
0	0	6,4%	5	0	6,4%	10	0	11,5%
0	5	6,4%	5	5	6,4%	10	5	11,4%
0	10	6,4%	5	10	6,4%	10	10	11,3%
0	15	6,3%	5	15	6,3%	10	15	11,2%
0	20	6,2%	5	20	6,2%	10	20	11,0%
0	25	6,2%	5	25	6,1%	10	25	10,7%
0	30	6,4%	5	30	5,9%	10	30	10,4%
0	35	6,7%	5	35	5,8%	10	35	10,0%
0	40	6,9%	5	40	5,8%	10	40	9,5%
0	45	7,1%	5	45	5,8%	10	45	9,1%
0	50	7,3%	5	50	5,8%	10	50	8,6%
0	55	7,5%	5	55	5,8%	10	55	8,0%
0	60	7,6%	5	60	5,8%	10	60	7,5%
0	65	7,7%	5	65	5,8%	10	65	7,2%
0	70	7,8%	5	70	5,7%	10	70	7,0%
0	75	7,8%	5	75	5,7%	10	75	6,7%
0	80	7,9%	5	80	5,6%	10	80	6,5%
0	85	7,7%	5	85	5,6%	10	85	6,3%
0	90	0,5%	5	90	0,5%	10	90	0,5%
0	95	7,6%	5	95	5,2%	10	95	5,6%
0	100	7,4%	5	100	4,8%	10	100	5,1%
0	105	7,1%	5	105	4,6%	10	105	4,8%
0	110	6,8%	5	110	4,3%	10	110	4,4%
0	115	6,6%	5	115	4,1%	10	115	4,1%
0	120	6,3%	5	120	3,8%	10	120	3,8%
0	125	6,0%	5	125	3,6%	10	125	3,5%
0	130	5,7%	5	130	3,3%	10	130	3,2%
0	135	5,3%	5	135	3,1%	10	135	2,9%
0	140	5,0%	5	140	2,8%	10	140	2,7%
0	145	4,6%	5	145	2,6%	10	145	2,4%
0	150	4,2%	5	150	2,3%	10	150	2,2%
0	155	4,0%	5	155	2,1%	10	155	1,9%
0	160	3,9%	5	160	1,9%	10	160	1,7%
0	165	3,9%	5	165	1,8%	10	165	1,6%
0	170	3,9%	5	170	1,8%	10	170	1,5%
0	175	3,9%	5	175	1,8%	10	175	1,5%
0	180	4,0%	5	180	1,8%	10	180	1,5%

► **Lesser Kestrel (*Falco naumanni*)**

The collision risk is calculated with an angle to head wind 180 degree. The biometric and speed parameters of the species used for the calculation of the collision risk:

Length (m)	**0,30**
Wingspan (m)	**0,65**
Speed relative to air (m/s)	**10**
Flapping (0) or Gliding (1)	**1**

Table 6-28 The collision risk for Lesser Kestrel under condition of 0,5 and 10 m/s wind speed

Wind speed (m/s)	Angle	Risk	Wind speed (m/s)	Angle	Risk	Wind speed (m/s)	Angle	Risk
0	0	6,1%	5	0	10,9%	10	0	*
0	5	6,1%	5	5	10,8%	10	5	*
0	10	6,1%	5	10	10,8%	10	10	*
0	15	6,0%	5	15	10,6%	10	15	*
0	20	6,0%	5	20	10,5%	10	20	*
0	25	6,0%	5	25	10,2%	10	25	*
0	30	6,1%	5	30	10,0%	10	30	*
0	35	6,3%	5	35	9,7%	10	35	*
0	40	6,5%	5	40	9,3%	10	40	*
0	45	6,7%	5	45	9,0%	10	45	*
0	50	6,9%	5	50	8,8%	10	50	*
0	55	7,0%	5	55	8,8%	10	55	*
0	60	7,1%	5	60	8,7%	10	60	*
0	65	7,1%	5	65	8,5%	10	65	*
0	70	7,2%	5	70	8,4%	10	70	*
0	75	7,2%	5	75	8,2%	10	75	*
0	80	7,2%	5	80	8,1%	10	80	*
0	85	7,2%	5	85	7,6%	10	85	*
0	90	0,5%	5	90	0,5%	10	90	0,5%
0	95	7,0%	5	95	7,3%	10	95	9,2%
0	100	6,8%	5	100	6,9%	10	100	13,2%
0	105	6,5%	5	105	6,5%	10	105	9,3%
0	110	6,3%	5	110	6,1%	10	110	7,6%
0	115	6,0%	5	115	5,7%	10	115	6,5%
0	120	5,8%	5	120	5,4%	10	120	5,8%
0	125	5,5%	5	125	5,0%	10	125	5,1%
0	130	5,2%	5	130	4,6%	10	130	4,6%
0	135	4,9%	5	135	4,3%	10	135	4,1%
0	140	4,6%	5	140	3,9%	10	140	3,7%
0	145	4,3%	5	145	3,5%	10	145	3,3%
0	150	3,9%	5	150	3,2%	10	150	2,9%
0	155	3,7%	5	155	2,8%	10	155	2,5%
0	160	3,6%	5	160	2,5%	10	160	2,1%
0	165	3,6%	5	165	2,3%	10	165	1,8%
0	170	3,6%	5	170	2,2%	10	170	1,7%
0	175	3,6%	5	175	2,3%	10	175	1,6%
0	180	3,7%	5	180	2,3%	10	180	1,7%

Common Kestrel (*Falco tinnunculus*)

The collision risk is calculated with an angle to head wind 180 degree.

The biometric and speed parameters of the species used for the calculation of the collision risk:

Length (m)	**0,35**
Wingspan (m)	**0,75**
Speed relative to air (m/s)	**10**
Flapping (0) or Gliding (1)	**1**

Table 6-29 The collision risk for Common Kestrel under condition of 0, 5 and 10 m/s wind speed

Wind speed (m/s)	Angle	Risk	Wind speed (m/s)	Angle	Risk	Wind speed (m/s)	Angle	Risk
0	0	6,4%	5	0	11,5%	10	0	*
0	5	6,4%	5	5	11,4%	10	5	*
0	10	6,4%	5	10	11,4%	10	10	*
0	15	6,3%	5	15	11,2%	10	15	*
0	20	6,2%	5	20	11,0%	10	20	*
0	25	6,2%	5	25	10,8%	10	25	*
0	30	6,4%	5	30	10,5%	10	30	*
0	35	6,7%	5	35	10,2%	10	35	*
0	40	6,9%	5	40	9,8%	10	40	*
0	45	7,1%	5	45	9,4%	10	45	*
0	50	7,3%	5	50	9,3%	10	50	*
0	55	7,5%	5	55	9,3%	10	55	*
0	60	7,6%	5	60	9,2%	10	60	*
0	65	7,7%	5	65	9,1%	10	65	*
0	70	7,8%	5	70	9,0%	10	70	*
0	75	7,8%	5	75	8,8%	10	75	*
0	80	7,9%	5	80	8,7%	10	80	*
0	85	7,7%	5	85	8,1%	10	85	*
0	90	0,5%	5	90	0,5%	10	90	0,5%
0	95	7,6%	5	95	7,8%	10	95	9,3%
0	100	7,4%	5	100	7,5%	10	100	13,9%
0	105	7,1%	5	105	7,1%	10	105	9,9%
0	110	6,8%	5	110	6,7%	10	110	8,2%
0	115	6,6%	5	115	6,3%	10	115	7,1%
0	120	6,3%	5	120	5,9%	10	120	6,3%
0	125	6,0%	5	125	5,5%	10	125	5,6%
0	130	5,7%	5	130	5,1%	10	130	5,0%
0	135	5,3%	5	135	4,7%	10	135	4,5%
0	140	5,0%	5	140	4,3%	10	140	4,0%
0	145	4,6%	5	145	3,9%	10	145	3,6%
0	150	4,2%	5	150	3,5%	10	150	3,2%
0	155	4,0%	5	155	3,1%	10	155	2,8%
0	160	3,9%	5	160	2,7%	10	160	2,4%
0	165	3,9%	5	165	2,5%	10	165	2,0%
0	170	3,9%	5	170	2,4%	10	170	1,8%
0	175	3,9%	5	175	2,5%	10	175	1,8%
0	180	4,0%	5	180	2,5%	10	180	1,8%

6.7.3.4.3 Recommendations

Unfortunately, among all animal group birds and in first turn large-sized and medium-sized soaring bird species shave the highest risk of mortality on the wind turbines and other technical constructions, including transmission power lines and various towers and pylons, typically located at the territory of wind parks or in adjacent areas. To minimize the potential negative impacts on the birds and sensitive breeding, feeding, resting and stop-over habitats, a number of methods have been developed and are being used in different countries. In this connection, for the effectiveness of proposed mitigation measures, the most serious attention paid to the problem of preventing bird death at transmission power lines. The overview reviews of environmental issues analyzed for the selection of most optimal and effective measures for the Ruisi WPP Project area.

Thus, in the case of the implementation of this project, already at the construction stage and subsequently during operation of the Ruisi WPP the following actions/measures are recommended for implementation:

► **Systematic control of the territory of Ruisi WPP**

More systematic the territory of Ruisi WPP, all Turbine Generators (WTG), substation(s), transmission power lines, various technical constructions, etc. searches, control and monitoring, in first turn during snowless seasons of year, especially during seasonal migrations of birds. Typically, the measurement of the effectiveness of any mitigation measure carried out through systematic monitoring of the territory of wind power plants. This involves walking, in some cases driving, across monitored area from first to last WTG, all other technical buildings and constructions and along the power lines and searching for collision victims - bird carcasses. Taking into account that most collision victims commonly may be found directly under WTGs or within 50 meters distance from a WTG or power line, observation should be done not only directly under turbines, but also in adjacent with WTG areas. The search area should include the area up to at least 50 meters, on both sides, measured from each WTG in tree-less habitats or at least 25 meters in woodlands and 100 m on open habitats. Preferably, the monitored areas should be covered on foot, but for large open bare areas, like upper and southern parts of the planned Nigoza WPP, searches can be carried out by at least of two observers from a slowly moving car with using methods of road-side survey. Victim searches should be carried out in good weather conditions. All cases of death should be documented in detail. It is very important to establish if the dead bird has truly suffered from an impact with the WTG or access power line or if there is another reason how the bird died (shooting, poisoning, prey victim - kills by birds of prey, other reasons). Evidence of collision can include fractured bones of the extremities (wings, legs and shoulder bones), broken vertebrae and skull fractures, torn off wings and limbs, flesh wounds, impact wounds on head or body where the bird hit the wire. Birds that have been shot often show shattered bones, spattered blood, contusions and bullet wounds (references in APLIC, 2006; Haas *et al*., 2005). Evidence of electrocution on the power line can include burn marks on feathers, feet, or bill, visible as *e.g*., small well-defined burn holes in the plumage, scorched areas at current entry and exit points, or large necrotic areas on the limbs. Of course it is necessary to establish which species is involved. Sometimes it is very difficult for the non-professional persons. Besides that, often this may be difficult when few parts of the carcass remain. There are, however, several web sites and books detailing the identification of birds by its individual feathers. The position of the carcass should be printed on a map or form to later identify the most problematic sections or WPP and each turbines or poles. It can also give information with which turbine the bird has collided. Information on age and sex of the bird should be noted to analyze the effect of age and gender on susceptibility for collision;

The most "dangerous" parts of the Ruisi WPP Project Area for large-sized and medium-sized diurnal birds of prey are fields in the southeastern and central parts of area under consideration or in areas around the following Wind Turbine Generators (WTG) - WTG No 02, WTG No 03, WTG No 07, No 08, WTG No 12, WTG No 16 and WTG No 20, WTG N0 23, WRG No 25 two turbines located to the north of this group of turbines – WTG No 27 and WTG No 33. It is this part of the Ruisi WPP Project Area that the largest number of target bird species was counted during the collection of materials in 2021 – 2022 – around ¾ of the total number of recorded birds of prey, especially those that prey on small rodents – mice and voles.

The following turbines can be considered less dangerous – WTG No 14, WTG No 17, WTG No 19, WTG No 35, WTG No 41 and WTG No 54.

The remaining turbines, located along the edges of the territory under consideration, are visited by birds of prey by chance, practically only during seasonal migrations. Due to the very high level of human economic activity, a strong factor of disturbance, the lack of suitable biotopes for hunting, raptors fly there without stopping and at high altitude – usually at 200+ m.

Conductors (wires) of the power line should be spaced at least as far apart as the wingspan of large birds (approximately three meters) apart, and pylons will be constructed to be "bird-proof" as much as it is possible.

► **Wind turbines and access power lines marking – making lines more visible to birds**

Wind turbine

In recent decades, in many countries, many wind farms have begun to use such a bird protection method as painting turbines in bright (red, orange, yellow), fluorescent or contrasting (dark black) colors (Figure 6-41, Figure 6-42). This method is indeed very productive and has been widely adopted and approved by specialists.

The all parts of WTG, especially WTG pylons and rotor blades, should be colored with luminescent paints and in the nights lighted with light of special spectrum – with low-pressure sodium lamps which emit monochromatic orange light with following characteristic - the wavelengths of light is about 600 nm.; the Correlated Colour Temperature (Kelvin) - 1807 K (Figure 6-43).

Figure 6-41 Marked wind turbines at the wind farm.

Figure 6-42 Marking of wind turbines with luminescent paint

Figure 6-43 The Dialight 860 Series Red LED Obstruction Light

A series of bird flight diverters of different types presented lower (Figure 6-44). For example, products of Ensto Utility Networks factories (Finland) - Bird protector wire markers and balls are presented at pictures below;

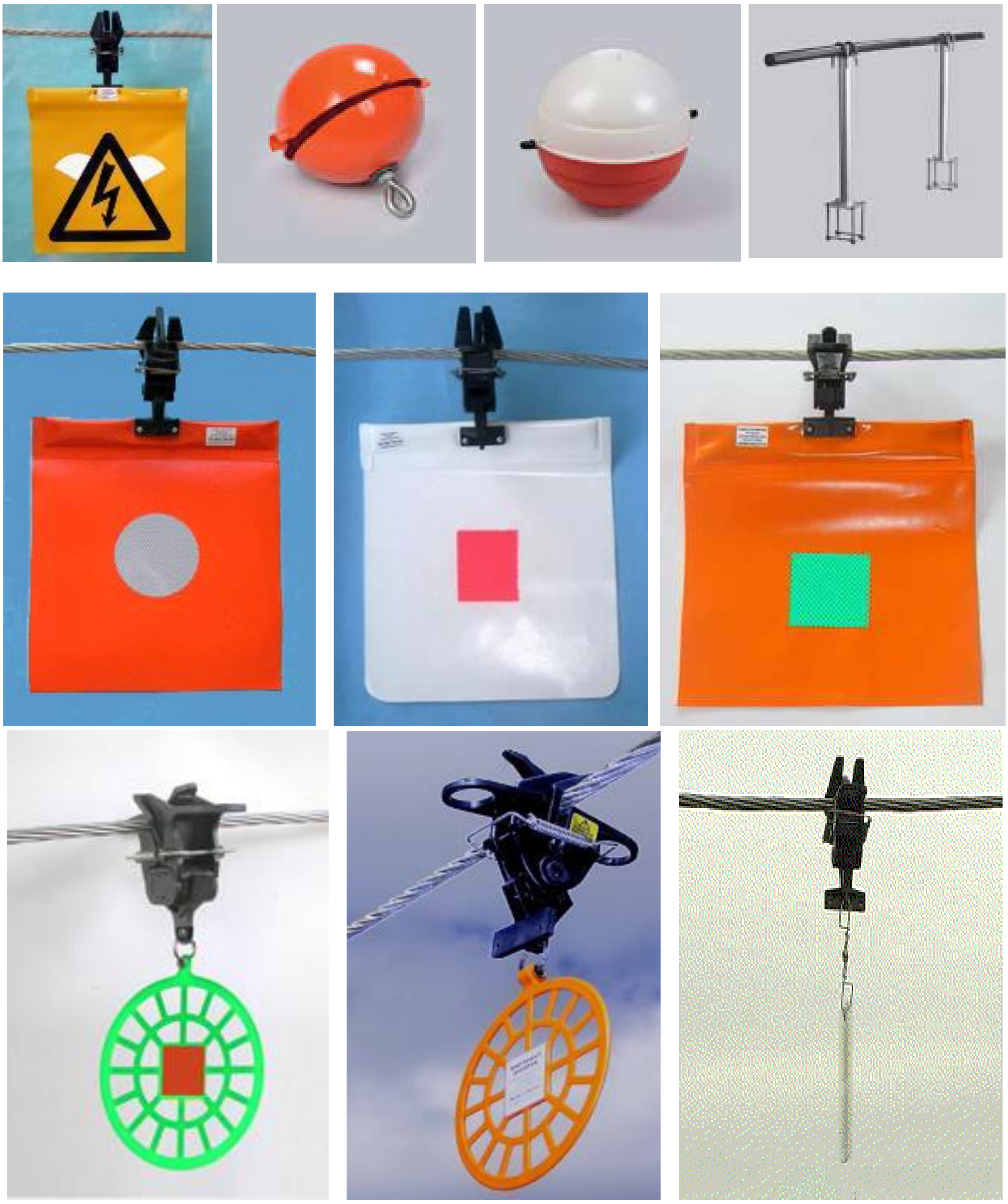


Figure 6-44 Bird flight diverts of various types

All constructions, buildings, structures, fences potentially suitable for birds of prey to sit on them should be equipped with anti-bird devices (Figure 6-45). The so-called “bird diverters” should be placed on the conductors. The “bird diverters” - shiny metal objects that spin in the wind, catch birds’ attention, and cause them to avoid the wire. Other mitigation measures that may be appropriate may be found in the

Avian Power Line Interaction Committee's Suggested Practices for Avian Protection on Power Lines (APLIC, 2006).

Figure 6-45 Anti-bird devices to be fixed on the different structures of the WWP

Use of some raptor species (Goshawk or large falcons) plastic or metal-plastic silhouettes, profiles (Figure 6-46) as well as models of Birds of Prey to reduce the risk bird collisions on turbines. Models or silhouettes should be prepared in natural sizes and colors (for more details see Janss, G.F.E., Lazo, A. & Ferrer, M., 1999. Use of raptor models to reduce avian collisions with powerlines // Journal of Raptor Research 33: 154-159).

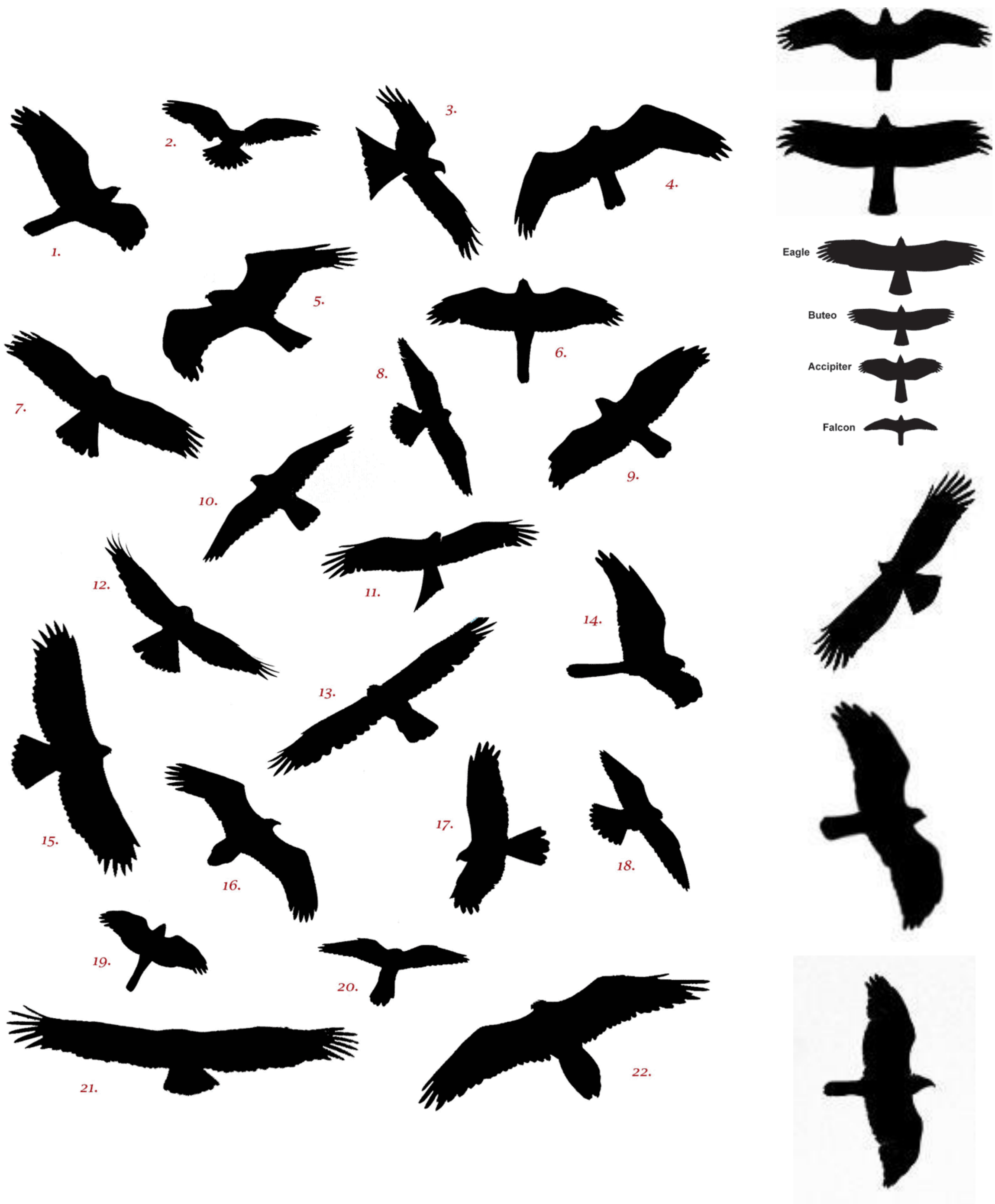


Figure 6-46 Various silhouettes and profiles of Birds of Prey

Some species of Birds of Prey use for hunting observation posts located at high points of area – on the tops of dry trees, pylons, roofs, rocks, etc. Taking into account that upper part of study area may be considered as feeding habitats for some raptor species, hunting on small rodents in open habitats, it is necessary to make and install artificial perches of various types and sizes, see pictures below (Figure 6-47). More optimal sizes of perches for the wind power plant will be 400- 500 cm with the horizontal axis 100 – 120 cm. The ideal materials for artificial perches are steel pipes with diameter 50 – 70 mm. The perches should be installed at distance at least 500 m (500 – 700 m) from the nearest turbines. Optimal number of artificial perches for the Ruisi WPP Project Area should be 15 – 20, mostly along eastern and northern borders of the Project Area.

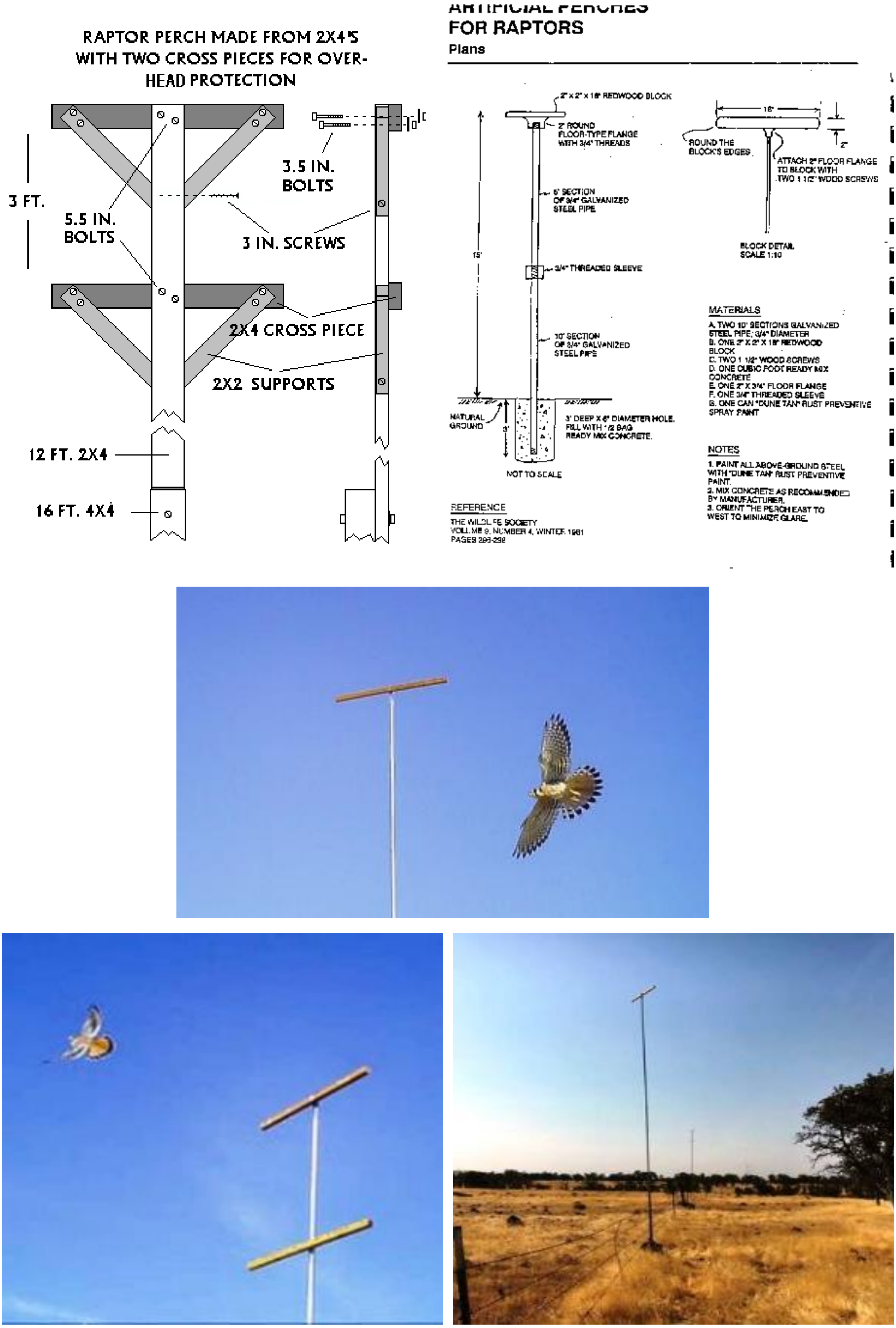
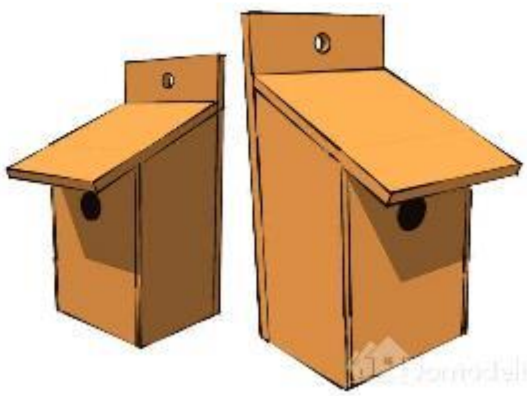


Figure 6-47 Artificial perches

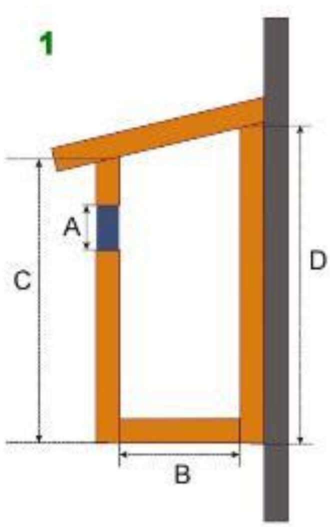
For the small-sized passerine birds will be necessary preparing of artificial nest-boxes and installation in adjacent areas, no closer than 300 m from the turbines. This will allow to control the breeding behavior of birds and attract them to nest away from turbines. Total optimal number of nest-boxes for instalation within the limits of Ruisi WPP Project Area 50 - 100. Nest-boxes No 1 and No 6 should be situated at trees in areas adjacent with territory of WPP, other types at various constructions, buildings, ruins, pylons, walls, fences in adjacent area, at trees in artificial pine forests, etc.

<u>Number of nest-boxes by types:</u>

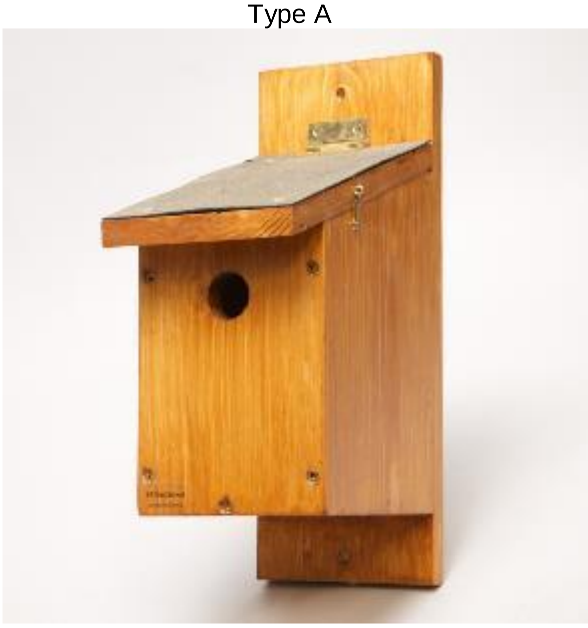
- Types No 1 A, B and C Number: 15 – 20



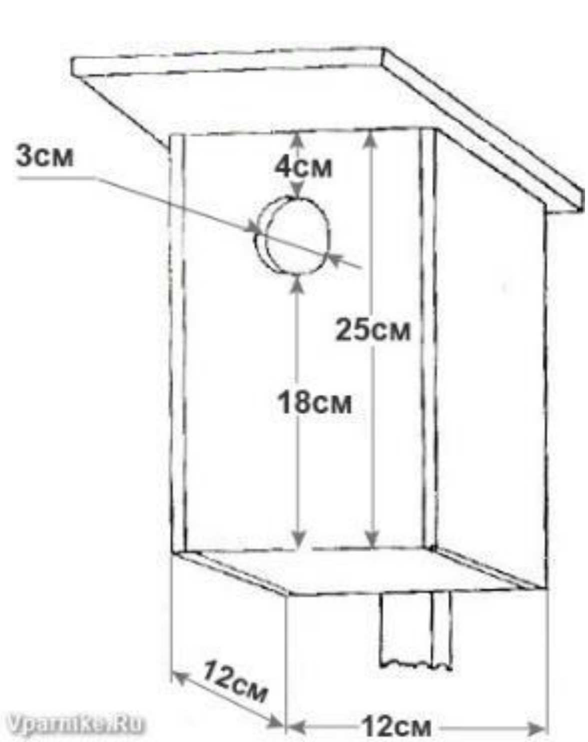
Type A



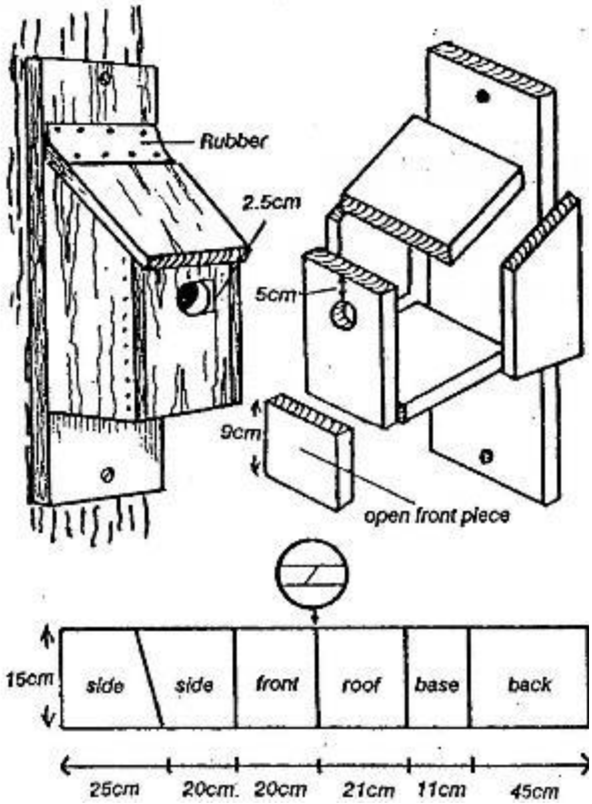
Nest-box No 1, type A



Type B

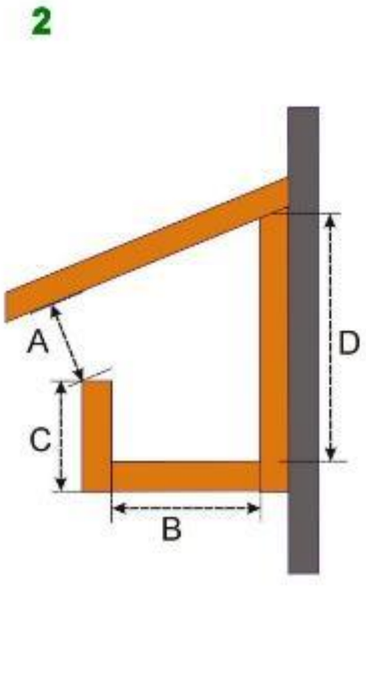


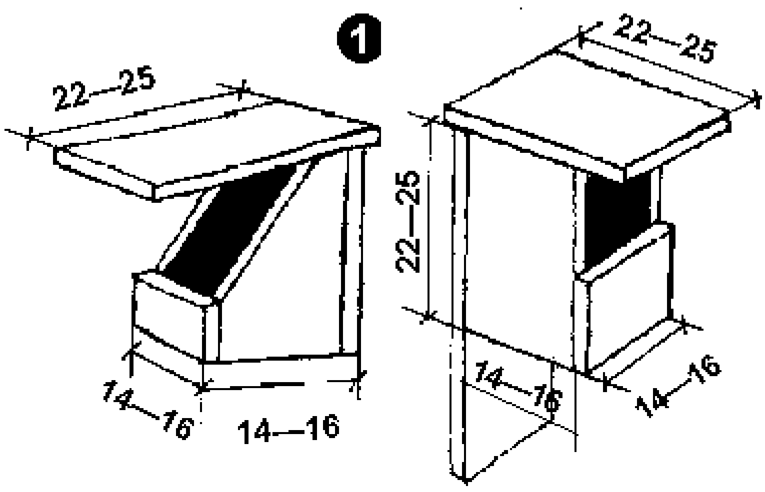
Type C



Sizes of Nest-boxes No 1

Nest-boxes No 2; Types A and B
Number: 15 – 20

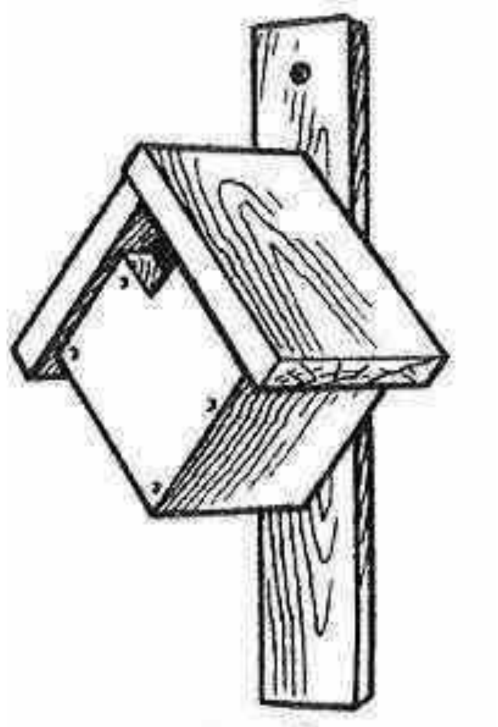


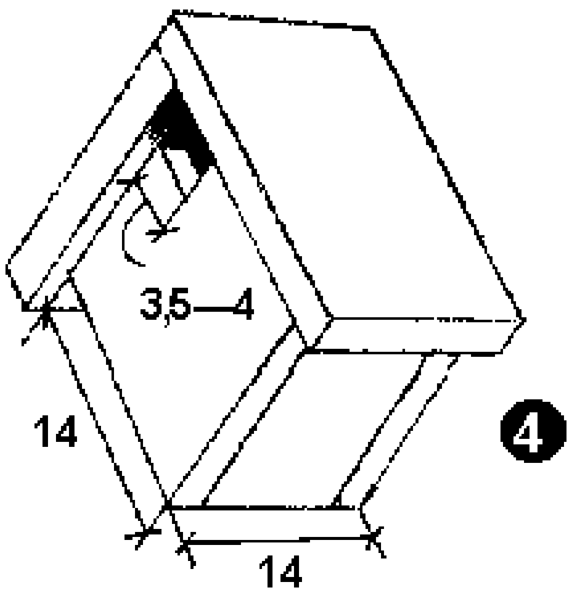


Nest-boxes No 2, sizes

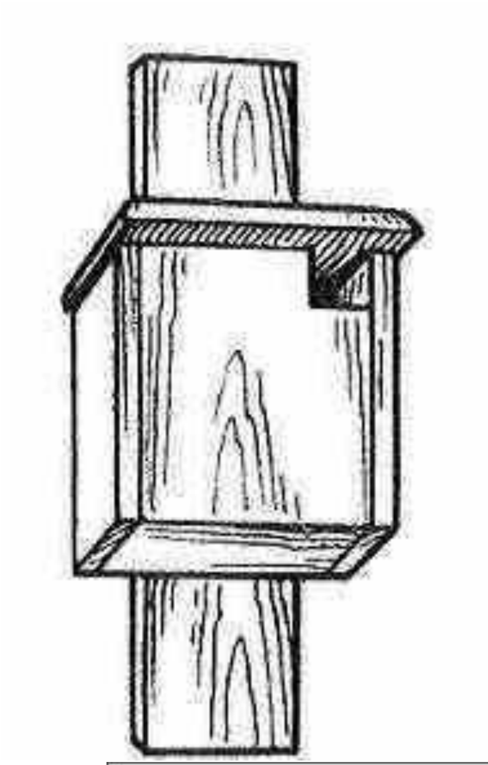
Nest-boxes No 3
Number: 20
Sizes – like Nest-boxes No 1

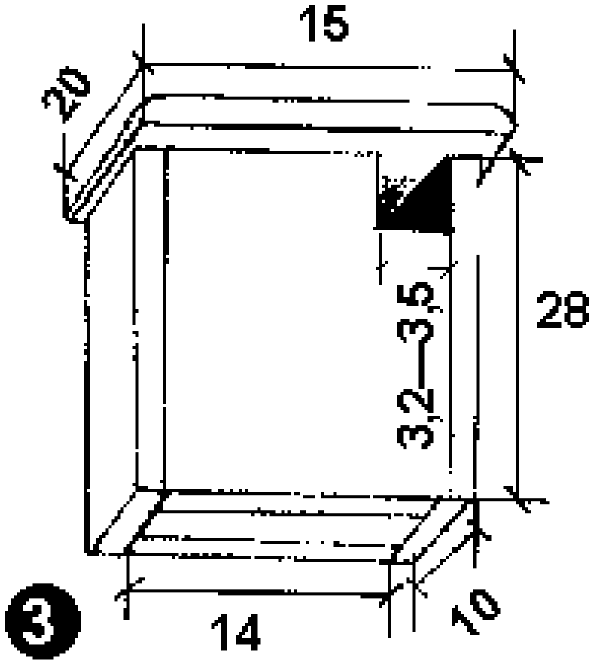
Nest-boxes No 4; Number: 5 – 10

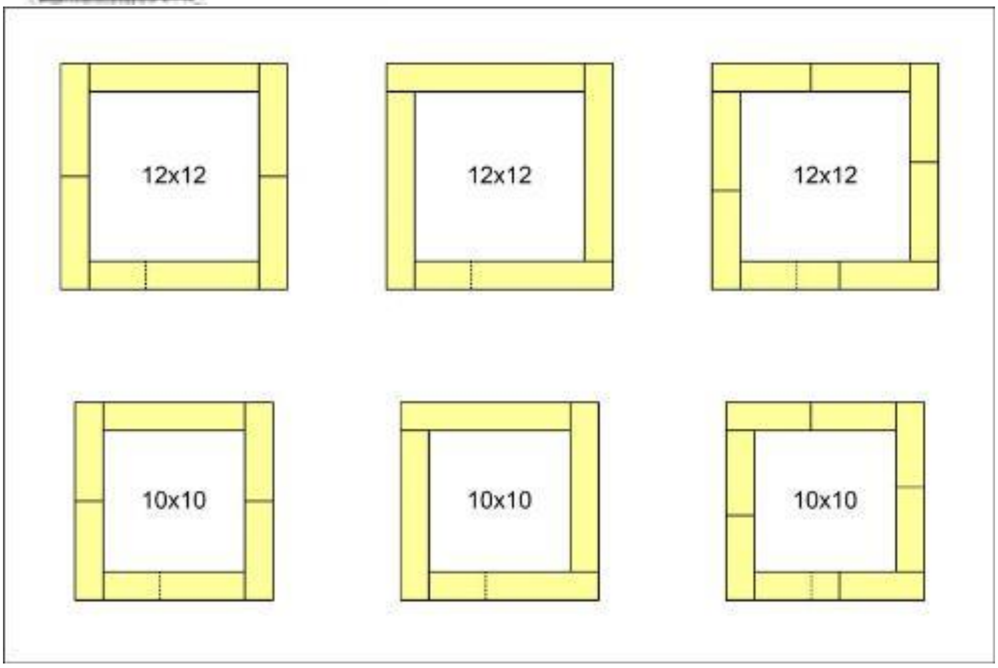


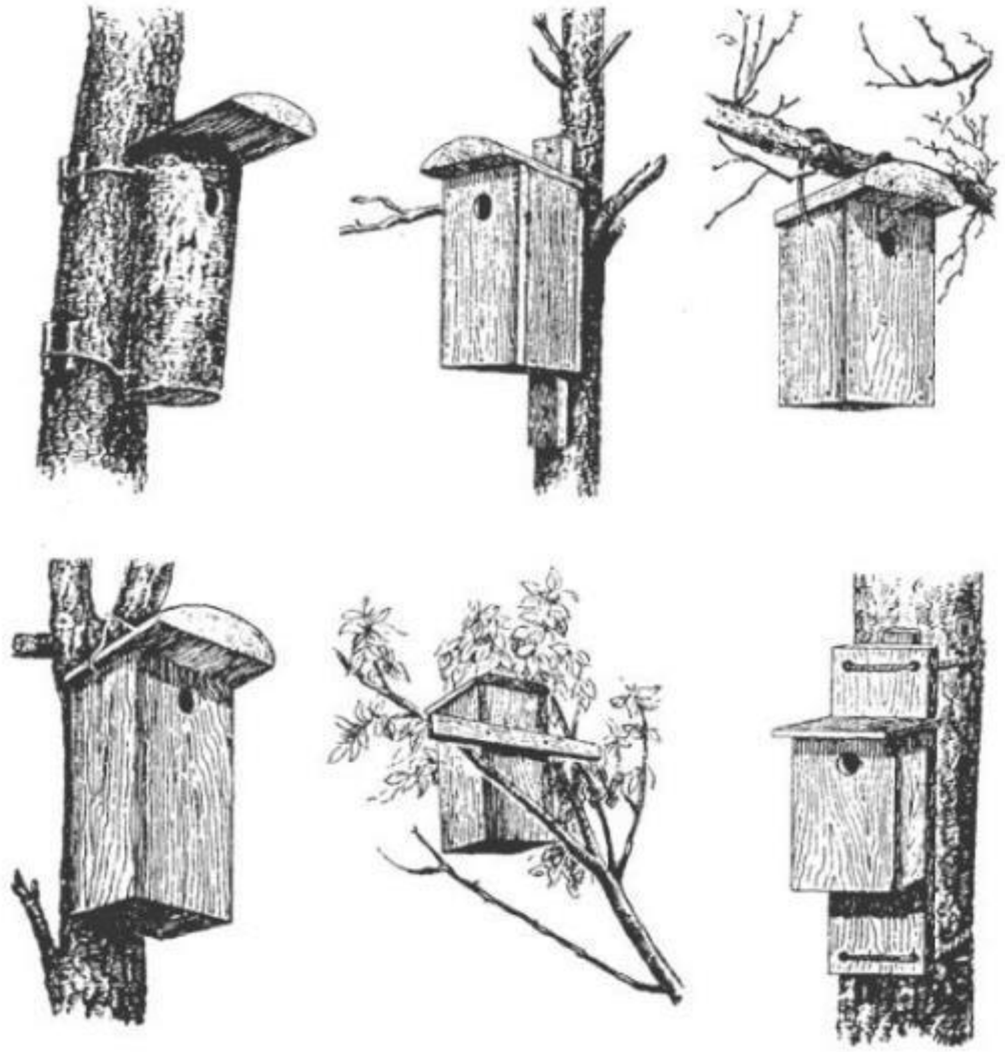


Nest-boxes No 5
Number: 5 - 10









In the Ruisi WPP Project Area, pre-construction field-survey needs to be carried out in all four seasons, or during breeding season, spring passage, autumn passage and wintering.

1. It is highly recommended that evaluation and monitoring programs, study designs and protocols are internationally standardized to overcome the large differences in the methodologies currently in use.
2. For participating in ornithological monitoring activities, it is necessary to attract experienced professionals.
3. Ban heavy vehicles movement within the limits of Ruisi WPP Project Area from early April to middle of June in order to prevent destruction of breeding habitats for some bird species and their disturbance during nesting season.
4. Removal of garbage, ruins, organic remains from area (site) where temporary camp of builders was located during construction period. Rehabilitation measures of this site.
5. Removal of all construction material such as steel profiles, remnants of plastic packages in which structural elements were delivered to the turbine installation site, isolators, conductors, concrete, fuels, lubricating oils, etc.
6. After the completion of construction work, it is necessary to carry out the rehabilitation of all access roads that were laid for the transportation of turbines to their installation sites. Rehabilitation of access roads.

6.7.3.5 Potential impacts on other terrestrial vertebrates

A significant impact on other terrestrial vertebrates such are mammals (excluding bats), reptiles and amphibians is not expected in the construction area of wind power plants. The negative impact that the construction of a wind power plant might have on the above-mentioned animal species is noise disturbance, habitat degradation (small rodents, amphibians and reptiles), environmental pollution, or creating edge effect.

The results of the zoological surveys demonstrate that the project area is not important area for these faunal features, and the species that are present or could be present within the project area are not sensitive to the above mentioned potential impacts. Generic mitigation measures that are proposed for the project are sufficient to efficiently prevent or minimize impact on these elements of fauna.

Only exception concerns two small mammal species - Brandt's Hamster (*Mesocricetus brandti*) and Grey Dwarf Hamster (*Cricetulus migratorius*). Both of them are put in the Georgian Red Data List as Vulnerable (VU). They are year-round residents on the project area. Brandt's hamsters burrow recorded at WTG 03 and WTG 08 and between them in the arable land. This territory represents a small part of its key-habitat. The hamster species can be impacted by construction process if burrow of individual hamster will found within the construction site of certain WTG or any other project facility (e.g. access road or transmission line corridor). To minimize impact on these protected by law species, the expert zoologist has to survey each constructed site before ground works for the presence of their burrows to avoid their destruction where practicable.

6.7.3.6 Major conclusions and recommendations

The identification and assessment of the biodiversity impact present at the construction area of the Ruisi wind farm was carried out considering the summarized impacts on the habitats and the fauna.

Based on the data collected during zoological field surveys carried out within the limits of Ruisi WPP project area and adjacent territories as well as all available literature data, the faunistic importance of the Project territory should be considered in general as a low.

Some of the potential impacts on biodiversity will be temporary, thus primarily related to the construction period, or they may be permanent related to the operation period.

Negative impacts are generally expected during the construction phase of the Ruisi Wind Farm project due to the following:

- Generation of noise and vibration during the operation of the construction machinery, which will highly disturb the amphibians, birds and mammals;
- Use the explosives that would result in direct mortality of terrestrial animals or indirect impacts such as noise disturbance is not planned for the project.
- Large frequency of big vehicles and people presence during the construction of Ruisi Wind Farm will disturb the birds and other living organisms, especially during their mating season;
- Fragmentation of habitats and creation of edge effect which threatens biodiversity will not be significant, as the project facilities are deployed in highly transformed agricultural landscapes and no linear aboveground facilities are planned.
- Potential occurrence of new access roads that will destroy the existing ecosystems and cause of erosion; This type of impact is not significant, as the project mostly used existing access roads. Only minor realignment at some particular locations is planned.

- Pollution of the soil and the ground waters caused by the oil from vehicles and machinery, if they are not handled appropriately or in case of accidents;
- Various construction activities will result to generation of construction waste.

The following recommendations need to be taken into consideration at the operational stage of the Ruisi WPP:

- Areas used for disposing harmful substances must be kept at minimum. It is also necessary to organize adequate handling and storage;
- All locations that shall be used as temporary deposits for construction materials and resources should be initially identified and surveyed by zoologist in order to avoid the possible negative impact on the animals;
- The project area has to be provided with proper waste management facilities such as dust bins and earthen pits. After the construction all waste fuel, oils, lubricants etc. will be stored separately and given for relevant recycling use.
- Avoid the impact on the sites with tree canopy – remains of windbreakers and artificial pine grove, that are the important habitat of animals.
- During the operation phase of the wind farms, to observe a bat and bird mortality rate caused by turbines. This observation will give an opportunity to reveal turbines with negative impacts on bats and birds, if such does exist. In case of identification of such turbines, additional recommendations will be developed for the site specific cut-in speed and functionality schedule (with indication of times when it is necessary to stop) in order to minimize their negative impacts on bats and birds;
- To drain artificial small-size stagnant waterbodies within the construction sites of each separate WTGs and its adjacent territories. This will decrease attractive areas for the insects, a pray of bats, and accordingly minimise the artificial feeding sites for bats. Ultimately, draining of the wetlands/swamps will minimize bats mortality cases might be potentially caused by turbines of the wind farm;
- To use a cold lighting directed to the land at both phases of construction and operation of the Ruisi Wind Farm;
- In order to reduce the mortality of the birds that migrate at night or during bad weather conditions that collide with the cables of the transmission line it is recommended to use Bird Flight Diverters.

6.7.4 Impact on Ecosystem Services

Several ecosystem services have been identified in the study area. Dependence of local communities on these ecosystem services varies from high to low, by their types and functions. Ecosystems are complex and interconnected, what makes difficult to isolate and assess each of the likely impacts of a project on particular ecosystems services. This task is even more complicated by the fact that in most cases ecosystem services are susceptible to several types of potential impacts, and it is often troublesome to discuss all potential impacts according to four types. For instance, food provisioning service could be affected due to changing land use as well as degradation of air and water quality, alteration of water and nutrient cycling, pollination capacity, etc. To simplify impact assessment, our approach is to focus only on the main impact factor(s) and major outcome(s) for each type of ecosystem services.

Using the above described approach, the significance of potential impacts on the identified ecosystem services has been assessed based on expected magnitude of change in the ecosystem, vulnerability of each ecosystem and their services to particular impacts, as well as dependence of receptors on provided services. The assessment of the Project impacts on the ecosystem services is presented in tabular form, in Table 6-30 below.

Table 6-30 Assessment of the Project impacts on ecosystem services

Ecosystem Services	Description of Potential Impacts
Provisioning Services: goods or products obtained from ecosystems	
Food (crop growing, livestock breeding)	The Project will change land use of around 150 private agricultural land plots (around 300 ha) and limited area of dry grasslands used for cattle grazing, which is the negligible portion of the total agroecosystem present in the affected communities. The affected agroecosystem will lose its provisioning function for affected households and businesses. However, sufficient area of agroecosystem is available in the affected communities and businesses to substitute their loss. Considering high dependence of the local communities on agroecosystem, **the impact on food provisioning is considered as moderate.**
Surface water	Impact on the availability of surface water resources is not anticipated. The impact on water quality will mainly include increased turbidity due to sediment laden runoffs from construction sites and disturbed areas. Pollution with hydrocarbons or other chemicals may occur only in case of spills. Distance of the construction sites from surface water bodies and local terrain together with planned mitigation measures will minimize impact on the quality of surface water bodies. Local population does not use local surface water for drinking. They utilize surface water for irrigation and watering of cattle. This category of water use is not highly sensitive to pollution with suspended solids. The quality of surface water is of high importance for local fish farms. They supply water from the irrigation network in the study area. According to our assessment, only limited portion of irrigation network is at a risk of water pollution from the project sites and this risk will be controlled by relevant pollution prevention measures. **Considering the above mentioned, construction impact on the provisioning of surface water resources is assigned low significance for local population and medium significance for fish farms. Surface water provisioning will not impacted on the operation phase.**
Groundwater	Impact on groundwater is not expected on most construction sites. Some sections of the Project Area are characterized by shallow groundwater, where the table rises up to 3 m. The Project will affect the quality of this groundwater horizon during construction of turbine foundations. This impact will be short term and localized at construction sites. Importantly, this shallow groundwater is not directly connected with drinking water sources of the local communities, which relay on deep groundwater aquifer for water supply. **Respectively, groundwater availability and quality will not be affected for dependent communities.**
Natural medicines	The Project will affect only limited area of grassland ecosystem. The planned mitigation measures will minimize disturbance of meadows outside work sites and ensure recovery once construction is finalized. **Considering low dependence of local population on this ecosystem service, the impact will be negligible on the construction phase and will not have place on the operation phase.**

Ecosystem Services	Description of Potential Impacts
Forest products	The project will affect artificial pine forest, where some trees will be fallen to install planned infrastructure. As an offset, 3 new saplings will be planted for each removed tree. Despite considering compensation measures, the availability of forest products (e.g. firewood) will be limited for some time, until replacement trees maturate. On the other hand, local population does not depend on forest product, and **therefore impact on the provisioning of forest products will be low**.
Regulating Services: benefits obtained from the regulation of ecosystem processes	
Air quality	The construction works will entail air emissions and clearing of vegetation that participates in air purification at local level. Therefore, health risk will increase for local population which is a high sensitivity receptor for air quality deterioration, especially at locations where residential areas are close to construction sites or access roads. The impact will be short term, limited mostly to the construction phase. Relevant mitigation measures are planned to minimize air pollution during all project operations. Due to the high sensitivity of local population toward air quality deterioration and their moderate dependence on this regulating service of local ecosystem, **the impact on air quality regularity capacity is assigned medium significance for the construction phase. The impact will not have place on the operation phase.**
Climate (local)	Vegetation clearance mainly include removal of grass species during ground works, which have limited influence on micro-climate conditions, e.g. formation of temperature and wind regime, etc. On the other hand, the ecosystem of artificial pine woodland, which is likely to have greater role in the micro-climate of adjoining territories will be also affected as number of pine trees will be fallen for the Project needs. The project envisages offset of removed trees and revegetation of temporary sites once the construction works are finalized. Therefore, this impact on vegetation and its climate regulating capacity will be short term. Other elements of the environment that can influence local climate (e.g. rivers and ponds) will not be affected in a way that may affect their climate regulating capacity. In overall, changing of local climate regulating capacity would be of the scale that is not likely to affect well-being of local communities. **Therefore, the impact on local climate regulating capacity of the ecosystems would be negligible.**
Regulation of water timing and flows	Vegetation clearance at the construction sites will reduce the ecosystem capacity to regulate rainwater runoffs. However, considering planned mitigation measures, which will minimize vegetation disturbance and facilitate revegetation of affected sites, this impact will be insignificant and limited to the construction phase only. Riparian forest found in the vicinity of the Project Area are rather distanced from the project sites to undergo direct impact, among them their water regulation capacity will not be changed. **Due to the mentioned, the impact on water regulation service is assessed as negligible.**

Ecosystem Services	Description of Potential Impacts
Water quality	The project will not affect riparian forest that participate in purification of river water. Vegetation clearance in the project sites may increase amount of suspended solids delivered by rainwater runoffs to the rivers courses in the vicinity of disturbed sites. As repeatedly mentioned, mitigation measures are planned to minimize impact on vegetation cover and revegetate disturbed sites after construction works. The impact will be short-term, limited to the construction phase. Dependence of local community on water purification service is moderate, because surface water bodies of the study area are not used as a drinking water source. Other water use types by local population are not so sensitive to increased content of suspended solids. **Thus, the project impact on the water purification service is assessed as low.**
Regulation of geohazards	As identified in the baseline section, the ecosystems ensure erosion control as well as prevention of landslides and washing of river banks. The project will not have direct impacts on riparian ecosystem which ensures the stability of river banks. Impact on the erosion regulation capacity will be associated with vegetation clearance needed to arrange the project infrastructure, access roads and temporary facilities. This will have short term character, followed by site reinstatement. Besides, mitigation measures are planned to minimize vegetation removal and ensure revegetation of temporary and disturbed sites, where erosive sites would be paid particular attention. Erosion monitoring is considered on the operation phase to identify and remediate areas with erosive processes. All these will reduce erosion risk to low level. On the other hand, the erosion control service of the ecosystem is highly important for local population to protect their lands and other assets from geohazards. This ecosystem service is equally of high importance for the Project. **Considering the above mentioned, the impact on geohazards regulation capacity of the ecosystem is assessed assigned medium significance both for the local population and the Project.**
Cultural Services: non-material benefits obtained from ecosystems	
Recreation	The Project's impact on the quality of river water and respectively fishery resources will be low. Considering the sensitivity of armature fishermen, the impact on armature fishing will be low. The project will have notable visual impact on the aesthetic value of local landscape. On the other hand, it is not likely that local population would be highly sensitive to the expected landscape changes and most probably they will continue using beloved areas for relaxation. **The project's impact on the cultural services of the local ecosystems is assigned low significance.**
Supporting services: natural processes that maintain the other ecosystem services	

Ecosystem Services	Description of Potential Impacts
Pollination	Pollination service is of high importance for local agricultural practices. Besides, it ensures maintenance of vegetation cover and thus enable ecosystems to provide other attributed services (e.g. erosion control, water regulation, etc.) on which local population depend. As the project will affect vegetation cover and habitats, certain impact on insects that participate in pollination of crops is likely. A set of mitigation measures is considered for the Project to minimize impact on vegetation and habitats so that impact on the population of insects will be insignificant. **Therefore, the impact on pollination capacity of the ecosystem will be low despite high dependence of local population.**

6.8 Waste Generation and Management

6.8.1 Waste Anticipated on Construction Phase

Certain types of hazardous and non-hazardous wastes are expected on the construction phase of the proposed project. Waste will be mainly produced by construction works. The following waste types are anticipated:

➢ **Hazardous**

- Contaminated topsoil and subsoil;
- Paint containers;
- Oiled cloths, etc.

➢ **Non-hazardous**

- Ferrous metal;
- Plastic waste;
- Mixed municipal waste;
- Printing tonners;
- Spoil, etc.

Estimated volume of wastes generated by the Project and waste management issues are discussed in detail in Annex 12 - Waste Management Plan.

- The following waste types will not be produced on the construction phase: Lead batteries, oil filters, tyres and other wastes coming from vehicle maintenance because such maintenance works will not be implemented on site.
- Soil excavated during earth moving works will be mainly used for backfilling, and only small portion will be stockpiled.
- Municipal wastes will be disposed at local solid waste landfill;

The management measures considered for other wastes resulting from the construction phase are discussed in the Waste Management Plan.

► **Management of residual soil and storage of humus layer at the construction stage:**

The volume of the ground from the turbines to the dumpsite is 20,000 m^3.
The volume of non-humus ground removed from the substation, which will be placed at the dumpsite does not exceed 6 000 m^3, and at the camp site - 1000 m^3.

The arrangement of access roads does not create the soil to be placed at the landfill. On the contrary, for arranging access roads, 82,000 M³ filler inert material (sand, gravel,) is necessary. Part of the material placed at temporary dumpsite may be used as inert material for filling roads.

Most of the soil non-humus layer removed from the cable ditches will be completely placed back into the trench and covered with the previously removed and nearby stored humus layer (10,000 m^3 (40,000 m^3 x 25%) of removed soil). Soil with the same area will also **be stored at the temporary dumpsites -** 10,000 m^3.

Total amount of soil to be placed at temporary dumpsites does not exceed 37 000m^3. In fact, this volume will also be significantly less, since it is expected that at least half of the removed ground can be used to cover access roads, for which a total of 82,000 m^3 of inert material is required. Part of this material will be brought from quarries (gravel and sand), but part of the material placed on temporary dumpsites will also be used.

Proposed area of temporary dumpsites:

- Dumpsite 1 (near camp) – 10 400m^2
- Dumpsite 2 (Between turbines 49 and 53) – 28 800m^2
- Dumpsite 3 (Near turbine 46) – 66 000m^2

The ballast soil will be temporarily stored at 3 designated places (separate from soil humus layer) in 3m high cone-shaped stacks. During the construction process, the ballast soil from these temporary storage areas will be distributed to the construction sites where additional filler will be required.

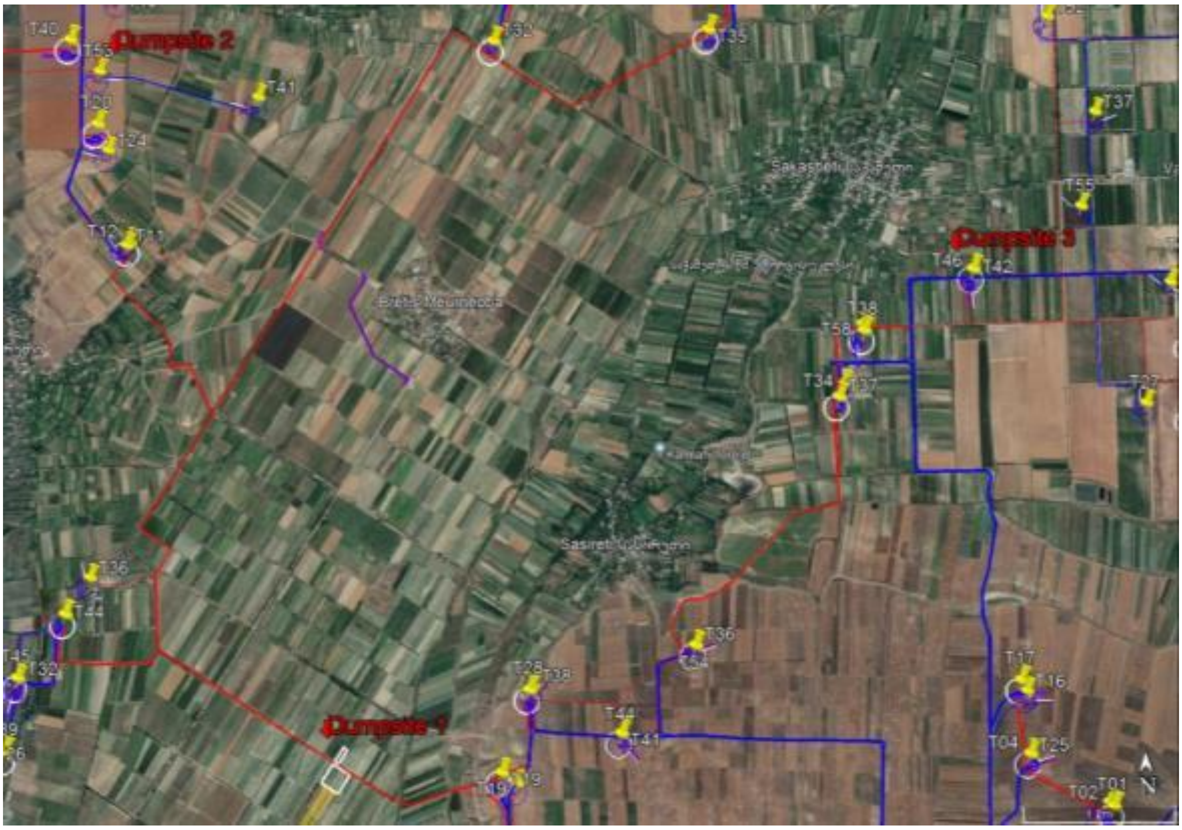


Figure 6-48 Location of temporary dumpsites

Wastes Expected on Operation Phase of Wind Power Plant Different types of waste material accumulate during normal operation of the wind turbine. These are generated mainly during a planned maintenance. The specified values are based on experience only and may vary due to different running times or due to project- and turbine-specific parameters.

Types and volumes of wastes expected during the construction and operation of Ruisi WPP are given in Table 6-31.

Considering that the Access Road will be well-equipped, the risk of soil and ground contamination is minimal. Both on construction and operation stages it will be necessary to place bins in the construction camp and afterwards in the substation area for proper management of hazardous and municipal waste.

Table 6-31 Wastes expected during the construction and operation of the wind farm

Waste Code	Name of Waste	Hazardous (Yes/No)	Hazardous Property	Physical State of Waste	Approximate Amount of Waste by Years		Disposal/ Recovery Operations	Waste Management/ Contractor Companies
					Construction Phase	Operation Phase		
					2020	2021		
Wastes from the manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks - group code 08								
08 01 Wastes from MFSU and removal of paint and varnish								
08 01 11*	Waste paint and varnish containing organic solvents or other hazardous substances	Yes	H 3 A- “flammable” H 6 - “hazardous”	Solid	40 kg	-	D10	Sanitari LLC
08 03 Wastes from MFSU of printing inks								
08 03 17*	Waste printing toner/ink containing hazardous substances	Yes	H15	Solid	10 kg	-	D10	Sanitari LLC
Wastes from shaping and physical and mechanical surface treatment of metals and plastics - group code 12								
12 01 Wastes from shaping and physical and mechanical surface treatment of metals and plastics								
12 01 10*	Synthetic machining oils	Yes	H 3-B - flammable H 5 - “hazardous”	Liquid/solid	30 kg	2 kg	D10	Sanitari LLC
12 01 13	Welding wastes	No	-	Solid	220 kg	-	R4	Will be delivered to scrap metal collection points, or handed to a relevant licenced company for further management
Oil wastes (except edible oils, and those in chapters 05, 12 and 19) - group code 13								
13 02 Waste engine, gear and lubricating oils								
13 02 08*	Other engine, gear and lubricating oils	Yes	H 3-B - flammable H 5 - “hazardous”	Liquid	35 l	1 l	D10	Sanitari LLC
Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified - groups code 15								
15 01 Packaging (including separately collected municipal packaging waste)								
15 01 06	Mixed packaging	No	-	Solid	1600 kg	30 kg	D1	Solid household waste will be landfilled, and/or paper and cardboard waste will be delivered to waste paper collection point

Waste Code	Name of Waste	Hazardous (Yes/No)	Hazardous Property	Physical State of Waste	Approximate Amount of Waste by Years		Disposal/ Recovery Operations	Waste Management/ Contractor Companies
					Construction Phase	Operation Phase		
					2020	2021		
15 02 Absorbents, filter materials, wiping cloths and protective clothing								
15 02 02*	Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by hazardous substances	Yes	H 15	Solid	70 kg	5 kg	D10	Sanitari LLC
Wastes not otherwise specified in the List - group 16								
16 01 End-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)								
16 01 07*	Oil filters	Yes	H 5 - "hazardous" H-15	Solid	80 kg	3 kg	D10	Sanitari LLC
16 01 17	Ferrous metal	No	-	Solid	80 kg	2 kg	R4	Will be delivered to waste metal collection point
16 01 18	Non-ferrous metal	No	-	Solid				
Waste group 17 - Construction and demolition wastes (including excavated soil from contaminated sites)								
17 04 Metals (including their alloys)								
17 04 11	Cables other than those mentioned in 17 04 10	No	-	Solid	65 kg	10 kg	D1	Will be disposed on construction waste landfilled
17 05 Soil (including excavated soil from contaminated sites), stones and dredging spoil								
17 05 03*	Soil and stones containing hazardous substances	Yes	H 5 - "hazardous"	Solid	Waste amount depends on the volume of spilled oil and scale of the spill		D10	Sanitari LLC
17 05 05 *	Spoil containing hazardous substances (soil and subsoil polluted with petroleum hydrocarbons)	Yes	H 5 - "hazardous"	Solid	Waste amount depends on the volume of spilled oil and scale of the spill		D10	Sanitari LLC

Waste Code	Name of Waste	Hazardous (Yes/No)	Hazardous Property	Physical State of Waste	Approximate Amount of Waste by Years		Disposal/ Recovery Operations	Waste Management/ Contractor Companies
					Construction Phase	Operation Phase		
					2020	2021		
17 05 06	Spoil other than those mentioned in 17 05 05 (Spoil from earth moving works and excavation of foundations)	No	-	Solid	47,000 m^3	-	D1	Soil excavated during earth works will be fully used for backfilling of foundation tranches, arrangement of the road sub-base and other works. This soil will be temporarily stored at 10 stockpile sites
Waste Group 18 - Wastes from human or animal health care and/or related research (except kitchen and restaurant wastes not arising from immediate health care)								
18 01 Wastes from natal care, diagnosis, treatment or prevention of disease in humans								
18 01 03*	Wastes whose collection and disposal is subject to special requirements in order to prevent infection	Yes	H 6 - “toxic”	Solid/liquid	1,0 kg	0,1 kg	D10	Sanitari LLC
Waste Group 20 - Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions								
20 03 Other municipal wastes								
20 03 01	Mixed municipal waste	No	-	Solid	65 m^3/yr	1,4 m^3/yr	D 1	These waste will be disposed at the household waste landfill
Sanitari LLC - activities of the company: enterprise that treats hazardous wastes (arrangement of bioremediation sites for treatment of soils contaminated with industrial chemical wastes and petroleum). Environmental Permit №000021, code MD1, 08/10/2013. The Permit is granted on the basis of the Opinion of Ecological Expertise №51; dated 07.10.2013 If required, the company can cooperate with other companies having the Environmental Permit for the waste treatment. Information on these companies are available at: **http://maps.eiec.gov.ge** - Map/registry of environmental permits.								

6.8.2 Mitigation measures

Wastes resulted from the operation phase will be managed in line to the Waste Management Plan (WMP), specifically:

- Household waste from the substation and office will be disposed at municipal landfills by respective municipal companies.
- The substation and office areas will be equipped with properly labelled watertight waste containers to ensure temporary storage of hazardous wastes, which will be disposed with use of contractors having the Environmental Permit on this activity.
- Waste management will be ensured by adequately trained personnel who will be periodically trained and tested.

6.9 Landscape and Visual Impacts

6.9.1 Construction Phase

Construction works will cause certain visual changes in the landscape because the arrangement of construction sites, operation of building machinery and stockpiling of building materials will be required. In any case, this impact will be localized and temporary. Permanent impact will be connected only to permanent infrastructure of the Project. Visual impact could be described considering the layout of project sites regarding visual receptors, that is if sites with modified landscape are within their views.

Only residents of impacted villages will be receptors during construction works when they move along access roads. The impact will have limited scale and temporal character, and will not exceed typical impacts that occur from common infrastructural development/ maintenance works

In terms of landscape impact, the effect caused by forest felling would be of importance. We do not have forests in the project area and the impact on forests is limited. The only area where the felling of trees will take place is the turbine mast T08, which falls within the artificial pine forest. However, since complete cleaning of the pine trees in the area is not planned and only one mast and access roads are subject to cleaning, this impact will be negligible and will be compensated by appropriate compensatory measures (it is proposed to plant three new trees instead of each cut down on the adjacent territory or on the territory agreed with the municipality and the Ministry of Environment Protection and agriculture. In addition, the forest habitat rehabilitation program will be implemented, which will contribute to the restoration of the Grove damaged and aesthetically degraded by Wood parasites.

6.9.2 Operation stage

Visual change at the stage of operation is expressed mainly by the presence of WPP turbines and, to some extent-other infrastructure facilities (substation; office).

The visibility map is generated in the GIS-software Global Mapper (version 20.1.1), using a view shed calculation tool. With this tool a view shed analysis is performed based on loaded elevation grid data, selected turbine positions, transmitter height of 230 m above ground and receiver height of 1.8 m above ground. A view radius of 20 kilometers was used, and a resolution of 25x25 m. The visibility was calculated for each turbine individually, then combined by counting overlapping layers in each grid point. The results were exported and used in the GIS-software QGIS for generation of the map with explaining text.

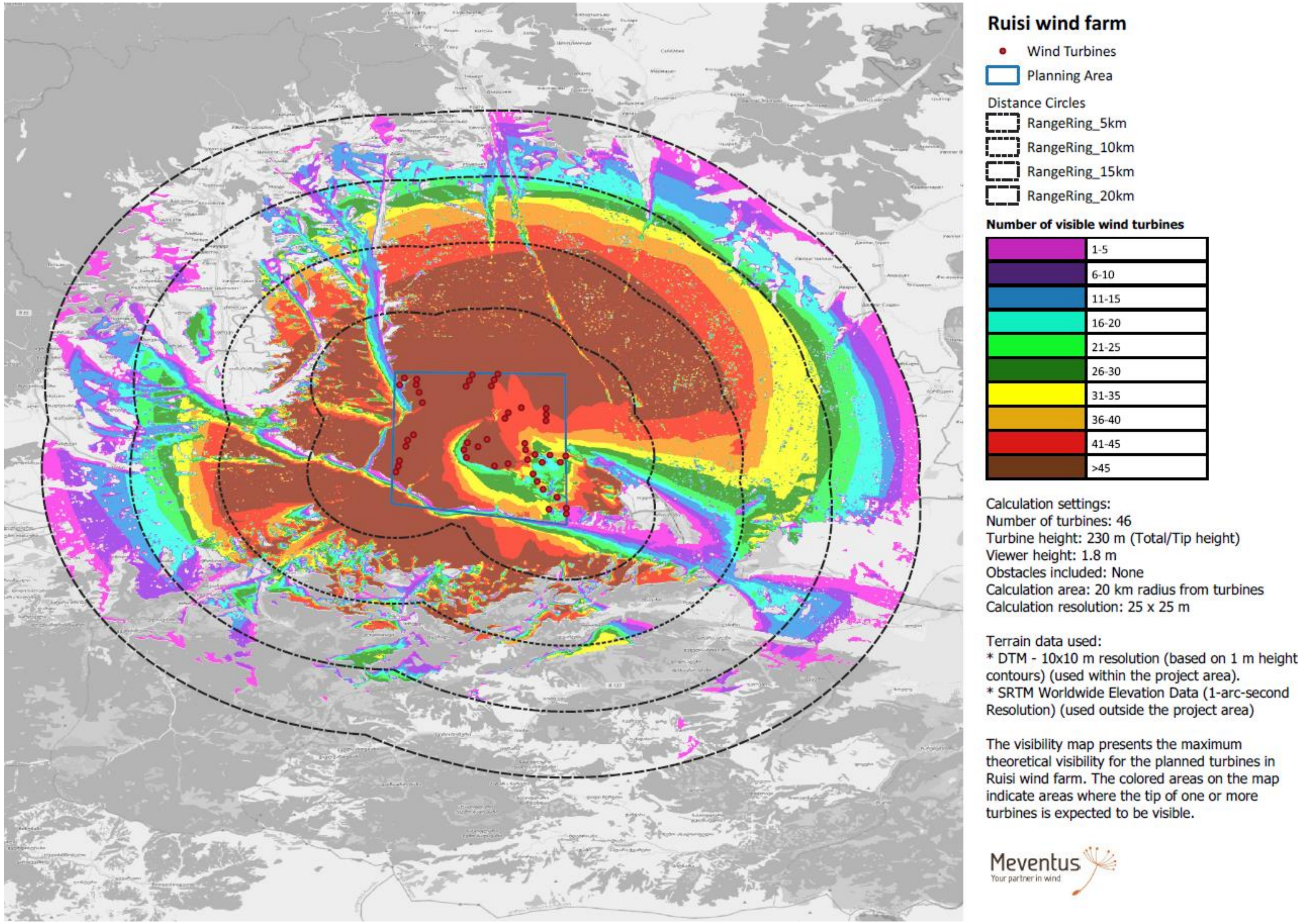


Figure 6-49 The visibility map

A visibility map presenting the maximum theoretical visibility for the planned turbines (L22e – 46 turbines with 230 m total height) in Ruisi wind farm. The map is calculated based on a generated terrain grid with 10 m resolution within the planning area (this dataset is based on 1m height contours provided by the customer) and the SRTM-dataset with 1-arc-second resolution outside this area. The turbine visibility is calculated for an area up to 20 km from each turbine and the resolution of the map is 25x25m. Note that no obstacles are included in the calculation (e.g. forest).

Turbine visualizations based on Google Earth views are included for the provided 8 positions within and close to the project area.

Vis P1 Highway-	419386,	4652231
Vis P2 Highway-	417015,	4652413
Vis P3 Highway-	412516,	4654155
Vis P4 Highway-	408370,	4656789
Vis P5 Ruisi-	413066,	4655179
Vis P6 Breti-	409448,	4659189
Vis P7 Dzlevijvari-	411322	,4661668
Vis P8 Variani-	419175,	4658692

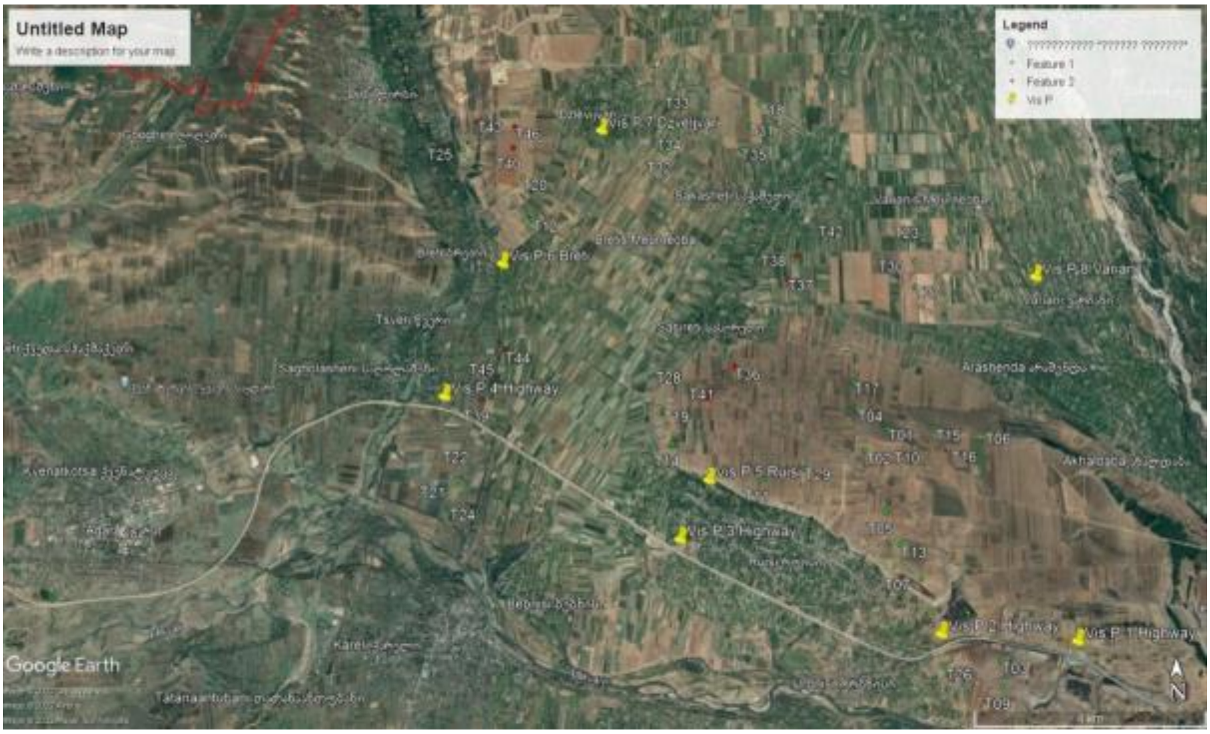


Figure 6-50 View Points for Visualisation

The layout used for the visualizations is L22e (46 x N163 – 5.9MW – 148m HH).

The 6 existing turbines in the Gori wind farm are also seen in the background in some of the visualizations. As turbines are visible in several directions from each of the viewpoints, multiple visualizations are included for each position. The turbines are mainly facing east or west in the visualizations, as these are the prevailing wind directions. However, for some of the positions also are included included visualizations where the turbines are facing in directions opposite to this.

For the naming of the visualizations, the positions are numbered from VP1 (ViewPoint1) to VP8 and then there is a numbering of the visualization for each specific viewpoint.

Wind turbines will be noticeable both from the nearest settlements (village. Ruisi, Aradeti, Tsveri, Variani settlement, etc.), as well as from a relatively long distance - mainly on the Ruisi districts of the international highway (from Gori tunnel to Agara section). Due to the peculiarities of the terrain - most of the turbine masts will not be visible from the highway at all. Only part of the turbines will be visible on Ruisi sections of the track and in essence, this view does not differ substantially from the view of Gori WPP, which directly borders the project area. Practically, Gori wind turbine landscape will be transformed into new WPP turbine landscape.

Figure 6-51 - Figure 6-54 shows how Ruisi WPP turbines appear from different locations.

The entire set of visualisations for all 8 view points is provided in ESIA volume 2, annex 9.

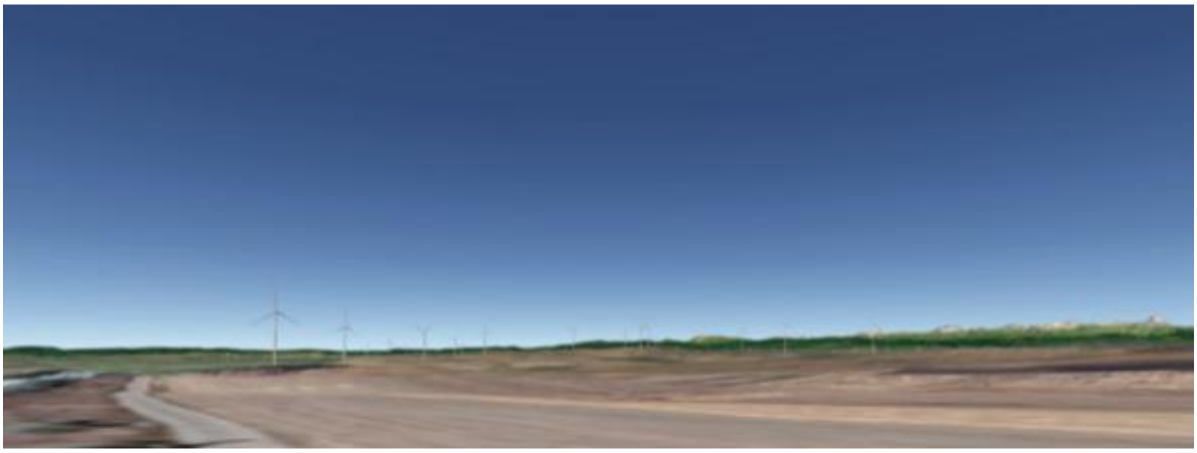


Figure 6-51 View from Ruisi section of the highway (VP 1)

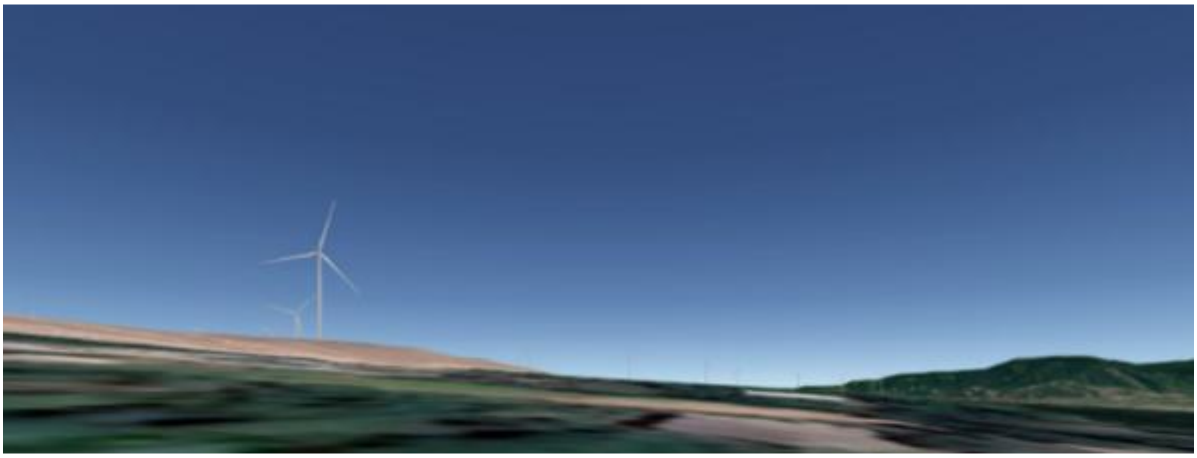


Figure 6-52 View from Village Ruisi territory (VP 5)

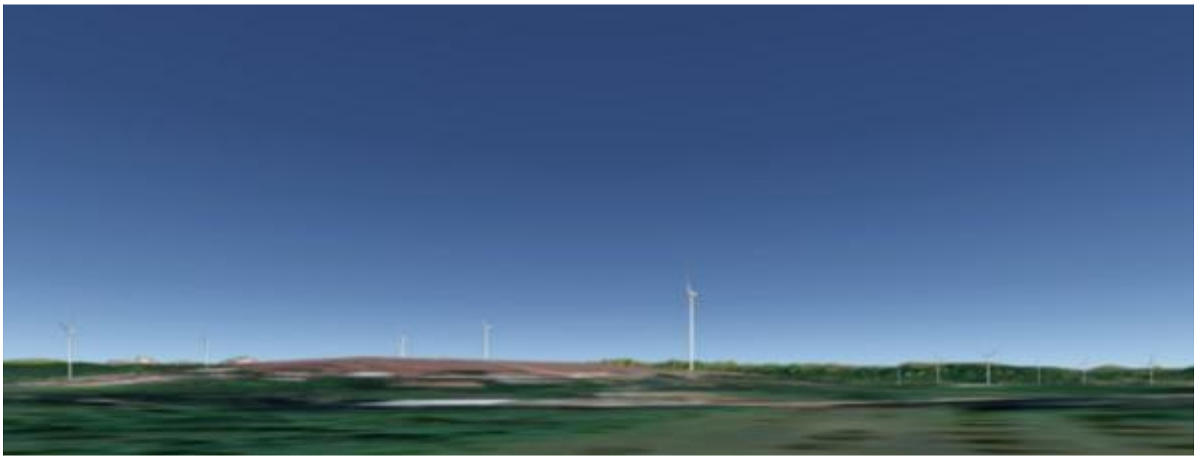


Figure 6-53 View from territory of village Breti (VP 6)

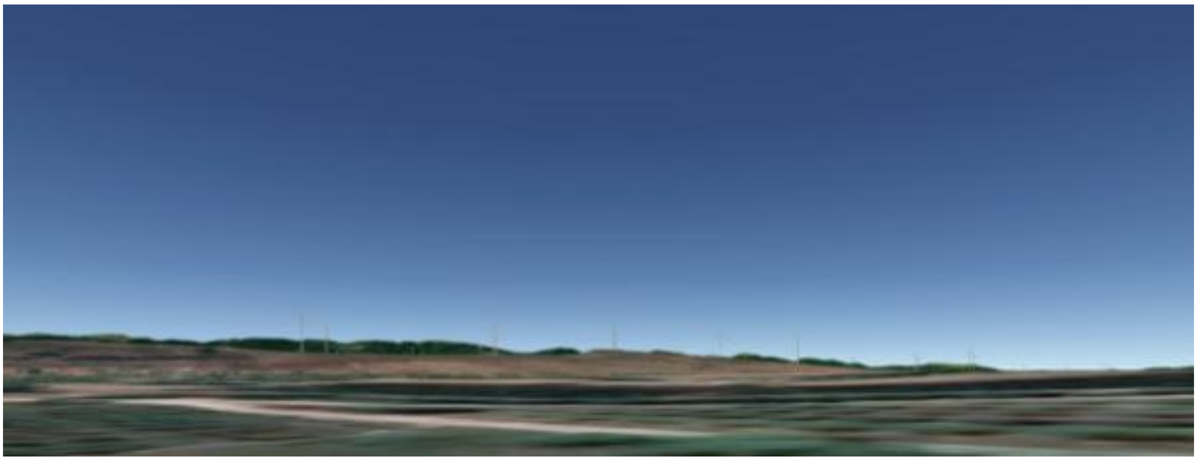


Figure 6-54 View from Variani (VP 8)

6.9.3 Mitigation measures

Landscape and visual impacts of the construction phase will be mitigated with use of the following measures:

- Less visible sites will be identified to locate temporary structures and store materials and waste;
- Proper sanitary and ecological conditions will be maintained during the construction and operation phases;
- Reinstatement will be implemented after completion of construction works.

Mitigation measures that could reduce operational impact due to presence of wind turbines are not practicable. Residual visual impact is not significant and as practice shows (on Gori WPP section) - does not cause negative reaction of the population and tourists moving on the highway.

6.10 Impact on Local Socio-Economic Environment

6.10.1 Impacts on Land Use

The project is implemented on the territory, which is relatively remote from residential areas and concerns private agricultural lands (annual crops and gardens) and state lands, but not homestead lands. The project does not envisage physical resettlement of the population from the place of residence.

Social impact is mainly expressed in agricultural land loss and economic displacement. Most of the private land area (up to 40%) is used for growing grain crops, up to 30%- for growing various kinds of vegetables and the rest (up to 30%) is orchards. Small part of the state land represents pastures. No protected areas fall within the project impact zone

The Impact Scale is not yet precise. Taking into account the current configuration of turbines (46 turbines) and selected areas for them, it will be necessary to occupy approximately 165 registered land plots, most of which (152) are private plots. Apart from that, the land required for expansion of access roads and laying of connecting cables should be acquired.

The number of impacted private plots can be reduced by minor adjustments to the turbine layout (fine tuning). When the mast is located on several plots, moving the mast by just a few meters may result in a decrease in the number of plots (instead of 2 or 3 plots, it is possible to place the turbine mast within only one plot). Such micro-correction works are currently underway and the number of affected plots and affected households is likely to be significantly less at the Detailed Design stage.

Reducing the number of impacted private plots will also help to reduce the total number of turbines. It is expected that at the stage of the DEtailed Design, in the final configuration less than 46 turbines will remain (most likely - from 35 to 46)

According to the preliminary assessment, in total 165 land plots needs to be acquired for placing wind generator turbines. Out of this 152 are private plots (138 registered, 8 still under registration and 6 more registered plots are owned by business companies). Some households own several land plots and many plots are co-owned by several PAPs. In total 234 households and 3 companies will be affected. Most of the affected land plots are agricultural (148). Two of the affected plots have residential status, although they are used for only agricultural needs. Two of the affected land plots are of non-agricultural. category. Below in Table 6-32 and Table 6-33 more details are provided. The area of the affected land plots means here the total area of the affected plots. The actual affected area is less and needs to be specified through the detailed measurement survey.

The land take associated with the widening of access roads and laying cables needs to be specified at the later stages of the project design.

Table 6-32 Affected plots by Land Tenure Category

	Land Tenure Category	Number of plots	Total Area sqm	Number of AHs
1	Private registered	138	2,265,056	226
2	Private Under registration	8	147,293	8
3	Land owned by Companies	6	659,409	3 Companies
4	State used by private users	0	0	0
5	State land not used	13	4,088,554	0
	TOTAL	**165**	7,160,312	234 + 3 Companies

Table 6-33 Affected plots by Land Use Category

	Land Use Category	Number of plots	Total Area
1	Residential land; Perennials	2	16,060
2	Arable land; Annual Crops	120	2,906,694
3	Arable land; Mixed Annual Crops and perennials;	6	46,600
4	Arable land; perennials	22	94,799
5	Non-agricultural	2	7,605
6	State used by private users	0	0
7	State land not used	13	4,088,554
	TOTAL	**165**	**7,160,312**

No residential or other houses and buildings are affected and no physical relocation of the AHs is planned. The only affected structure (apart from the fences): on one land plot a non-residential 267.m^2 ancillary building and well is located.

The issue of use of the State owned land by legitimate or illegitimate land users is under the investigation. At this preliminary stage no tenants or leaseholders have been identified. The employed personnel works for 3 affected businesses, however the mentioned businesses lose only minor part of their total land and it is not expected that the employees will lose their jobs and incomes.

Currently, both optimization of the turbine layout scheme and negotiations with private land owners are underway. At the later stages, the results of the negotiations as well as the results of the optimization of the deployment will be reflected and accurate calculation of the expected socio-economic impact and assessment of the loss (compensation cost) will be given.

The project under consideration is not subject to expropriation legislation. Negotiations with private owners on compensation for losses are based on the principle of voluntary agreement (willing buyer/willing seller). At the same time, the company will develop a plan for restoring the source of income and social conditions.

At this stage of the project development it is not planned to prepare Resettlement Action Plan for the project. JSC Wind Power is encouraged to conduct negotiations with the PAPs and execute land acquisition based on amicable agreements, following the principles set forth in this RPF. The main requirement is to conduct internal monitoring and properly document the land acquisition process. JSC Wind Power shall ensure that the implementation of the land acquisition is verified through the submission and approval of the “Land Acquisition and Resettlement Execution Report” by the Bank upon completion of all activities. The “Land Acquisition and Resettlement Execution Report” will contain detailed description of all impacts and losses associated with the land take needed for this project.

More details on these matters are provided in the Land Acquisition and Livilihood Resoration Framework (LALRF), which is included in the ESIA supplementary package.

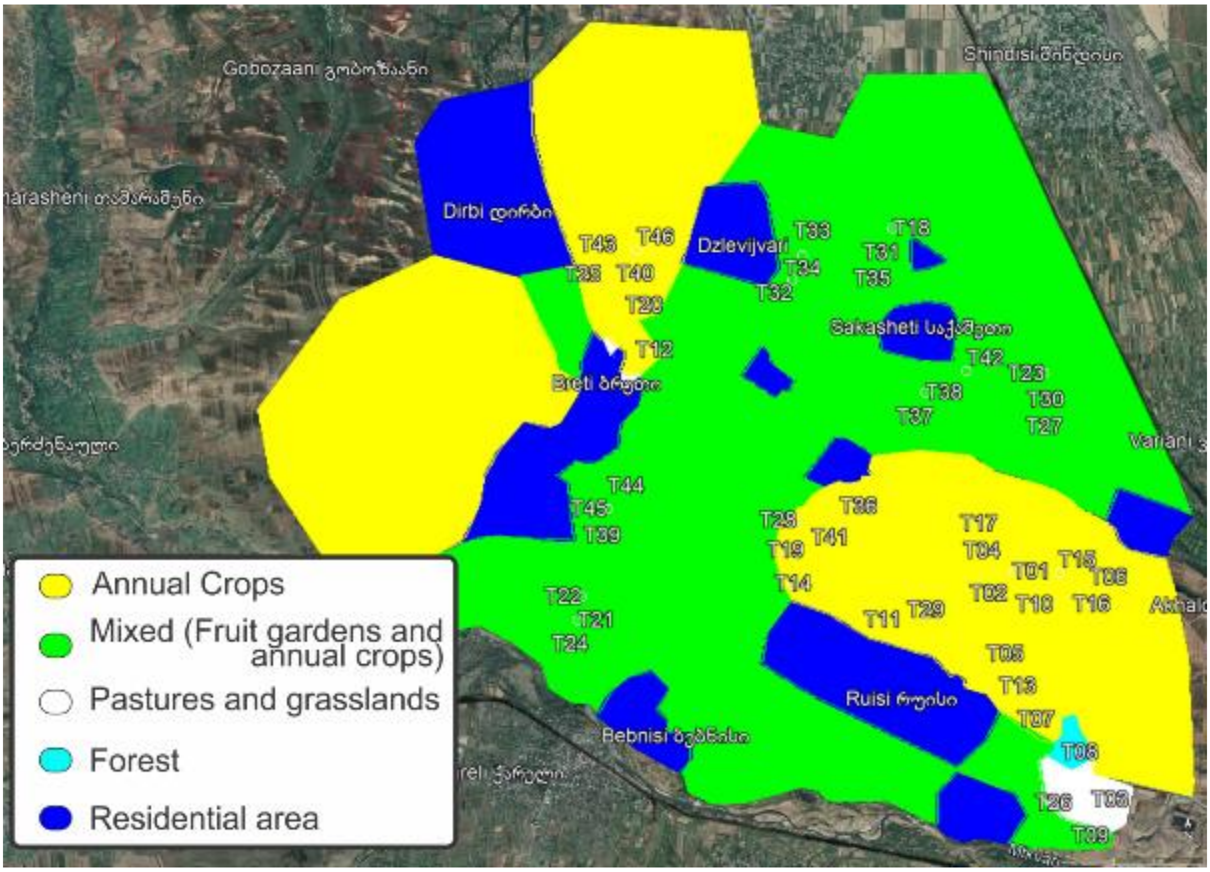


Figure 6-55 Land Use Map

6.10.2 Positive and Negative Impacts on Employment

The project will have an overall positive impact on the lives of local residents. During the construction of Ruisi WPP, 200 people will be directly employed, of which 60% will be local residents and their average salary will be no less than the average salary in Georgia. The company is ready to undertake the obligation to employ the local population directly from the neighboring villages in the conditions of minimum qualification requirements.

10-15 people will be employed during the operation of the station, this number does not take into account the number of indirect employees for operation of the substation and/or transmission line when connecting to the network. 70% of the employees will be qualified personnel in the field of Engineer, electrical engineer, mechanic, electrical mechanic, civil engineer, heavy equipment operator and other related professions.

Before the completion of the construction process, it is planned to retrain local permanent employees in comparable scale wind power stations and wind turbine generator manufacturer factories. The purpose of the training is to train local personnel to the level that operational services to be provided throughout the life cycle of turbines are provided by local (not invited) personnel. On the one hand, this will increase the efficiency of response to technical shortcomings and on the other hand will accumulate technical and applied skills in Georgia.

6.10.3 Input in Economy

The construction and operation of the wind farm will positively contribute to the economic development both at local and national levels. Besides, the Project will improve energy security of the country and reliability of the power supply. Local communities and municipalities will be impacted due to taxes (property tax) collected at local level as well as the use of local resources and services. Energy security and reliability of electricity supply will increase in the country because Ruisi WPP will produce major portion of electricity during the period when the energy system suffers power shortage. Therefore, this plant will notably contribute to the elimination of seasonal power shortage and reduction of dependence on import.

6.10.4 Impact on Transport Infrastructure and Restriction of Traffic Flow

The planned project will have minimal impact on transport infrastructure. This will be limited to impact on local roads connecting villages, which will be used to access the Project Area and implement construction works. Road traffic may increase in certain periods during the construction phase. Construction works should be planned in a manner to minimize impacts. The following measures will be implemented to achieve this:

- Local population will be informed about timing and period of planned works;
- All damaged road sections will be rehabilitated as soon as practicable in order to ensure their availability to population;
- Specially designated personnel (flagman) will control the traffic if needed;
- Complaints/ grievances will be recorded and adequately addressed.

As of the operation phase: impact will be similarly minimal at this stage, and will mainly result from maintenance works of turbines and substation.

6.10.5 Impact on Human Health and Safety Risks

Together with indirect impact of the construction works (e.g. due to deterioration of ambient air, propagation of noise, etc. that are described in relevant sections), direct risks to impact human health and safety are present (for population and the Project labour).

Direct impacts of these type may include: The collision of transportation means, electrocution, falling from height, injuries gained when working at building machinery, etc. Safety standards will be followed to prevent direct impacts, and strict supervision will be implemented to ensure their implementation. These will include:

- Training of personnel regarding health and safety standards;
- Provision of personal protection equipment (PPE) to workers;
- Installation of proper warning, information and prohibition signs at hazardous sites and along roads;
- Provision of standard first aid kits at hazardous sites and construction camp/ base;
- Proper maintenance of machinery and equipment;
- Adherence to safety standards defined for transportation operations, and establishment of speed limits;

- Using of ropes and special fixtures to protect personnel working at heights;
- Ensuring of proper conditions at work sites and work spaces;
- Maintenance of incident and accident log-book.

The construction contractor will install relevant safety, information and other signs at hazardous zones. The information board with the following notification should be installed at the site entrance: “For Staff only, safety gloves and boots are required, personnel shall use PPEs”.

Measures that are needed to prevent health and safety impacts are further discussed in the Emergency Response Plan.

6.10.6 Impacts of Wind Turbines Operation

Wind turbines are the source of clean renewable energy and their operation does not cause environmental pollution or loss of significant area of agricultural lands. However, shadow flickering affect and noise could be disturbing factors for people living nearby turbines. As described in the noise impact assessment, the noise modelling shows that none of neighbouring settlements or their individual sections fall under the noise impact. Results of shadow flicker modelling are provided in chapter 6.10.6.3 and in attachment (ESIA volume 2 annex 9). The results of flickering modeling will be taken into account during the final selection of turbine sites (in case if the final number of turbines will be less than 46).

Table 6-34 Distance from the Ruisi WPP Facilities to the Residential Houses and Cultural Heritage Objects

Turbine N	Coordinates (38 T)		Distances (m)					
	X	Y	Residential area/ closest house			Cultural Heritage Objects		
1	416362	4656165	2055	S/W	Ruisi	2073	S/W	Ruisi St. Marine church cemetery
2	415941	4655779	1500	S/W	Ruisi	1456	S/W	Ruisi St. Marine church cemetery
3	418084	4652080	1447	S	Skra	1910	S	Skra Mother of God named church
4	415833	4656535	2105	S/W	Ruisi	1933	S/W	Ruisi Kvirackhoveli church
5	416235	4654695	903	S/W	Ruisi	610	S/W	St.Kvirike and Ivlita monastery cemetery
6	418096	4656038	649	N/E	Arashenda	1081	N/E	Arashenda Mother of God named church
7	416787	4653517	889	N/W	Ruisi	851	S/W	Ruisi Mother of God small church
8	417568	4652920	1326	S/W	Urbnisi	1664	N/W	Ruisi Mother of God church
9	418078	4651798	1015	S	Skra	1480	S	Skra Mother of God named church
10	416761	4655570	1935	N/E	Arashenda	1633	S/W	St.Kvirike and Ivlita monastery cemetery
11	414067	4655324	527	S/W	Ruisi	633	W	Ruisi St. Demetre church cemetery
12	410058	4660177	594	S/W	Breti	610	S/W	Cemetery
13	416458	4654118	714	S/W	Ruisi	446	S/W	St.Kvirike and Ivlita monastery cemetery
14	412485	4655984	574	S/E	Ruisi	746	S/E	Ruisi St. Demetre church cemetery
15	417205	4656123	1276	N/E	Arashenda	1872	N/E	Arashenda Mother of God named church
16	417783	4655561	1221	N/E	Arashenda	1618	N/E	Arashenda Mother of God named church
17	415799	4657018	2413	NW	Arashenda	1837	N/W	Ildaeti John The Baptis church
18	414338	4662288	550	S/E	Sakasheti cottages	979	N/E	St. Nicholas church
19	412348	4656581	1171	S/E	Ruisi	1255	S/E	Ruisi St. Demetre church cemetery
20	409883	4660970	990	S/W	Breti	884	S/W	Cemetery
21	408631	4655374	910	S/E	Bebnisi	2250	S	Kareli Khareba church
22	408706	4655795	1156	N/W	Sagholasheni	1763	N/W	Sagholasheni Zion basilica
23	417027	4659671	656	N/E	Variani Farm	1090	S/E	Variani Cylindrical Tower (417375.66 , 4658639.37)
24	408494	4654948	554	S/E	Bebnisi	1801	S	Kareli Khareba church
25	408788	4661538	408	N/W	Dirbi	1309	N/W	Dirbi St. George church

Turbine N	Coordinates (38 T)		Distances (m)					
	X	Y	Residential area/ closest house			Cultural Heritage Objects		
26	417103	4652013	515	W	Urbnisi	1628	S/W	Urbnisi Church
27	417016	4658726	1497	N/E	Variani Farm	375	S/E	Variani Cylindrical Tower (417375.66 , 4658639.37)
28	412557	4657113	707	N/E	Sasireti	1210	N/E	Sasireti St. George church
29	414831	4655492	868	S/W	Ruisi	616	S/W	Ruisi Kvirackhoveli church
30	417038	4659205	1048	N/E	Variani Farm	670	S/E	Variani Cylindrical Tower (417375.66 , 4658639.37)
31	414129	4661859	570	N/E	Sakasheti cottages	1279	N/E	St. Nicholas church
32	412532	4661391	611	N/W	Dzlevidjvari	2297	S/E	Sakasheti St.George church
33	412897	4662256	816	N/E	Dzlevidjvari	2427	E	St. Nicholas church
34	412723	4661825	607	N/E	Dzlevidjvari	2493	S/E	Sakasheti St.George church
35	413962	4661398	731	S/E	Sakasheti cottages	1540	S/E	Sakasheti St.George church
36	413666	4657350	549	N/W	Sasireti	823	N/W	Sasireti St. George church
37	414699	4658932	916	N/W	Sakasheti	386	S/E	Ildaeti John The Baptis church
38	414889	4659361	535	N/E	Sakasheti	783	N/W	Sakasheti St.George church
39	409084	4656879	707	N/W	Sagholasheni	563	N/W	Cemetery
40	409728	4661538	1221	N/W	Dzlevidjvari	1361	S/W	Cemetery
41	413149	4656799	942	N/W	Sasireti	1288	N	Sasireti St. George church
42	415632	4659731	512	N/E	Sakasheti	1116	N/W	Churc of the Entry of the Most Holy Mother of God into the Temple
43	409064	4662059	499	N/W	Dirbi	1489	N/W	Dirbi St. George church
44	409523	4657755	809	N/W	Breti	730	S/W	Cemetery
45	409188	4657353	673	S/W	Sagholasheni	347	N/W	Cemetery
46	409763	4661954	1060	N/E	Dzlevidjvari	2191	N/W	Dirbi St. George church
Substation	411272	4656665	1797	S/E	Ruisi	2379	S/E	Ruisi St. Demetre church cemetery

6.10.6.1 Impact due to Ice Throw

Ice and snow build-up notably reduces the performance of wind turbines as well as this affects balance of blades and thus damages mechanisms. Besides, there is a risk that ice can dislodge from rotating mechanism and flung away on a long distance.

There are much discussions around this topic. As with any structure, sever atmospheric conditions may result in ice formation on wind turbines. Whilst ice accumulation depends on weather conditions and operational state of turbines, ice melting depends on the same factors.

Ice that gathers on turbine blades is a potential hazard for the WPP personnel and people present in adjacent territories. Vehicles moving nearby wind turbines could be also impacted (if any).

Considering climate conditions of Gori and Kareli Municipalities, blades of wind turbines could be covered by ice only for short time, specifically several days in January and February. Impact risk exists only for operational personnel, because other people are highly unlikely to enter impact zone during the winter.

Ice build-up on with turbines and risk of respective adverse impacts are more characteristic to northern countries and less topical in climate conditions of Georgia

General Measures for Mitigating Risk of Ice Throw

Daily monitoring is required during strong frosts in winter months and the wind farm should be stopped for a while if needed to prevent ice build-up on wind turbines and related risks. First of all, the stoppage of the wind farm is important to avoid damaging of turbines. As of the risk for population due to ice throw, in this particular case turbines are rather distanced from residential areas and roads, and such risk factually does not exist.

Some countries successfully use drones to de-ice wind turbines (e.g. „Aerones“, Latvian company). The main takes are to deice and clean blades. ‘Cleaning’ drone can clean up to 30 blades (10 wind turbines) per day, depending on the size of blades and weather conditions.

The drone can to lift up to 400m height, and operate for 20 minutes in off-line mode. The drone is equipped with 2 accelerometers, 5 gyroscopes (to accurately measure angle), and thermovisor to enable inspection of blade surface. 2 controllers and 3 parachute are included as well. Water consumption system is very efficient, and is automatically regulated depending of contamination type and volume.

In addition to main purpose, the drone can fight localized fire.

The need for wind turbines’ de-icing should be established according to monitoring results, and respective preventive measures should be defined, in particular: to stop the wind farm for a while, or to deice turbines.

Figure 6-56 Use of the drone for cleaning of the wind turbine

6.10.6.2 Electro-magnetic Radiation

Wind turbines can cause interference to signals of radio frequency. Mechanisms of such impact are diffraction, reflection and scattering.

Wind turbines may disrupt operation of cellular or TV towers that are in close proximity. In this case, the telecommunication towers of Magti and Biline is 500 m away, and therefore impact on them is minimized. In case of the first alternative which is discussed in the section devoted to the analysis of alternatives turbines are located close to these towers and their operation could be jeopardized. Alternative 1 was discarded to this and some other factors. As already mentioned, the risk for this impact is minimal in case of the preferred option.

Electro-magnetic field of 33kV lines is negligible (the protection zone comprises 150m from the outermost cables), and all interconnecting lines are distanced from residential areas.

6.10.6.3 Shadow Flickering Impacts

6.10.6.3.1 Regulatory Requirements and Impact Criteria

Shadow flicker occurs when the sun passes behind the wind turbine and casts a shadow. As the rotor blades rotate, shadows pass over the same point causing an effect termed shadow flicker. The magnitude of the shadow flicker effect varies both spatially and temporally, and depends on a number of environmental conditions coinciding at any particular point in time, including, the position and height of the sun, wind speed and direction, cloudiness, and proximity of the turbine to a sensitive receptor. Shadow flicker may become a problem when potentially sensitive receptors (e.g., residential properties, workplaces, learning and/or health care spaces/facilities) are located nearby, or have a specific orientation to the wind energy facility.

The magnitude of the shadow flicker effect varies both spatially and temporally, and depends on a number of environmental conditions coinciding at any particular point in time, including, the position and height of the sun, wind speed and direction, cloudiness, and proximity of the turbine to a sensitive receptor. The magnitude of the shadow flicker effect varies both spatially and temporally, and depends on a number of environmental conditions coinciding at any particular point in time, including, the position and height of the sun, wind speed and direction, cloudiness, and proximity of the turbine to a sensitive receptor.

Previously, blade or tower glint, which could occur when the sun reflects off a rotor blade or the tower at a particular orientation, was considered to have a potential impact on communities. However, provided that wind turbines are painted with a matt, non-reflective finish, as is typical with modern wind turbines, blade or tower glint is no longer considered to be a significant issue.

There is no standard methodology that all developers employ when introducing environmental and site specific data into shadow flicker assessments. Different guidelines produced by European countries, USA, Canada and Australia, as well as international organisations, make focus on several criteria for estimating the magnitude of impacts.

Criteria: Shadow flicker only occurs inside buildings where the flicker appears through a narrow window opening;

This criterion is recognized by:

- Planning for Renewable Energy – A Companion Guide to PPS22 Office of the Deputy Prime Minister (2004); England;
- Best Practice Guidance to Planning Policy Statement 18 'Renewable Energy', Northern Ireland Department of the Environment (2009);
- Planning Advice Note (PAN) 45: Renewable Energy Technologies Scottish Executive (2002
Planning Advice Note (PAN) 45: Renewable Energy Technologies Scottish Executive (2002

In Spain, shadow flicker is not included in the planning requirements at present. As wind farms in Spain tend to be located far enough from any populated settlement, no complaints have been registered and no standard practice has been implemented.

Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM Administered Lands in the Western United States, US Department of the Interior – Bureau of Land Management (2005). This document produced by the United States" Department of the Interior states that shadow flicker is not considered as significant issue in the United States as in Europe.

France has no set limits on shadow flicker effect.

6.10.6.3.2 Methodology of Assessment and input data

At present the final configuration of the turbines is not specified. The number of turbines, physical diminsions, exact coordinates and orientation will be specified later at the detailed design stage. All of these factors are important for precise modelling of the shadow flickering effects. Under these circumstances, the shadow flicker assessment is done as a worst case scenario analysis: number of the turbines is taken as maximum possible (46 and 50), as well as dimensions of the turbine (hub height 148m; rotor diameter 163m). For the orientation the assumption taken is that the plane of all of the rotor blades is perpendicular to the sun's rays. It is also assumed that during the entire period of the turbine operations, the sunshine is bright. In reality the final number of turbines will be much less than 46 and their orientation will not be perpendicular to the sunshine rays. The real magnitude and friqency of expacted impacts will be much less than for the worst case scenario presented below. The rational for producing this preliminary worst case study is to determine maximum negative impact that the project may have and the areas of the potential impact. This will help to optimize the final configuration of the turbines at the detailed design stage: the shadow flickering impacts will be taken into account during the alternative analysis, as well as for developing the mitigation strategy. At the detailed design stage the comprehensive shadow flickering modelling will be conducted describing the impacts for the actual situation (final configuration of turbines and exact values of all parameters affecting the level of the shadow flickering).

Wind turbines cast the shadow of their rotating blades during periods of bright sunshine. If these shadows are cast on the windows of nearby dwellings, residents may experience a strobe shadow flicker effect inside the house. This effect is particularly pronounced at dawn and dusk.

The purpose of this report is to graphically represent the impact of shadow flicker in terms of modeled maximum shadow hours per year and maximum shadow minutes per day in the vicinity of planed wind farm. SHADOW module of WindPRO 3.6 [1] software package (licensed to Fractal d.o.o. Split) is used to model the „worst-case“ impact in the vicinity of planed wind farm.

Model applied for calculation of shadow flicker impact is conservative, i.e. it is expected that the values achieved during the wind farm operation will be lower than calculated.

Applied model implements worst case scenario:

- receptors installed in all directions (green house),
- disregards the beneficial influence of local vegetation,
- assumes the constant sunny weather from dusk till dawn,
- assumes the constant operation of wind turbines,
- assumes the perpendicular alignment of wind turbine blades between the sun and the receptor.

Calculation is performed for two predefined layouts (rejected, new). 3D terrain model with contours of 10m equidistance is prepared and used for the calculation purposes.

In order to conduct the calculation, the following steps are implemented:

- identification of wind turbines input data,
- calculation of shadow flicker effects,
- graphical representation of shadow flicker impact.

Wind turbine type that would be used for planned wind farm site is not yet determined. One of the considered turbine types is Nordex N163/5.9 h.h. 148m, therefore wind turbine dimensions that correspond to this turbine type are used in calculation:

- hub height: 148.0m,
- rotor diameter: 163m,
- tip height: 229.5m.

The following calculation parameters are used:

- minimal angle of the sun from the horizon: 3°,
- daily calculation step: 1 day,
- calculation time-step: 1 minute,
- spatial resolution: 1m,
- window dimensions 1m x 1m, 1m a.g.l., perpendicular to each turbine position,
- receptor (eye) height 1.5m.

Relevant parameter for qualifications of the shadow flicker effects is the influence duration, calculated in hours per year (h/year) and minutes per day (min/day).

Although there are no legal regulations that determine the limits of shadow flicker impact, “Environmental, Health, and Safety Guidelines for Wind Energy” [2] apply the following criteria: “If it is not possible to locate the wind energy facility/turbines such that neighboring receptors experience no shadow flicker effects, it is recommended that the predicted duration of shadow flicker effects experienced at a sensitive receptor not exceed 30 hours per year and 30 minutes per day on the worst affected day, based on a worst-case scenario”.

6.10.6.3.3 Shadow Flickering Calculations

Graphical representation of modeled maximum hours per year and maximum minutes per day under the influence of shadow flicker in the vicinity of planed wind farm is given at the following figures

Modelling is performed for two layouts: alternative version (50 turbines) used at the early stages of design and the selected configuration (46 turbines).

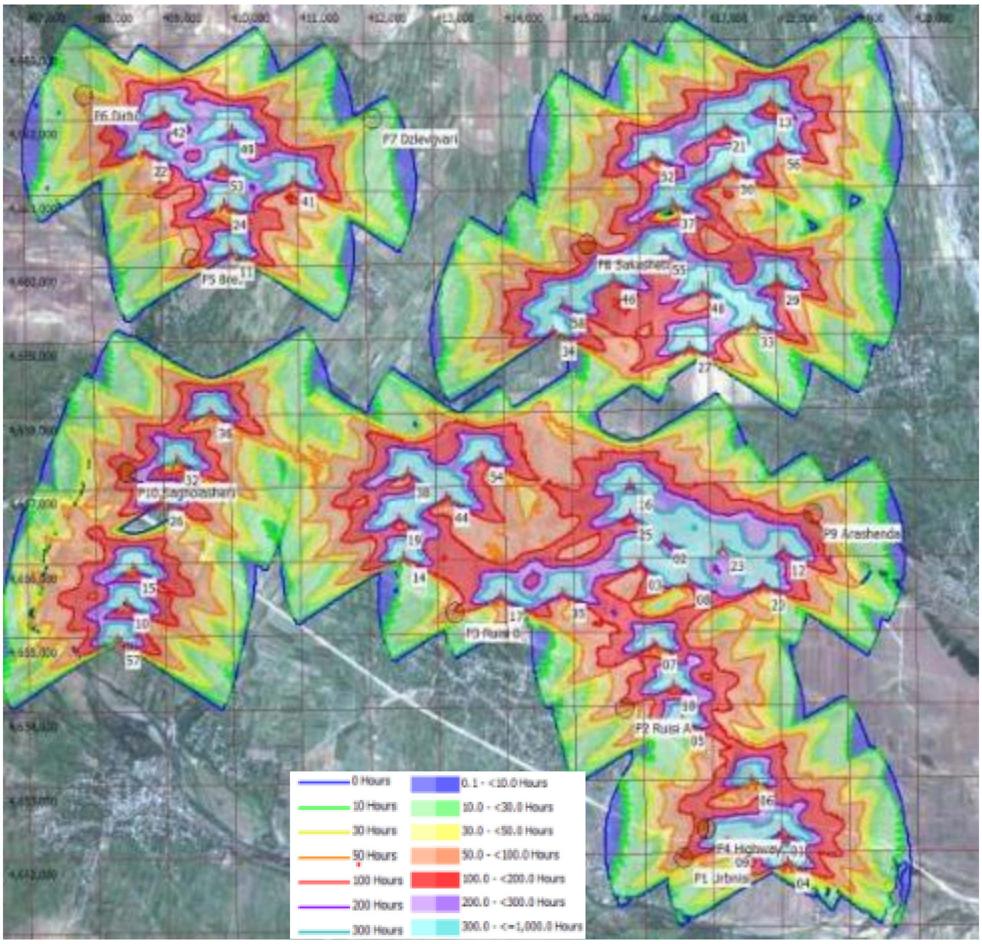


Figure 6-57 Alternative (rejected) layouts : graphical representation of modeled maximum hours per year under the influence of shadow flicker in the vicinity of planned wind farm

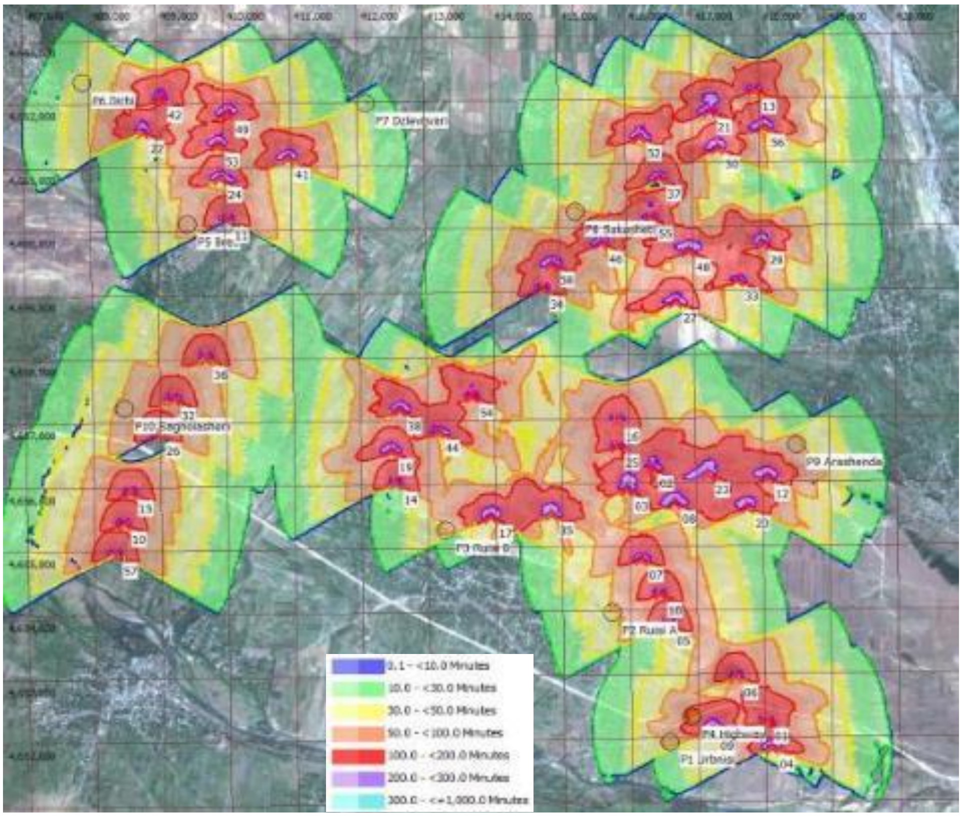


Figure 6-58 Alternative (rejected) layouts : graphical representation of modeled maximum minutes per day under the influence of shadow flicker in the vicinity of planned wind farm

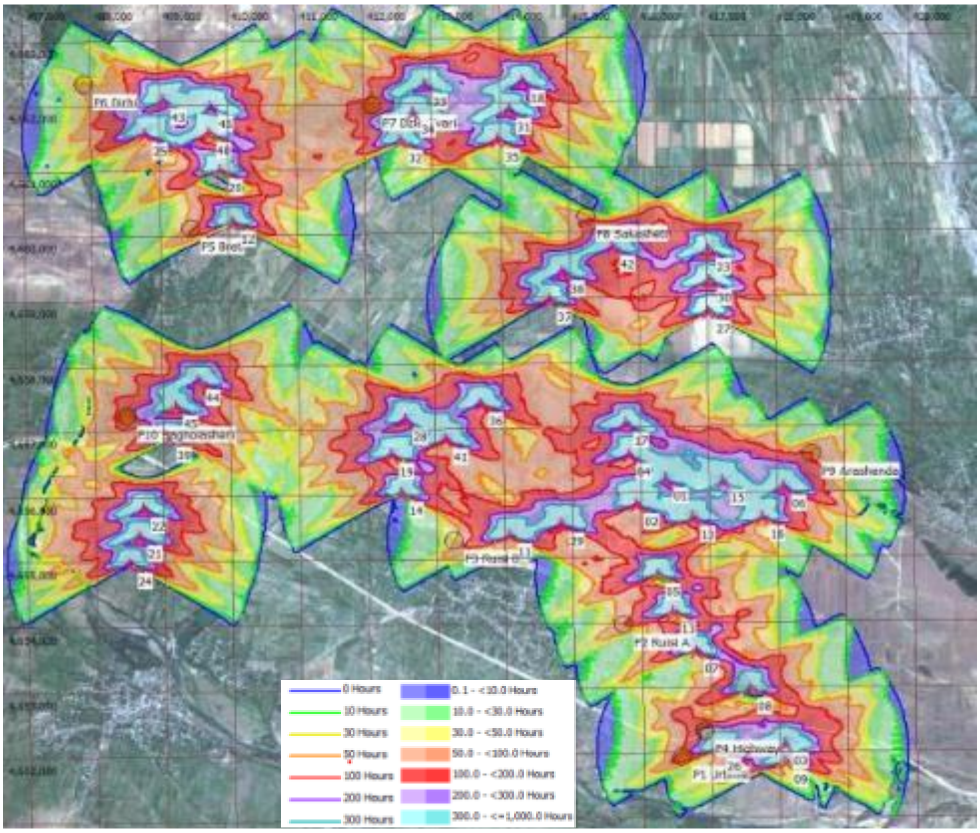


Figure 6-59 Final (selected) layouts : graphical representation of modeled maximum hours per year under the influence of shadow flicker in the vicinity of planned wind farm

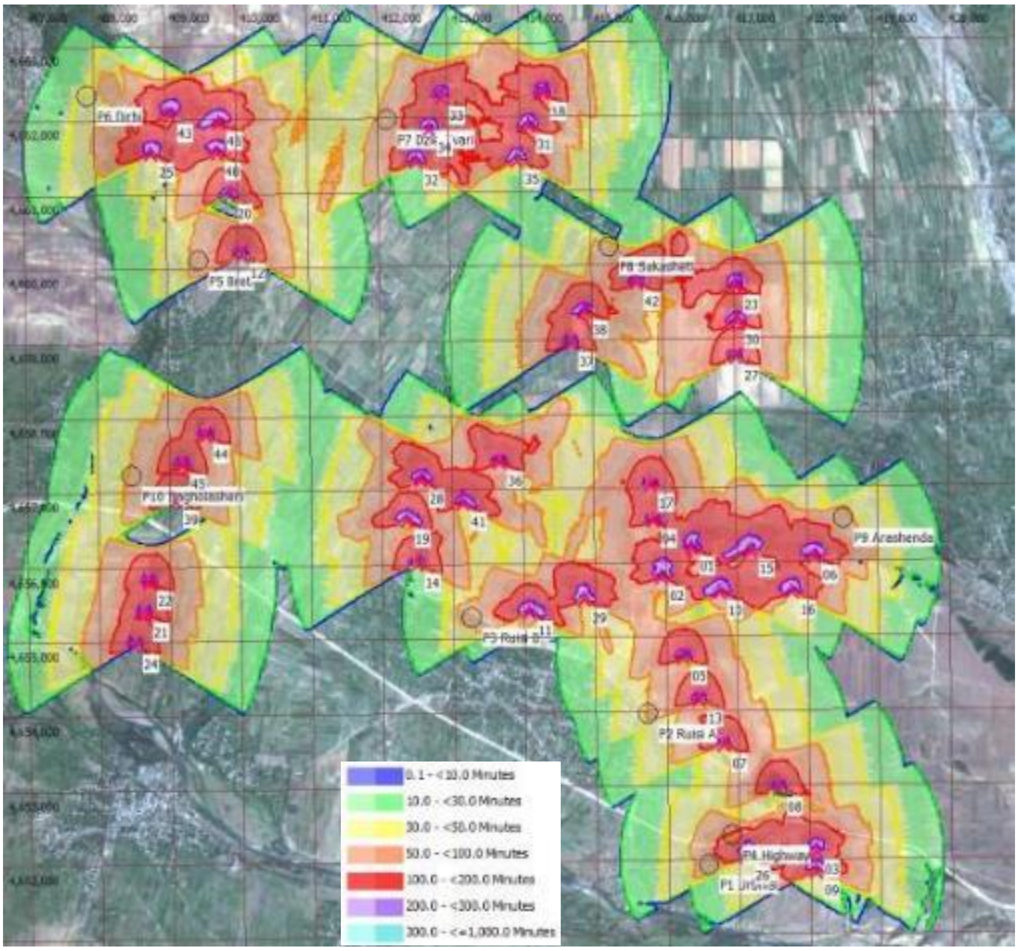


Figure 6-60 Graphical representation of modeled maximum minutes per day under the influence of shadow flicker in the vicinity of planned wind farm

6.10.6.3.4 Results of calculation for the most exposed receptors

Table 6-35 Results of calculation for Rejected Alternative layout (50 turbines)

	Rejected Alternative (50 turbines)	
ID	Hours per year	Max hours per day
P1 Urbnisi	**101:31:00**	**0:59**
P2 Ruisi A	**72:55:00**	**0:48**
P3 Ruisi B	**94:00:00**	**0:57**
P4 Highway	**183:30:00**	**1:59**
P5 Breti	**85:05:00**	**1:02**
P6 Dirbi	**50:40:00**	**0:35**
P7 Dzlevijvari	27:07:00	0:28
P8 Sakasheti	**118:53:00**	**1:02**
P9 Arashenda	**97:49:00**	**0:55**
P10 Sagholasheni	**160:17:00**	**1:00**

Table 6-36 Results of calculation for Final layout (46 turbines)

	new	
ID	Hours per year	Max hours per day
P1 Urbnisi	**142:20:00**	**1:08**
P2 Ruisi A	**98:07:00**	**0:51**
P3 Ruisi B	**50:23:00**	**1:05**
P4 Highway	**251:07:00**	**1:57**
P5 Breti	**82:35:00**	**1:00**
P6 Dirbi	**50:39:00**	**0:35**
P7 Dzlevijvari	**152:36:00**	**0:59**
P8 Sakasheti	**65:19:00**	**1:02**
P9 Arashenda	**101:54:00**	**0:57**
P10 Sagholasheni	**140:07:00**	**0:54**

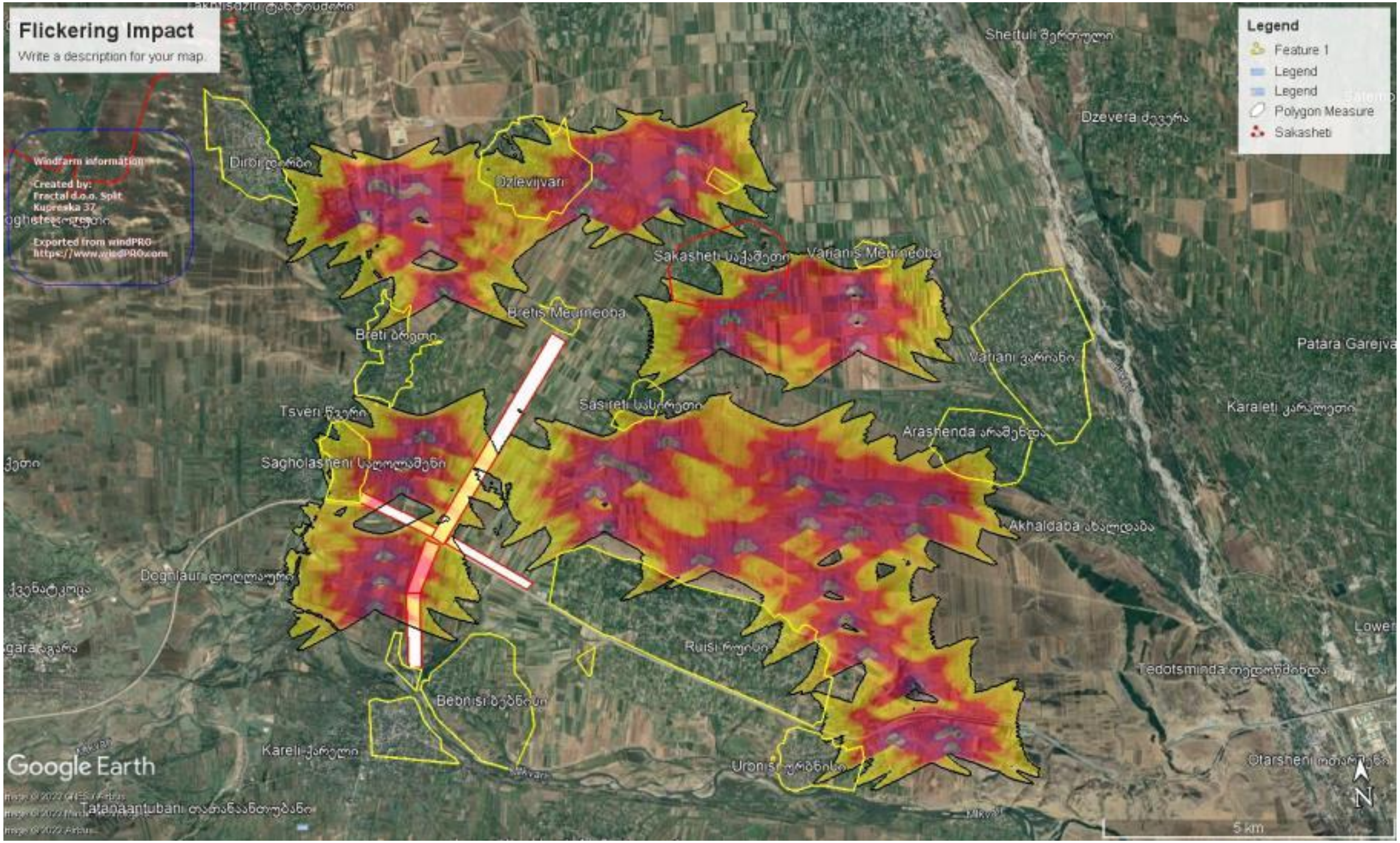


Figure 6-61 Graphical representation of medium and severe shadow flicker impacts on residential areas (hours per year)

6.10.6.3.5 Conclusion

Calculating the shadow flicker impact in the vicinity of planed WF Ruisi using the SHADOW module of WindPRO 3.6 software package, considering the worst-case scenario, graphical representation of these phenomena is obtained. As it can be observed, for the **Alternative** and both for the **Final** layout calculated worst scenario results at most exposed receptors exceed the limits of informal guidelines (30 hours per year and 30 minutes per day on the worst affected day) at al selected nearby receptors.

Figure 6-61 shows in more details how the residential areas in the vicinity of villages are affected for the reviewed worst case scenario (selected configuration of turbines). The yellow zone show the marginal level of flickering (more than 30 hours per year, less than 50 hours), while the red zone shows high levels – 100hours per year. The residential areas are shown as yellow and red contours.

In Table 6-37 the flickering impacts are summarized by villages, residential areas and houses and the turbines having major input in these impacts are marked.

Table 6-37 Impacts by Receptors and Turbines

Villages	% of residential area within the medium flickering impact zone 30 – 50 hours/year	% of residential area within the high flickering impact zone 100 hours/year	No of Turbines with most severe impact	Comments
Vill. Ruisi;	13% 208 houses	1.12% 19 houses	11; 29; 05; 13; 07;	Despite the fact that affected residential land area is only 13%, the number of affected houses is significant. About 208 houses fall in medium impact zone and 19 houses within the severe impact zone. The major input is provided by turbines 11; 29; 05 and 13;
Vill. Sagolasheni;	96% 75 houses	24% 15 houses	44; 45; 39;	% of affected residential land and number of affected houses is high. Major impacts are related to turbines No 39 and 45;
Vill. Breti;	11% 26 houses	2% 1house	12; 20;	% of severely affected residential land and number of severely affected houses is low. Major impacts are related to turbine No 12;
Vill Bretis Meurneoba	0	0	-	
Vill. Sasireti;	32% 13 houses	3.5% 1 house	28; 36; 37	% of severely affected residential land and number of severely affected houses is low. Major impacts are related to turbine No 36.
Vill. Dirbi;	0.5% 0 houses	0 0 houses	25; 43;	The impact is low
Vill. Dzvelijvari;	87% 128 houses	30% 16 houses	32; 33; 34;	% of affected residential land and number of affected houses is high. Major impacts are related to turbines No 32; 33; 34;

Villages	% of residential area within the medium flickering impact zone 30 – 50 hours/year	% of residential area within the high flickering impact zone 100 hours/year	No of Turbines with most severe impact	Comments
Vill. Sakasheti;	41% 67 houses	25% 2 houses	37; 38; 42;	% of severely affected residential land is high nut number of severely affected houses is low. The most part of the affected residential land is a reserve for future development and no houses are located there at present. Major impacts are related to turbine No 38; 42;
Vill. Variani;	0	0	-	
Vill. Varianis Meurneoba	21% 14 houses	1% 0 houses	23;	% of severely affected residential land and number of severely affected houses is low. Major impacts are related to turbine No 23;
Vill. Arashenda.	17% 75 houses	3% 3 houses	06; 15; 16;	% of severely affected residential land and number of severely affected houses is low. Major impacts are related to turbines No 06; 16;
Vill. Urbnisi;	21% 13 houses	4.5% 3 houses	26;	% of severely affected residential land and number of severely affected houses is low. Major impacts are related to turbines No 26;
Vill. Bebnisi;	0	0	-	
Kareli.	0	0	-	

About 619 houses are presumably affected by shadow flickering. Out of this, 58 are affected severely (more than 50 and close to 100 hours per year).

The results of total amount of flickering caused by each WTG are presented in the full report Calculation of shadow flicker (ESIA volume 2, Annex 9).

Recommendations for mitigation and compensation:

The general recommendations proposed in the IFC Environmental, Health, and Safety Guidelines for Wind Energy August 7, 2015 is as follows:

- Site wind turbines appropriately to avoid shadow flicker being experienced or to meet limits placed on the duration of shadow flicker occurrence, as set out in the paragraph above.
- Wind turbines can be programmed to shut down at times when shadow flicker limits are exceeded.

Different international guidelines referred above in chapter 6.10.6.3.1, propose following mitigation measures:

- Proper siting and layout. Site and position the turbine to avoid shadow flicker (where possible). It is considered that locating the turbines at a distance exceeding 10 rotor diamteres minimizes impacts to the acceptable level. Orientation of the blades is also important factor: blades positioned perpendicularly to the sun rays has more impact, while rotor with the blades parallel to the sun rays have almost no impacts.

- Reduction of the rotor diameter reduces the zone of impact (10 rotor diameter principle)
- Screen shadow flicker impacts using planting tall trees or installing blinds.
- Temporary (periodical) shut down turbine

Table 6-38 Summary of mitigation measures in International guidance.

	Careful site design	Turbine shut-down	Installation of blinds	Landscaping / vegetation screening
United Kingdom guidance				
England	Yes			
Northern Ireland	Yes	Yes		
Wales	Yes	Yes	Yes	Yes
International guidance				
Ireland	Yes	Yes		Yes
Germany		Yes		
United States	Yes			Yes
Canada		Yes		
Non-governmental organisation guidance				
International Finance Corporation	Yes			

Source: Update of UK Shadow Flicker Evidence Base/ Department of Energy and Climate Change. Evidence BaseShadow Flicker FINAL REPORT

For this particular project, following recommendations are given to the project proponent:

At present the final configuration of the turbines is not specified. The number of turbines, physical diminsions, exact coordinates and orientation will be specified later at the detailed design stage. All of these factors are important for precise modelling of the shadow flickering effects. Under these circumstances, the shadow flicker assessment is done as a worst case scenario analysis. The company takes a committement that at the detailed design stage the comprehensive shadow flickering modelling will be conducted to describe the impacts for the actual situation (final configuration of turbines and exact values of all parameters affecting the level of the shadow flickering). The outcomes of the comprehensive modelling will be used to match the most efficient mitigation measures out of the alternatives presented below. The special shadow flickering mitigation plan will be developed based on the results of modelling.

Below we provide a proposed strategy for mitigating shadow flickering impacts and the priority of mitigation measures.

1 **Removing the turbines with the highest flickring impact**. The final number of turbines and configuration is still under consideration. In case if finally it is planned to reduce number of WTG positions then WTGs with the largest SF influence could be removed (results of total amount of flickering caused by each WTG are presented in the calculation appendix). The shadow flickering impact is not the only factor or the most important factor during the process of selecting final location of turbines: the wind conditions and technical-economical feasibility will be the main factors. However, the cost of alternative mitigation measures (e.g. temporary shut-downs) will be also takent into account. **This option of mitigation will be taken into account by JSC**

Wind Power at the stage of Detailed Design and procurement of the finally selected models of the turbines.

2 **Rotor diameters.** During the selection of final models of turbines, if it will be possible, select the turbines with less rotor diameters for the positions with the highest shadow flickering impacts. This is not an obligatory requirement, but an option to be considered at the **detailed design stage**.

3 **Temporary Shutdowns of turbines.** JSC Wind Power takes commitment to develop a schedule for shutting down turbines to achieve acceptable S/F impact. Precise modeling for developing the schedule is not possible at this stage, as final precise locations, number of turbines and orientation of blades, as well as particular models of turbines are not yet determined. The final schedule will be developed during the first year of operations, based on actual monitoring data. As a preferable option the company plans to use automated "shadow flicker protection system". However, final decision will be taken during consultations with the suppliers at the stage of Detailed Design. At the detailed design stage, when all technical parameters (locations; orientation; dimensions etc.) are finally specified, additional modeling of shadow flickering will be conducted. Results of the additional modeling will be used for developing preliminary versions of the "shut down schedule" and automative or manually regulated shut-down schemes and will be taken into account during procurement of turbines and automated shut-down systems. Further, based on actual monitoring data, the final version of the "shut-down" schedule will be elaborated..

4 **Screening through landscaping**. At the detailed design stage, when all locations and orientation of turbines, as well as particular models are specified, JSC Wind Power will conduct additional modeling of shadow flickering and determine those locations, where installation of "blinds" or planting tall trees may efficiently serve as the screens protecting the receptors from shadow flicker impacts. The feasibility of arranging the screens depends on the number (%) of the residential houses and other receptors that could be protected.

5 **Compensations.** In parallel with the schedule for shutting down turbines, the JCS Wind Power will develop compensation packages to off-set the residual flickering impacts. It is assumed that the schedule for shutting down turbines will allow significantly reducing the severe flickering impacts, however, the certain residual impact of low and medium magnitude may still remain unmitigated. On a basis of monitoring data, permanent consultations with the residents of affected villages and grievances collected through GRM, the affected residents eligible for compensation will be determined. The amounts for compensation will be determined based on consultations and negotiation with the affected residents.

6.11 Possible impact on material cultural heritage objects

The entire area was searched and carefully inspected. As far as possible, the placement points of the turbines (the same towers) in the area defined by Point1, Point2, Point3 and Point4 were checked with their circular areas. Sections of roads and power lines (cables) included in the project were inspected by car and, to a large extent, on foot. In some, not rare cases, specific areas were enclosed by iron and wire fences, which could not be viewed from the inside, however, due to their location on the open terrain, they were also more or less explored.

Directly in the project area, except for a few places, there are no remains of any object and/or artefact with the mark of cultural heritage anywhere. However, due to the number of important archeological-architectural monuments and objects cited above from the scientific literature, which are abundantly recorded and largely studied in the area under consideration by the project, we consider it appropriate to have the supervision of an archaeologist during the earthworks.

As a result of the review of the project area, several noteworthy places were selected, where the supervision of an archaeologist and/or the production of archaeological works will be necessary before the start of earthworks. these are:

- **Mound**/**Registration number:** 21227/ (**GPS coordinates:** 410408.00 m E, 4659177.00 m N - to be confirmed) of Korgani /**Registration number:** 21227/ (**GPS coordinates:** 410408.00 m E, 4659177.00 m N - to be specified) the electricity transmission line (cable) provided for by the project, which will connect the different masts, should go within 200 meters from the possible location. In the above-mentioned location, earthworks must be carried out under the supervision of an archaeologist.

- **St. Demetre Church of Ruisi** (**GPS coordinates:** 413297.00 m E, 4655452.00 m N - correct) is located in the **village cemetery**, a few meters from the extreme northern section of which the electricity transmission wire (cable) provided by the project, which will connect the different towers, should pass. In the above-mentioned location, earthworks must be carried out under the supervision of an archaeologist.

- **Archaeologically sensitive site, tentatively, "Ceramics1".** GPS coordinates of the site: 416353.98 m E, 4654187.04 m N. The area of interest is located 90 meters south-west of the T18 turbine (mast), 16 meters south of the turbine arc (estimated work area). Fragments of ceramics from the late Middle Ages are collected at the site. The planned earthworks in the area must be preceded by the inspection of the adjacent section by means of test trenches (shurfs), the size and number of which will be decided on the spot.

- **Probable archaeological site, tentatively "Cross 1".** GPS coordinates of the place: 416104.35 m E, 4654467.61 m N. An iron cross (height 1.65 m) is placed right next to the road in one section of the road passing through agricultural land. The above-mentioned section is 0.26 and 0.3 km away from turbines T05 and T07, respectively, however, earthworks (if planned) must be carried out under the supervision of an archaeologist.

- **Probable archaeological site, tentatively, "Cross 2".** GPS coordinates of the site: 417728.10 m E, 4655682.41 m N. The area of interest is located 115 meters north-west of the T20 turbine (mast), 39 meters north-west of the turbine arc (estimated work spread area). An iron cross (height 2.0-2.2 m) has been erected on the site, at the bottom of which is placed a marble stone with the inscription: “Sulia”, Suliko Kopadze, 1972-2002.” Earthworks on the site (in case of such planning) must be agreed with the local population and conducted under the supervision of an archaeologist.

- **Archaeologically sensitive place, conditionally "inhabited".**

  GPS coordinates of the place: 435349.39 m E, 42558.65 m N. The area of interest is located in the northwestern corner of the project area, on the left bank of the East Prone River, 150 meters away from it. Directly includes T22, T24 turbines and its surrounding area. about 16 m. high hill is spread on a north-south axis. The hill dominates the environment. Its western part is bordered by the river, the southern part is flat, the eastern side is surrounded by a narrow gorge, and the northern side is bordered by a wide range. Its southern slope is completely, and the western and eastern slopes are partially, probably in the last century, artificially terraced, on which a cover of coniferous trees is planted. In the center of the hill and on its southern slope, small rectangular depressions can be observed, which were probably also used as military trenches in the last century. Due to the mechanical interventions in the area, traces of buildings and structures are not visible on the surface, although stones of various sizes scattered here may have been used for construction purposes in the historical period.

As a result of conducted field reconnaissance, archaeological ceramic products are collected on the entire perimeter of the hill. Among the excavated materials, physical entities are represented in the form of a kvevri base, a jug ear, a pot rim, and a bread oven fragment. According to preliminary information, the artefacts should belong to the Middle Ages. The area of distribution of artefacts decreases about 70 meters north of turbine T22, T24, and gradually stops, however, it is not excluded that the archaeological layers also extend in the direction of turbine T42, on the ridge north of the hill. Accordingly, construction activities in the mentioned sections must be carried out under archaeological supervision. Accordingly, the earthworks planned in the area must be preceded by the inspection of the adjacent section by means of test trenches (shurfs), the size and number of which will be decided on the spot.

- **Paniashvili family obelisk.** GPS coordinates of the site: 435951.32 m E, 42124.49 m N. It is located in the southeast corner of the study area. From the north side of the Tbilisi-Senaki-Leselidze freeway, in the central section of the project road leading to T09 and T06 turbines, on the left bank of the irrigation channel. The obelisk is a modern, red brick stele, on which the inscription on the granite stone informs us that "ninety-five representatives of the Paniashvili clan innocently killed by the Bolsheviks in 1924 rest in this area."

  In the case of planning earthworks in the mentioned area, the process must be agreed with the local population and conducted under the supervision of an archaeologist.

- **Probable archaeological site, tentatively, "arc-shaped quarry".** GPS coordinates of the place: 435858.15 m. E, 42327.55 m. N, is located in the central-eastern part of the study area. Near the central section of the wire (cable) running from turbine T04 T25 northwest to turbine T16 T19, 30 meters north of it. It is an arc-shaped stone whose diameter does not exceed 2 meters. It is composed of fine and small stones. The outer edge of the edge is irregular in shape, while the inner side is smooth. It is true that the archaeological materials in the vicinity of the structure are not confirmed, but the dump is of an unspecified period, cultural origin. Accordingly, earthworks in the mentioned area must be carried out under archaeological supervision. For this, the earthworks planned in the area must be preceded by the inspection of the adjacent section by means of test trenches (shurfs), the size and number of which will be decided on the spot.

- **Probable archaeological site, tentatively, "small quarry".** GPS coordinates of the place: 417450.45 m E, 4655531.41 m N. It is located in the central-eastern part of the study area. T18, T20 0.32 km west of the turbine, on the cable leading to the turbine. It represents today a shapeless, piled-up stone site. A little remaining arrangement of stones (?) and slight indentations can be observed here and there, with approx. 1.5-2 sq/m. Accordingly, earthworks in the mentioned area must be carried out under archaeological supervision. For this, the earthworks planned in the area must be preceded by the inspection of the adjacent section by means of test pits, the size and number of which will be decided on the spot.

6.11.1Recommendations and mitigating measures

Due to the number of important archaeological-architectural monuments and objects mentioned above from the scientific literature, which are abundantly recorded in the vicinity of the construction area, we consider it appropriate to appoint an archaeologist to supervise the earthworks.

In the event that cultural heritage is discovered in the entire section of the project area during the earthworks, according to Article 10 of the Law of Georgia "On Cultural Heritage", the works must be stopped immediately and the Ministry of Culture, Sports and Youth of Georgia (at this stage - National Agency of Cultural Heritage Protection of Georgia) should be notified about this.

At the construction stage archaeological monitoring ("Chance Finds Procedure") should be ensured by the constructing contractor under the supervision of the Ministry of Culture, Monument Protection and Sport of Georgia. The budget necessary for the archaeological supervision and other agreed works should be fixed under the construction works appraisal.

6.11.2 Chance Finds Procedure

Construction Contractor engages 1 especially dedicated archaeologist (archaeological supervisor) for conducting daily supervision activities during the earthwork operations. Good practice is to agree the candidature of person assigned for that task with the Ministry of Culture and Monument Protection.

The Ministry of Culture and Monument Protection may also assign a person or company for periodical supervision of construction works, although this is practiced only in exclusive cases of sensitive projects.

Archaeological supervisor conducts daily monitoring at all construction sites, where the earthworks (land clearance; grading; excavations etc.) are planned according to the schedule.

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

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

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

2. Archaeological supervisor reports to the Chief Engineer at site and requests to stop activities at the site of finding. Archaeological supervisor executes first checking of the finding and the site where finding was made

3. In case the finding has no potential archaeological value, the Archaeological Supervisor reports to the Chief Engineer and the works are restarted. Appropriate record regarding the case is made in record book.

4. In case if the finding is estimated as potential archaeological relic, the Archaeological Supervisor reports to Chief Engineer of the Construction Contractor and to MDF Environmental Specialist (and supervising company / Engineer) requesting to stop construction activities and to inform the Ministry of Culture and Monument Protection about the incident.

5. Chief Engineer of the Construction Contractor also reports to MDF informing about the stopped operations and requesting immediate engagement of the Ministry of Culture and Monument Protection.

6. Ministry of Culture and Monument Protection will assign expert or group of experts and conduct necessary archaeological works at the site to identify the problem.

7. In simpler cases, after removal of the movable artefacts, fixing materials and conducting other required works, the experts of the Ministry of Culture and Monument Protection will issue decision on recommencement of stopped construction works.

8. In exclusive cases of valuable and spatially spread findings, the Ministry of Culture and Monument Protection may issue request to relocate the RoW shifting it on a safe distance from the archaeological site.

6.12 Cumulative impact

In terms of the cumulative impact of Ruisi Wind Farm, the possible interaction of the Wind Farm with other existing or planned wind farms in the vicinity is of interest. As for the planned, but not yet implemented projects, two projects are considered within the area of Ruisi Wind Farm:

- Çalik Georgia Wind LLC Project "Construction and operation project of 50 MW wind power plant (Nigoza), 110 kV substation and 35 kV underground transmission line"
- Project of JSC Caucasian Wind Company “Kaspi Wind Power Plant”.

Both projects are planned quite far away from Ruisi Wind Farm (more than 20 km). The two wind farms may have a cumulative impact on each other, as the distance between them is much shorter, and at the same time, the area of Nigoza wind farm covers a sensitive ecological habitat - the living and feeding area of the Egyptian vulture, while the area of Kaspi wind farm directly adjoins the vulture feeding area. The area of Ruisi Wind Farm is significantly distant from the area of the mentioned wind farms, as well as from the vulture feeding area. There are no cumulative impacts on the mentioned wind farms expected.

As for the operating wind power plants, Gori wind farm should be taken into account. The distance between the nearest towers of Gori wind farm and planned Ruisi Wind Farm is 3 km. Consequently, the flight of birds and bats will be significantly less affected by the locations of these wind farms to one another than by the locations of the towers within each complex. Within each project, the distance between the turbine towers has been set to avoid increased risk of bird mortality. Ruisi and Gori wind farms will not have a cumulative impact on bird and bat flight (trajectory; height; or frequency) or risk of their mortality, especially since both facilities are far away from the Important Bird Areas and corridors of migratory species.

The wind farms in question will not have cumulative impacts in terms of either noise or turbine oscillation: 3 km is quite a great distance for such cumulative impacts to occur.

The only expected cumulative impact is the visual impact on the aesthetic view of the landscape. Ruisi Wind Farm will surely have more significant visual impact as 50 turbines are planned to install in a rather large area, while Gori wind farm has 6 locally concentrated turbines. In this sense, Gori wind farm has very little visual impact compared to Ruisi Wind Farm. Many years of experience of the operation of Gori wind farm suggests that the visual impact of wind farms on the landscape in general is less than the visual impact of for example, high-voltage power lines: both locals and tourists get accustomed to the presence of turbines in visual environment much easier than to power lines.

Currently, no other approved projects are planned within the area of Ruisi Wind Farm project to exert a cumulative impact with the wind farm project.

According to the data obtained from the Ministry of Economy and Sustainable Development of Georgia, there are six proposals for new Wind Power Plant projects in Gori and Kareli Municipalities. The projects are at the pre-feasibility stage. No technical and economical details, potential layouts, environmental and social impacts and feasibility of the mentioned proposals have been assessed and no Memorandums have been signed with the Government to initiate the Feasibility Studies and more detailed elaboration of the project details. Accordingly, it is not known whether these projects could be implemented in reality. Below we provide a list of the mentioned projects and coordinates. Be that as it may, the assessment of the cumulative impact can be carried out only after a decision is made on the implementation of any of the listed projects, and this assessment can be carried out as part of the EIA developed for these projects.

№	Project	Company	Municipality	Capacity MWT
1	Urbnisi WPP	Wento Energy LLC	Kareli	10
2	Breti WPP	Wento Energy LLC	Kareli	30
3	Chero Energy West WPP	Chero Energy LLC	Gori	49.50
4	Skra WPP	GIEC LLC	Gori	20.70
5	Argi Energy WPP	Argi Energy LLC	Gori	27.00
6	Kareli WPP	Kareli Wind LLC	Kareli	28.00
Total		6		165.20

6.13 Risks Associated with the proximity to the Conflict Zone

The Ruisi Wind Power project site is located close to the Georgia's territories known as South Ossetia and currently occupied by Russian Federation. This is a conflict zone and potential risks for the project associated with proximity to the conflict zone should be analyzed.

6.13.1 Proximity to the Conflict Zone

The maps below demonstrate the conflict zones of Abkhazia and South Ossetia in Georgia, the territories occupied at present by Russian Federation.

Figure 6-62 Conflict Zones in Georgia (Abkhazia and South Osetia) Occupied by Russian Federation

The Ruisi Wind Power project is planned to be developed in Gori and Kareli districts of Georgia, which are adjacent to South Ossetia, territories of Georgia, which are currently occupied by Russian Federation. The closest distance from the project facilities (turbines #25 and 43) to the border of South

Ossetia is 3,5km. The distance from different project facilities to the different sections of the border varies from 3,5km to 25km.

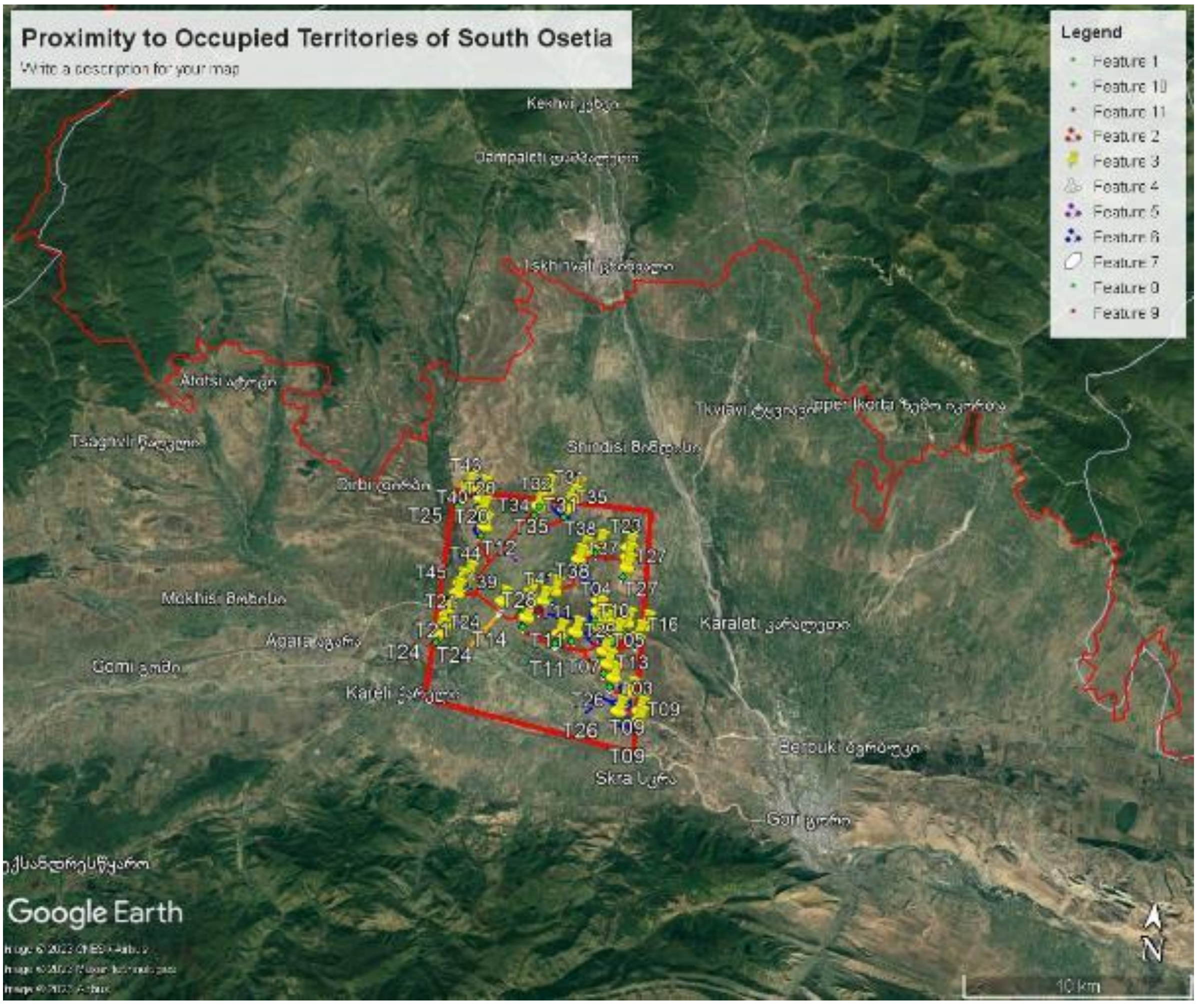


Figure 6-63 Proximity of the Project Sites to the Occupied Territories of South Ossetia

6.13.2 Prehistory and Current Status of the Conflict Zone

During the dissolution of the Soviet Union, conflicts erupted in Georgia in the Autonomous Republic of Abkhazia, and the Autonomous Oblast of South Ossetia. The Russian Federation played a pivotal role in fueling these conflicts, including by participating directly in the hostilities and continuously working to prevent their resolution (inter alia by obstructing international conflict resolution efforts). In the spring and summer of 2008, these Russian policies escalated into a series of acute provocations that culminated in the full-scale invasion of Georgian territory, followed by Russia's recognition of the self-declared independence of Abkhazia and the Tskhinvali region/South Ossetia. The war between Russia and Georgia in August 2008 illustrated that the primary nature of the conflicts on the territory of Georgia is of an international character. The Government of Georgia, supported by the consensus of the international community, believes that the Russian invasion and subsequent recognition took place in blatant violation of fundamental principles of international law – notably the principles of sovereignty and territorial integrity. Georgia's legal position is supported by international law and norms, and reinforced by arrangements concluded during and after the August 2008 war; it is further reinforced by the statements of numerous international forums, including the EU-commissioned "Independent International Fact Finding Mission on the Conflict in Georgia," which confirmed the illegality of the secession of these regions from Georgia and rejected Russia's arguments for its invasion and recognition. Since August 2008, Russia has increased its permanent military presence in and beyond the two occupied regions, including areas that were under Georgian-government control prior to the war. This constitutes a direct violation of the EU-brokered ceasefire agreement of August 12, 2008. Moreover, by deploying FSB border guards along the administrative boundary lines, Russia is preventing the EU Monitoring Mission (EUMM) from fulfilling its mandate — to oversee compliance with the ceasefire agreement. Since the invasion, Russia has continued to disregard international arrangements, vetoing the extension of UNOMIG and impeding consensus on extending the OSCE's presence in Georgia, including its military-monitoring component. In response to Russia's occupation of Abkhazia and the Tskhinvali region/South Ossetia, in October 2008 the Georgian Parliament adopted **the Law on Occupied Territories**, defining a new legal regime that applies to the two regions. The legal arrangements vis-à- vis the regions is currently based on this law, as well as on international norms and arrangements. Chief among these are the ceasefire agreement of August 12, 2008; the Conclusions of the September 1, 2008 meeting of the EU Council; the August 28, 2009 United Nations General Assembly resolution on "Status of IDPs and Refugees"; Resolutions of the Parliamentary Assembly of the Council of Europe on "The Consequences of the War Between Georgia and Russia" (#1633 (2008), #1647 (2009), #1648 (2009), #1664 (2009), #1683 (2009)), and "Reports on the Human Rights Situation in the Areas Affected by the Conflict in Georgia" (SG/Inf(2009)7, SG/Inf(2009)9, SG/Inf(2009)15); and the November 27, 2008 report of the OSCE Office of Democratic Institutions and Human Rights and High Commissioner for National Minorities on "Human Rights in the War-Affected Areas Following the Conflict in Georgia" (ODIHR/HCNM report). Russia's occupation of Abkhazia and Tskhinvali region/South Ossetia, and its policy of annexing them, complicates the reconciliation of all the peoples of Georgia and the peaceful reintegration of the occupied territories into Georgia's constitutional ambit. Given these circumstances, while committed to the full de-occupation of Georgia, the Government of Georgia deems it important to employ a human-centric, proactive policy that addresses the needs of the war-affected populations

6.13.3Risks Associated with the Proximity to the Conflict Zone

The military forces of Russian Federation are arranging the borders and thus isolating territories of South Ossetia from the main body of Georgia. The people intentionally or occasionally crossing the border are arrested for being claimed for "crossing the state border". Such cases are regularly recorded and sometimes the arrested people claim that they have been kidnapped from the territory of Georgia, when they were passing close to the "so called" border. However, there are no cases of kidnapping recorded from the sites located close to Georgian villages located at a distance of 3,5k and more from the border.

It may happen that during the construction of the project facilities, or even during operation some employees of JSC Wind Power or their subcontractors may occasionally come close to the border of South Ossetia. Probability for that is extremely low, as the distance from the project site to the border is 3.5km, but the matter will be taken into account. In such cases there is a risk that the persons could be arrested or kidnapped by Russians and South Ossetians. To avoid such incidents, all employees should be informed about the situation and exact location of the borders with South Ossetia and instructed to avoid visiting sites close to the border. The persons violating these inform instructions should be subject to administrative punishment by JSC Wind Power, according to the labor legislation of Georgia. The provisions related to the instructions/regulations and punishment should be reflected in contracts with the employees.

There is a risk that in case of further escalation of the conflict with Russian Federation, the borders of conflict zone could be widened and cover the project zone. However, these risks are low and could be estimated as similar to risks for any other territories of Georgia.

7 Mitigation Measures for Environmental and Social Impacts

7.1 General Overview

Information provided in the Mitigation Measures Plan is based on the assessments described in individual sections of the ESIA Report for the Ruisi WPP project. The proposed mitigation measures are designed considering planned works and impacts expected during their fulfilment.

The hierarchy of environmental measures is as follows:

- Avoidance/ prevention of impact;
- Minimization of impact;
- Mitigation of impact;
- Compensation of damage.

Avoidance of certain impacts and minimization of risks could be achieved through application of the best practices during the construction and operation phases. Some mitigation measures are embedded in the project design. However, as all impact could not be avoided, the Mitigation Measures Plan has been developed so that environmental safety could be ensured at maximum practicable level during the Project implementation.

The Project Implementer is a party responsible for the implementation of these mitigation measures as well as all other measures described in annexed documentation (Waste Management Plan, Emergency Response Plan).

7.2 Mitigation Measures for Anticipated Impacts

The below provided tables describe measures that mitigate potential impacts of the Project and define required monitoring activities. Specifically, Table 7-1 includes mitigation measures of the construction phase, and Table 7-2 - measures for the operation phase.

Table 7-1 Mitigation measures for the construction phase

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
The residential houses and public buildings in the residential areas adjacent to the project sites	➢ Emission of inorganic dust in ambient air. ➢ Emission of combustion products in ambient air. ➢ Noise	• Dusts generated during earth works; • Dust and noise from vehicle movement; • Dust and noise emissions during loading/unloading of inert materials and excavated soil; • Dust and noise from construction work; • Exhaust gases and noise of vehicles and building machinery; • Exhaust gases and noise of generators and other devices.	Low adverse	**Any specific measures are not required. The best practices used for construction works will be applied, including:** • The construction works will be conducted during only daytime. Night time works will be rejected to avoid any noise impacts on residential areas and dwellings. • Proper maintenance of machinery and equipment will be ensured. Vehicles and machinery with increased air emissions (due to impairment) will not be allowed to work sites; • Engines of machinery will be shut down or operated at minimum load when idle (this is especially relevant for machinery operated at the construction camp); • Vehicle will be driven at optimal speed both on site and on main roads; • Preventive measures will be implemented to avoid excessive dust during earth works and locating/ unloading of materials (e.g. dumping of materials from height will be prohibited during loading/unloading); • Personnel will be instructed before launching works; • Complaints/ grievances (if any) will be recorded and respectively addressed, considering all the above described measures.
Artificial Pine Forests described near T 08	Logging	Total 59936 trees growing on the forestry lands fall within the Project sites.		• Compensation measures requested by Georgian legislation should be implemented and respective monetary compensations should be paid. • For each cut tree, 3 new saplings will be planted, in agreement with the municipality and the Ministry of Environment Protection and Agriculture. • In the above-mentioned artificial pine grove, the trees are withering, which might be caused by the spread of parasites. As a compensatory measure, plant protection specialists will study the target habitat and develop a plan for rehabilitation measures. Immediately after the completion of the construction, the company will start implementing the rehabilitation plan developed by the specialists.
	Impact on flora	• Vegetation clearing from work sites and access roads (this does not envisages logging);	Very low adverse	• Boundaries of work site should be observed to avoid excessive damage to vegetation cover; • Road sides should be revegetated.

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
				• Visual check of each work site for the presence of Xanthium spinosum before site preparation works are started; • Removal invasive plant species whenever possible before starting vegetation clearance and site preparation works to avoid their distribution and further collonization; • Use native plants for revegetation of disturbed sites where the need for artificial revegetation is identified; • Ensure proper topsoil storage to avoid seed loss and reduce the need for artificial revegetation.
	Impact on animal species (including birds) and their habitats	• Disturbance of wildlife habitats; • Disturbance of animals and their abandoning surroundings of the Project Area; • Direct impacts - killing and injury of animals. • Impact on birds.	Medium adverse	• The Project Area should be checked before launching works for the presence of nesting sites/ dens of individual species; • Before ground works all constructed sites shall be surveyed for the presence of burrows of Brandt's Hamster (*Mesocricetus brandti*) and Grey Dwarf Hamster (*Cricetulus migratorius*) to avoid their destruction where practicable. • The use of night lighting system should be optimized; • Preventive measure should be applied to avoid noise propagation and emissions of air born pollutants; • Waste should be properly managed, and soil quality should be preserved; • Reinstatement works are planned after completion of construction works; • Awareness of workers will be improved, and any actions (e.g. approaching to dens/ nests, hunting, etc.) that may result in deterioration of habitats and living conditions of animals will be prohibited; • Any activates envisaged by construction operations will not be tankan off the construction sites; • Before the start of the site clearing works, all large trees on the construction sites that are subject to removal should be inspected on the presence of bats colonies. If the bat colony will be found, the tree cannot be destroyed without consultation with MoEPA officials and bat experts. • Transportation will be ensured along pre-defined routes; • Optimal driving speed will be ensured to minimize direct impact on animals (collision); • Excavation, tranches, etc. will be enclosed to prevent animal falling;

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
				• Works that could be highly disturbing for animals will be accomplished as soon as practicable; • Areas disturbed adjacent to communication and access roads will be reinstated after the completion of construction works so that impact due to habitat fragmentation will notably decrease; At the same time, the following issues will be paid adequate attention: • Proper management of wastes; • Measures envisaged for mitigation of air pollution, noise propagation, etc.
Sites of maximum 46 WTGs; Permanent sites: Stripped topsoil – 73,073 m3 Temporary sites: 164 860m3 of topsoil to be stripped	Destabilization of topsoil / subsoil; Loss or contamination of topsoil;	• Destabilization during construction works; • Topsoil loss during cleaning works to prepare construction sites. • Soil pollution with waste; • Contamination due to spillage of fuel, oil or other substances.	Medium Adverse	• Proper management of wastes; • In case of spill, timely remove contaminated layer and take out of the site; • Topsoil will be stripped in line with the Technical Regulations on Topsoil Stripping, Storage, Use and Reinstatement approved by the Government of Georgia through Resolution #424 from December 31, 2013. • Once works are completed, humus layer will be to reinstate soil stockpiling site and areas around access roads and turbine locations; • Boundaries of work sites will be defined accurately to avoid pollution, disturbance and compaction of soil in adjacent areas; • Transportation routes will be defined and offroad driving will be prohibited; • Malfunctioning machinery should be allowed to work sites; • Sewage waters generated on site will be properly managed (collected in watertight cesspools that will be evacuated immediately when full); • In case of spillage, spill will be localized and contaminated site should be immediately cleaned up; • If contaminated material is voluminous, properly licensed contractor will be used to take topsoil and subsoil out of the site for subsequent remediation. • Personnel will be instructed before launching works; • The territory will be cleaned up and reinstated once construction works are accomplished.
All selected sites are stable.	The risk to trigger hazardous geodynamic processes	Triggering of erosion due to road rehabilitation	Low adverse	**Any specific measures are not required, because landslides or other geohazards are not observed in immediate proximity of the Project structures and access roads. The best practices used for construction works will be applied to prevent erosion, including:**

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
				• Surface runoffs should be managed at sites where gulling is detected; • Protective structure should be provided below the roadbed if required to avoid its deformation; • Drainage ditches should be arranged along the roadbed to collect rainwater and thus prevent erosion and landslides due to road construction; • Territories around road and turbine locations should be reinstated after completion of construction works. This should include the arrangement of topsoil and sowing of perennial grass; • Erosive processes should be monitored during the construction and operation of the wind farm, and appropriate corrective measures should be implemented if needed. • Findings of engineering-geology survey and recommendations defined on their basis that are described in this EIA Report will be taken into account during the Project implementation; • Construction works will be carried out under strict supervision of engineering geologist. Additional preventive measures will be applied based on his/her recommendations; • Construction sites will be reinstated and revegetated when works are finalized.
Surroundings of all construction sites (temporary) Tower locations (permanent)	Landscape and visual changes	• Landscape and visual changes nearby existing roads; • Landscape and visual changes due to increased traffic;	Medium adverse	• To locate temporary structure, materials and wastes in a manner to make them less visible for visual receptors; • To reinstate and revegetate sites after completion of works; • Both on construction and operation phases, the colour and design of permanent structures (e.g. the substation) will be selected in a manner to match the environment; • Proper sanitary and ecological conditions will be maintained during the construction and operation phases;
Surroundings of all construction sites (temporary) 3 site that are selected for temporary storage of	Waste	• Construction waste (soil excavated from foundation tranches, etc.); • Hazardous waste (wastes of fuels and lubricants, etc.); • Household waste.	Low adverse	• To deliver building and other materials in amounts need for the Project purposes; • To temporary stockpile topsoil and subsoil at specially allocated area (10 sites); • To utilize major portion of subsoil for the Project needs (backfilling), and dumping of excessive subsoil at the spoil disposal site;

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
subsoil. Then subsoil will be used for reinstatement works and rehabilitation of access roads. Maximum 37 000m3 of spoil to be stored at temporary dumpsites;				• To reinstate the surfaces of spoil disposal sites; • To reuse waste to the extent practicable; • To take hazardous waste out of the site for further management only with help of contractors holding permit on such activity; • To allocate adequately trained personnel for waste management; • To arrange special storage facilities for temporary storage of hazardous waste at the construction camp site, and to place respectively labelled watertight containers on construction sites; • To adhere accurately to safety rules when transporting wastes; • To take hazardous waste out of the site for further management only with help of contractors holding permit on such activity; • To introduce recordkeeping procedure to record data on generation, temporary storage and management of waste and maintenance of respective log-book;
At least 152 land parcels are to be acquired The impact could be minimized through "fine-tuning" of the turbine locations;;	Impact on private assets and restricted availability of local resources	• Risk for resettlement and restriction of resource availability • No physical relocation; only one ancillary building affected; • About 152 private land plots are affected (two plots are non-agricultural and the rest is used for agricultural needs) • The small size pasture used by locals covers less than 5% of the forage need for their cattle. The project will not restrict access to the pasture, but will slightly reduce the area (not more than 10%).	Medium adverse	• Private lands that are located within the impact zone will be acquired based on amicable agreement; No expropriation is acceptable for the project. • The eligibility for compensations, valuation of assets to determine minimal compensation values and consultation process will be conducted in accordance with PR 5, despite the fact that this PR is not applicable for the project. • Discontent of population will be eliminated through meaningful consultations; • If needed, damaged real assets will be compensated or/and rehabilitated; • Relevant negotiations will be carried out with landlords; • Landlords will be given adequate compensation or alternative resources. • Population will be informed in advance about decisions that result in temporary restriction of the availability of local resources. • The local communities will be allowed to use the land acquired but not taken by permanent facilities. The local communities will maintain access to the pasture.

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
	Employment and related risks of adverse impact	• Expectations regarding employment of local population and their dissatisfaction; • Violation of workers' rights; • Cutting of jobs due to completion of construction works and dissatisfaction with this fact; • Conflicts with local population and introduced workers.	Low adverse	• Workforce will be recruited on the basis of respective testing; • Individual work contract will be signed with each worker; • All introduced workers will be informed about local culture and how to communicate with locals; • Local products will be given preference when procuring various materials (e.g. inert materials) to support local enterprises; • Grievance mechanism will be prepared and put in place for personnel; • Grievance logbook will be maintained for personnel.
	Impact on traffic flow	• Traffic congestion; • Damaging road pavement; • Restricted assess.	Low adverse	• The use of public roads by the Project vehicles (especially crawler machines) will be restricted; • Population will be informed time and period of transportation operations; • All damaged road sections will be rehabilitated as soon as practicable in order to ensure their availability to population; • Complaints/ grievances will be registered and adequately addressed if any.
	Impact on historical and cultural monuments	• Damaging of unknown archaeological sites during earth works.	Low probability	• Construction process will be halt if any artefacts are found. Professional archaeologists will be invited to survey a chance find, and based on their recommendations the company will facilitate to the conservation of the site, or delivery of the artefact to a repository. Works will be renewed only when respective permit is obtained.

Table 7-2 Mitigation measures for the operation phase

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
Residential houses at the outskirt of the villages located at the sites adjacent to the project area;	Air quality	Low impact is anticipated during the maintenance of turbines.	Very low Adverse	Air quality could be impacted only during maintenance works, and therefore mitigation measures are identical to those developed for the construction phase;

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
Residential houses at the outskirt of the villages located at the sites adjacent to the project area;	Noise	Noise sources include: • Mechanical and aerodynamic noise of wind turbines; • Transformers and substations; • Traffic; and • Noise produced during maintenance operations.	Low adverse	• Modelling shows that no noise impacts are expected for the residential and public areas due to wind turbines. • To select locations remote from residential areas on the design phase, what is already ensured during design works; • All received complaints/ grievances will be registered and adequately addressed.
Tower and substation sites	Soil resource and geology	Operational impact will include only small erosion due to vehicle movement.	Very low adverse	• To follow rules for topsoil stockpiling; to use topsoil for the reinstatement of temporary construction sites. • To improve access roads to wind turbines; • To strictly observe boundaries of transportation routes during maintenance works; • To properly manage sewage water; • To reinstate and revegetate areas adjacent to turbines.
Residential houses at the outskirt of the villages located at the sites adjacent to the project area;	Visual resources	• Operation of wind turbines;	Visual impact - high adverse	• Project sites are remote from roads of the national and international importance and touristic routes • Integration of the substation and turbines into the existing landscape; • All received complaints/ grievances will be registered and adequately addressed.
Residential houses at the outskirt of the villages located at the sites adjacent to the project area;	Visual resources	• Disturbance due to the shadow flicker (stroboscopic) effect. About 619 houses are presumably affected by shadow flickering. Out of this, 58 are affected severely (more than 50 and close to 100 hours per year).	From medium to high adverse	• 1. Removing the turbines with the highest flickring impact. The final number of turbines and configuration is still under consideration. In case if finally it is planned to reduce number of WTG positions then WTGs with the largest SF influence could be removed (results of total amount of flickering caused by each WTG are presented in the calculation appendix). This option will be taken into account by JSC Wind Power at the stage of Detailed Design and procurement of the finally selected models of the turbines. • 2. Rotor diameters. During the selection of final models of turbines, if it will be possible, select the turbines with less rotor

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Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
				diameters for the positions with the highest shadow flickering impacts. This is not an obligatory requirement, but an option to be considered at the detailed design stage. • 3. Temporary Shutdowns of turbines. JSC Wind Power takes commitment to develop a schedule for shutting down turbines to achieve acceptable S/F impact. Precise modeling for developing the schedule is not possible at this stage, as final precise locations, number of turbines and orientation of blades, as well as particular models of turbines are not yet determined. The final schedule will be developed during the first year of operations, based on actual monitoring data. As a preferable option the company plans to use automated “shadow flicker protection system”. However, final decision will be taken during consultations with the suppliers at the stage of Detailed Design. At the detailed design stage, when all technical parameters (locations; orientation; dimensions etc.) are finally specified, additional modeling of shadow flickering will be conducted. Results of the additional modeling will be used for developing preliminary versions of the “shut down schedule” and will be taken into account during procurement of turbines and automated shut-down systems. Further, based on actual monitoring data, the final version of the “shut-down” schedule will be elaborated and automative or manually regulated shut-down schemes added to the preliminary schedule. • 4. Screening through landscaping. At the detailed design stage, when all locations and orientation of turbines, as well as particular models are specified, JSC Wind Power will conduct additional modeling of shadow flickering and determine those locations, where installation of “blinds” or planting tall trees may efficiently serve as the screens protecting the receptors from shadow flicker impacts. The feasibility of arranging the screens depends on the number (%) of the residential houses and other receptors that could be protected. • 5. Compensations. In parallel with the schedule for shutting down turbines, the JCS Wind Power will develop compensation packages to off-set the residual flickering impacts. It is assumed that the schedule for shutting down

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
				turbines will allow significantly reducing the severe flickering impacts, however, the certain residual impact of low and medium magnitude may still remain unmitigated. On a basis of monitoring data, permanent consultations with the residents of affected villages and grievances collected through GRM, the affected residents eligible for compensation will be determined. The amounts for compensation will be determined based on consultations and negotiation with the affected residents.
Turbines	Ice throw	• Impact due to ice throw from turbine blades	Low adverse	• Monitoring of ice build-up on wind turbines during winter months; • Haling the farm operation and implementation of de-icing works based on monitoring results.
	Waste	Small amount of waste is expected during the maintenance of the wind farm; however, the adverse impact will occur only in case of improper waste management.	Low adverse	• To hand over hazardous waste to a licensed contractor to ensure proper management; • To elaborate and implement the Waste Management Plan; • To properly manage sewage water.
	Fauna	On the operation phase of the wind farm the wildlife (especially avifauna) could be impacted due to the following: • Incidental collision of birds with turbine blades; • Impact of night lighting on birds; • Noise propagation	Medium adverse	• To locate the wind farm so that to avoid intrusion into flyways and migration routes of birds (considering during the design phase). • To optimize or minimize lighting systems so that not attract birds to turbines and towers; • To ensure systematic monitoring to study collision of birds and bats with wind turbines and their killing/ injury rate and to document monitoring data in special logbook; • To use special technical means based on monitoring results, e.g.: radar systems, which can detect bird folks and shut down or slow down turbines when the folk approaches the wind farm; • If monitoring shows such a need, portable ultrasonic deterrents could be used to reduce impact on bats. These devices generate high frequency sounds (10 to 100 kHz) to interfere with bat echolocation and keep them away.

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
				• All unnecessary light should be turned-off in night hours to prevent attracting of birds.
Bats	Potential mortality due to turbines	Wind turbines can cause a certain number of bat mortality. However, it should be noted that in areas and habitats similar to the Ruisi wind farm project corridor, the bats may not be strongly affected. Overall, during the surveys conducted on the project area and vicinities, no bat roosts were located. Based on the results of the surveys, we can assume that the project area is used by bats for foraging/feeding and movements. Based on the results, generally, the bat activity on most territories of the project area, except on single nights, is quite low. Also, bat activity is decreasing when wind speed is increasing. The increase of BAI during the selected night in June, July, and the beginning of August can be partially explained by the fact that during this period of time bats have youngsters		• From the 10th of November through the beginning of March, wind turbines could operate without switching them off because during winter bats are not active. • Turbine #8 can operate without switching it of only if it is moved/relocated to the eastern direction, until the coordinates 42.02588°N/44.00978°E. It is important to consider that in such a mode of operation, the distance to the artificial pine forest should be at least 2000F20 meters or more. Otherwise, when wind speed is below 7 m/s (measured at nacelle height) during nights without rain, it is recommended (i) increase cut-in wind speed; or (ii) feathering of blades; or (iii) shutting down. This recommendation should be also applied during drizzle weather conditions and after the period when the rain stops as bats are active during a drizzle and they start activity shortly after rain. These restrictions apply to the period 30 minutes before sunset through 30 minutes after sunrise. These turbines should be equipped with a passive bat detector as this is the recommendation for all turbines in order to observe bat activity in the surrounding areas of each turbine. • For the wind turbines #45, #37, #29, #44, #34, #31, #35, #24 and #38, given in table #6, when wind speed is below 7 m/s (measured at nacelle height) during nights without rain, it is recommended (i) increase of cut-in wind speed; or (ii) feathering of blades; or (iii) shutting down. This recommendation should be also applied during drizzle weather conditions and after the period when the rain stops as bats are active during a drizzle and they start activity shortly after rain. These restrictions apply to the period 30 minutes before sunset through 30 minutes after sunrise. These turbines should be equipped with a passive bat detector as this is the

[20]This distance should be calculated as "the shortest straight line distance between a given point or line and the horizontal circle with a center at the wind turbine tower axis and a radius equal to the turbine blade length" (EUROBATS Publication Series No. 6, page 79).

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
		and they are increasing feeding/foraging activity and cover longer distances for food. However, no maternity colony was recorded in abandoned buildings close to the project area.		recommendation for all turbines in order to observe bat activity in the surrounding areas of each turbine. • Turbines #37alt(removed); #52alt (removed), #55 (alt. removed) #52alt (removed), #55 (alt. removed), required the same measures as in p.3, but these turbines have been removed from the final configuration. • During the blooming season, the following limitations of operations apply to those wind turbines planned to be located in fruit gardens and in their close vicinities: when wind speed is below 7 m/s (measured at nacelle height) during nights without rain, it is recommended (i) increase of cut-in wind speed; or (ii) feathering of blades; or (iii) shutting down. This recommendation should be also applied during drizzle weather conditions and after the period when the rain stops as bats are active during a drizzle and they start activity shortly after rain. These restrictions apply to the period 30 minutes before sunset through 30 minutes after sunrise. These turbines should be equipped with a passive bat detector as this is the recommendation for all turbines in order to observe bat activity in surrounding areas of each turbine. • All other turbines can operate without switching them off due to almost no activity close to these turbines. However passive bat detectors should be installed on the wind turbines to measure BAI and develop relevant mitigation measures if/as needed. • Maximally avoid artificial lightening, use it where and when necessary. In the wind farm area should use lightings that do not attract insects (using lights with a reduced amount of blue and UV, increased amount of red in the spectrum) and direct downward light flux toward the area of need to light. Use a shielded lighting-unit that does not emit lights above the horizontal. Avoid lamps emitting wave-length below 540nm and with a correlated color temperature more than 2700K. • The nacelles should be made inaccessible for bats as much as technically possible and feasible. • It is recommended to avoid the development of bushes and wetlands under the wind power turbine.

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
				• Passive bat detectors should be installed on the wind turbines to measure BAI for each turbine and then, based on particular results, develop the relevant recommendations for the operation of each turbine on the project sites. • Maximally avoid or put limitations on cutting trees. • If cutting the trees is unavoidable and necessary for wind power plant construction and safe operation, the tree-cutting activity should be done according to the following steps: (i) to select those trees which should be cut; (ii) check these selected trees by bats-specialist on the potential roost-occurrence and mark those trees which will be considered as potential roosts for bats; (iii) Marked potential roost-trees are not allowed to cut from 20 May until 15 August and from 1 December until the end of February, and bats-specialist should attend cutting of marked potential roost-trees in the allowed period of time. If the roosting bats occur in the cut trees, immediate measures need to be taken to identify alternative roosts for these individuals or colonies; and (iv) non-marked trees can be cut any time during the year. • To consult with a bat specialist if during the tree-cutting process suddenly roosting bats occur in the cut trees. • Post-construction monitoring should be carried out as recommended by the Resolution 8.4 adopted at the 8th meeting of parties of the Agreement on the Conservation of Populations of European Bats (EUROBATS). • Continue post-construction monitoring and mitigation measures as long as needed to guarantee the effectiveness of mitigation measures.
	Employment and economic situation	• Creation of permanent jobs; • Increasing of local budgetary incomes.	Low positive	To train and recruit local population.
	Health and safety	• Potential impacts of the operation phase are connected to noise propagation, so called stroboscopic effect, and	Medium Adverse	• To train personnel; • To use ropes and fixtures to protect personnel working at heights; • To shut down turbines if ice builds on turbine;

Receptor	Impact	Description of Impact	Anticipated impact level	Mitigation measures
		working at heights and rotating equipment • Impact due to ice throw.		• To install warning, prohibiting and information signs at work sites.
At least 152 land parcels are to be acquired The impact could be minimized through “fine-tuning” of the turbine locations	Land use	Turbine sites and areas needed to arrange access roads to each turbine will be lost permanently.	Low Adverse	• Private lands that are located within the impact zone will be acquired based on amicable agreement; No expropriation is acceptable for the project. • The eligibility for compensations, valuation of assets to determine minimal compensation values and consultation process will be conducted in accordance with PR 5, despite the fact that this PR is not applicable for the project. • Discontent of population will be eliminated through meaningful consultations; • If needed, damaged real assets will be compensated or/and rehabilitated; • Relevant negotiations will be carried out with landlords; • Landlords will be given adequate compensation or alternative resources. • Population will be informed in advance about decisions that result in temporary restriction of the availability of local resources. • The local communities will be allowed to use the land acquired but not taken by permanent facilities. The local communities will maintain access to the pasture.
	Traffic	Not anticipated on the operation phase. Impact may have place only during maintenance works, and it will not be significant.	Very low Adverse	• The use of public roads by the Project vehicles (especially crawler machines) will be restricted; • Population will be informed time and period of transportation operations; • All damaged road sections will be rehabilitated as soon as practicable in order to ensure their availability to population; • Complaints/ grievances will be registered and adequately addressed if any.

8 Environmental Monitoring Plan

8.1 Introduction

In the frames of Ruisi WPP Project, the environmental monitoring considers the solution of the following objectives:

- To confirm compliance to requirements of environmental legislation during the construction and operation phases;
- To ensure management of risks and environmental impacts;
- To provide relevant environmental information to stakeholders;
- To confirm the implementation of mitigation measures, define their efficiency and adopt corrective measures if needed;
- To ensure continuous environmental control during the Project implementation (the construction and operation phases).

8.2 Environmental Monitoring Plan

The Environmental Monitoring Plans (EMPs) for the construction and operation phases of the wind farm are provided in Table 8-1 and

Table 8-2 respectively. It should be mentioned that these plans could be further detailed and corrected during the Project implementation process. JSC Wind Power represent a party responsible for the fulfilment of the EMP.

Results of surveys carried out in the frames of the EMP will be submitted biannually to the Ministry of Environmental Protection and Agriculture of Georgia and EBRD.

Table 8-1 Environmental Monitoring Plan for the construction phase

Parameter/ Activity to be Controlled	Control/ Sampling Point	Method	Frequency/Timing	Purpose	Responsible Party
Quality of ambient air:					
Ambient air (dust and exhaust gases)	• Construction camps; • Construction sites; • Access roads to construction sites.	• Visual; • To control technical condition of machinery and equipment	• Periodically during earth works, in dry weather. • During construction works; • During intensive transportation operations in dry weather. • To control of technical condition of machinery - before beginning of work.	• To ensure worker safety; • To minimize wildlife disturbance; • To identify the need for additional measures (e.g. sprinkling of roads, maintenance of machinery).	JSC Wind Power
Noise and vibration	• Construction camps; • Construction sites; • Access roads to construction sites;	• To control technical condition of machinery and equipment.	• To control technical condition of machinery before beginning of work	• To ensure compliance to health and safety standards; • To ensure comfortable working conditions for personnel; • To minimize wildlife disturbance; • To identify the need for additional measures.	„-------------“
Geological conditions, soil stability, hazardous geodynamical processes:					
Gravitational-landslide processes	• Slopes adjoining roads subject to rehabilitation	• To monitor development of erosive processes; • To check slope stability.	• Continuously during the construction period; • Especially during laying the sub-base of roads being rehabilitated	• To ensure slope stability; • To prevent damage of installed structures and injury of workers; • To maintain environmental resources (soil, flora, wildlife habitats).	„-------------“
Topsoil/subsoil:					
Stability of stockpiles.	• Soil/subsoil stockpiling sites.	• To monitor development of erosive processes.	• To check after completion of works and after the reinstatement.	• To prevent erosion and ensure stability of stockpiles	„-------------“
Quality of soil/subsoil	• Camp site; • Construction sites; • Material and waste storage sites.	• Control, supervision • To control technical condition of machinery; • Laboratory control	• Periodical control; • Checking after completion of works. • Laboratory testing - if pollutants are spilt	• To maintain the quality of soil/subsoil.	„-------------“

Parameter/ Activity to be Controlled	Control/ Sampling Point	Method	Frequency/Timing	Purpose	Responsible Party
Vegetation cover and habitats:					
Flora, among them species of Georgian Red List and other sensitive species;	• At turbine sites and along access roads, paying particular attention to the sensitive sites identified in the EIA process	• To assess the need for replanting of protected or endemic species or other measures (e.g. to assess sites densely covered with such species and to assess the need for re-routing of particular road section). • To prevent vegetation clearance and/or disturbance which is not preliminary agreed in the respective document	• At all sites before starting vegetation clearance works.	• Plant Conservation Plan for each site, monitoring reports for fulfilled works that provide basis to assess efficiency of applied measures. Development of additional mitigation measures if needed. Executive summary of reports will be submitted to the lander if requested.	„-------------“
Forest habitats, other sensitive habitats	• Corridors of access roads and underground cables as well as turbine sites that are located in the forest	• Vegetation clearance within corridors and other works implemented in forested sections. To assess the need for re-routing particular section if they cross sensitive habitats	• Daily during construction works, along all forested sections.	• Reports of daily monitoring, • Monitoring report after completion of construction works and implementation of mitigation measures. Reports on the efficiency of mitigation measures. Development of additional mitigation measures if needed. • The Executive summary of the report will be submitted to the lander.	„-------------“
Wildlife:					
Resident or visitor animals	• Surroundings of the construction camp and construction sites; • The corridor of access roads;	• To record nests of birds and shelters of bats; • To monitor bird migration routes; • To monitor animal species and compare results with baseline; • To visually inspect tranches and pits	• To monitor bird migration routes biannually; • To identify/ record dens and nets before launching construction works and to check them after completion of works; • To monitor animal species - periodically during the construction period and after completion of works;	• To minimize the risk to adversely affect wildlife, especially species protected by Georgia Red List and Bern Convention; • To assess efficiency of mitigation measures; • To define compensation and additional mitigation measures if needed; • To specify the location of bird migration routes within the region of the planned wind farm.	„-------------“

Parameter/ Activity to be Controlled	Control/ Sampling Point	Method	Frequency/Timing	Purpose	Responsible Party
		excavated for foundations.	• To check ditches and tranches - daily and before backfilling.		
Implementation of mitigation measures by the construction contractor	• Surroundings of the construction camps and construction sites; • Transportation corridors;	• On-site supervision; • Unplanned inspections	• To inspect before launching and after finishing work; • Supervision - permanently (especially on the preparatory phase); • Inspections - unscheduled.	• To confirm the implementation of mitigation measures by on-site personnel; • To provide additional trainings and clarifications to on-site personnel; • To prevent poaching.	„--------------“
Waste:					
Waste management practices	• The construction camp and its surroundings; • Construction sites; • Waste storage sites (including stockpiles)	• To visually inspect the area; • To control waste management;	• Periodically, especially during windy and rainy weathers and after them;	• To protect soil and water quality; • To minimize impact on biodiversity; • To minimize landscape and visual changes.	„--------------“
Worker safety:					
Observance of safety rules by on-site personnel	• Work sites	• Inspection; • To periodically control the availability of PPEs and their condition; • To control technical condition.	• Periodic control during working process; • Unscheduled inspection.	• To ensure compliance to health and safety standards • To prevent/minimize injuries	„--------------“
Monuments of archaeological and cultural heritage:					
Possibility of chance finding of archaeological items on the construction phase	• Work sites	• Visual observation	• Continuous supervision of earth moving works;	• To prevent incidental damaging of archaeological sites	„--------------“

Table 8-2 Environmental Monitoring Plan for the operation phase

Parameter/ Activity to be Controlled	Control/ Sampling Point	Method	Frequency/Timing	Purpose	Responsible Party
Ambient Air:					
Noise	• Turbine locations	• To control technical condition of devices; • Instrumental measurement.	• Periodical control; • Instrumental measurement - in case of complaints • or after maintenance works;	• To ensure compliance to health and safety standards; • To minimize impact on wildlife.	JSC Wind Power
Geological conditions, soil stability, hazardous geodynamical processes:					
Landslide and erosion processes	• Erosion of the stream present nearby N1 turbine; • Slopes adjoining access roads.	• To monitor development of hazardous geodynamical processes; • To inspect stability of slopes;	• Biannual inspection by engineering geologist during 3-5 years after putting in operation.	• To ensure slope stability; • To prevent damage of structures and injury of personnel; • To plan and implement additional mitigation measures.	„--------------“
Topsoil/subsoil:					
Quality of soil/subsoil	• Waste deposits; • Sites contaminated due to impaired vehicles.	• Visual control • Laboratory tests	• Laboratory tests - if oil spills are detected	• To protect soil quality;	„--------------“
Vegetation cover and habitats:					
Flora	• At turbine sites and along access roads, paying particular attention to the sensitive sites identified in the EIA process where mitigation measures were implemented.	• To monitor revegetation process at disturbed sites; to determine need for and implement specific compensation and restoration measures	• Annually and during maintenance works.	• Annual environmental monitoring report. Reports on the monitoring of the efficiency of reinstatement measures to determine the need for the development and implementation of additional measures; • Report on standard maintenance works.	„-------------“
Forest habitats	• Access roads and turbines located in forested areas	• Monitoring of disturbed sites; vegetation control during maintenance works; implementation of fire prevention measures.	• During scheduled maintenance works/ inspection of OHL corridor	Report on standard maintenance works. • Reports on the monitoring of the efficiency of reinstatement measures to determine the need for the development and implementation of additional measures;	„-------------“

Parameter/ Activity to be Controlled	Control/ Sampling Point	Method	Frequency/Timing	Purpose	Responsible Party
Biological Environment:					
• Birds and bats; • Animal species present in neighbourhoods.	• Surroundings of turbines' and substation sites;	• To detect facts of bird and bat collision with wind turbines; • To monitor animal species and compare results with baseline; • To monitor bird migration process.	• Systematic monitoring of impacts on birds and bats during initial 5 years of operation (daily by the wind farm personnel, and quarterly ornithological survey). • Biannual monitoring of impact on species present in the neighbourhoods of the wind farm during 2 years after launching; • To monitor bird migration routes biannually.	• To determine the likelihood of the impact on birds and bats, and plan and implement additional mitigation measures if necessary; • To assess efficiency of mitigation measures; • To minimize the likelihood of impact on species protected under Bern Convention; • To define compensation and additional mitigation measures if needed; • To specify the location of bird migration routes in relation to the wind farm.	„--------------“
Waste					
Waste	• Waste deposits	• To visually inspect the site • To control waste management	• Periodically	• To protect soil quality.	„--------------“
Health and safety					
So called stroboscopic effect at the boundary of Korbouli, Nigvzara, Khvani and Chalovani villages	• At the boundary of the residential area of the villages	• Visual observation	• Four times in a year during the first operational year	• To protect community health	„--------------“
The risk of ice throw	• Surroundings of wind turbines	• Visual observation	• On a daily basis during severe frosts throughout the operation period, by on-site personnel.	• To ensure safety of personnel and population.	„--------------“
Worker safety	• Work sites	• Inspection • To periodically control the availability of PPEs and their condition	• Periodic control during working process	• To ensure compliance to health and safety standards • To prevent/minimize injuries	„--------------“

9 Conclusions and Recommendations

During the environmental impact assessment, the following main **conclusions** had been worked out**:**

1. Planned activities will take place in Kareli and Gori Municipalities of Shida Kartli (Inner Kartli) region that is located in central part of Georgia on Inner Kartli plain at 100 km distance towards West from Tbilisi.

2. According to design the Ruisi Wind Farm will have total 206 MW power capacity; installed power capacity of each wind turbine is 4.5 MW. There are 46 locations selected for installation of wind turbines. Each of this locations are acceptable both from technical and environmental points of view. Environmental impact was assessed for worst case scenario that assumes installation of 46 wind turbines with installed power capacity of 4.5 MW each. In reality, impact will be lower because the specific models of wind turbines will be selected through tendering on the basis of best offer. In order to acquire permitted 206 MW power the final configuration of the Ruisi Wind Farm will include either 46 wind turbines with 4.5 MW power capacity each, or less number of wind turbines with more than 4.5 MW power. Both reduction of power rating of wind turbines and reduction of their number will cause decrease of impact intensity. Therefore, the environmental impact assessment was carried out for worst case scenario (construction sites; noise and shadow flickering simulation, impact on habitats and soil, etc.) at implementation of which the impact on environment will be exceeding the impact that the Project will have in reality.

3. Taking into account the specific character of activity the environmental impact assessment is carried out for two main stages of the Project: construction and operation phases;

4. During the environmental impact assessment, the background conditions of environment were studied for the Project implementation area by use of data in literature, results of previous studies and results of field surveys carried out within the boundaries of Project implementation territory. Study of background conditions of environment revealed that main sensitive receptor in the studied area is biological environment, especially birds and chiroptera;

5. Due to fact that the distance from the Project implementation territory to areas protected by national legislation is significant there are no risks of negative impact from the Project on them;

6. Impact on fauna: With implementation of proper mitigation measures only low or medium level residual impact is expected on specific habitats and animal species. It will be impossible to exclude completely the impact on birds and chiroptera and residual impact on them is inevitable. But, based on data collected during 2021-2022 ornithological surveys within the studied area, one can confirm that the Project territory is not located on main migration paths and migration corridors of birds of passage migrating on far distance. Size of flocks of birds of passage in this area is smaller than for main and additional paths, especially on paths that lay in valleys of large rivers in adjacent regions of Georgia – river Mtkvari and other gorges of the Black Sea basin. Based on information mentioned above and with account of seasonal transit paths of birds of passage, main directions of Spring and Autumn migration, number and density of flocks of birds, height of paths above ground surface we can conclude that risk of collision with wind turbines is relatively low. Operation of wind turbines cannot have significant negative impact on birds of passage.

7. Bird protection program will be developed after completion of the environmental impact assessment and it will take into account the final configuration of wind turbines.

8. Cheiroptera – Wind turbines located on the territory of wind farm can cause mortality of certain number of bats. But, it should be noted that at territories and habitats similar to the Ruisi Wind Farm corridor significant impact on chiroptera fauna was not observed. In general, it is recommended to install wind turbines at 200 m distance from the edges of forests. In cases when it's impossible to fulfil this recommendation it will be necessary to stop the turbines at certain periods of time (periods of increased activity of chiroptera). This is common practice in operation of wind farms. Temporary stopping is achieved automatically by means of automatic controlling systems installed on wind turbines software algorithms of which detect number of such parameters that together with data from bat detectors allows to forecast information on expected activity of bats and automatically stop wind turbines in high-risk conditions for bats.

9. With implementation of proper mitigation measures the residual impact on other environmental receptors is expected on low or medium level.

10. Due to planned activities no impact is expected on surface or ground water environment.

11. According to calculations carried out within the framework of the environmental impact assessment the impact on local population due to noise distribution and emissions of hazardous substances during the Ruisi Wind Farm construction process is not expected and will be limited to construction activities on access roads that are close to residential buildings (number of such areas is limited). Areas of construction of wind turbines and territory of substation, as well as construction camp where diesel-generators will be operating, are located at much more than 750 m distance from residential buildings. Specific mitigation measures will be implemented during the construction period in order to mitigate the impacts. After starting the operation of the Ruisi Wind Farm the impact of noise and emissions of hazardous substances on environment will be reduced even more. Emissions can be related only with operation of machinery at repair works that will be low intensity and short-term impact. As for noise of wind turbines the computer simulation of noise showed that noise distribution near residential buildings will be insignificant.

12. Development of any significant hazardous geodynamic processes within the Ruisi Wind Farm Project territory is not expected.

13. Visual landscape impact is expected both in construction and operation stages of the Project. On construction stage it will be necessary to implement appropriate mitigation measures;

14. Shadow flickering impact will be assessed in detail by means of computer simulation. By preliminary estimate from medium to high impact is expected on population. Following mitigation measures are planned to mitigate or offset the residual impacts:

    - **Removing the turbines with the highest flickering impact**. The final number of turbines and configuration is still under consideration. In case if finally it is planned to reduce number of WTG positions then WTGs with the largest SF influence could be removed (results of total amount of flickering caused by each WTG are presented in the calculation appendix). **This option will be taken into account by JSC Wind Power at the stage of Detailed Design and procurement of the finally selected models of the turbines.**
    - **Rotor diameters.** During the selection of final models of turbines, if it will be possible, select the turbines with less rotor diameters for the positions with the highest shadow flickering impacts. This is not an obligatory requirement, but an option to be considered at the **detailed design stage**.
    - **Temporary Shutdowns of turbines.** JSC Wind Power takes commitment to develop a schedule for shutting down turbines to achieve acceptable S/F impact. Precise modeling for

developing the schedule is not possible at this stage, as final precise locations, number of turbines and orientation of blades, as well as particular models of turbines are not yet determined. The final schedule will be developed during the first year of operations, based on actual monitoring data. As a preferable option the company plans to use automated “shadow flicker protection system”. However, final decision will be taken during consultations with the suppliers at the stage of Detailed Design. At the detailed design stage, when all technical parameters (locations; orientation; dimensions etc.) are finally specified, additional modeling of shadow flickering will be conducted. Results of the additional modeling will be used for developing preliminary versions of the “shut down schedule” and will be taken into account during procurement of turbines and automated shut-down systems. Further, based on actual monitoring data, the final version of the “shut-down” schedule will be elaborated and automative or manually regulated shut-down schemes added to the preliminary schedule.

- **Screening through landscaping**. At the detailed design stage, when all locations and orientation of turbines, as well as particular models are specified, JSC Wind Power will conduct additional modeling of shadow flickering and determine those locations, where installation of “blinds” or planting tall trees may efficiently serve as the screens protecting the receptors from shadow flicker impacts. The feasibility of arranging the screens depends on the number (%) of the residential houses and other receptors that could be protected.
- **Compensations.** In parallel with the schedule for shutting down turbines, the JCS Wind Power will develop compensation packages to off-set the residual flickering impacts. It is assumed that the schedule for shutting down turbines will allow significantly reducing the severe flickering impacts, however, the certain residual impact of low and medium magnitude may still remain unmitigated. On a basis of monitoring data, permanent consultations with the residents of affected villages and grievances collected through GRM, the affected residents eligible for compensation will be determined. The amounts for compensation will be determined based on consultations and negotiation with the affected residents.

15. Existing access roads to the Project territory will be widened and new sections of roads will be constructed. Most of new sections of roads will be located at several meter distance from existing roads and there will be no new impacts on environment. Significant impact will be only on humus layer of soil that will be removed from these new sections of roads and will be used for recultivation of temporary construction sites.

16. Wind turbines and substation will be installed on land plots owned by JSC Wind Power;

17. With account of habitats of the Project territory cutting of trees and vegetation will be reduced to minimum;

18. No cumulative impacts are expected within the Project territory. There are no other projects planned for the territory of the Ruisi Wind Farm territory.

19. Implementation of construction and operation of the Project will be related with positive impacts. Namely:

    - Certain number of temporary workplaces will be created during construction of infrastructure that will have positive impact on employment of local population;

    - Local budget will receive new significant source of income in form of property tax.

- Operation of wind farm will create additional renewable energy resource that will become one more step towards to energy independence of Georgia.

20. There are no visible historical/cultural monuments within the Project area. No direct impact is expected.

Recommendations:

1) Project implementing company and construction contractor should establish strict control on implementation of mitigation measures given in the Environmental Impact Assessment Report and environmental decisions. Agreement signed with construction contractor should include appropriate clauses on fulfilment of environmental norms/responsibilities;

2) Personnel involved in construction and operation should periodically undergo training and testing on environment protection and professional safety issues;

3) Personnel involved in construction and operation should be equipped with personal protection equipment (PPE);

4) In order to minimize the risks of development of erosion processes the permanent monitoring should be performed;

5) In case of need of additional economic resettlement, the private property compensation measures should be implemented;

6) For construction works mostly the local population should be employed;

7) Priority in procurement of construction materials should be given to local materials.

Responsibility on implementation of environment protection measures during Ruisi Wind Farm construction and operation stages lays on the Project implementing company JSC Wind Power.

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