RUISI WIND POWER PLANT PROJECT

Wind Farm Layout Definition Procedure

July 2024

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1 Executive summary

JSC Wind Power is planned to construct and operate 206 MW Ruisi Wind power plant (Ruisi WPP) on the territory of Kareli and Gori Municipalities in Shida Kartli (Inner Kartli) region of Georgia.

JSC Wind Power is the company whose team has a significant experience in development of renewable energy projects in Georgia. JSC Wind Power is developing the Ruisi Wind Farm Project on selected territory on the basis of the Memorandum of Understanding signed on 10-th of August 2021 with the Government of Georgia.

The final layout will be prepared on the basis of the EBRD Environmental and Social Policy (2019), IFC Environmental, Health and Safety Guidelines for Wind Energy (August 7, 2015) and Environmental legislation of Georgia.

JSC Wind Power will take into consideration IFC requirements, particularly issues specific to the construction and operation of wind projects: landscape and visual impacts, noise, biodiversity, shadow flicker and implement mitigation measures.

Separate attention will be taken on the social impact, no involuntary impact on land or livelihoods.

JSC Wind Power already prepared the draft layout of the windfarm and detail design based on the studies led during the period 2022-2024, particularly surveys for bats and birds, noise, flicker effect, cultural heritage sites, land acquisition and visual impact.

Site selection is critical to avoid and minimize potential adverse impacts on biodiversity. Early screening, scoping and comprehensive ESIA was prepared, as well as were taken into consideration national and international protected areas, important bird areas, migration routes or breeding areas.

The works are on the completion stage and the originally proposed 46 turbines were decreased down to 33 turbines.

According to preliminary assessment of wind regimes on the selected territory location of the Ruisi Wind Farm is suitable for installation of 33 wind turbines with 206 MW total installed capacity

This paper provides explanation of the procedures how the draft final layout of the Ruisi windfarm has been defined by mitigating and/or reducing possible impact on environment, population, cultural heritage and how the final layout will be fixed by taking into account the additional landscape and visual impact assessment results.

2 Introduction

JSC Wind Power is the company whose team has a significant experience in development of renewable energy projects in Georgia. JSC Wind Power is developing the Ruisi Wind Farm Project on selected territory on the basis of the Memorandum of Understanding signed on 10-th of August 2021 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 33 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
- Significantly increasing the budget of local municipalities by paying taxes.

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 6.25 MW in average. There are 33 locations selected for installation of wind turbines.. In reality the impact will be lower because actual specific models of wind turbines was selected during tendering process on the basis of best offer.. Finally, the number of turbines as was expected is lower, which means that capacity of the turbine increased in a way to get 206. MW installed capacity of the entire wind power plant. Reduction of their total number \results in reduction of impact intensity.

Nowadays,

- the number of the turbines is – 33
- height of turbines – 105m
- rotor diameter – 171m
- model of turbine is GOLDWIND GWH171-6.25MW

Due to EBRD Requirements:

- construction of Large-scale wind power installations for energy production (wind farms) is included in the 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, full scale ESIA was prepared and public consultations was conducted in accordance with the requirements set forth in Georgian legislation and ESP 2019 guidelines.

2.1 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 2-1 Location of the Ruisi wind farm over Georgia political map

The project layout's old version is shown on Figure 5-1, and final version on Figure 5-1. 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.

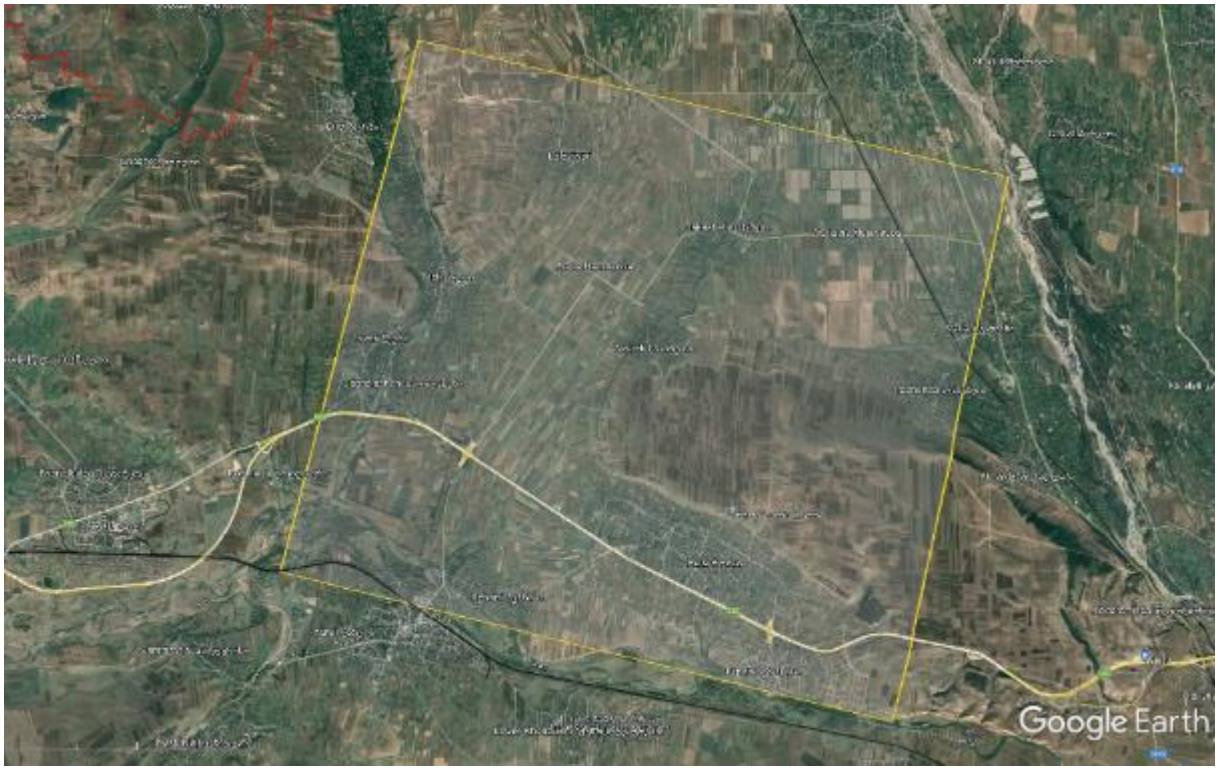

Figure 2-2 Overview map of Ruisi wind farm site (source: Google Earth)

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:

3 Legal Framework

3.1 Environmental Legislation of Georgia

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.

Table 3-1 provides the list of environmental laws of Georgia, while Table 3-2 includes applicable environmental standards.

Table 3-1 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
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 3-2 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
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	360160000.10.003.019209

Adoption Date	Name of Regulation	Registration Code
	Record-Keeping on Temporary Storage (March 29, 2016, Tbilisi City)	
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

3.2 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).

3.3 EBRD Environmental and Social Policy

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

Overall approach

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

IFC has defined specific requirements for key areas of environmental and social issues and impacts as listed below:

- Environment, which includes:
    - Landscape, Seascape, and Visual impacts
    - Noise
    - Biodiversity
    - Shadow Flicker
    - Water Quality
- Occupational Health and Safety, which includes
    - Working at Height
    - Working over Water
    - Working in Remote Locations
    - Lifting Operations
- Community Health and Safety, which includes:
    - Blade and Ice Throw
    - Aviation
    - Marine Navigation and Safety
    - Electromagnetic Interference and Radiation
    - Public Access
    - Abnormal Load Transportation

The IFC EHS Guidelines for wind energy include information relevant to environmental, health, and safety aspects of onshore and offshore wind energy facilities. It should be applied to wind energy facilities from the earliest feasibility assessments, as well as from the time of the environmental impact assessment, and continue to be applied throughout the construction and operational phases.

4 Wind farm layout definition

This chapter presents the comparison of alternative locations for wind turbines and procedures of defining the final layout.

4.1 Description of placement of turbine-generators

4.1.1 Overview

The selection of optimal location of turbines 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, as well as environmental and social.

These criteria are considered as basic criteria. an additional technical criteria is 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, original 57 locations were decreased on 46 during the initial ESIA stage and at the end of detail design and final ESIA 33 turbine[1] layout locations have been selected for Ruisi WPP.

[1] Initially we studied 50 locations, then we added 6 alternative locations. Finally, we selected max 33 locations.

For their selection were considered: wind speed distribution and turbulence maps, preliminary data of the study of dangerous geological processes.

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

4.1.2 Selection of turbine deployment locations

4.1.2.1 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**

Three measuring towers/stations were 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.

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

Specifying turbine layout locations in the final design did not imply selecting radically different areas from the considered alternative areas, but envisaged moving some areas only a few meters to minimize the impact.

After selecting the wind turbine model and detailed surveys of shadow flickering, noise, avifauna and bats, which were made in 2024, finally, were selected 33 areas to place turbines to minimise affect on environment and community.

Nowadays the project uses 33 units of GOLDWIND GWH171-6.25MW WTG, hub height of 105 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.

The coordinates of the sites selected as of now for wind turbines are given in Table 4-1 below.

Table 4-1 Coordinates of wind turbines

	UTM38N	
	X	Y
T 1	416362	4656165
T 2	415882	4655839
T 3	418003	4652105
T 4	415833	4656535
T 5	416248	4654654
T 6	418012	4656150
T 7	416718	4653729
T 8	417568	4652920
T 9	417999	4651651
T 10	416652	4655663
T 11	414123	4655324
T 12	416426	4654156
T 13	417601	4655568
T 14	415809	4657008
T 15	416187	4660752
T 16	412318	4656582
T 17	415813	4662111

	UTM38N	
	X	Y
T 18	417166	4654773
T 19	417210	4652063
T 20	412538	4657110
T 21	415829	4657482
T 22	415726	4655046
T 23	415816	4661653
T 24	417013	4653342
T 25	413582	4660803
T 26	413938	4661358
T 27	415099	4658671
T 28	414793	4659354
T 29	415699	4661242
T 30	417525	4656499
T 31	416041	4658372
T 32	417882	4651144
T 33	417508	4656908

Note: for the reference, please see the location of the turbines on the map Figure 5-1

The coordinates of the substation is 38T 410589.00 4657275.00.

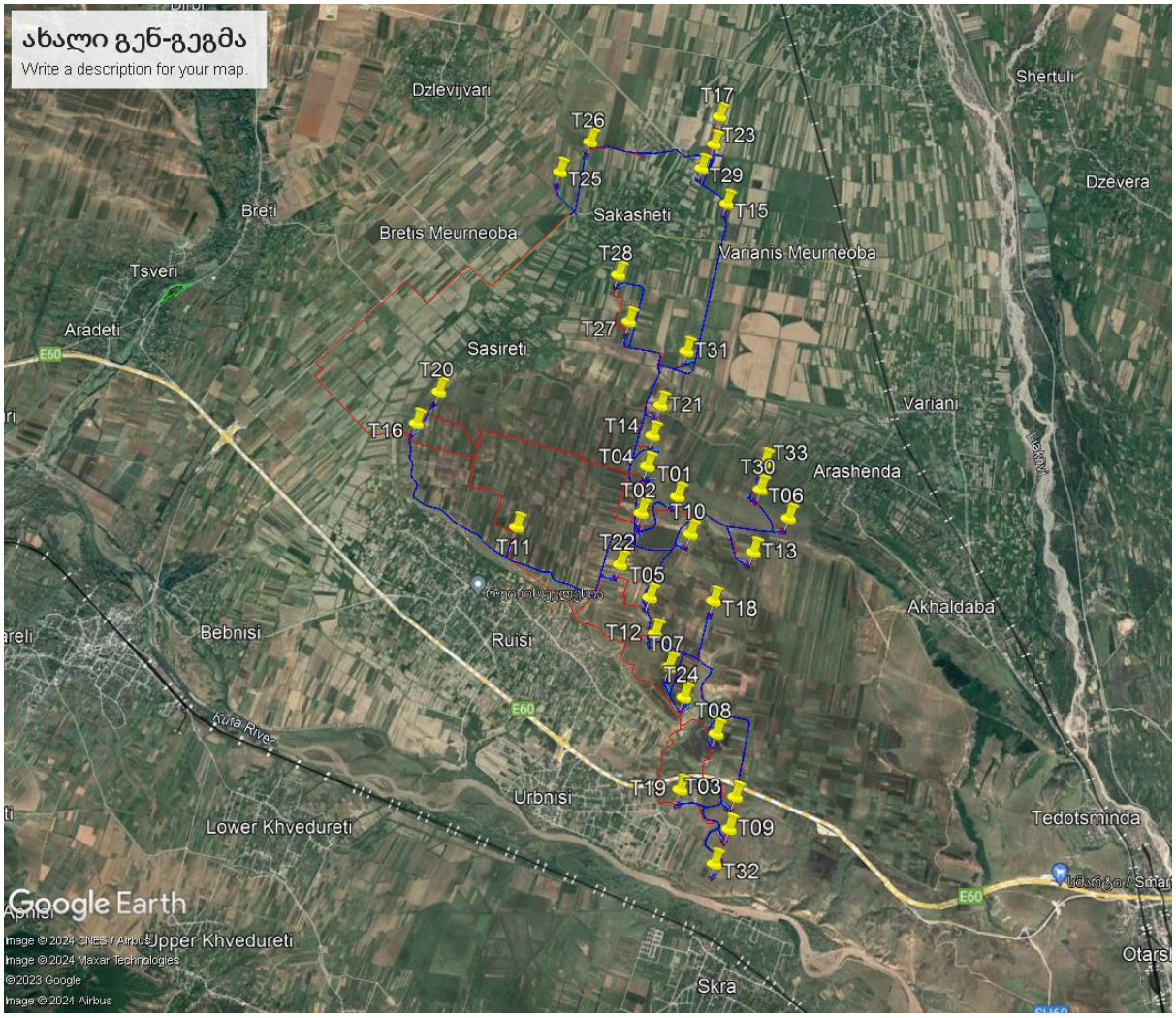

Figure 4-1 The location of the turbines

4.1.3 Grid Connection Analysis and Selection of Site for Substation

4.1.3.1 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.

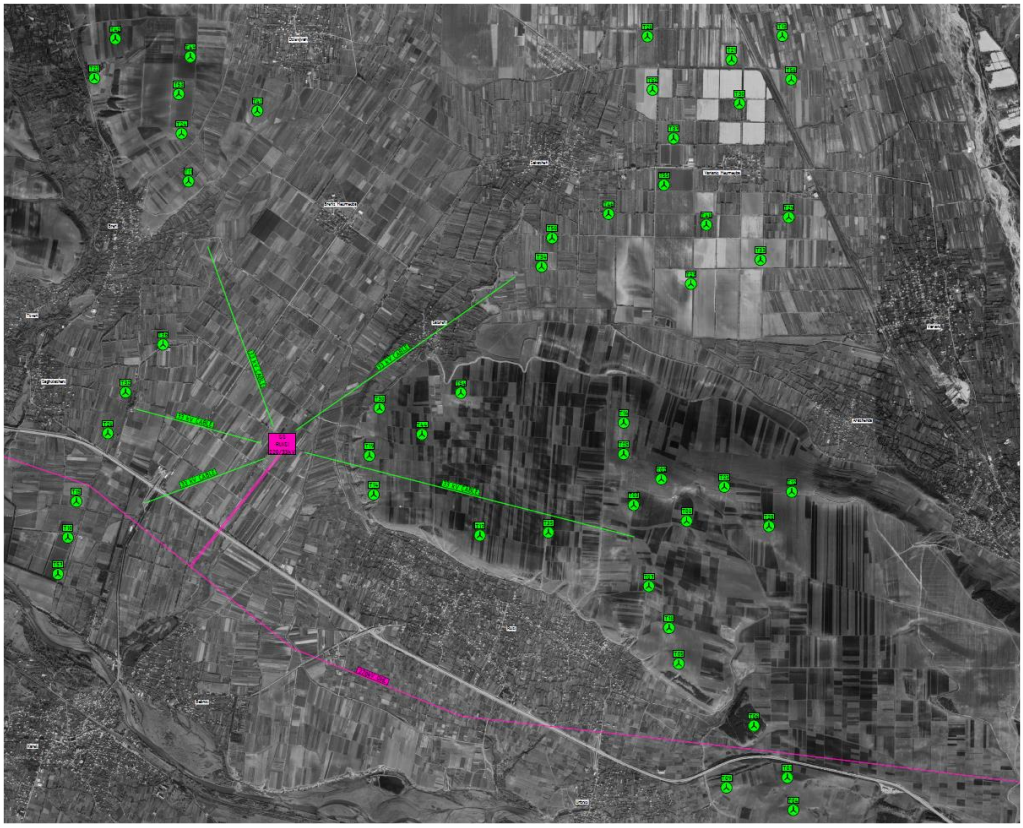

Figure 4-2 Connection to grid: alternative 1

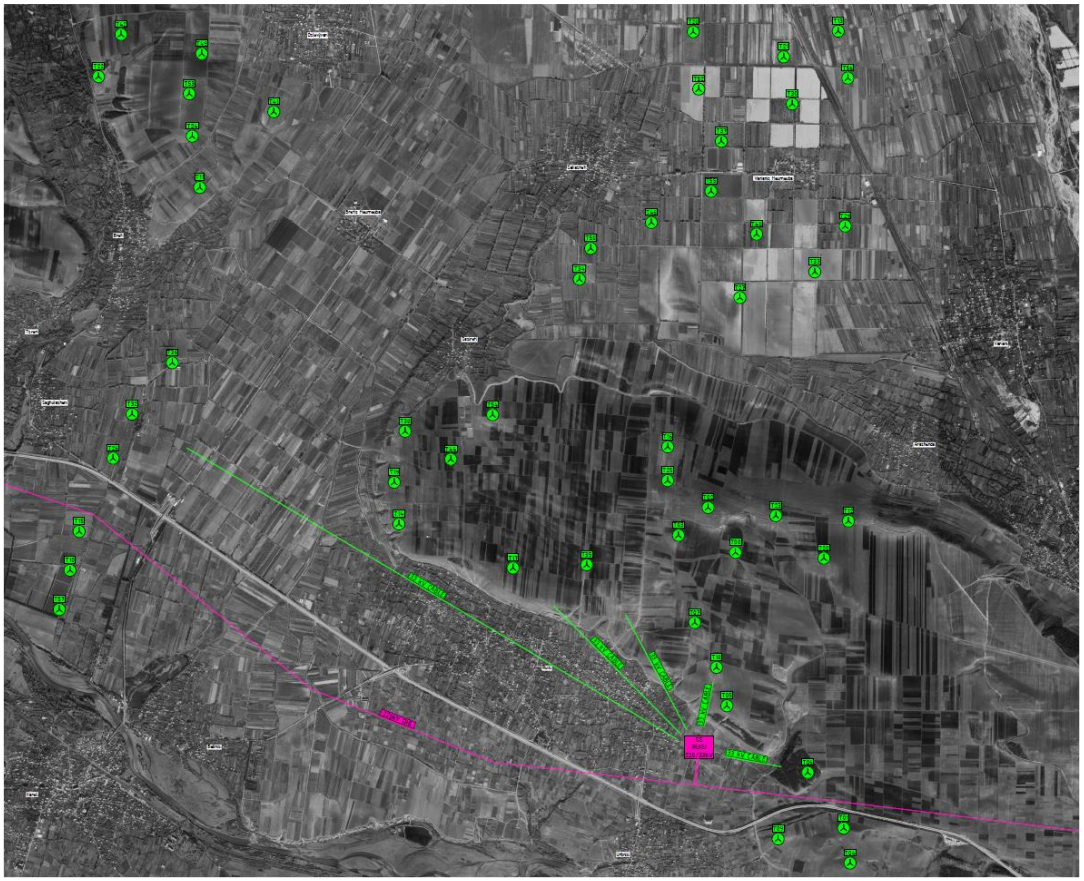

Figure 4-3 Connection to grid: alternative 2

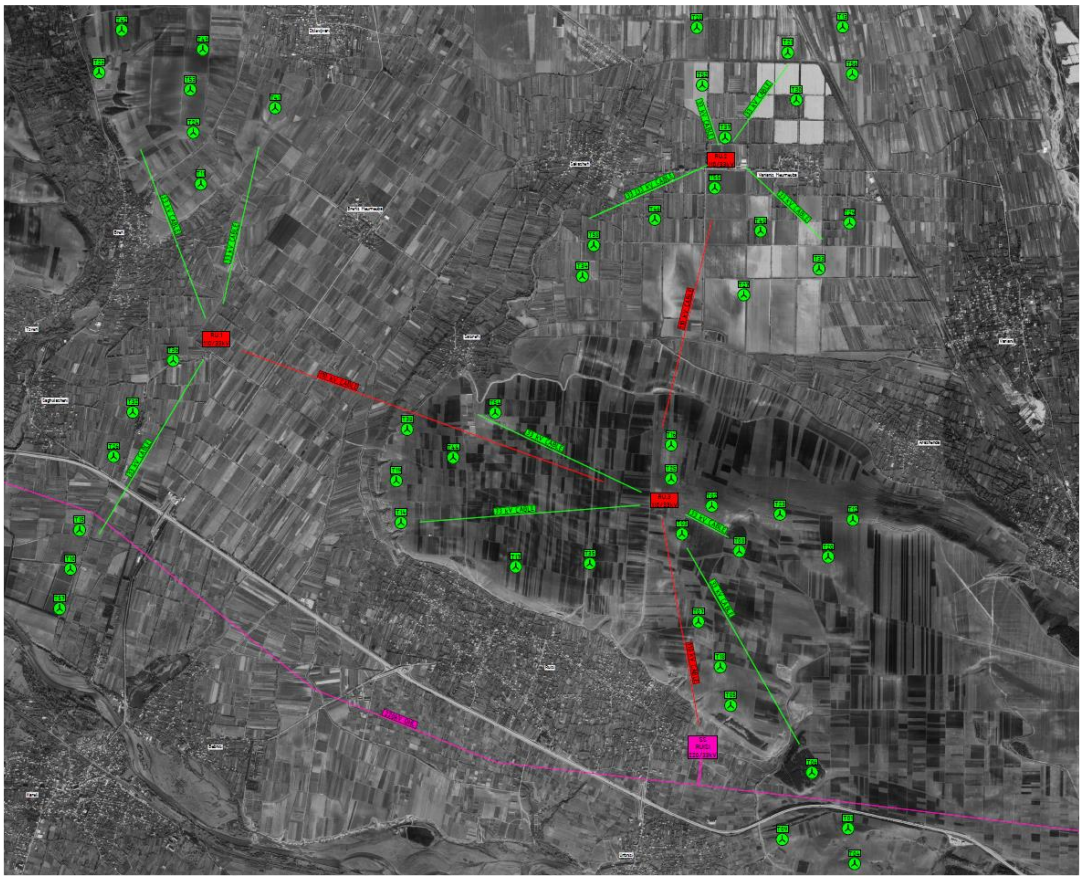

Figure 4-4 Connection to grid: alternative 3

4.1.3.2 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

4.1.3.3 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.

5 Project Description

5.1 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 5-1 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.
Ruisi village	527 m to T11 714 m to T12		
Sasireti village	707 m to T20		
Sakasheti village	512 m to T30 535 m to T28		
Arashenda village	649 m to T06		
Urbnisi village	515 m to T19		
Breti village	809 m to T31		
Dirbi building	408 m to T18		
Forest	Around T10	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

Object	Distance to project area	Limiting factor	Comment Alplan
			obstacle in micro-siting as they can be easily dismounted or moved to other positions
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.

5.2 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. 529 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 5-2. The distance from settlements is presented as the distance from the turbine to the nearest house located in this settlement.

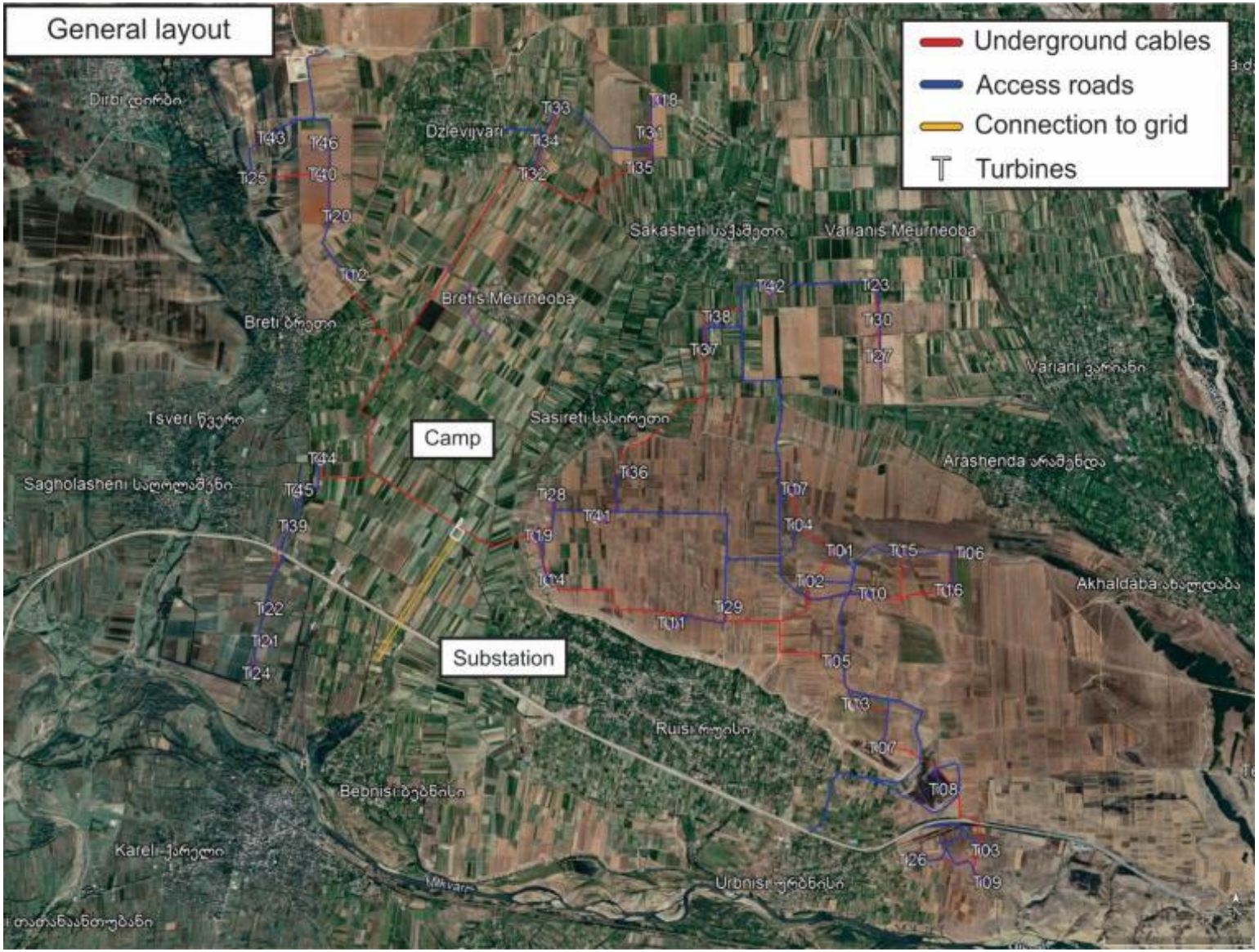

Figure 5-1 Old general plan of the project area

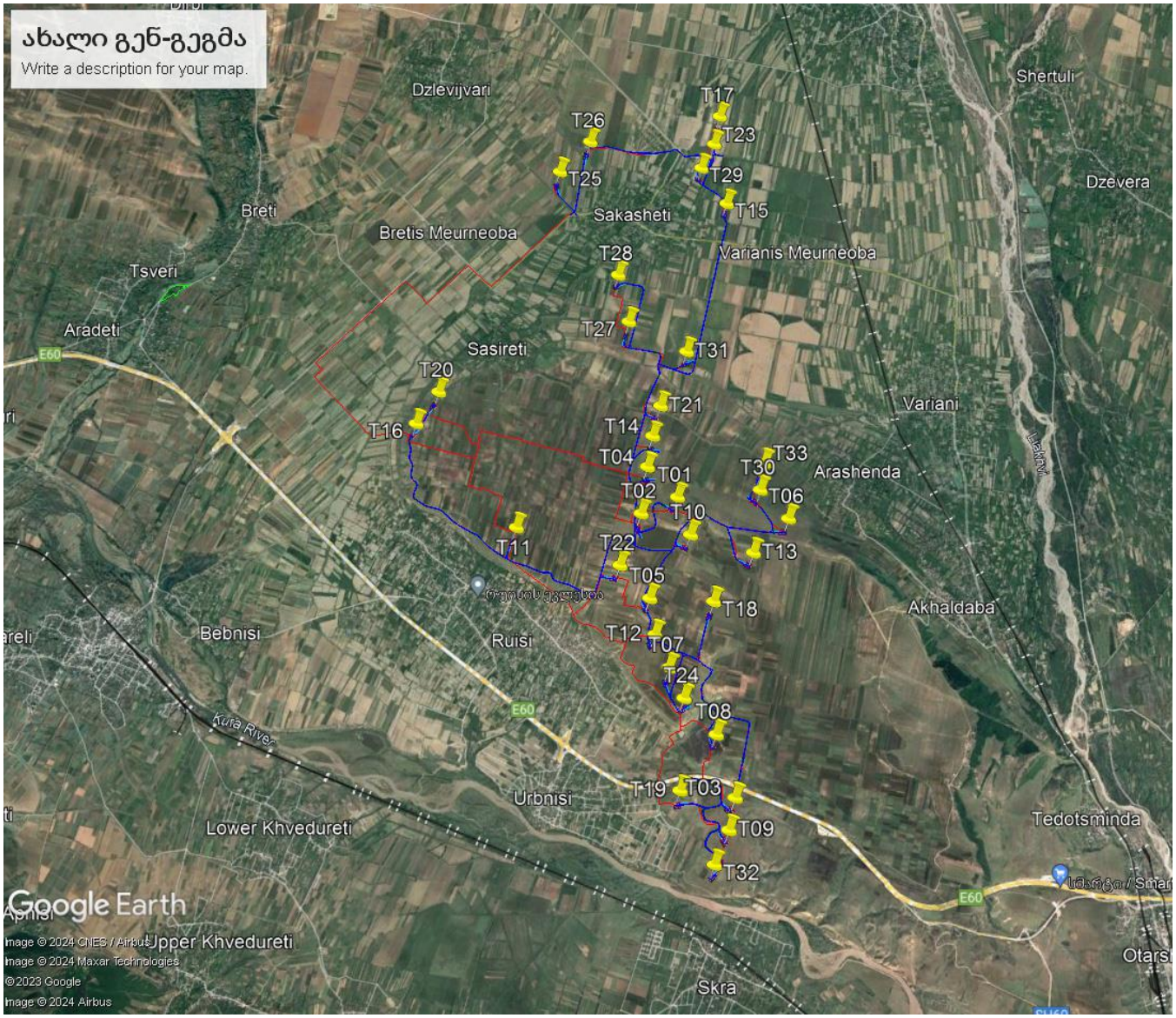

Figure 5-2 Final general plan of the project area

Table 5-2 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	415882	4655839	1500	S/W	Ruisi	1485	S/W	Zemo Ru Canal	1456	S/W	Ruisi St. Marine church cemetery
3	418003	4652105	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	416248	4654654	903	S/W	Ruisi	819	S/W	Zemo Ru River	610	S/W	St.Kvirike and Ivlita monastery cemetery
6	418012	4656150	649	N/E	Arashenda	554	N/E	Irrigation Canal	1081	N/E	Arashenda Mother of God named church
7	416718	4653729	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	417999	4651651	1015	S	Skra	825	S	River Mtkvari	1480	S	Skra Mother of God named church
10	416652	4655663	1935	N/E	Arashenda	1664	N	Irrigation Canal	1633	S/W	St.Kvirike and Ivlita monastery cemetery
11	414123	4655324	527	S/W	Ruisi	390	S/W	Zemo Ru River	633	W	Ruisi St. Demetre church cemetery
12	416426	4654156	714	S/W	Ruisi	508	S/W	Zemo Ru Canal	446	S/W	St.Kvirike and Ivlita monastery cemetery
13	417601	4655568	1221	N/E	Arashenda	1090	N/W	Irrigation Canal	1618	N/E	Arashenda Mother of God named church
14	415809	4657008	2413	NW	Arashenda	626	N	Artificial lake	1837	N/W	Ildaeti John The Baptist church
15	416187	4660752	550	S/E	Sakasheti cottages	73	N/E	Irrigation Canal	979	N/E	St. Nicholas church
16	412318	4656582	1171	S/E	Ruisi	86	N/W	Zemo Ru Canal	1255	S/E	Ruisi St. Demetre church cemetery
17	415813	4662111	990	S/W	Breti	922	S/E	River Bretula	884	S/W	Cemetery
18	417166	4654773	408	N/W	Dirbi	356	N/W	East Prone River	1309	N/W	Dirbi St. George church
19	417210	4652063	515	W	Urbnisi	993	S/W	River Mtkvari	1628	S/W	Urbnisi Church
20	412538	4657110	707	N/E	Sasireti	97	NW	Zemo Ru Canal	1210	N/E	Sasireti St. George church
21	415829	4657482	1048	N/E	Variani Farm	1067	S/W	Artificial lake	670	S/E	Variani Cylindrical Tower (417375.66 , 4658639.37)
22	415726	4655046	570	N/E	Sakasheti cottages	548	N/E	Irrigation Canal	1279	N/E	St. Nicholas church
23	415816	4661653	611	N/W	Dzlevidjvari	110	N/W	River Bretula	2297	S/E	Sakasheti St.George church
24	417013	4653342	816	N/E	Dzlevidjvari	58	N/W	River Bretula	2427	E	St. Nicholas church
25	413582	4660803	607	N/E	Dzlevidjvari	148	N/W	River Bretula	2493	S/E	Sakasheti St.George church

Turbine N	Coordinates (38 T)		Distances (m)								
	X	Y	Residential area/ closest house			Surface Water Objects			Cultural Heritage Objects		
26	413938	4661358	731	S/E	Sakasheti cottages	1038	N/E	Irrigation Canal	1540	S/E	Sakasheti St.George church
27	415099	4658671	916	N/W	Sakasheti	652	N/W	Zemo Ru Canal	386	S/E	Ildaeti John The Baptis church
28	414793	4659354	535	N/E	Sakasheti	518	N/W	Zemo Ru Canal	783	N/W	Sakasheti St.George church
29	415699	4661242	1221	N/W	Dzlevidjvari	1395	S/E	River Bretula	1361	S/W	Cemetery
30	417525	4656499	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
31	416041	4658372	809	N/W	Breti	1233	N/W	East Prone River	730	S/W	Cemetery
32	417882	4651144	673	S/W	Sagholasheni	1364	S/W	East Prone River	347	N/W	Cemetery
33	417508	4656908	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

5.3 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.

Initially, the location of the roads was chosen so that the access roads from the highway and connecting the turbines to each other were reduced as much as possible, since existing roads between the plots of land were also used, thus minimizing the environmental impact. In the process of purchasing land plots,, one of the landowners demanded an unrealistically large amount of money for his plot and did not come to a voluntary agreement.Therefore, JSC "Wind Power" started to develop a new alternative option and spent additional efforts to find optimal alternative access roads where the land owners were not against to sell land plots to JSC "Wind Power". Therefore, new alternative became socially friendly.

Nowadays, there are two access points located directly on E60 motorway:

Access Point 1 – at km 228,1 – turn right to wind turbines T03, T09, T19, T32

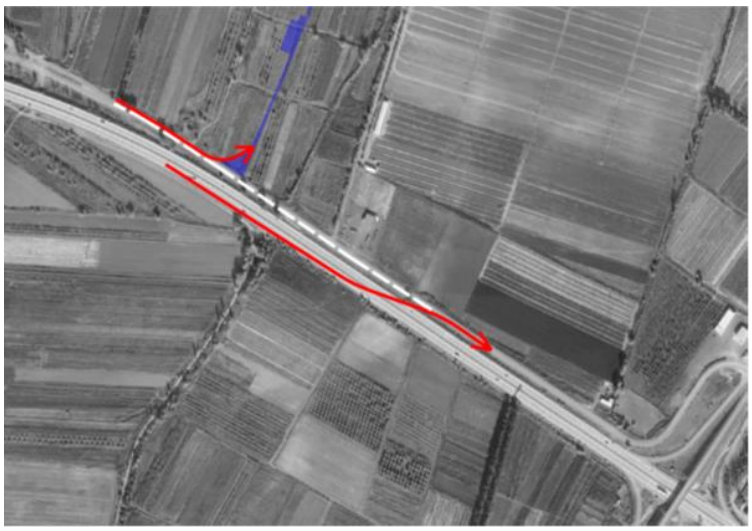

Figure 5-5 Access Point No. 1. Entrance toT03, T09, T19, T32

Figure 5-6 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 5-7 Access Point No. 1. Temporary exit

Figure 5-8 The supplementary lane

Figure 5-9 Location of temporary exit

Figure 5-10 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.

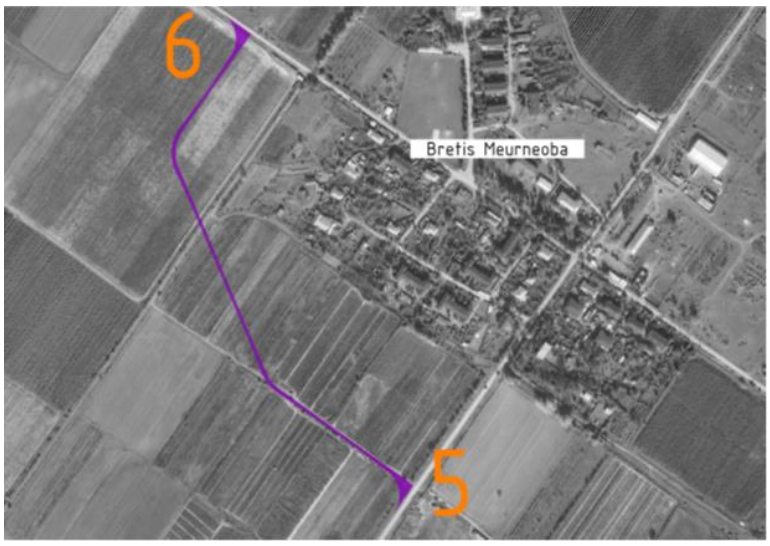

Figure 5-11 Temporary road

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

Figure 5-12 Gas pipeline to be rebuilt

Access point 2– at km 228,6 – – turn left to the remaining part of the site

Figure 5-13 Access Point 2.

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.

5.4 Internal Access Roads and Assembly Yards

5.4.1 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.

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.

5.4.2 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 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:

[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

- 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.

5.4.3 Assembly yards[3]

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.

5.4.4 List of roads and assembly yards

List of access roads in case of 33 turbines given in tables 5-3 and 5-4.

Table 5-3 Road legs available from Junction 1

Road No.	Road length [m]	Comments:
Access road T03	893,13	
Access road T09	275,17	
Access road T19	498,09	slope between 0+000,00 and 0+155,45 is 10,00%
Access road T32	1 685,32	slope between 0+060,40 and 0+342,73 is 10,00%; slope between 0+717,63 and 1+036,69 is 9,07%; slope between 1+301,70 and 1+450,44 is 11,00%

Table 5-4 Road legs available from Junction 2

Road No.	Road length [m]	Comments:
Access road 1	951,12	slope between 0+621,85 and 0+765,92 is 9,02%
Access road 2	230,08	
Access road 4	546,54	
Access road 5	1 232,47	

[3] An assembly yard is a temporary workspace located next to each wind turbine foundation during construction. It is used for assembling turbine components.

Road No.	Road length [m]	Comments:
Access road 6	1 907,15	slope between 0+282,33 and 0+411,83 is 9,89%
Access road 7	280,66	
Access road8	541,58	slope between 0+049,62 and 0+164,46 is 9,26%
Access road10	198,72	
Access road 11	286,42	
Access road 12	163,00	
Access road 13	729,66	slope between 0+049,30 and 0+239,43 is 9,99%
Access road 14	478,57	
Access road 15	3 975,69	
Access road17	426,04	
Access road 18	692,87	
Access road 20	4 740,23	
Access road 21	245,16	
Access road 22	250,15	
Access road 23	206,98	
Access road 24	1 059,84	
Access road 25	603,92	
Access road26	1 146,55	
Access road 27	1 198,87	
Access road 28	1 431,03	
Access road 30	680,00	
Access road 31	306,23	
Access road33	399,30	slope between 0+000,00 and 0+110,15 is 9,82%; slope between 0+110,15 and 0+213,97 is 11,84%;
Access road 1	1 707,70	slope between 0+110,00 and 0+200,00 is 10,00%; slope between 1+390,00 and 1+579,62 is 10,00%;
Access road 2	465,80	
Access road 3	868,28	slope between 0+000,00 and 0+114,21 is 9,50%;
Access road 4	467,02	
Access road 5	1 167,66	] slope between 1+009,95 and 1+095,44 is 9,00%;

In case of 33 turbines parameters of the access roads are:

- Total length of permanent access roads - 31 251.68 m
- Permanent roads and hardstands - 201 634.75 m^2
- Temporary surfaces - 90 110.15 m^2
- Access paths - 4 333.56 m^2

In case of 46 turbines parameters of the access roads were:

- 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

Thus, the length and area of access roads have been reduced, which is associated with less impact both socially and environmentally.

5.4.5 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 m²);
- 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);

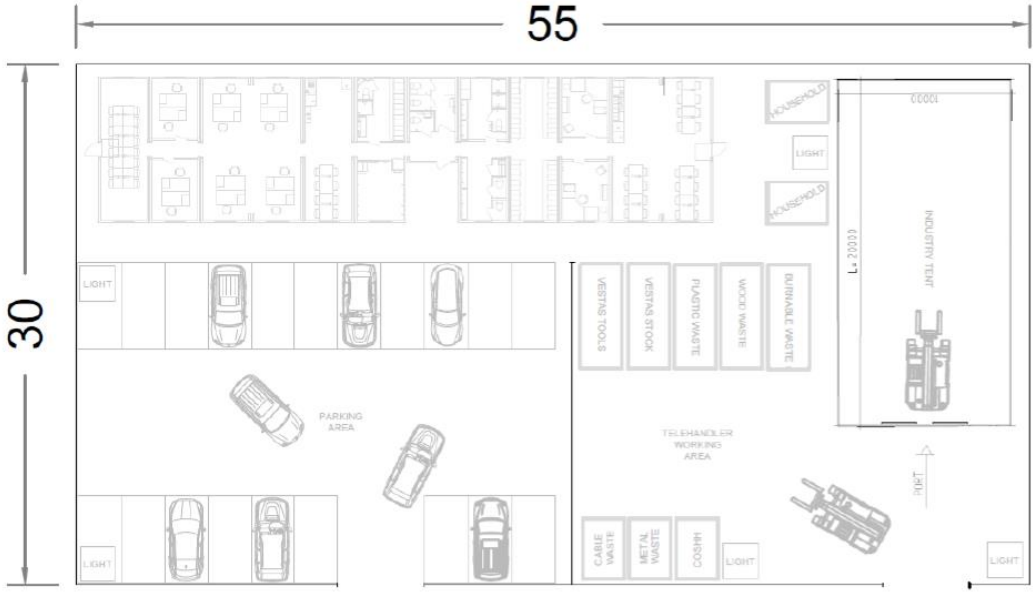

Figure 5-14 Example of site compound for 1 main crane

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.

5.4.6 Foundations

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 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.

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

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.

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/m3 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.

6 Baseline environmental conditions

6.1 Social and Cultural Heritage (CH) Receptors

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, Bebnisi, Breti Dirbi, Sasireti

- Villages of Gori Municipality: Sakasheti, Arashenda, Shindisi

The residents of all these villages have been considered as important stakeholders.
Directly at the project sites (location of WGT and other basic and temporary facilities, access roads and connection cables), except for a few places, there are no aboveground monuments or visible remains of any archaeological object and/or artefact with the mark of cultural heritage anywhere. After decrease of the number of turbines from 46 to 33 three cultural heritage locations were avoided. However, due to the number of important archaeological-architectural monuments and objects referred in the scientific literature, which are abundantly recorded and largely studied in the area under consideration by the project, it is requested in ESIA to ensure the professional supervision of an archaeologist during the earthworks and to develop and apply the chance finding procedure. The basic scheme for the chance-finding procedure is presented in the ESIA. The chance-finding procedure defines the rules for stopping works and further actions to be implemented by EPC contractor, archaeological authorities and JSC Wind Power in case if archaeologically valuable objects are excavated during the earth-works.

6.2 Environmental Receptors and Restriction Zones

Ruisi WPP is not located within or in the immediate vicinity of protected areas.

The project area is not located within or close to the important bird migration routes and sensitive ecological habitats.

Project site is not located close to airports, any specific restriction zones or sanitary protection zones usually established near the water-supply headworks, surface water objects and resort areas.

6.2.1.1 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.

► **Medium Sensitivity Sites/ Habitats**

Plot 17. Wind Turbine #10. 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.

6.2.1.2 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.

6.3 Expected Social Impacts

Land take related impacts (physical and economic displacement) and nuisance (noise, shadow flicker, visual impacts, dust emissions) were assumed as main potential impacts associated with the project and residential areas are seen as the major sensitivities in the project area.

6.3.1 Physical and Economic Displacement

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.

Taking into account the current configuration of turbines (33 turbines) and selected areas for them, it will be necessary to occupy 191 registered land plots, most of which (151) are private plots. Apart from that, the land required for expansion of access roads and laying of connecting cables.

All 191 land plots are acquired for placing wind generator turbines, Out of this 151 were private plots and 5 were owned by business companies. Some households owned several land plots and many plots were co-owned by several PAPs.

In total there are **151** project-affected **private land plots** for 33 turbines and a substation area (17.24 ha) and preliminary estimated **31** project-affected **private land plots** for the access roads **(19.64 ha)** The whole area of private lands plots for turbines and a substation have been already purchased by the project (134 ha). As for the private land plots for the access roads 14 out of 31 land plots have been already purchased as well **(7.52 ha)** There are three land plots where compensation for land use was paid for three land plots as private users could not register the affected areas (1.77 ha). Overall, there are preliminary identified project-affected **119 households** and **two business companies** *(102 affected households (AHs) and 1 business company for 33 turbines and a substation area and 17 AHs and **2** company for the access roads)* while in the case of 46 turbines in total 234 households and 3 companies were affected. Therefore the area of impact was reduced

6.3.2 Community Health, Safety, and Security

6.3.2.1 Noise Impacts

Source noise for the Goldwind GWH171-6.25MW wind turbines[4] with 105 m hub height was provided in a site-specific acoustic performance document [5]. This includes sound power levels both for standard operating mode and eight noise reduction modes, with and without use of serrated trailing edges (STE).

[4] GWH171-6.25MW Site Specific Calculated Power Curve and Thrust Coefficient (Rated Power 6.25 MW) Ruisi, Goldwind International, Edition: D,No.: GWI-08SS.b0615, 22 Feb 2024.

[5] Description of GWH171-6.25MW Acoustic Performance Ruisi Wind Power Project, Goldwind International Solution Department, Edition: H, No.: GSC-08AP.a0040, 29 May 2024.

The 1/3 octave data is also available for all the different noise modes. The respective sound power levels are presented in Table 6-1.

Table 6-1 – Maximum sound power level and rated power output for available noise modes

Operating mode	Sound Power Level (dBA) without STE	Sound Power Level (dBA) with STE	Rated power output (kW)
Standard mode	111.0	108.0	6250
SRM1	109.9	106.9	5384
SRM2	109.5	106.5	5276
SRM3	109.0	106.0	5168
SRM4	108.5	105.5	5053
SRM5	108.1	105.1	4945
SRM6	107.6	104.6	4836
SRM7	107.1	104.1	4721
SRM8	106.6	103.6	4612

As seen in Table 6-1, the use of serrated trailing edges (STE) on the turbine blades reduces the source noise with 3 dBA without impact on production. A power output reduction is associated with the sound reduced operating modes.

The noise impact for the respective neighbor buildings was calculated for a 33 turbine layout using Goldwind GWH171-6.25MW at 105 m hub height (as presented in Figure 1) for the following two general scenarios:

- Baseline scenario with standard operational mode and STE installed on all turbines. Results of this calculation were used to determine the extent of noise reduction required to ensure no noise level exceedance at neighbor positions.
- Noise reduced scenario with STE installed on all turbines as well as use of noise reduced mode(s) on selected turbine(s) to ensure noise level compliance at neighbor positions.

6.3.2.1.1 Baseline Scenario (standard operating mode)

The baseline noise calculations for the planned wind turbine layout were performed using standard operational mode settings and serrated trailing edges (STE) installed on all turbines, without use of sound reduced modes (SRM). The resulting noise levels for the surrounding areas are presented in Figure 6-1. Areas in orange and red exceed the adopted limitation.

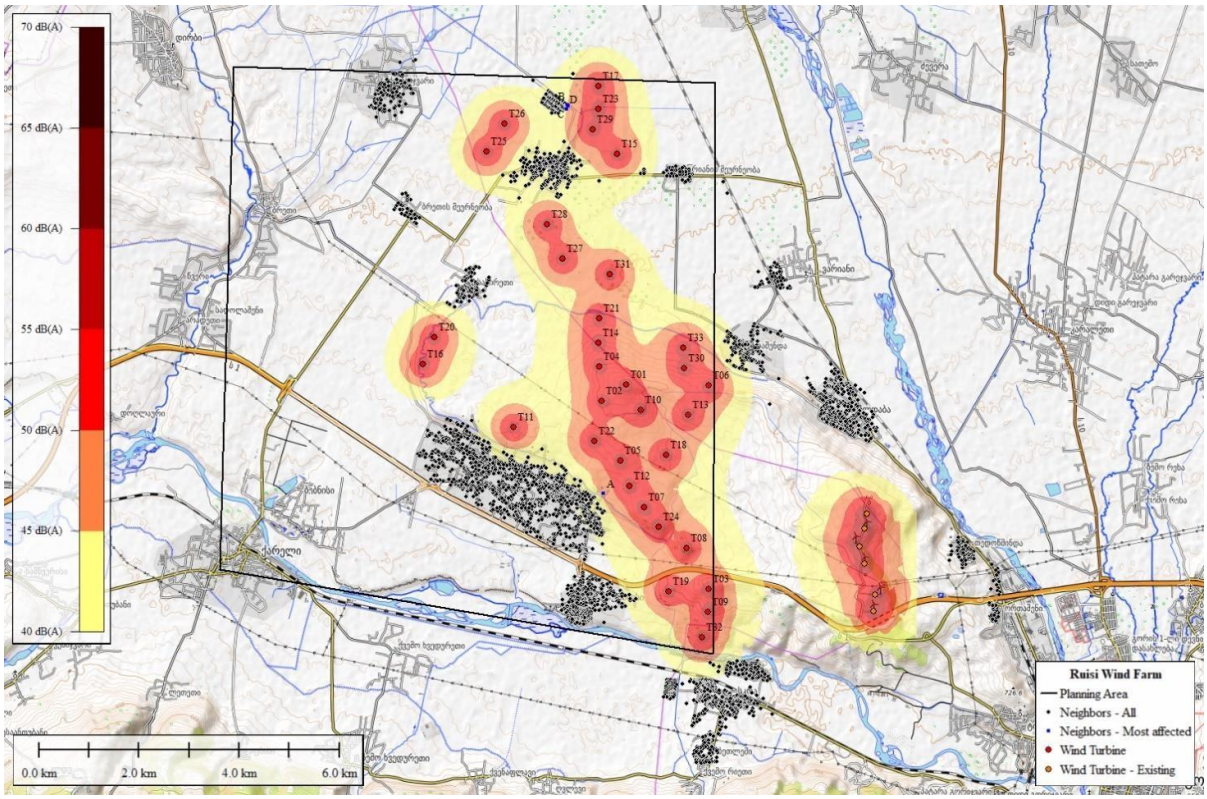

Figure 6-1 Noise map based on calculated noise level (L_{eq}) for worst case scenario using standard operational mode and STE installed on all turbines

The calculations indicate none of the 4462 noise receptors will experience noise levels exceeding the daytime limit of 55 dB. The nighttime noise limit of 45 dB is expected to be exceeded at one neighbor building (Neighbor A located in the south-central planning area), with three other neighbor buildings located in the northern planning area with calculated noise levels at the 45 dB limit. These four neighbor buildings are marked by blue squares with neighbor IDs in the presented noise maps.(Note that due to smoothing and interpolation when generating the noise map, some of these are located within the orange area on the map although their calculated noise impact does not exceed the noise limit.)

The highest expected noise level without any noise reduction is 46 dB at Neighbor A, an older church in the northeastern part of Ruisi (and south- central in the planning area).

6.3.2.1.2 Noise Reduced Scenario

For the neighbor building where the calculated noise level exceeds the 45 dB limit (Neighbor A), mitigating measures must be used to reduce the noise level to an acceptable level. In some cases, the exceedance can be resolved by an agreement between the developer and the owner of the respective

building, otherwise the exceedance can be mitigated by running individual turbines in sound reduced modes (SRM).

The recommended noise reduction strategy to achieve compliance at neighbor building A is to run the closest turbine (T12) in noise reduced mode SRM1 at nighttime (between 22:00 and 07:00). Details are provided in Table 6-2 below.

Table 6-2 Suggested noise curtailment strategy

Turbine ID	Turbine operating mode	Turbine ID	Turbine operating mode
T01	Standard mode with STE	T18	Standard mode with STE
T02	Standard mode with STE	T19	Standard mode with STE
T03	Standard mode with STE	T20	Standard mode with STE
T04	Standard mode with STE	T21	Standard mode with STE
T05	Standard mode with STE	T22	Standard mode with STE
T06	Standard mode with STE	T23	Standard mode with STE
T07	Standard mode with STE	T24	Standard mode with STE
T08	Standard mode with STE	T25	Standard mode with STE
T09	Standard mode with STE	T26	Standard mode with STE
T10	Standard mode with STE	T27	Standard mode with STE
T11	Standard mode with STE	T28	Standard mode with STE
T12	SRM1 with STE	T29	Standard mode with STE
T13	Standard mode with STE	T30	Standard mode with STE
T14	Standard mode with STE	T31	Standard mode with STE
T15	Standard mode with STE	T32	Standard mode with STE
T16	Standard mode with STE	T33	Standard mode with STE
T17	Standard mode with STE		

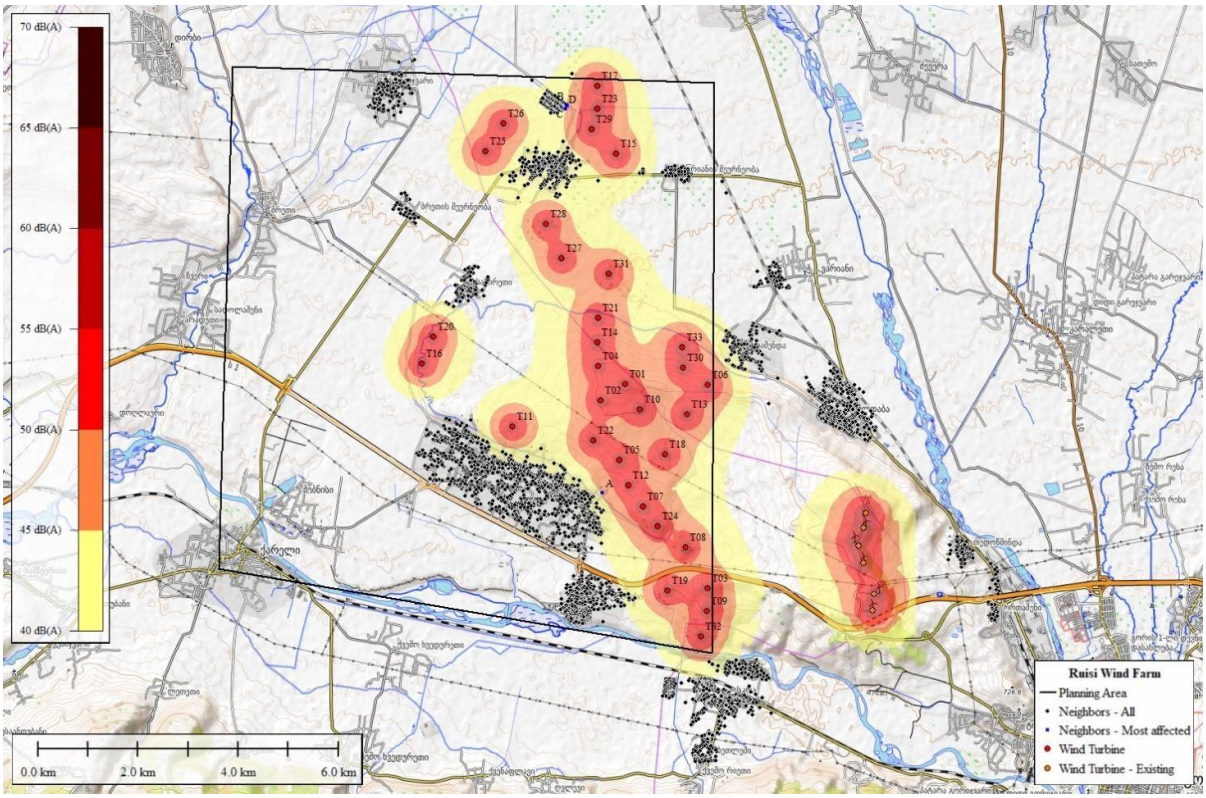

Figure 6-2 Noise map based on calculated noise level (L_{eq}) for worst case scenario using serrated trailing edges (STE) and sound reduced mode (SRM) on individual turbine

The resulting noise map based on the suggested curtailment strategy is presented in Figure 6-2.

There were done calculated noise levels' calculation for the 143 most affected neighbor buildings. The neighbor building selection includes all buildings with calculated noise impact exceeding 42 dB when SRM is not used.

6.3.2.1.3 Summary and Conclusion

The assessment was performed in accordance with the key objectives in EBRD Performance Requirement 1: Assessment and Management of Environmental and Social Risks and Impacts with regards to noise impact of the project. Noise limits 45 dB outlined in the IFS (International Finance Corporation) EHS (Environmental, Health and Safety) guidelines from World Bank Group were used as the regulatory limits in the assessment.

With all 33 wind turbines in Ruisi wind farm equipped with serrated trailing edges (STE), noise level exceeding the acceptable limit of 45 dB is calculated for one neighbor building. By implementing a noise mitigation strategy of running the closest turbine (T12) in noise reduced mode SRM1 at nighttime (between 22:00 and 07:00), noise compliance with IFC limitations is achieved for all neighbor buildings in the project area.

The use of SRM1 on T12 during the night hours between 22 and 7 is estimated to result in a production curtailment loss of 0.1 %.

The main conclusion is as follows: in overall, as the modelling results have evidenced, the noise level generated during the construction and operation phases of the wind turbines at the nearest residential buildings does not exceed the day and night noise standards.

6.3.2.2 Shadow Flickering Impacts and Electromagnetic Waves

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 shadow flicker impact generated by the planned 33 wind turbines at Ruisi wind farm was calculated using turbine type Goldwind GW171-6.25MW with 105 m hub height.

According to the IFC guidelines, the maximum theoretical shadow flicker should not exceed 30 hours per year or 30 minutes per day.

The calculated shadow flicker maps for the planned layout are provided in Figure 6-3 through Figure 6-4. Green (or unshaded) areas depict locations where the shadow flicker is less than the adopted limits. The yellow areas are close to the limit, while orange and red areas exceed the limits.

Neighbor locations with expected shadow flicker impact exceeding any of the adopted shadow flicker limits are marked with blue squares, while neighbor buildings with less or none shadow flicker impact are marked with black dots.

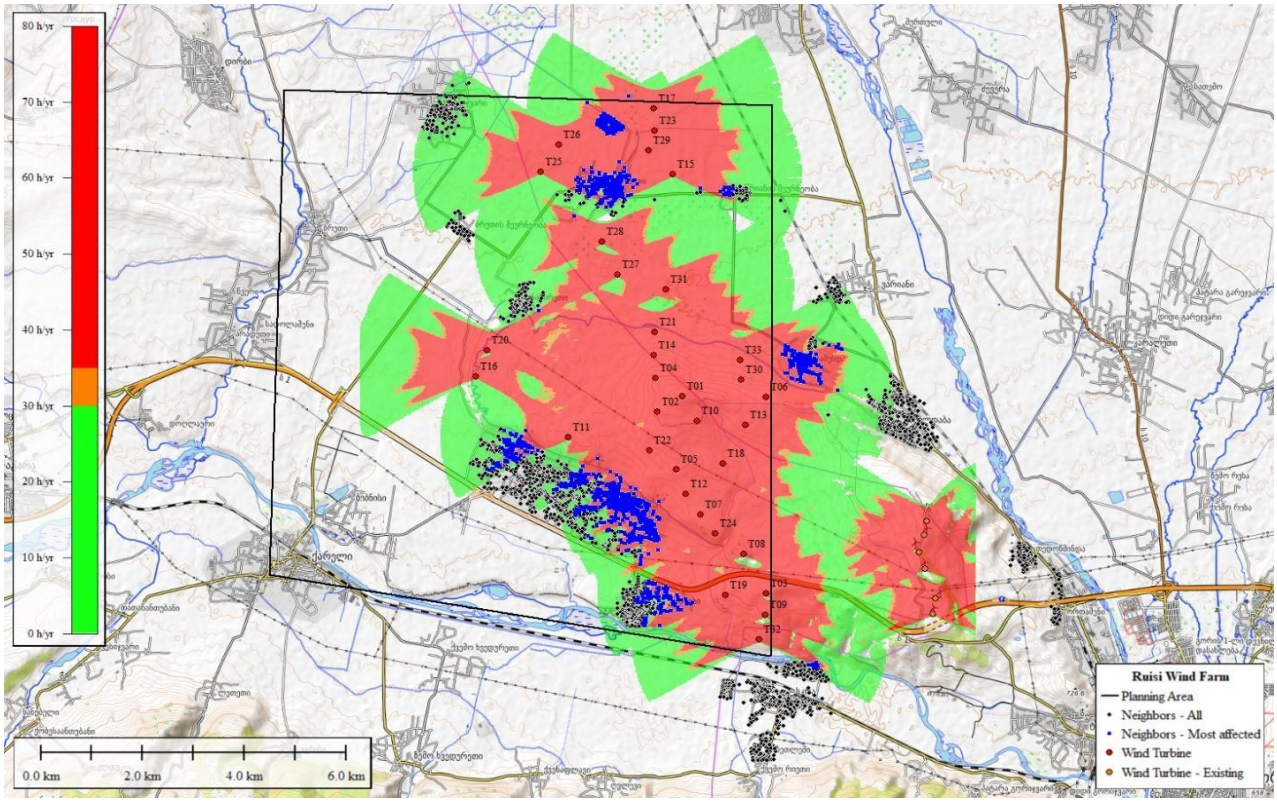

Figure 6-3 Expected shadow flicker map (worst-case, hours/year) with turbines and neighbors

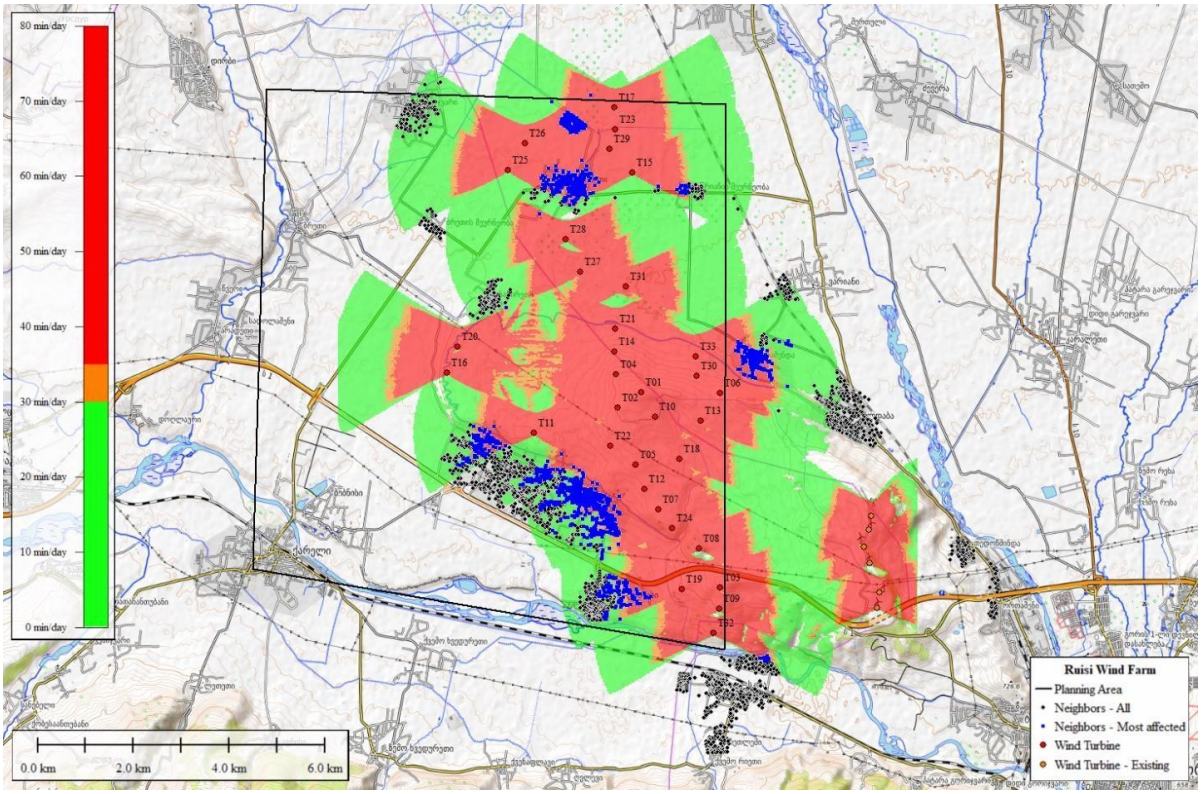

Figure 6-4 Expected shadow flicker map (worst-case, max min/day) with turbines and neighbors

Amongst the 4462 identified shadow flicker sensitive neighbor buildings within 2.5 km from the wind turbines, shadow flicker impact exceeding the adopted limits was calculated at 1484 of the buildings.

Mitigation measures are required to reduce the shadow flicker impact on these buildings to an acceptable level. A common mitigating measure is monitoring system with light sensor(s) that shuts down certain turbines in periods where shadow flicker is occurring after limits are exceeded.

A curtailment strategy was developed in WindPRO to evaluate the extent of curtailment required to sufficiently reduce the shadow flicker impact for the neighbor locations.

Software constraints limited how many neighbors could be included in these calculations, so a selection of 270 of the 1484 most affected neighbor buildings was used. These 270 selected neighbors include stand-alone buildings, buildings on the borders and central portion of each affected neighbor village, and general buildings considered representative. The neighbor buildings selected for detailed assessment are presented by pink squares in Figure 6-5 below, together with the calculated real-case shadow flicker map.

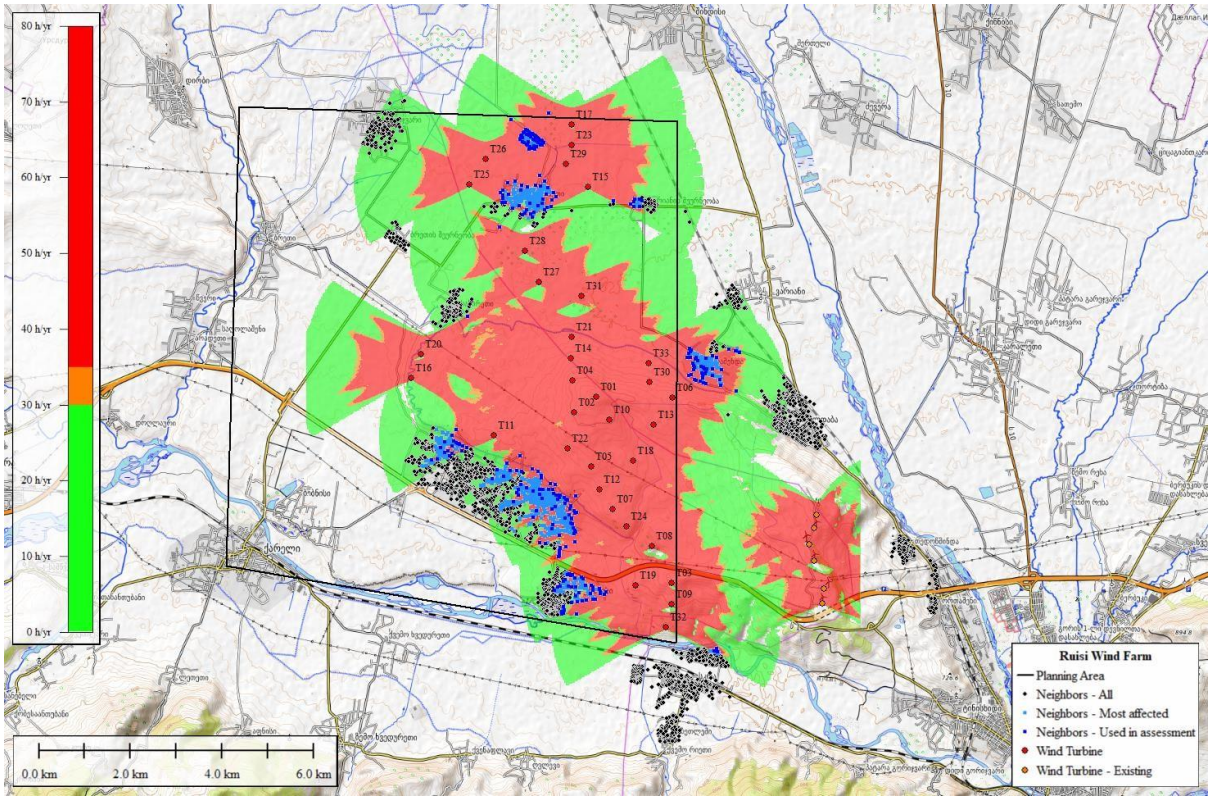

Figure 6-5 – Expected shadow flicker map (worst-case, h/yr) with neighbor buildings included in assessment marked by pink squares

The suggested curtailment strategy includes occasional shutdown of 26 of the 33 turbines, with a summary of which turbines provided in Table 6-3 below.

Table 6-3 Turbines with recommended curtailment

Turbine ID	Status	Turbine ID	Status	Turbine ID	Status
T01	Curtailment	**T12**	Curtailment	**T23**	Curtailment
T02		**T13**	Curtailment	**T24**	Curtailment
T03	Curtailment	**T14**		**T25**	Curtailment
T04		**T15**	Curtailment	**T26**	Curtailment
T05	Curtailment	**T16**		**T27**	
T06	Curtailment	**T17**	Curtailment	**T28**	Curtailment
T07	Curtailment	**T18**	Curtailment	**T29**	Curtailment
T08	Curtailment	**T19**	Curtailment	**T30**	Curtailment
T09	Curtailment	**T20**	Curtailment	**T31**	
T10	Curtailment	**T21**		**T32**	Curtailment
T11	Curtailment	**T22**	Curtailment	**T33**	Curtailment

6.3.2.3 Summary and Conclusion

The assessment was performed in accordance with the key objectives in EBRD Performance Requirement 1: Assessment and Management of Environmental and Social Risks and Impacts with regards to shadow flicker impact of the project. Shadow flicker limits of 30 hours per year and 30 minutes per day on the worst affected day, based on worst-case scenario outlined in the IFS (International Finance Corporation) EHS (Environmental, Health and Safety) guidelines from World Bank Group were used as the regulatory limits in the assessment.

Amongst the 4462 identified shadow flicker sensitive neighbor buildings within 2.5 km from the wind turbines, shadow flicker impact exceeding the adopted limits was calculated at 1484 of the buildings. Software constraints limited how many neighbors could be included in detailed calculations, so a representative selection of 270 of the 1484 most affected neighbor buildings was used.

A curtailment strategy was proposed that includes occasional shutdown of 26 of the 33 turbines. Proper implementation will ensure compliance with IFC shadow flicker guidelines for all evaluated neighbors.

Implementation of this recommended turbine curtailment strategy is estimated to result in a park-level production loss of 1.0 %. It should be noted that this assumes the selected 270 neighbor buildings are representative of all 1484 affected positions. These results may vary with a shadow flicker control system that considers all affected positions to ensure compliance with the IFC limits.

If a monitoring system with light sensors is used at the site, as expected, less production loss is expected as the turbines are only shut down during periods where exceedance of the shadow flicker limits is actually occurring. The estimated production loss related to shadow flicker is estimated at 0.6 % when a monitoring system with light sensors is used. Consultation with local authorities is recommended.

Updated Flickering assessment for 33 turbine has much less impacts then it was done for 46 wind turbines.

6.3.3 Landscape and Visual Impacts

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 – turbines and substation. 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.

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. The Georgian population has got used to the landscape of Gori WPP and it does not cause negative associations (no complaints have been ever received by operating company, local authorities or MEPA). During the public consolation visual impact assessment was presented for 46 turbines.Society and NGO’s

haven't make any remarks or .complaints regarding this issue JSC Wind Power will finalize detail survey for Visual impact assessment and this report will finally confirm locations of the 33 turbines.

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.

6.4 Expected Environmental Impacts

6.4.1 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 will be distanced from the nearest residential buildings by more than 700 m.

Construction and operation activities of wind power project are passive in nature and do no result in any key air emissions. However, construction activities may increase level of dust and particulate matter emissions, which will temporarily impact ambient air quality. Moreover, the use of machinery and equipment are expected to be a source of noise and vibration within the Project site and its surroundings.

As part of the ESIA, appropriate mitigation measures have been identified for dust suppression and control and which will be implemented during the construction phase. This includes for example regular watering of all active construction areas, proper management of stockpiles.

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. The project envisages the use of diesel generators only as reserve units during the unforeseen events.

6.4.2 Water Resources

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.

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.

The rivers are located quite far from the project site and no impacts are expected. The only surface water receptors within the construction impact zone are the branches of the irrigation channels. During the consultations with the Georgia Amelioration (amelioration authority in Georgia), it has been revealed that no indirect impacts on the channels are envisaged.

For most of the turbines and project facility sites the established level of the groundwater is significantly below 3m. At few sites, where the groundwater level is higher than 3m, this is a local, shallow groundwater, which is not used for drinking and has no connection to the deeper groundwater aquifers and rivers. During the construction works the ground will be excavated 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 a local receptor, 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.

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.

6.4.3 Biodiversity

6.4.3.1 Protected Areas and Habitats

The biodiversity baseline assessment concludes that the Project site in general is of low ecological significance and sensitivity. The assessment identified several flora, fauna and avi-fauna species within the Project site most of which are considered of least concern and common to such area habitats.

Ruisi WPP is not located within or in the immediate vicinity of protected areas, Special Protection Areas (SPAs), Emerald Sites and Important Birds Areas (IBAs). The project area is not located within or close to the important bird migration routes and sensitive ecological habitats.

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 dense network of unpaved field roads is developed within the project area and neighbourhood in addition to the well-developed network of the municipal asphalt roads.

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.

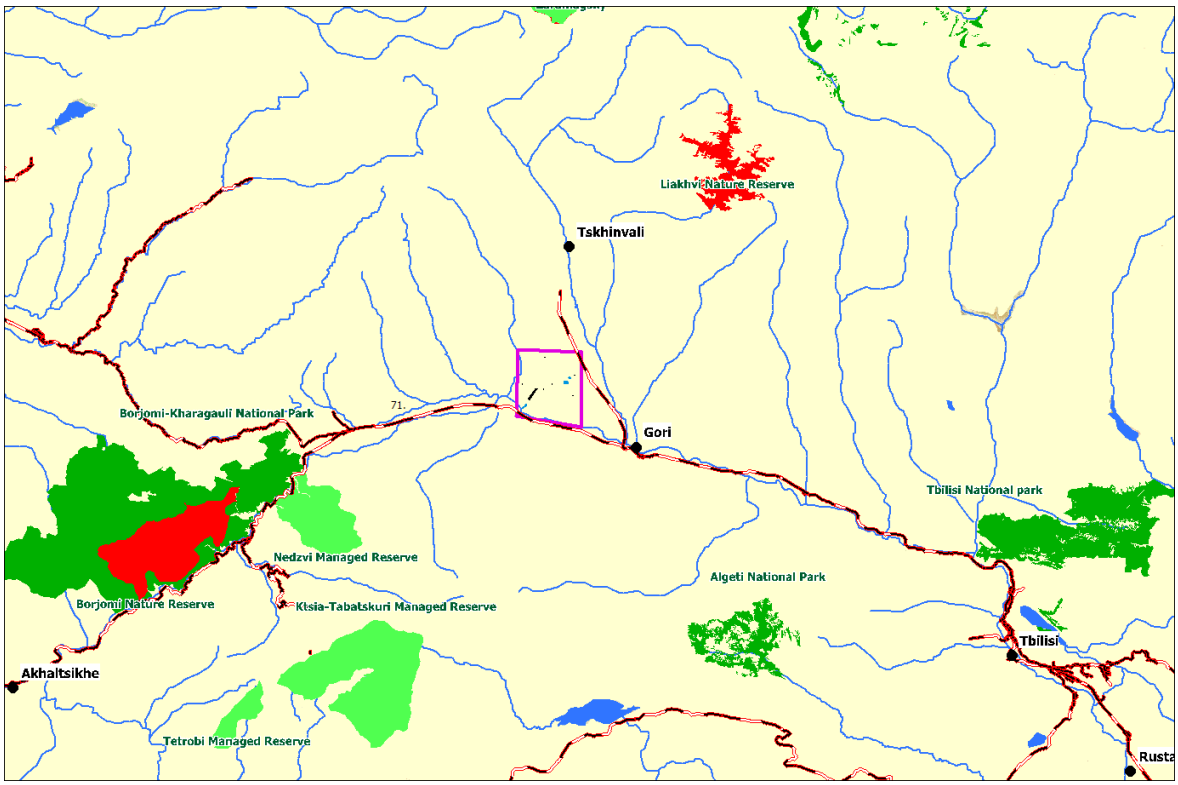

Figure 6-6 Protected areas established under national law and Ruisi WPP Area

State Nature Reserves – red polygons, National parks - dark green polygons, Managed reserves - light green polygons, Protected landscape – orange polygon; Project Area – magenta polygon.

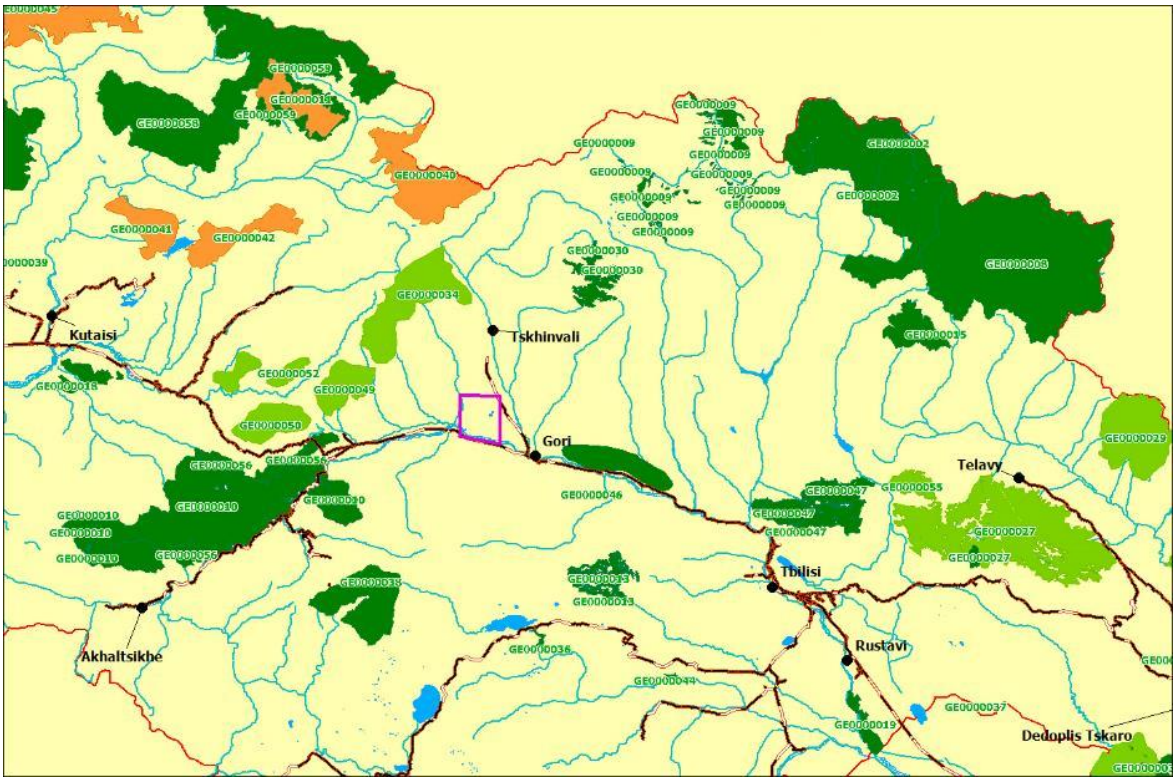

Figure 6-7 Emerald sites and IBAs near Ruisi WPP Area

Designated Emerald sites - dark green polygons, the candidate sites – orange polygons and the proposed sites - light green polygons; Project Area – magenta line.

6.4.3.2 Flora

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.

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.
- Critical Habitat Assessment does not identify any habitats or plant species that could classify as a Critical Habitat or Priority Biodiversity Feature according to the EBRD PR6 (2019) criteria.
- 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. Only one habitat of medium value is identified (the small, artificial pine grove at Turbine #10).

The pine grove at Turbine #10 site is artificially planted. Tree identification and cadastral description are in the process of determination. 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, 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.

Five species endemic to the Caucasus have been found in the study area. 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. The identified endemic species are not range-restricted according to the EBRD Guidance Note 6, and destruction of some specimen would not reflect on their occurrence.

In addition, a conservation programme before starting the construction shall be prepared for five rare plant species that are endemic to the Caucasus

6.4.3.3 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.

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. 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*).

All records of mammal species within the project area are summarized below:

- Hedgehog (*Erinaceus concolor*) was recorded at WTG 25
- Molehills were found in ten locations at WTG 10, WTG 32, WTG 24, WTG 33, WTG 29.
- 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 02, WTG 13, WTG 20, WTG 24 – at the west edge of the not irrigated arable lands occupied by wheat.
- Brandt's hamsters (*Mesocricetus brandtii*) burrow recorded at WTG 02 and WTG 10 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.
- Golden Jackals (*Canis aureus*) was recorded in two places. Voice of jackal packs heard at WTG 18 (one pack) andWTG 25 (two packs)
- One cat (*Felis sp*.), undefined up to species level, was seen at WTG 25.

According to the results of the zoological field surveys, there are no sites of the Ruisi WPP project which can be considered as potentially important from mammals' biodiversity preservation standpoint.

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. 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. 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 09 and WTG 19.

There are no sites of the Ruisi WPP project area those can be considered as potentially important for reptilian fauna.

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. 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.

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.

As an overall, summarising conclusion based on the results of the zoological field surveys, we can state that there are no sites of the Ruisi WPP project which can be considered as potentially important from animal biodiversity preservation standpoint.

6.4.3.4 Avi-Fauna

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. 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 is neither habitat preferred by this vulture within the Ruisi WPP project area and immediate neighbourhoods, 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.

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.

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.

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. Ruisi WPP Project Area situated outside of the major migratory corridors and so-called “bottle-necks” of long-distance migrating birds of prey. The project area is lying on the secondary way of birds' migration. In autumn, within the project area, part of the migratory birds is flying along the Mtkvari River valley from east to west, and part is flying from north to south crossing the river. 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.

Collision risk modelling (CRM) was undertaken for fourteen bird species and based on flight activity data collected from vantage point (VP) surveys undertaken during the period April – May/June 2024 at Ruisi Wind Power Plant (WPP). Data obtained during VP surveys was used to determine the theoretical collision risk for a range of species by incorporation into a CRM (Band et al. 2007[6]) and herein referred to as ‘the Band model’.

[6] Band, W., Madders, M. and Whitfield, D.P. (2007) Developing Field and Analytical Methods to Assess Avian Collision Risk at Wind Farms. In: De Lucas, M., Janss, G. and Ferrer, M., Eds., Birds and Wind Power, Quercus Editions, Madrid, 259-275.

Table 6-4 Collision risk modelling output summary

Species name	Spring season - April to June 2024			
	Avoidance rate (%)	Modelled collisions per year	Years per collision (approximate)	Modelled collisions per 25 years (approximate)
Black Kite	No avoidance	3.65	0	91
	95	0.18	5	5
	98	0.07	14	2
	99	0.04	27	1
Booted Eagle	No avoidance	2.63	0	66
	95	0.13	8	3
	98	0.05	19	1
	99	0.03	38	1
Common Buzzard	No avoidance	15.39	0	385
	95	0.77	1	19
	98	0.31	3	8
	99	0.15	6	4
Common Kestrel	No avoidance	1.35	1	34
	95	0.07	15	2
	98	0.03	37	1
	99	0.01	74	0
Eastern Imperial Eagle	No avoidance	9.72	0	243
	95	0.49	2	12
	98	0.19	5	5
	99	0.10	10	2
Eurasian Marsh Harrier	No avoidance	8.78	0	220
	95	0.44	2	11
	98	0.18	6	4
	99	0.09	11	2
European Honey Buzzard	No avoidance	1.88	1	47
	95	0.09	11	2
	98	0.04	27	1
	99	0.02	53	0
Hen Harrier	No avoidance	0.20	5	5
	95	0.01	99	0
	98	0.00	247	0
	99	0.00	493	0

Species name	Spring season - April to June 2024			
	Avoidance rate (%)	Modelled collisions per year	Years per collision (approximate)	Modelled collisions per 25 years (approximate)
Lesser Spotted Eagle	No avoidance	19.33	0	483
	95	0.97	1	24
	98	0.39	3	10
	99	0.19	5	5
Long Legged Buzzard	No avoidance	5.94	0	148
	95	0.30	3	7
	98	0.12	8	3
	99	0.06	17	1
Peregrine Falcon	No avoidance	0.41	2	10
	95	0.02	49	1
	98	0.01	123	0
	99	0.00	246	0
Red Footed Falcon	No avoidance	4.09	0	102
	95	0.20	5	5
	98	0.08	12	2
	99	0.04	24	1
Short Toed Snake Eagle	No avoidance	4.69	0	117
	95	0.23	4	6
	98	0.09	11	2
	99	0.05	21	1
Steppe Eagle	No avoidance	1.52	1	38
	95	0.08	13	2
	98	0.03	33	1
	99	0.02	66	0

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.

- 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. 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.

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.

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6.4.3.5 Bats

To assess the potential impact on bats during the construction and operation of the wind farm, field surveys were conducted in 2022. At the beginning of the study, it was planned to deploy 56 wind turbines within the project area. As a result of one-year surveys and considering the bat activity, recommendations to mitigate thepotential impact on bats were developed for the turbines indicated in Table 6-5, Figure 6-9, namely:

Table 6-5 Turbines with need of mitigation measures.

#	Number of WT	Coordinates	The color of turbines on the maps
1	6	42.02399°N/44.00428°E	Blue
2	32	42.06187°N/43.90395°E	Blue
3	34	42.08097°N/43.96223°E	Blue
4	35	42.04688°N/43.97047°E	Blue
5	36	42.06870°N/43.90835°E	Blue
6	37	42.09427°N/ 43.99025°E	Blue
7	43	42.10292°N/43.94450°E	Blue
8	47	42.10336°N/43.96161°E	Blue
9	50	42.09868°N/43.95999°E	Blue
10	52	42.10007°N/43.98677°E	Blue
11	55	42.08868°N/43.98879°E	Blue
12	57	42.04101°N/43.89281°E	Blue
13	58	42.08291°N/43.97120°E	Blue

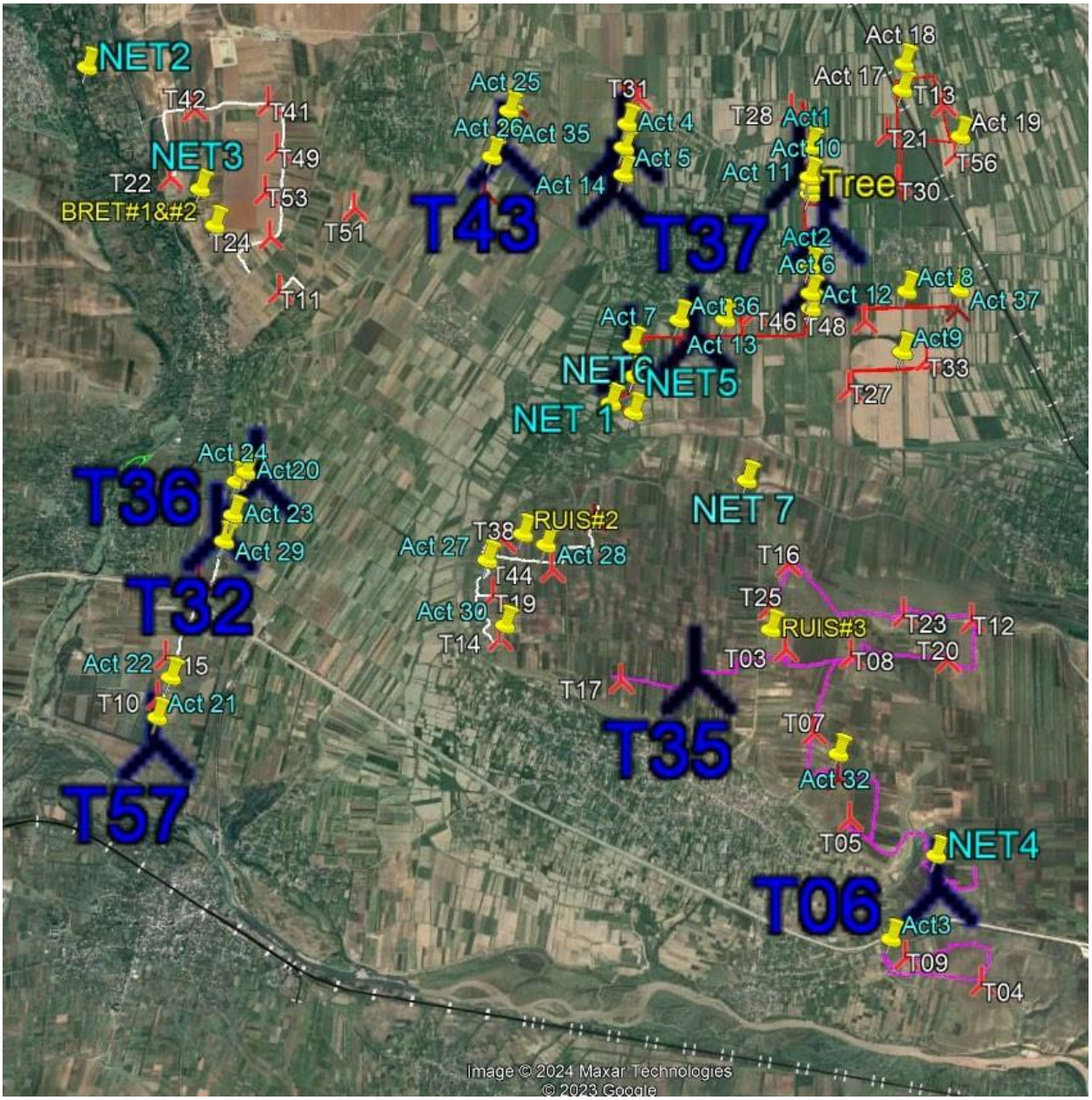

Figure 6-8. First lauyout of the turbines and WT with the operating schedule

On Figure 6-8, it is given the field routes taken, the initial layout of the turbines (marked in red), and the turbines (turbines in blue) for which an operating schedule has been developed.

In early 2024, we were provided with an updated turbine layout, and the total number of turbines was reduced to 33 turbines (Figure 6-9). Figure 6-9 shows the initial WT layout (red markers), turbines for which an operating schedule has been developed (turbines in blue), and the updated layout of WT (Green markers) is mentioned.

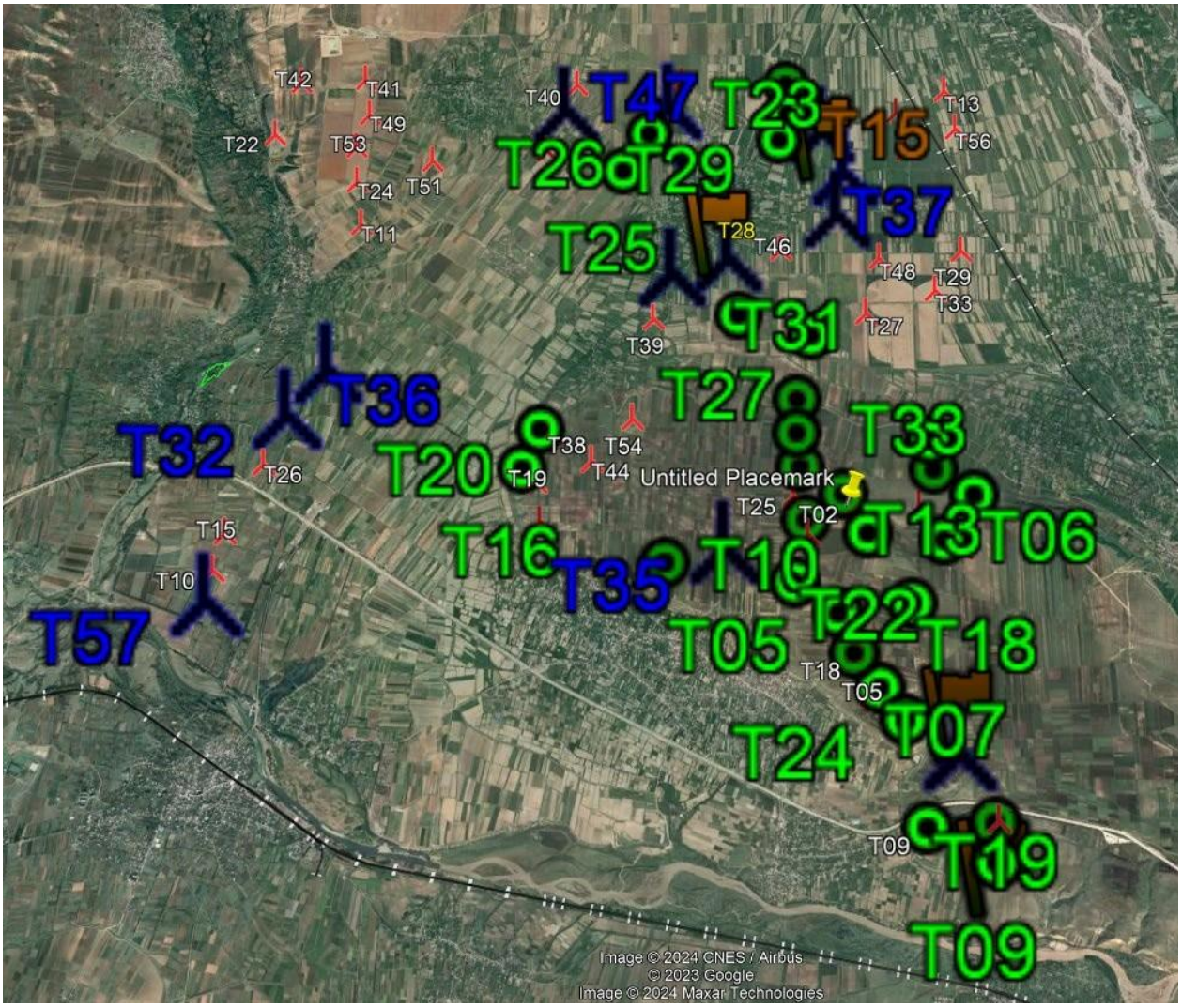

Figure 6-9. Initial and last layout of WT and WT with the operating schedule.

We have extrapolated the results of the studies for the updated layout. For this, the initial and last layouts, as well as the conducted filed routes, were placed on one map (Figure 6-10) and the data collected during the survey were re-processed.

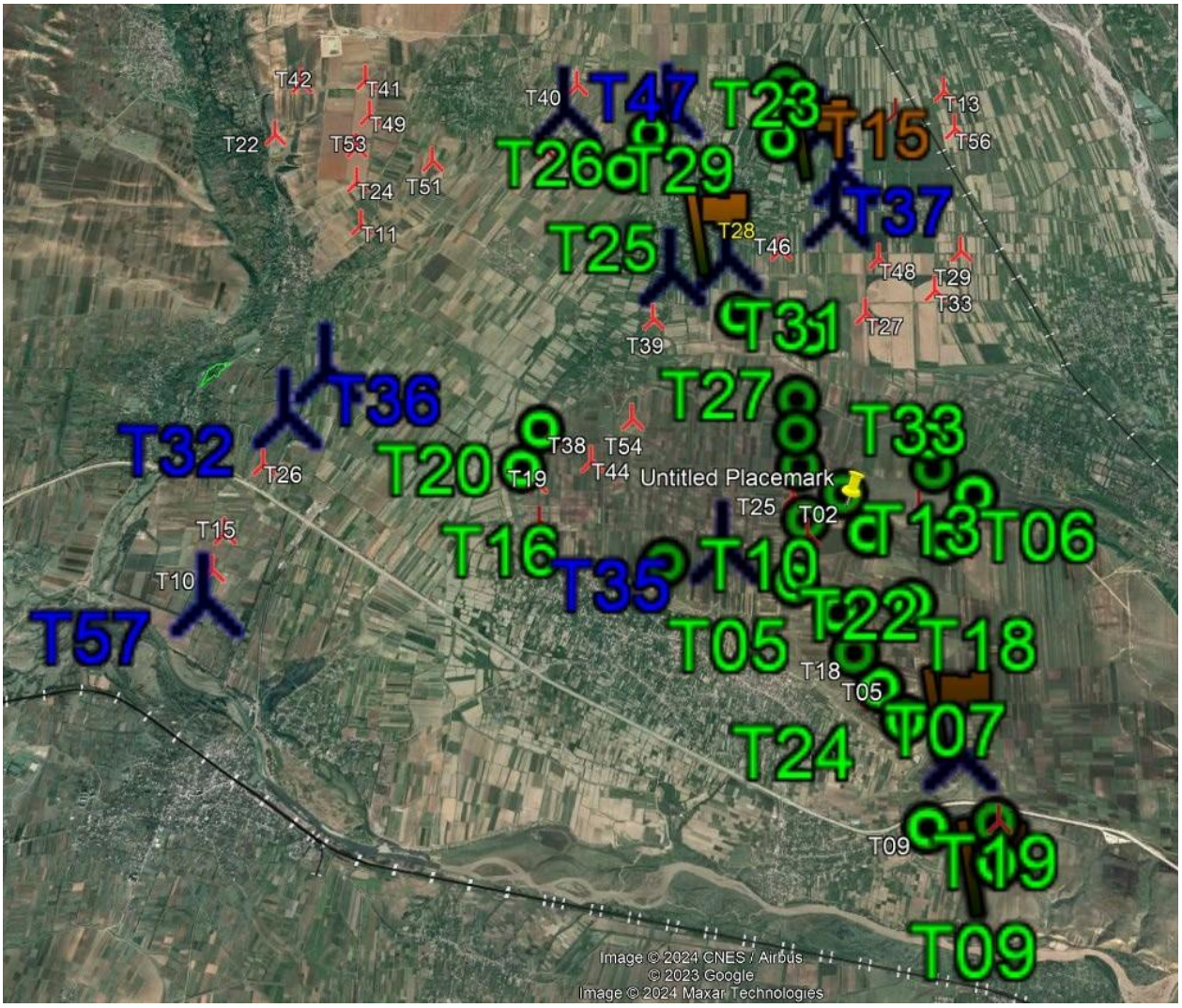

Figure 6-10. Initial and last layouts of the WT, conducted field routes, Bat activity areas

As a result, the revised layout of the turbines may be generally better. Based on the extrapolation of our filed data, the quantity and number of turbines which requires to maintain the recommendations from the previous report have changed. Taking into account the results of our studies and the updatedlayout of the turbines, the developed recommendations remain valid for the next updated WT - #8. #15, #28. We were not able to extrapolate the results for turbine #32. However, considering that WT #32 is located in the vicinity of the Mtkvari River and rivers, especially a large river like the Mtkvari, can be used as a potential migratory route, we believe that a special operating schedule should be maintained for the mentioned turbine as well. Accordingly, in Table 6-6 and Figure 6-11. with brown colorare given the WT for which the operating schedule needs to be maintained.

Table 6-6. Turbines with need of mitigation measures.

#	Number of WT	Coordinates	The color of turbines on the maps
1	8	42.02399°N/44.00428°E	Brown
2	15	42.06187°N/43.90395°E	Brown
3	28	42.08097°N/43.96223°E	Brown
4	32	42.04688°N/43.97047°E	Brown

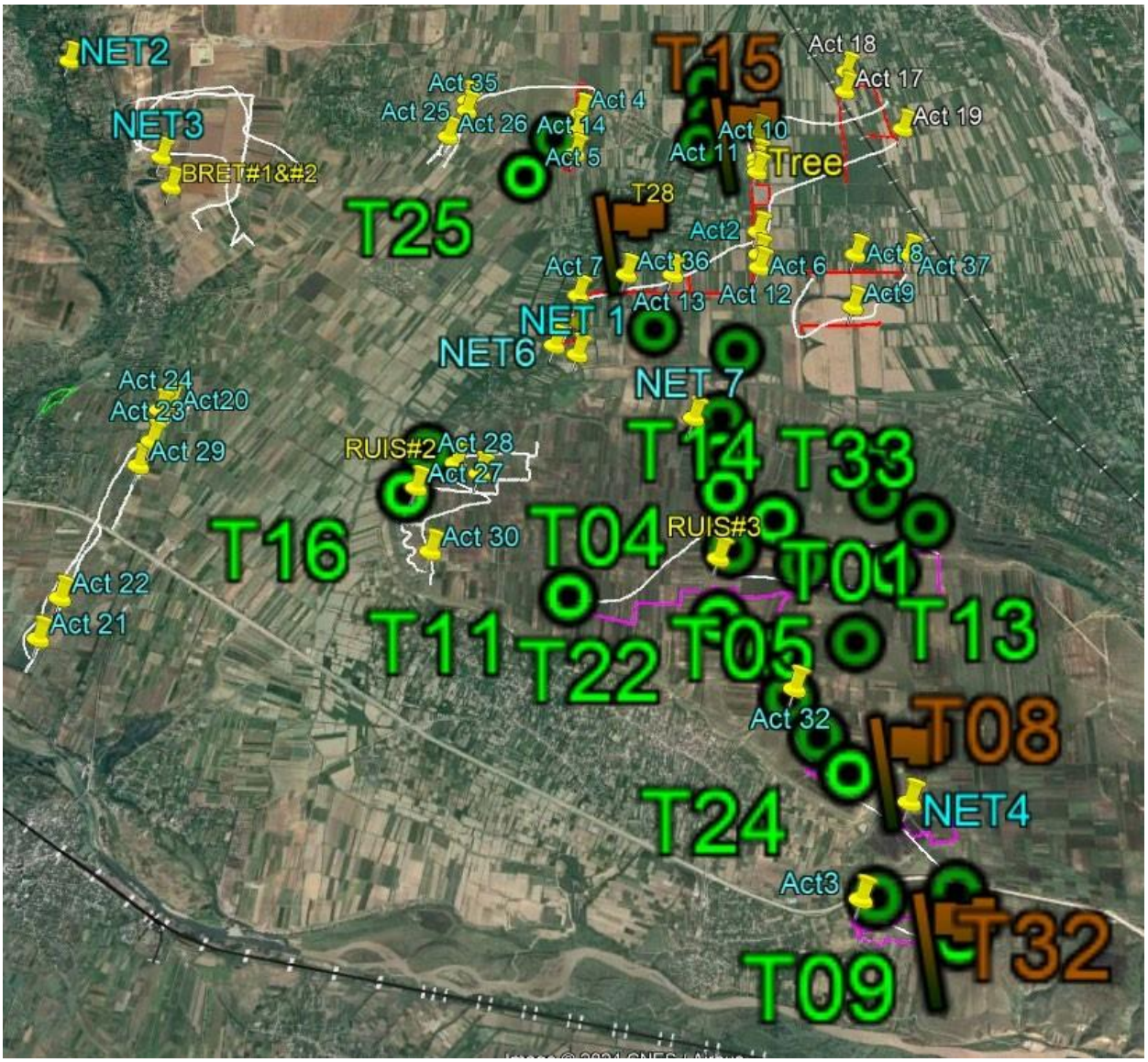

Figure 6-11. Last layout of WT and WT (Brown) with the operating schedule

Based on the results of the field works, the most important recommendations at this stage are:

1. From the 10th of November through March when the night temperature is below 5°C, wind turbines could operate without switching them off because during winter bats are not active.
2. For the wind turbines - #8, #15, #28, #32, when the night temperature is above 5°C, 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 periodwhen 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. 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.
4. Maximally avoid artificial lightening, except for essential safety measures (aviation lights, etc.),and 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 inthe 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-lengthbelow 540nm and with a correlated color temperature more than 2700K.
5. The nacelles should be made inaccessible for bats as much as technically possible and feasible.
6. It is recommended to avoid the development of bushes and wetlands under the wind power turbine.
7. Passive bat detectors should be installed on the wind turbines to measure BAI for each turbineand then, based on particular results, develop the relevant recommendations for the operationof each turbine on the project sites.
8. Maximally avoid or put limitations on cutting trees.
9. 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 potentialroost-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 from1 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.
10. To consult with a bat specialist if during the tree-cutting process suddenly roosting bats occur in the cut trees.
11. 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).
12. Continue post-construction monitoring and mitigation measures as long as needed to guaranteethe effectiveness of mitigation measures.

These recommendations might be revised, further developed and/or adapted taking into consideration the results post-construction monitoring.

6.5 Waste Generation and Management

6.5.1 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 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 m^3 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 33 and 29) – 28 800m^2
- Dumpsite 3 (Near turbine 30) – 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.

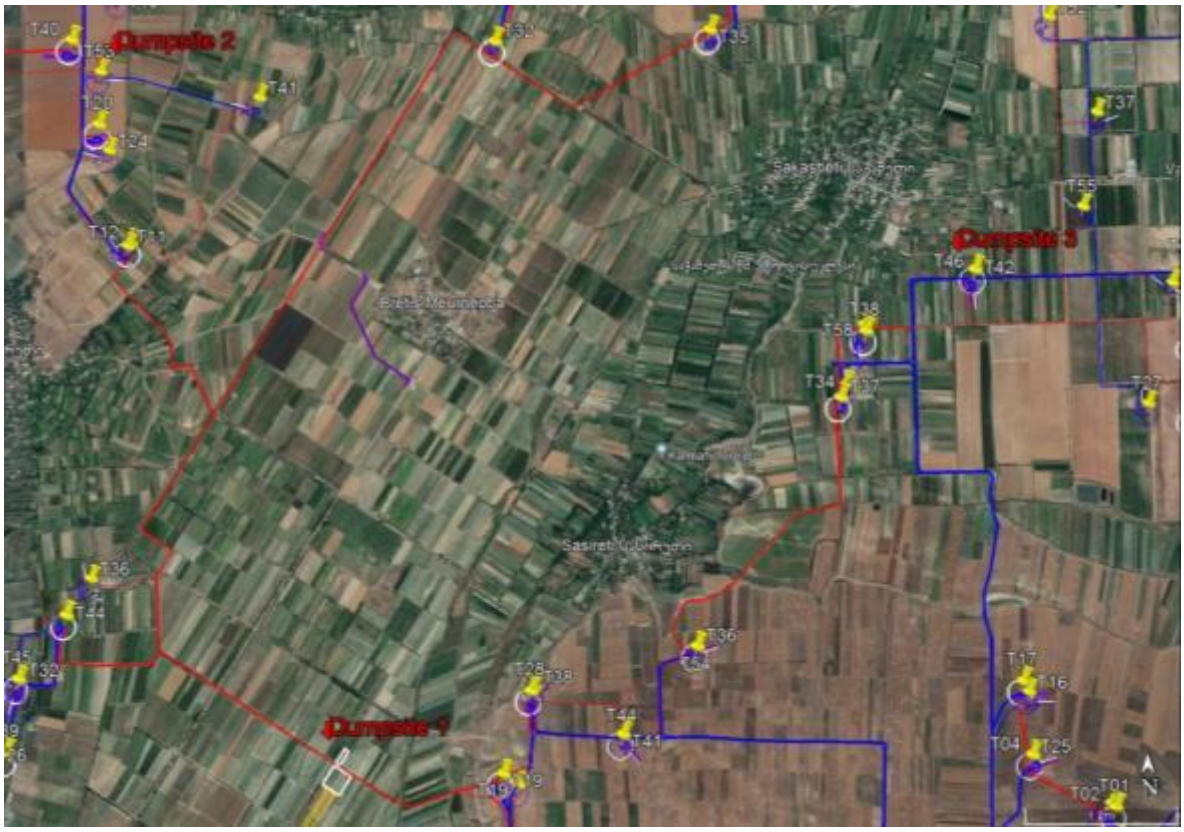

Figure 6-12 Location of temporary dumpsites

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 **Error! Reference source not found.**.

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.

6.5.2 Safety Measures and Prevention of Possible Emergency Situation during Waste Management Operations

Emergency response works can be carried out only by properly trained and briefed persons.

- Persons not involved in emergency response works must leave the danger zone.
- Spilled hazardous substances must be neutralized and removed immediately with use of sawdust or dry sand. Floors must be wiped with cloths and washed with water with use of detergents or 10% soda solution. During the cleaning works the personal protection equipment (respirators, gloves, etc.) must be used.
- Floors of premises should be kept in order. Floor covers must be chemical resistant to avoid

absorbtion of hazardous substances. Rooms, where during the working process the hazardous substances are used or stored, must have appropriate warning signs.

- Areas used for oil storage areas shall have vessels for storing of lime and sand (for neutralization and collection of spilled liquids);
- In order to avoid explosion danger welding works are forbidden near the areas for storage of used oil.
- Foam shall be used during response on emergency situations related with inflammation of wastes. Fire-fighting equipment shall be installed close to areas where flammable wastes are disposed.
- In case of spills of electrolyte from batteries spill area shall be treated with use of sawdust, neutralized with use lime solution and then washed with water. Prior to discharge of electrolyte into sewage it must be neutralized with use of roasted lime solution.
- Areas where works related with lubricants are carried out must be equipped with tanks/vessels for collection of used oil and filters. Risks of polluting the soil and surface waters must be excluded.
- Spilled paints/varnishes or solvents must be removed immediately with use of sand or sawdust.

6.5.3 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.

6.6 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.