

EIA for the Wind Power Plant Park “Limbaži”

**Environmental Impact Assessment for the implementation of the
WPP park “Limbaži” and associated infrastructure project in Limbaži
municipality**

Ltd Enviroprojekts

28.11.2024

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ATTACHMENTS

1. annex

EIA Programme No 5-03/7/2023 as amended.

2. annex

- Letter from the Nature Conservation Agency 17.04.2024. No 4.9/2372/2024-N
- Letter from the Nature Conservation Agency 26.03.2024. No 1.6.1/1811/2024-N
- Letter from the Nature Conservation Agency 23.10.2023. No 4.9/6588/2023-N
- Letter from the Nature Conservation Agency 06.09.2023. No 4.9/5504/2023/N
- Letter from the Nature Conservation Agency 23.08.2024. No 4.9/5192/2024-N
- Order of the Nature Conservation Agency 27.12.2023. No 1.1/249/2023
- Letter from Limbaži Municipality 13.06.2024. No 8.2/24/736
- Letter from Limbaži Municipality 01.07.2024. No 8.2/24/789
- Letter from Limbaži Municipality 29.04.2024. No 8.2/24/581
- Letter from Limbaži Municipality 17.11.2023. No 8.2/23/1443
- Letter from Vidzeme Livic Centre 25.04.2024. No MA24-V11
- Letter from AST 15.01.2024. No 2.5/2024/188
- Letter from the Latvian Centre for Environment, Geology and Meteorology 30.09.2024. No 4-6/1433
- Letter No DT-6.4.1/203-2024 from SJSC Latvijas dzelzceļš 13.03.2024
- Letter from SJSC "Latvijas gaisa satiksme" 29.02.2024. No VI-AD/JPN-03/2024/118
- Letter 02.02.2024 from the State Agency "Civil Aviation Agency" No 01-8/198
- Letter from SJSC "Latvijas valsts ceļi" 23.02.2024 No.4.8/3379
- Letter from SJSC "Latvijas valsts ceļi" 03.10.2024 Nr.4.8/18231
- Letter from SJSC "Latvian State Radio and Television Centre" 13.03.2024. Nr.40TD.05-02/01/22/BA-16694
- Letter from SJSC "Elektroniskie sakari" 05.08.2024. No 2.1-2/586
- Letter 09.07.2024 from the State Forest Service. No VMD1-10/1184
- Letter from the State Environmental Service 05.09.2023. No.2.3/AP/9752/2023
- Letter from the Health Inspectorate 06.09.2023. No 2.4.1.-2./7112

- Correspondence with the Estonian Environment Agency regarding C-band radars in the Republic of Estonia
- Letter from the National Heritage Board 06.09.2023. No 06-05/6867

3. annex

Overview of the initial public consultation

4. annex

Overview of how the proposals submitted during the initial public consultation have been considered

5. annex

CO₂ and GHG emissions

6. annex

Nature expert opinions

6.1. Expert opinion on species and habitats

6.2. Opinion of an ornithologist

6.3. Mammal expert opinion

7. annex

Noise assessment

8. Attached

Assessment of the flicker effect

9. Attached

Landscape assessment

10. Attached

Assessment by a hydrologist/hydrogeologist

11. annex

Calculation of costs and benefits

12. annex

Mitigation measures

13. annex

SKDS survey

14. Attached

Summary of the EIA Report

15. Attached

Cartographic material (*.shp or *.gdb format):

- planned infrastructure facilities, access roads,
- deforested areas
- natural values: biotopes, habitats of rare species, nests of large birds and risk zones around them, beech trees, micro-reserves, Natura 2000 sites, planned Special Protection Areas, protected areas

of JSC "Latvia's State Forest", protection zones and other natural values identified during the preparation of the EIA report.

INTRODUCTION

The Environmental Impact Assessment (hereinafter - EIA) has been prepared for the proposed activity: implementation of the wind power plant (hereinafter - WPP) park Limbaži and its related infrastructure project in Salacgrīva and Vilķenes parishes of Limbaži municipality.

The Environmental Impact Assessment assesses a total of 37 WPP sites. The EIA report provides an explanation of the analysis of all the WPP locations that determine the feasibility of this WPP park.

Each potential WPP could have a maximum rated capacity of 8 MW. The proponent of the proposed activity is Ltd Latvijas vēja parki (hereinafter - LVP), registration No 40203415150, registered office: Pulkveža Brieža iela 12, Rīga, LV-1010. Pursuant to the decision of the Cabinet of Ministers, LSC Latvenargo has become the owner of 100 % of LVP shares. LVP is a national company whose goal is energy independence, long-term renewable energy and value growth for the benefit of all Latvian citizens and businesses.

Decision No 5-03/7/2023 of the State Environmental Monitoring Bureau (hereinafter - SEB) on the application of the EIA procedure to the proposed activity of Ltd Latvijas vēja parki - implementation of the WPP park Limbaži and its related infrastructure project in Salacgrīva and Vilķene parishes of Limbaži municipality was adopted on 15 August 2023. EIA Programme No 5-03/7/2023 was issued on 12 September 2023 (as amended on 10 January 2024 by No 5-02-1/3/2024 and No 5-02-1/61/2024. 2024. of. 20. november) (Annex 1). The initial public consultation on the proposed action took place from 10 to 30 November 2023.

During the EIA preparation process, the following consultative working group meetings on the Limbaži Wind Park were held in Salacgrīva in February 2024: "Landscape", "Socio-economic aspects. Climate", "Biodiversity" and "Physical impacts".

The implementation of the Limbaži WPP Park and its related infrastructure project in the Salacgrīva and Vilķene municipalities of Limbaži County (hereinafter - the Proposed Action) includes and the EIA also assesses the infrastructure related to the functioning of the WPP Park: construction and operation of transmission cable lines, transformer substations, a generated electricity storage solution (BESS), turbine assembly and maintenance yards, and access roads.

The EIA report has been prepared by Ltd Enviroprojekts, involving experts from various fields. A list of the experts involved in the preparation is provided in the chapter "Authors of the Environmental Impact Assessment". The report provides detailed information on the proposed activity itself, the existing state of the environment, the impact on natural values in the area of the proposed activity and its surroundings, as well as alternatives to the proposed activity and their assessment. In accordance with the terms of the programme issued by the NWFD, the report also provides information on monitoring requirements, assessment methods, etc.

The Environmental Impact Assessment Report, including all its annexes, has been prepared in accordance with the terms of Contract No 610000/23-16. Therefore, all the conclusions and findings of the Environmental Impact Assessment correspond to the situation (actual, physical, climatic, etc.) at the time of its preparation and to the information provided by the client of the work, Ltd Latvijas vēja parki. However, environmental parameters and observations of natural values may change over time, so it is not acceptable to use data without updating if the reference data used in the environmental impact assessment are time-barred. Similarly, no interpretation or optimisation of the results of the environmental impact assessment that is not in line with the terms of reference of Contract No 610000/23-16 is allowed.

1. REASONED JUSTIFICATION FOR THE CHOICE OF THE PROPOSED ACTIVITY AND THE PLACE OF OPERATION

Up to 20 WPPs are planned to be installed in the area of the proposed operation, with a maximum rated capacity of 8 MW per WPP.

In the initial feasibility phase of the project, 45 potential WPP sites were investigated, but in consultation with certified experts and the Nature Conservation Agency (NCA), the number of WPPs was reduced to 37 WPPs, which were investigated in more detail in the EIA procedure, and those whose environmental impacts would cause significant adverse changes were eliminated. The study area of the proposed activity is the territory of JSC Latvia's State Forests lands (hereinafter - LVM)¹, and its total area is 1894 ha. The LVM wind farm study areas and the locations of the evaluated WPPs in Limbaži municipality are shown in Figure 1.1.

The proposed action also includes, and the EIA also assesses the infrastructure related to the functioning of the WPP park: construction and operation of transmission lines, transformer substations, BESS, assembly and maintenance yards and access roads.

The WPP park is planned to be built in Limbaži municipality, about 5-13 km south-east of Salacgrīva. Other nearby settlements (villages) are Korģene, Svētdciems and Vecsalaca. There are also a number of farmsteads in the immediate vicinity of the proposed wind farm, see Figure 3.2.2 (Chapter 3).

LVM, as the manager of Latvia's strategic asset - land - is actively involved in achieving the goals set out in the Latvian National Energy and Climate Plan 2021-2030 to strengthen energy independence and economic development. In addition to the requirements for protected forest areas, LVM has identified land units under its management where it is justified to carry out wind farm surveys.²

LVM has determined that no wind farms will be built on LVM land³:

- in and within 800 m of towns and villages, and within 800 m of residential and public buildings;
- in nature conservation areas where the construction of wind farms is incompatible with the laws and regulations of the Republic of Latvia;
- in areas where the purpose of forest land management is nature conservation and LVM has additionally established protection for preserved environmental values, as well as in forest areas important for recreation of the population, etc;
- where cultural monuments are located.

The location of the WPP study area and the 37 WPP assessed in detail in Limbaži municipality are presented below (Figure 1.1).

¹ <https://www.lvmgeo.lv/dati>

² Ibid,

³ <https://www.lvm.lv/biznesa-partneriem/zemes-pirksana-un-noma/veja-parki>

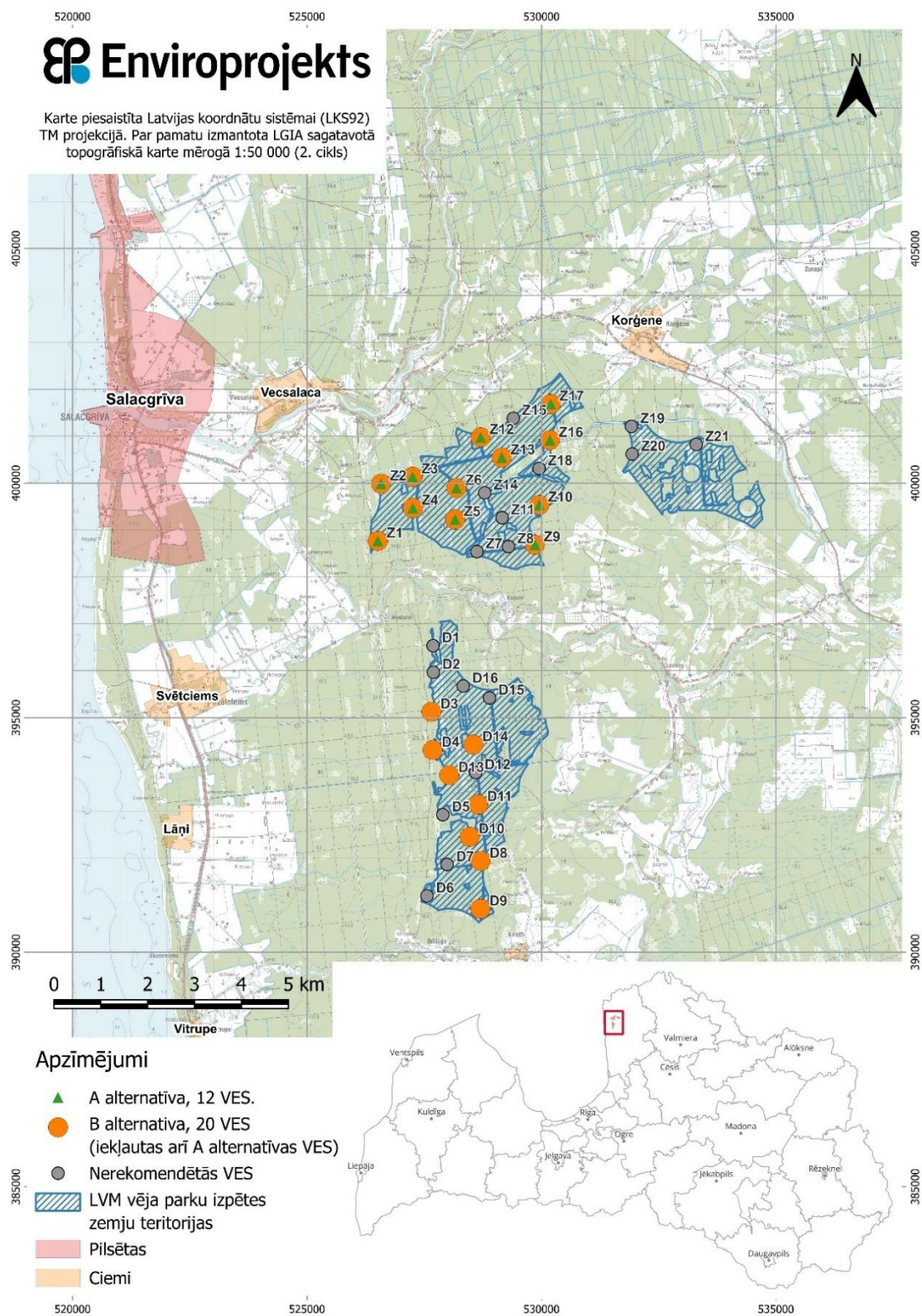


Figure 1.1. Location of the WPP Limbaži study area and the 37 WPPs evaluated in Limbaži municipality

Based on the data of the State Land Service information system kadastrs.lv, the type of use of the land units included in the territory of the Proposed Action is forest. Given that the construction of the WPP Park

is planned in a forest area, in accordance with Article 4 of the Law on Procedures for the Construction of Facilitated Energy Supply Structures to Promote Energy Security and Independence (hereinafter - the Law on Energy Security), the construction of the WPP Park infrastructure will be subject to deforestation and land transformation to the extent necessary in accordance with Article 9(1) of the same Law. Information on the area and volume of land to be transformed (deforestation) is provided in Chapter 7.1. Under the current regulations, such activities are not allowed on agricultural land. According to the Energy Security Act, if wind power plants are built on forest land, the negative effects of deforestation shall be compensated by afforestation in accordance with the opinion of the NRW on the EIA report. The costs of the compensatory measures shall be borne by the Proponent of the Proposed Action.

In terms of environmental impacts, the proposed activity is planned on 28 land parcels, summarised in Table 1.1.

Table 1.1. Land units included in the recommended area of the Limbaži WPP Park

No.	Name of the real estate	Administrative territory of the land unit	Cadastral number	Cadastral designation of the land unit
1	Silupītes	Salacgrīva parish, Limbaži	66720040090	66720040090
2	Arkādijas	Salacgrīva parish, Limbaži	66720040017	66720040015
3	Aušas	Salacgrīva parish, Limbaži	66720040174	66720040175
4	Arkādijas	Salacgrīva parish, Limbaži	66720040017	66720040019
5	Upeslīči 1	Salacgrīva parish, Limbaži	66720040078	66720040079
6	Viļi	Salacgrīva parish, Limbaži	66720100070	66720040247
7	Jaunbirzuļi	Salacgrīva parish, Limbaži	66720040244	66720040244
8	Leinieki	Salacgrīva parish, Limbaži	66720040192	66720040193
9	Toskana	Salacgrīva parish, Limbaži	66720040011	66720040013
10	Tuiskas-II	Salacgrīva parish, Limbaži	66720040045	66720040045
11	Senlejas	Salacgrīva parish, Limbaži	66720040449	66720040450
12	Stienuži 1	Salacgrīva parish, Limbaži	66720040272	66720040272
13	Fotmeži-Noriņas	Salacgrīva parish, Limbaži	66720040288	66720040288
14	Jaunkrusteici	Salacgrīva parish, Limbaži	66720040191	66720040191
15	Ziedugravas	Salacgrīva parish, Limbaži	66720040250	66720040250
16	Vecmelderi	Salacgrīva parish, Limbaži	66720040099	66720040100
17	Jaunjeceni	Salacgrīva parish, Limbaži	66720040109	66720040110
18	Salacgrīvas valsts mežs Nr.6672	Salacgrīva parish, Limbaži	66720010129	66720040295
19	Smilgas-Toskana	Salacgrīva parish, Limbaži	66720040283	66720040283
20	Kirbižu mežs,	Vilķenes pag. Limbaži	66880010040	66880010034
21	Jaunvējiņi	Salacgrīva parish, Limbaži	66720080006	66720080006
22	Salacgrīvas valsts mežs Nr.6672	Salacgrīva parish, Limbaži	66720010129	66720080070
23	Lielkuikuļi	Salacgrīva parish, Limbaži	66720080033	66720080034
24	Varkalni	Salacgrīva parish, Limbaži	66720080005	66720080005
25	Salacgrīvas valsts mežs Nr.6672	Salacgrīva parish, Limbaži	66720010129	66720080112
26	V143	Salacgrīva parish, Limbaži	66720040292	66720080068
27	Salacgrīvas valsts mežs Nr.6672	Salacgrīva parish, Limbaži	66720010129	66720080069

No.	Name of the real estate	Administrative territory of the land unit	Cadastral number	Cadastral designation of the land unit
28	Salacgrīvas valsts mežs Nr.6672	Salacgrīva parish, Limbaži	66720010129	66720050195

This project has the significant advantage of locating the WPPs in predominantly forested areas, thus minimising flicker, noise and landscape change impacts for farmsteads and residents.⁴ However, there are 42 farmsteads in the study area of the proposed wind farm⁵ (Figure 3.4, Chapter 3). According to the Cabinet of Ministers Regulation No.240 of 30.04.2013 "General Regulations on Spatial Planning, Use and Construction", for wind power plants with a capacity greater than 2 MW, the distance from the nearest planned wind power plant and wind park boundary to residential and public buildings must not be less than 800 m. This EIA has established that the closest to the boundary of the WPP park (from the closest located/smallest WPP) is the homestead "Tamišāri": 824 m.

Based on the data of the Nature Data Management System (hereinafter - NDMS) "Ozols", there are no Specially Protected Nature Areas (hereinafter - SPAs) and micro-reserves included in the Natura 2000 network in the study areas of the LVM wind park Limbaži⁶. For more detailed information on protected nature areas and natural monuments, as well as biodiversity in the study area, see Chapters 6.4 and 6.5 below. The nearest Natura 2000 site is the nature reserve "Vitrupe ieleja" 0.8 km from the boundary of the land units and the distance to the nearest WPP is 0.9 km. The Nature Park "Salaca ieleja" is located 1.6 km from the boundary of the land units, the distance to the nearest WPP - 1.8 km. The proposed activity is located in the NWBR (Neutral Zone) area (part of the study area is also located in the Landscape Protection Zone, but no WPPs or infrastructure are proposed).

The territory of the proposed action is located in the Gauja river basin district. Major watercourses: Korge, Vedamurga, Ķulaurga and Ūgenurga. For more information on the hydrological conditions of the study area, see Chapter 6.2.

The mineral resources required for construction are available in the vicinity of the proposed activity (see Section 6.12.2 below).

There are no contaminated or potentially contaminated sites in the site and vicinity of the proposed activity (Chapter 3.2).

There are no protected cultural monuments in the area of the proposed development (Chapter 6.5.2).

There are no objects included in the Cabinet of Ministers Regulation No 46 of 21.01.2021 "List of objects of increased danger" at the site and in the vicinity of the proposed activity.

The site of the proposed activity has a well-developed infrastructure: the P12 regional motorway, V143, V142 and V138 local motorways, the existing LVM road network and, in the wider vicinity, the main national A1 motorway.

A high voltage 110 kV transmission line runs along the area of the Proposed Action, which economically justifies the construction of the WPP in close proximity to the electricity connection, reducing the area to be deforested and shortening the new connection line.

⁴ https://www.zalabriviba.lv/wp-content/uploads/veja_izmantosanas_analize_skersli_iespejas-1.pdf

⁵ <https://www.kadastrs.lv/>

⁶ Natura 2000 sites in Latvia | Nature Conservation Agency

The existing 110 kV power line of JSC Augstsprieguma tīkls (Latvian electricity transmission system operator, hereinafter - AST) and the location of possible 110 kV substations are shown in Figure 1.2.

In the vicinity of the Limbaži WPP park there are and in the future, there are plans to develop companies that are large consumers of electricity, such as Aldar Latvia Ltd, Aloja-Starkelsen, a producer of starch and starch products, BS-Holzs, a wood processing company, and Limbažu WOOD, etc.

In 2022 the Energy Security Law was adopted, with the aim of promoting renewable energy production, energy security and independence of the Republic of Latvia, as well as mitigating climate and environmental change. In order to fulfil the objectives set out in the Law, as well as in the context of the European Green Deal and other factors and aspects affecting energy supply, on 28 November 2023 the Cabinet of Ministers approved Order No 831 "On Approval of the Lump Sum Amount in Connection with the Right to Conclude a Development Right Agreement for the Siting of Strategically Important Wind Parks on State Forest Land", which allows the Ministry of Agriculture to grant exploration and development rights to Ltd Latvijas vēja parki for strategically important wind parks on state forest land. The development right agreement with Ltd Latvijas vēja parki has been signed by the state forest land manager LVM. The contract is for 30 years, with the right to extend it if permitted by law.

The rationale for the location of the proposed Limbaži WPP Park was determined, inter alia, by the following factors:

- the possibility to transfer the generated electricity to the AST transmission infrastructure (the high voltage power lines in the vicinity of the study area are shown in Figure 1.2);
- restrictions, requirements and minimum distances set out in legislation and sectoral guidelines:
 - For WPPs with a capacity greater than 2 MW, the distance from the nearest planned wind power plant and wind park boundary to residential and public buildings is at least 800 m (in accordance with the Cabinet of Ministers Regulation No.240 of 30 April 2013 "General Regulations on Planning, Use and Construction of Territory", p. 163.2, see Figure 3.2.2);
 - The construction of wind turbines is allowed outside towns and villages in the industrial area, technical area, agricultural area, forest land as defined in the local municipality's spatial plan, provided that the distance from residential and public buildings to the nearest boundary of the planned wind turbine and wind park is at least 800 metres (according to the Energy Security Law (2022)) 4. article 3.2.2), see Figure 3.2.2;
 - The siting of WPP is prohibited in Special Protection Areas: Natura 2000 territories (in accordance with Cabinet of Ministers Regulation No.264 of 16.03.2010 "General Regulations on the Protection and Use of Specially Protected Nature Areas") and microreserves (in accordance with Cabinet of Ministers Regulation No.940 of 18.12.2012 "Regulations on the Establishment and Management of Microreserves, their Protection, as well as the Establishment of Microreserves and their Buffer Zones", p. 37);
 - in order to protect bird species or nature values from the impact of wind power plants and wind farms, the conditions and minimum permissible distance for the location of wind power plants shall be determined in accordance with the environmental impact assessment (in accordance with Cabinet of Ministers Regulation No.240 "General Regulations on Planning, Use and Construction of Territory", 30.04.2013, p. 163.3);
 - in the zone of visual perception of state-protected cultural monuments, the impact of WPPs and wind farms on the landscape should be assessed, taking into account the specific situation and the specifics of the cultural monument (in accordance with Cabinet of Ministers Regulation No.240 of 30.04.2013 "General Regulations on Planning, Use and

Construction of the Territory", p. 163.4) (see Figure 6.5.5 for a map of the cultural heritage sites in the area adjacent to the Proposed Action);

- WPP are not allowed in the protection zones around land-based navigational aids for national defence and military maritime surveillance aids. The maximum width of the protection zone around navigational aids for national defence purposes on land is 15 kilometres from the centre of the object (according to the Protection Zones Act (1997) 50.article 4(3));
 - if the wind farm's WPP will be located up to 16 km from the navigation aid, or the beacon's outermost zone of influence, an in-depth analysis and assessment of the WPP's impact on the beacon's operation is required (in accordance with the European Organisation for Safety in Air Navigation's Guidelines for Assessing the Potential Impact of Wind Turbines on Surveillance Sensors (EUROCONTROL-GUID-0130; Ed.No.1.2; Ed.Date 09/09/2014));
 - in addition, restrictions in the operational, sanitary and safety protection zones along linear and associated objects: gas pipelines, gas supply installations and structures, gas warehouses and storage facilities, electronic communications networks and radio monitoring points, electricity networks, heat networks, optical telescopes and radio telescopes, national and public use railway lines; other public use roads, etc., must be considered.
- an assessment of the climatic conditions and wind parameters in the area to assess the efficiency of the WPP.

The envisaged activity directly follows from the overall strategic objectives of JSC Latvenergo and the Cabinet of Ministers' Order No 464 of 27 June 2022, establishing Ltd Latvijas vēja parki to implement strategically important wind park projects. The choice of the Limbaži WPP site is based on the possibility of concluding a development agreement, the proximity of the power transmission line and other factors listed above.

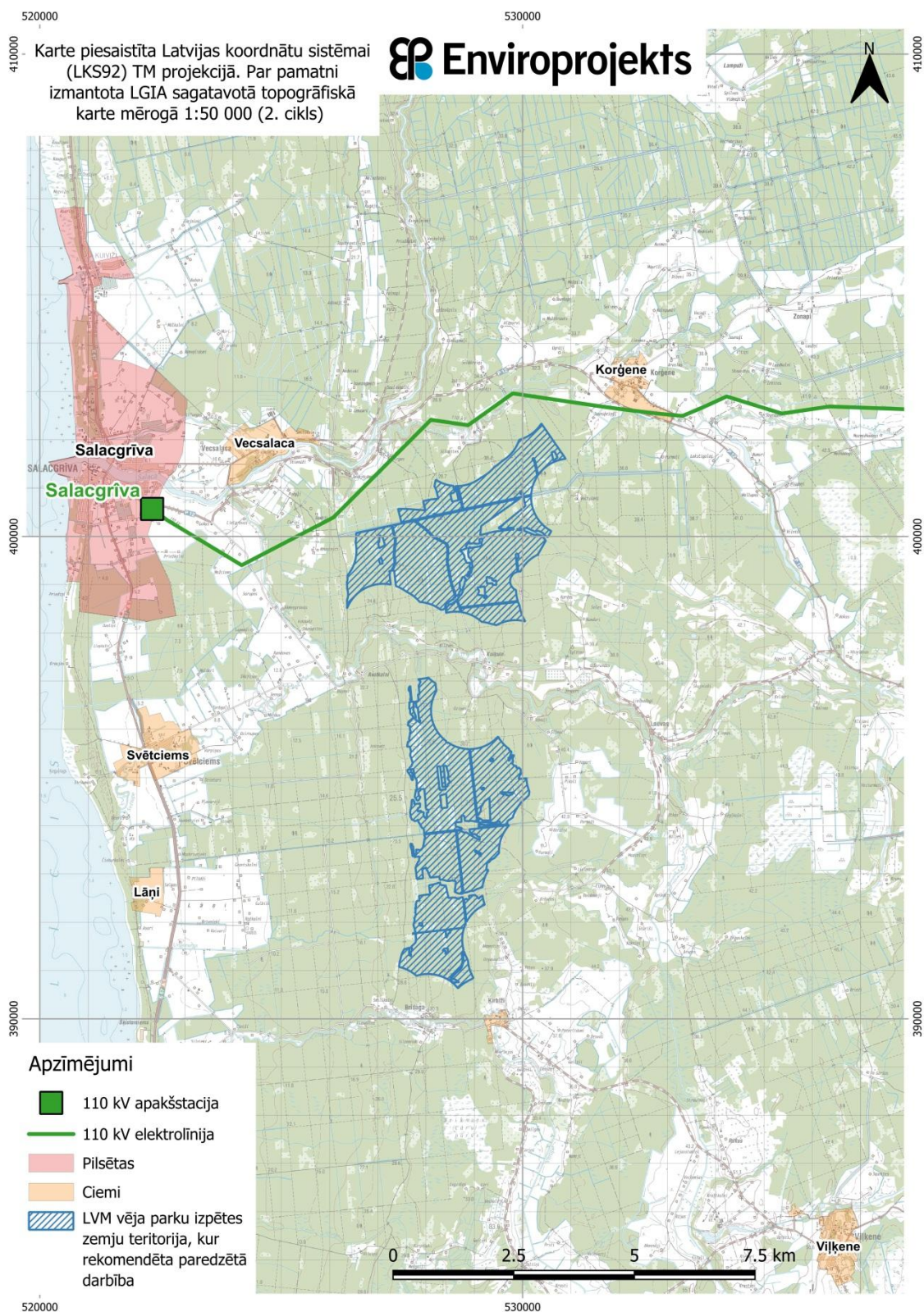


Figure 1.2. AST power line and substation in relation to the Limbaži wind park study land area in Limbaži municipality

2. ASSESSMENT OF THE COMPLIANCE OF THE PROPOSED ACTIVITY WITH ENVIRONMENTAL, NATURE PROTECTION AND OTHER REGULATORY ENACTMENTS CONTAINING REQUIREMENTS FOR THE PROPOSED ACTIVITY

Areas of legislation assessed: protection zones, drainage systems, waste management, air protection, noise, SACs, species and habitats protection, spatial planning, energy, environmental risks, aviation safety, etc. Table 2.1 below summarises the assessment of the compatibility of the proposed activity with the environmental, nature protection and other regulatory enactments that contain requirements for the proposed activity.

Table 2.1. *Overview of regulatory requirements and how they have been taken into account in the EIA report*

No.	Statutory instrument and its requirements	How it has been taken into account in the EIA report
1.	European Landscape Convention (Florence, 20 October 2000).	Taken into account in the assessment of landscape impacts (Chapter 6.5).
2.	Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC and repealing Council Directive (EU) 2015/652 with regard to the promotion of the use of energy from renewable sources.	Directive 2023/2413 sets the EU the target of becoming climate neutral by 2050 at the latest, with an interim target of reducing net GHG emissions by at least 55% below 1990 levels by 2030 (Chapter 7).
3.	Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery and amending Directive 95/16/EC (recast) (Text with EEA relevance).	This Directive requires that the conformity assessment process under the EU Directives requires the manufacturer to carry out a risk analysis and assessment of its product and its intended use, covering design, manufacture, production and use as well as operation (Chapter 5.3).
4.	Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.	The water quality of the water bodies under GUBA is assessed in relation to the requirements of the EU Water Framework Directive (Chapter 6).
5.	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.	The Directive has been taken into account in the SEA assessment. Species of Annex II of the Habitats Directive (BD II) have been recorded and mapped in the site (Section 4.1).
6.	Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869 (Text with EEA relevance).	Taken into account in the NATURA 2000 Nature Conservation Impact Assessment (Chapter 7.9).
7.	Council Directive of 2 April 1979 on the conservation of wild birds.	Identify the bird species and groups of bird species to be assessed for the effects of the Proposed Action (Chapters 6 and 7).

No.	Statutory instrument and its requirements	How it has been taken into account in the EIA report
8.	Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast) Text with EEA relevance.	The Directive has been taken into account with regard to the protection of citizens (chapter 5.3).
9.	Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the management of major-accident hazards involving dangerous substances and amending and subsequently repealing Council Directive 96/82/EC Text with EEA relevance.	Taken into account in the preparation of the Environmental Impact Assessment (Chapter 5).
10.	Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) (Text with EEA relevance).	Taken into account in the preparation of the Environmental Impact Assessment (Chapter 7).
11.	European Commission Regulation No 601/2012 of 21 June 2012 concerning monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council.	Taken into account in the climate change impact assessment (chapters 5.4 and 12).
12.	Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing a framework for climate neutrality and amending Regulations (EC) 401/2009 and (EU) 2018/1999 ("the European Climate Act").	Specifies that Member States should support the accelerated development of renewable energy projects, in cooperation with local and regional authorities, by identifying and designating land, surface, underground and marine or inland water areas required for the installation of renewable energy plants for the production of energy from renewable sources and related infrastructure to meet the 2030 renewable energy target. this will also support the achievement of the 2030 renewable energy target and support the achievement of the 2050 climate neutrality target under Regulation (EU) 2021/1119 (Chapter 7).
13.	Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions - A European Green Deal.	Taken into account in the preparation of the Environmental Impact Assessment (Chapter 6.10).
14.	EC report on the Council conclusions of 12.07.1999. (1999/519/EC) Recommendation on the limitation of exposure to electromagnetic fields (0 Hz to 300 GHz).	Taken into account for the protection of the population (chapter 5.3).

No.	Statutory instrument and its requirements	How it has been taken into account in the EIA report
15.	Waste Management Law , 18.11.2010, amended 11.04.2023.	Taken into account in the assessment of waste management during construction. There is a low risk of contamination of soil and groundwater during construction. During construction and operation, the requirements for the organisation of works and the technical condition of the equipment (Chapter 5.1) will be complied with.
16.	Law on Specially Protected Nature Areas , in force since 07.04.1993, with amendments in force since 13.04.2022. The aim of the Law is to establish the basic principles of the system of specially protected nature territories, the procedure for establishing and ensuring the existence of specially protected nature territories, the procedure for managing specially protected nature territories, monitoring and accounting for their status, as well as to combine national, international, regional and private interests in the establishment, conservation, maintenance and protection of specially protected nature territories. The annex to the law contains Latvia's Natura 2000 list of protected areas of European importance.	The statutory list has been taken into account in the characterisation of the natural values of the area surrounding the Proposed Development (Chapters 3.1, 6.4, 7.6 and 7.9). Three Natura 2000 sites are located in the vicinity of the proposed development: <ul style="list-style-type: none">– Vitrupe valley 1.8 km from the area of the Proposed Action;– Salaca Valley 2.1 km;– Niedrāju-Pilka swamp 2.7 km.
17.	Energy Law , in force since 06.10.1998, Article 24: the energy supply company shall compensate the owner of the immovable property for losses directly related to the installation of new facilities of the energy supply company or to the operation and repair of existing facilities. The energy supply undertaking shall compensate the owner of the immovable property for the restriction of the right to use the land if: <ul style="list-style-type: none">1) the property is used for a new energy supply business;2) the redevelopment of the facility increases the area of land occupied by the energy supplier's facility or the buffer zone along or around the facility. 19. article 5 stipulates that the energy supply undertaking is obliged to coordinate with the land owner the conditions for the installation of new energy supply facilities, as well as the right to replace the coordination procedure with informing the land owner if the land is used for the installation of new energy supply undertaking facilities - equipment, devices, installations,	The EIA report takes into account and assesses changes to the buffer zones (Chapters 3 and 4). The procedure for the installation and approval of energy supply facilities will be followed.

No.	Statutory instrument and its requirements	How it has been taken into account in the EIA report
	<p>networks, lines and their accessories, if at least one of the conditions mentioned in the Article has occurred, including the installation of the energy supply undertaking facility is provided for in the spatial planning or detailed planning of the local municipality.</p> <p>Article 191 of the Energy Law stipulates that for the installation, reconstruction, renovation and operation of facilities of energy supply utilities (except buildings), restrictions on the right of use of immovable property shall be established, and the scope and procedure for the use of restrictions on the right of use of immovable property owners shall be determined in this Law and in the Law on Protection Zones.</p> <p>These restrictions shall apply to new facilities of energy supply undertakings from the date of their installation in accordance with the procedure laid down in Article 19 of this Law. If the landowner does not consent to the establishment of a new energy utility facility, the restrictions shall be determined by a court judgment in accordance with the procedure laid down in the regulatory enactments.</p>	
18.	<p>Law on the Procedure for the Construction of Facilitated Energy Supply Structures to Promote Energy Security and Independence, in force from 05.10.2022.</p> <p>7.articles. Environmental impact assessment and timelines for wind farm construction.</p> <p>(1) The environmental impact assessment of the construction of wind power plants shall be carried out in accordance with the Law "On Environmental Impact Assessment", unless otherwise provided for in this Law.</p> <p>(4) The State Environmental Bureau shall issue an environmental impact assessment programme within 15 days from the date of receipt of the decision referred to in the third paragraph of this Article or the decision of the State Environmental Service on the application of the environmental impact assessment procedure for the construction of wind power plants.</p>	<p>Taken into account in the context of the initial consultation foreseen in the assessment. Programme No.5-03/7/2023 for the Environmental Impact Assessment for the implementation of the Limbaži Wind Farm and related infrastructure project in the municipalities of Salacgrīva and Vilķene in Limbaži County was received on 12 September 2023, but the Law requires that the initial consultation be carried out despite the premature issue of the programme. Consequently, upon receipt of Programme No. 5-03/7/2023, the Proponent of the Proposed Action, in accordance with Article 15 of the Environmental Impact Assessment Law, was required to provide an initial consultation on the impacts of the Proposed Action, which took place from 10-30 November (Chapters 3, 4 and 8).</p>
19.	<p>Construction Law, in force from 01.10.2014.</p>	<p>Taken into account in determining the construction arrangements (Chapter 4).</p>
20.	<p>Water Management Act, in force from 15.10.2002.</p>	<p>Taken into account in determining the ownership of the area of the Proposed</p>

No.	Statutory instrument and its requirements	How it has been taken into account in the EIA report
		Action. According to this law, the territory of the Proposed Action falls within the Gauja river basin district (Chapter 6).
21.	Environmental Impact Assessment Act , in force since 13.11.1998.	Taken into account in the EIA procedure (throughout the document - all chapters).
22.	Protection Zones Act , the restrictions set out in the protection zones, the requirements of Articles 35 and 45, and others.	Taken into account for any works/activities in the buffer zones that require protection of the sites. These works will be carried out in agreement with the owner of the site (3. 6. and Chapter 7).
23.	Species and Habitats Conservation Act , in force since 19.04.2000.	Taken into account for the assessment of measures needed to protect protected plant, fungi, lichen and animal species, their habitats and habitats (Chapters 6.4, 7.6 and 7.9).
24.	Law on Land Reclamation , in force from 25.01.2010.	Taken into account in the assessment of drainage systems in the study area (Chapters 4, 6 and 8).
25.	Amendments to the Electricity Market Law , in force from 05.01.2024.	Taken into account in the Environmental Impact Assessment (Chapter 14).
26.	Law "On the Protection of Cultural Monuments" , in force from 10.03.1992.	Taken into account in the Environmental Impact Assessment (Chapter 7).
27.	Cabinet of Ministers 19.08. 2014. regulation No.500 "General Building Regulations", Annex 1.	Taken into account in determining the category of the substation structure and the measures required for its construction. For the purposes of these Regulations, a substation (high voltage) is a Category 3 structure and its design requires expert examination, which may take up to 6 months in addition to the design work (Chapter 4).
28.	Cabinet of Ministers Regulations No 982 of 05.12.2006 "Methodology for Determination of Protective Zones of Energy Infrastructure Objects": 8.paragraph 4.1 states that if, while carrying out earthworks, legal or natural persons discover a cable that is not specified in the technical documentation for the works, they shall stop the earthworks and ensure that the cable is preserved, and shall immediately notify the owner or operator of the electricity network and the local municipality.	Taken into account in the design of construction works and the corresponding buffer zones (Chapter 3.1).
29.	Cabinet of Ministers Regulation No.635 of 07.11.2023 "Regulations on Electricity Trade and Use" establishes the procedure for electricity supply to electricity users, the rights and obligations of the electricity trader and the	Taken into account when planning the connection of electricity installations to the electricity system. The connection of the electricity installations to the electricity system will

No.	Statutory instrument and its requirements	How it has been taken into account in the EIA report
	electricity system operator and the user in the supply and use of electricity. According to Paragraph 3 of the above mentioned Regulation, connection of the user's electrical installations to the electricity system or increase of the permitted loads shall be carried out in accordance with the system connection rules for electricity system participants approved by the Public Utilities Regulatory Commission.	take place after the decision of the Council of the Public Utilities Regulatory Commission on the system connection rules for the electricity system participants (Chapters 4 and 14).
30.	Cabinet of Ministers Regulation No.253 of 09.05.2017 "Construction Regulations for Certain Engineering Structures".	The design and construction of the electricity supply will be carried out in accordance with these Regulations (Chapter 4).
31.	Cabinet of Ministers Regulation No.574 of 30.09.2014 "Regulations on Latvian Building Code LBN 008-14 "Location of Engineering Networks".	Determine the location of utilities planned in the area of the Proposed Operation. The location of utilities planned in the planning area complies with the provisions of the Regulations. Easy access to the existing and planned power supply facilities will be ensured for the personnel of AS "Sadale tīkls", their vehicles and other equipment. The proposed action will involve the use of certain sites: - for the construction of wind power plants, including sites for their installation - for the construction of access roads; - for the construction of step-up transformer substations; - for the construction of temporary storage areas for materials and equipment. The development will be located on land with the owners of which the applicant for the Proposed Action has entered into development right agreements (Chapter 4).
32.	Cabinet of Ministers Regulation No 303 of 19.03.2011 "Individual Rules for the Protection and Use of the North Vidzeme Biosphere Reserve". It is prohibited to install WPP in the North Vidzeme Biosphere Reserve, except in the areas specified in Annex 2 to this Regulation, subject to the following conditions: WPP shall be sited after written permission from the NCA; WPPs shall be located in groups of no more than 20 WPPs, minimising the distance between adjacent WPPs. The distance between the groups shall not be less than two kilometres.	Taken into account in the Environmental Impact Assessment (Chapters 3 and 6). The proposed activity is not located within the Northern Vidzeme Biosphere Reserve.

No.	Statutory instrument and its requirements	How it has been taken into account in the EIA report
33.	<p>Cabinet of Ministers Regulation No.240 of 30.04.2013 "General Regulations on Spatial Planning, Use and Construction"</p> <p>According to the requirements of the Regulations, WPPs with a capacity greater than 20 kW are allowed to be located in the industrial area (R), technical area (TA), agricultural area (L) and forest area (M) under the conditions of the environmental impact assessment.</p> <p>163. The following conditions shall apply to the siting of wind turbines and wind farms:</p> <p>163.1. for wind power plants with a capacity of between 20 kW and 2 MW, the distance between the nearest planned wind power plant and the boundary of the wind park and residential and public buildings shall be at least 500 m;</p> <p>163.2. for wind farms with a capacity greater than 2 MW, a distance of at least 800 m from the nearest boundary of the proposed wind farm and wind farm to residential and public buildings;</p> <p>163.3. in order to protect bird species or natural values from the impact of wind farms and wind farms, the conditions and minimum permissible distances for the siting of wind farms shall be determined in accordance with the environmental impact assessment;</p> <p>163.4. in the zone of visual perceptibility of state protected cultural monuments, the impact of wind power plants and wind farms on the landscape shall be assessed, taking into account the specific situation and the specificity of the cultural monument;</p> <p>163.5. the boundary of the wind park is defined from the outermost tower of the wind farm.</p> <p>(in the wording of Regulation No 630 of the Cabinet of Ministers of 13.10.2020)</p> <p>163.1 The conditions referred to in Paragraph 163 of this Regulation shall also be complied with in cases where new residential or public buildings are planned in the vicinity of existing wind power stations and wind farms.</p>	<p>Taken into account in the siting of the WPPs: the planned WPPs will be sited within the established minimum distances to buildings. According to the Limbaži municipality spatial plan, the construction area of the WPP park includes land units or their parts, the planned (permitted) use of which is basically defined as a forest area. Relatively small areas of the WPP construction area are covered by water. Where necessary, changes or additions to the spatial planning documents will be initiated (Chapters 1, 3, 5, 6 and 7).</p>
34.	<p>Cabinet of Ministers Regulation No 163 of 23.04.2002. "On noise emission from equipment for use outdoors", point 5.</p>	<p>Taken into account in the buffer zone. The boundary of the wind park is defined from the edge of the WPP, so the decision not to install individual WPPs may affect the potential buffer zone, resulting in a change in the potential total population in each area (Chapter 7).</p>

No.	Statutory instrument and its requirements	How it has been taken into account in the EIA report
35.	Cabinet of Ministers Regulation No.208 of 12.04.2016 "Regulations on Electromagnetic Compatibility of Equipment".	Taken into account when assessing the cooperation of communication equipment with WPPs. The Regulations require that electrical and electronic equipment must, on the one hand, not cause electromagnetic interference to other equipment and, on the other hand, be capable of functioning to the required quality for its intended purpose, even in the presence of electric and magnetic fields likely to be present in a normal environment. Therefore, modern communications equipment manufactured in accordance with EU and Latvian requirements should not be subject to interference from WPPs, even in close proximity (Chapter 6).
36.	Cabinet of Ministers Regulation No.16 of 07.01.2014 "Noise assessment and management procedure" specifies permissible noise levels for various equipment, noise assessment, calculation methods, etc.	The assessment of noise from the operation of the WPP shall be carried out using the calculation methods specified in Annex 5 to this Regulation. The equipment to be used during installation and operation shall comply with the requirements of this Regulation (Chapters 6, 7 and 10).
37.	Cabinet of Ministers Regulation No 432 of 17.09.2017 "Regulations on Latvian Building Code LBN 003-19 "Building Climatology"".	Suitable for determining climatological performance of buildings and their elements (Chapter 4).
38.	Cabinet of Ministers Regulation No.306 of 02.05.2012 "Regulations on the Methodology for Determining the Operating Protection Zone around Drainage Structures and Devices on Agricultural Land and Forest Land".	Suitable for the establishment of operational protection zones around drainage structures and installations on agricultural land and forest land (Chapters 6 and 7).
39.	Cabinet of Ministers Regulation No 1055 of 19.09.2009 "Regulations on the List of Species of Fauna and Flora of European Community Importance in Need of Protection and the List of Individuals of Fauna and Flora of European Community Importance whose Harvest in the Wild may be Subject to Conditions of Restricted Use" establishes the list of species of fauna and flora of European Community importance in need of protection (Annex 1) and the list of individuals of fauna and flora of European Community importance whose harvest in the wild may be subject to conditions of restricted use (Annex 2).	The list referred to in the Regulations has been taken into account in the characterisation of the natural values of the area surrounding the Proposed Development (Chapters 4, 6 and 7).
40.	Cabinet of Ministers Regulation No.925 of 30.09.2010 "Content of the expert opinion in the	The species and habitat expert opinions annexed to the report have been prepared

No.	Statutory instrument and its requirements	How it has been taken into account in the EIA report
	field of species and habitat conservation and minimum requirements contained therein".	in accordance with the Regulations (Chapters 6 to 9).
41.	Cabinet of Ministers Regulation No 511 of 07.07.2008 "Procedure for assessing damage to natural monuments and calculating the costs of remediation measures".	The Regulations provide for damage assessment and remediation measures for natural monuments designated by the Cabinet of Ministers as well as the municipality (Chapters 6 and 7).
42.	Cabinet of Ministers Regulation No 213 of 31.03.2007 "Regulations on Criteria for Assessing the Significance of the Impact of Damage to Specially Protected Species or Specially Protected Habitats".	The Regulations require that significant adverse changes from the baseline condition are determined using numerical data for species and measurable data for habitats (Chapters 6 to 9).
43.	Cabinet of Ministers Regulation No.153 of 25.02.2006 "Regulations on the List of European Union Priority Species and Habitats Occurring in Latvia" provides a list of European Union priority species and habitats occurring in Latvia.	The list contained in the Regulations has been taken into account in the characterisation of the natural values of the area of the Proposed Development and its surroundings (Chapters 6 to 9).
44.	Cabinet of Ministers Regulation No.350 of 28.06.2017 "Regulations on the List of Specially Protected Habitat Types" defines the list of specially protected habitat types.	The list contained in the Regulations has been taken into account in the characterisation of the natural values of the area of the Proposed Action and the surrounding area (Chapters 6 to 9).
45.	Cabinet of Ministers Regulation No.264 of 31.03.2010 "General Regulations on the Protection and Use of Specially Protected Nature Territories".	Taken into account in determining the compliance of the Proposed Activity with the general procedure for protection and use of specially protected nature territories, including permitted and prohibited activities in protected areas, as well as the model of special informative sign to be used for marking protected areas in nature and the procedure for its use and establishment (Chapters 1 and 7).
46.	Cabinet Regulations 01.07.2015. No 329 "Regulations on Latvian Building Standard LBN 224-15 "Melioration systems and hydrotechnical structures"".	A large part of the area of the proposed action is forested. Paragraph 116 of the Regulation states that the regulation of woodland moisture shall be provided by a regulating network of drainage ditches, swales and road ditches (Chapters 4 and 6).
47.	Cabinet of Ministers Regulation No 133 of 01.07.2021 "Procedure for accounting of waste and its transportation".	Taken into account in the Environmental Impact Assessment (Chapter 5).
48.	Cabinet of Ministers Regulation No.720 of 26.10.2021 "Regulations for the Record-keeping, Protection, Use and Restoration of Cultural Monuments".	According to these rules, natural or legal persons who, in the course of construction or other works, discover an object of cultural heritage value, shall notify the

No.	Statutory instrument and its requirements	How it has been taken into account in the EIA report
		Administration and shall cease the works until notified by the Administration. Within one month, the Administration shall organise the identification of the open object, the ascertainment of its cultural and historical value and the establishment of measures for its conservation (Chapters 6 and 7).
49.	Cabinet of Ministers Regulation No.46 of 21.01.2021 "List of objects of increased danger".	Taken into account in the identification of sensitive receptors in the area of the Proposed Action. The sites listed (Chapters 1 and 3) are not located within the site.
50.	Cabinet of Ministers Regulation No 570 of 21.07.2008 "Regulations on marking and equipping objects with protective lights".	In accordance with these provisions, each WPP within the area of the Proposed Operation will be equipped with two protective lights so that their position in the horizontal plane provides the pilot of the aircraft with a view of at least one protective light from any direction and the area of the protective light is 360° (Chapter 4).
51.	Cabinet of Ministers Regulation No 131 of 01.03.2016 "Procedure for risk assessment of industrial accidents and risk reduction measures".	The potential risk of accidents associated with the operation of electrical energy storage installations shall be assessed in accordance with these Regulations (Chapter 5).
52.	Cabinet of Ministers Regulation No.397 of 03.07.2018 "Regulations on the Classification of Water Management Districts".	According to these rules, the area of the Proposed Action is located in two large basin areas: The Gauja (large catchment area code 52) and the Gauja-Salaca (large catchment area code 54) are divided into several catchment areas (Chapter 6).
53.	Cabinet of Ministers Regulation No.396 of 14.11.2000 "Regulations on the List of Specially Protected Species and Specially Protected Species of Restricted Use".	The status of protected species and habitats has been determined in accordance with these Regulations (Chapters 6 and 7).
54.	Cabinet of Ministers Regulation No 940 of 18.12.2012 "Regulations on the establishment and management of microreserves, their protection, as well as the designation of microreserves and their buffer zones".	The bird species and groups of bird species on which the impact of the Proposed Action has been assessed are those included in the list of Appendix I to Cabinet Regulation No 396 of 14 November 2000 "Regulations on the List of Specially Protected Species and Specially Protected Species of Restricted Use", Cabinet Regulation No 940 of 18 December 2012 "Regulations on the establishment and management of microreserves, their protection and the

No.	Statutory instrument and its requirements	How it has been taken into account in the EIA report
		designation of microreserves and their buffer zones" and Annex I or II (Chapters 1, 6 and 7) of Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds.
55.	Cabinet of Ministers Regulation No.674 of 21.11.2023 "Regulations on Nature Reserves".	Taken into account in the Environmental Impact Assessment (chapters 1, 3, 6 and 7).
56.	Cabinet of Ministers Order No 238 of 28 March 2024 "On the Landscape Policy Implementation Plan 2024-2027".	Taken into account in the Environmental Impact Assessment (chapters 6 and 7).
57.	Latvia's Sustainable Development Strategy "Latvia2030" .	Taken into account in the Environmental Impact Assessment (all chapters).
58.	Latvia's National Development Plan 2021-2027 (NDP2027) .	Taken into account in the Environmental Impact Assessment (all chapters).
59.	National Energy and Climate Plan 2021-2030 .	Taken into account in the Environmental Impact Assessment (all chapters).
60.	Landscape Policy Implementation Plan 2024-2027 .	Taken into account in the Environmental Impact Assessment (chapters 6 and 7).
61.	Latvia's climate change adaptation plan for the period to 2030 .	Taken into account in the Environmental Impact Assessment (all chapters).
62.	Latvia's strategy to achieve climate neutrality by 2050 .	Taken into account in the Environmental Impact Assessment (all chapters).
63.	Environmental Policy Guidelines 2021-2027	Taken into account in the Environmental Impact Assessment (all chapters).
64.	Gauja river basin district management plan and flood risk management plan 2022-2027 .	This has been taken into account in the preparation of the Environmental Impact Assessment.
65.	Vidzeme Planning Region Sustainable Development Strategy 2030 .	This has been taken into account in the development of the Environmental Impact Assessment (Chapters 6 and 7).
66.	Development programme of Salacgrīva town and rural areas.	Noted.
67.	Limbazi municipality spatial plan 2012-2024.	Noted.
68.	Spatial plan of territorial units of Salacgrīva municipality from 2009.	Noted.
69.	Limbazi Municipality Development Programme 2022-2028.	Noted.
70.	Limbazi Municipality Sustainable Development Strategy 2022-2046.	Noted.
71.	Nature Conservation Plan of the Northern Vidzeme Biosphere Reserve Nature Park "Salaca Valley", section "Salacgrīva", 2005-2019.	Noted.

3. DESCRIPTION OF THE SITE OF THE PROPOSED ACTIVITY AND ASSESSMENT OF ITS ENVIRONMENTAL STATUS

3.1. Compatibility of the proposed activity with the spatial plan and existing use of the site

Administratively, the territory of the Proposed Action includes the Salacgrīva municipality and Viļķenes municipality of Limbaži County, but the EIA study area also includes the territory of Ainaži, Pāles and Staicele municipalities of Limbaži County and the town of Salacgrīva.

Due to the fact that after the administrative-territorial reform of 1 July 2021, Limbaži municipality merges several administrative territories (former Aloja, Limbaži and Salacgrīva municipalities), Limbaži municipality does not have a single valid spatial plan so far: the spatial plans of the former municipalities are valid until their elaboration is completed.

According to the Limbaži municipality spatial plan, the construction area of the WPP park includes land units or their parts, the planned (permitted) use of which is basically defined as a forest area. Relatively small areas of the WPP construction area are covered by water.

The main use of forest and marsh land (M) is for forestry activities, but there are also natural areas that should be kept intact and also for recreation.

According to the TIAN of Limbaži Municipality, the permitted uses in these territories are:

- forestry use
- forest infrastructure;
- forest parks on municipally owned forest land;
- exploration and extraction of minerals through land transformation
- lookout and observation towers, paths, footbridges;
- buildings and structures related to forestry, game farming and game tourism;
- a wildlife garden;
- agricultural use (including cultivation of berries) through land transformation or deforestation;
- detached houses and outbuildings in private forests;
- sports facilities;
- a cemetery, including an animal cemetery;
- engineering networks and facilities;
- engineering infrastructure facilities necessary for the functioning of the site.

TIAN of Limbaži municipality stipulates that forest land transformation or deforestation can be carried out in accordance with the requirements of the existing state regulatory enactments. The Cabinet of Ministers Regulation No.240 of 30.04.2013 "General Regulations on Spatial Planning, Use and Construction" in the wording in force since 15.11.2024, stipulates: "161. Wind power plants (..) are allowed to be located in (..) forest area (M) according to the conditions of the environmental impact assessment."

The TIAN of Limbaži municipality stipulates that the minimum distance from the WPP or communication mast to the boundaries of the adjacent land plot is not less than one and a half metres of the height of the respective structure. Chapter 3.11 *Engineering and technical support of TIAN*, Paragraph 76 states that it is not allowed to locate WPP in specially protected nature territories, except for those territories defined in the normative acts of the North Vidzeme Biosphere Reserve (hereinafter - NVBR), in villages and town territories. In residential areas it is allowed to locate WPP with maximum power up to 20 kW, it is allowed

to locate in the construction zone of a detached house area, if the height of the WPP mast does not exceed 12 m and it is possible to provide a WPP protection zone equal to - mast height x 1.5 within the land plot, or if an agreement has been reached with the owner of the adjacent real estate on the imposition of a burden - protection zone on the land plot, registered in the Land Register.

During the EIA procedure, the Proponent of the Proposed Action consulted the Limbaži Municipality on the proposed activity. Limbaži Municipality, in its letter No 8.2/23/1443 of 17 November 2023 (attached as Annex 2), indicated a number of conditions to be taken into account in the EIA.

The proponent of the proposed activity also consulted the Limbaži municipality later - asking for its opinion on the construction of a WPP with height restrictions in the protection zone around the "Lībiešu upuralas" to allow the construction of WPPs with a maximum height of 250 m or 275 m, while avoiding the construction of 300 m high WPPs. In its letter No 8.2/24/789 of 1 July 2024 (Annex 2), the Limbaži Municipality states that it agrees to the construction of individual WPPs (Z8, Z11, Z9) within a two-kilometre protection zone around the "Lībiešu upuralas" with a height of 250 m or less.

The Guidelines on the inclusion of wind farms in municipal spatial development planning documents - spatial plans and sustainable development strategies⁷ (31.10.2022) state that the municipality cannot impose engineering requirements (height of the WPP, distance to sites, etc.) or require approval from adjacent property owners⁸.

The Limbaži Municipality spatial plan sets out the conditions for the implementation of the Proposed Action and the Proposed Action does not conflict with them.

3.2. Characteristics of the surroundings of the proposed activity

The implementation of the wind park and its related infrastructure is planned for the Salacgrīva and Viļķenes parishes of Limbaži municipality, in the LVM wind park research land area, with a total area of 1894 ha. The nearest settlements from the boundary of the area of the Proposed Action to the south are the village of Ķirbiži approximately 1 km away, to the west - Lāņi approximately 5 km and Svētdciems approximately 4.5 km, while to the north are the villages of Vecsalaca approximately 2 km and Korgēne approximately 1.5 km from the LVM wind farm study area (Figure 1.1). The nearest town is Salacgrīva: in a south-westerly direction approximately 5 km from the nearest assessed WPP and assembly and maintenance site. There are also several farmsteads in the immediate vicinity of the area of the proposed activity, which are not closer than the distance from the WPP as specified in the regulatory enactments. The population density in and around the LVM wind farm study areas is shown in Figure 3.2.1. There are no permanent residents in the area of the proposed activity and the adjacent area has a population density of less than 5 people per km².

The location of access roads and cable lines within the wind park area is planned, as far as possible, using the existing public road network: direct access roads to the WPP are planned as far as possible within the LVM land areas, so as not to encroach on other land property boundaries. It is expected that access to the planned wind farm during construction and operation will be provided by the national main road A1 (Riga - Estonian border), regional road P12 (Limbaži - Salacgrīva), state local roads V138 (Lāņi - Ķirbiži - Jelgavkrasti) and V143 (Akmeņkalni - Lauvas - Ķekari), municipal roads, forest roads maintained by LVM, as well as newly constructed or adapted existing access roads.

⁷ <https://www.varam.gov.lv/lv/media/33749/download?attachment>

⁸ Sub-paragraph 6.2 of the Constitutional Court's judgment of 24 February 2011 in Case No 2010-48-03.

According to the information published in the data management system "OZOLS" of the NCA, the study area of the Proposed Action, which is wider than the study area of the LVM wind farms, contains several Special Protection Areas and microreserves, species deposits and their areas, habitats of European Union importance and specially protected trees. The Proposed Action is located in the NWBR (Neutral Zone) area (part of the Proposed Action area is also located in the Landscape Protection Zone, but no WPPs are proposed). More detailed information on the natural values of the area is provided in subsections 6.4 and 6.5.

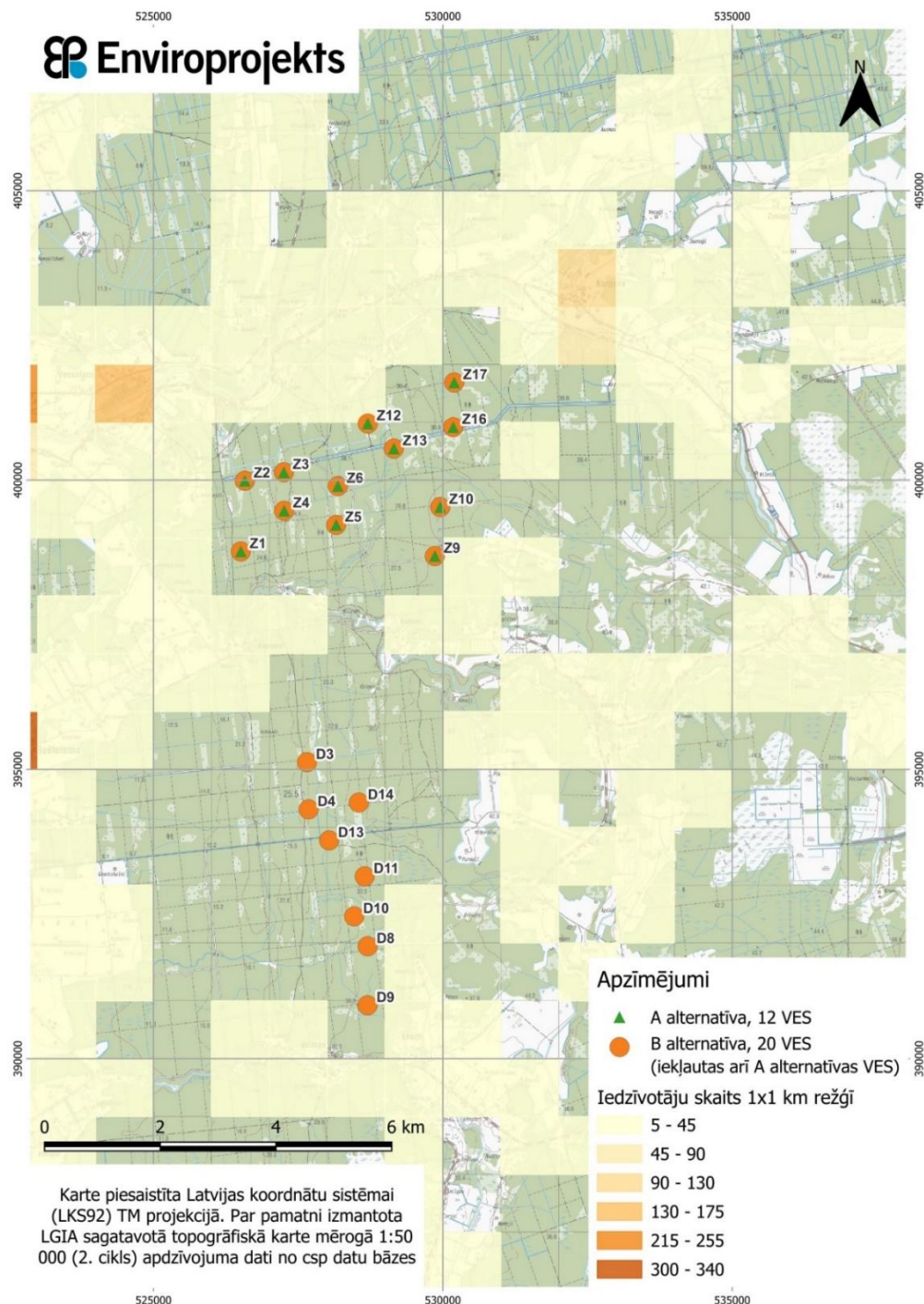


Figure 3.2.1. Population density around the 37 WPPs evaluated in the Limbaži WPP LVM wind park study area

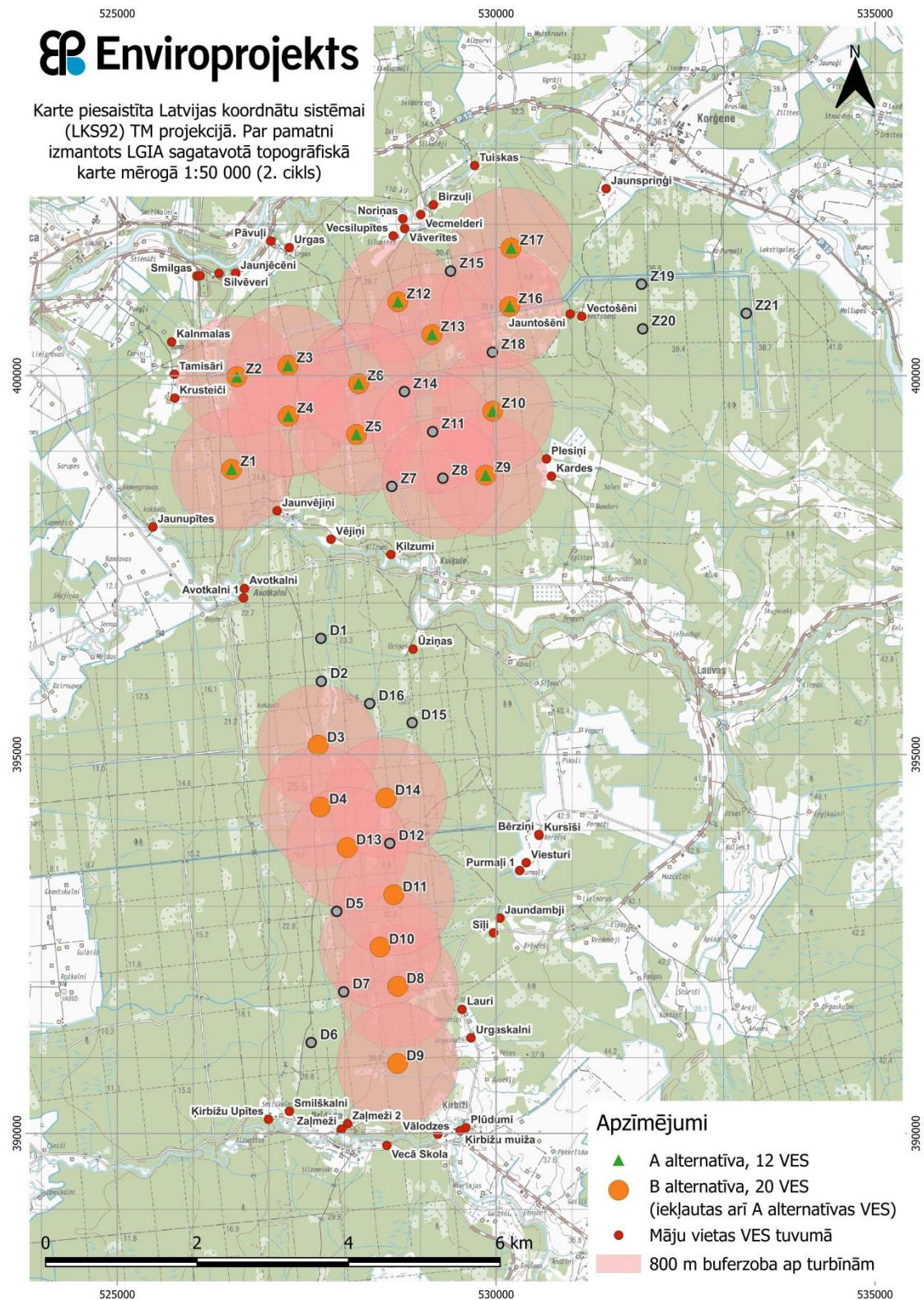


Figure 3.2.2. 800 m buffer zone around the WPP and the location of houses near the WPP and the assembly and maintenance areas (WWP park)

From 1 May 2024, the site for management of contaminated sites of the VVD and the Latvian Centre for the Environment, Geology and Meteorology (hereinafter - LVGMC) is available: pvps.vvd.gov.lv. However, given that this site has been opened to the public relatively recently, it does not yet contain the full list of contaminated and potentially contaminated sites, as was the case with the previous register of the LVGMC, available until 1 May this year. Therefore, the EIA report used the information obtained in February 2024 from the previous LVGMC register of contaminated and potentially contaminated sites. The information obtained indicates that no contaminated or potentially contaminated sites are located in the area of the Proposed Action⁹.

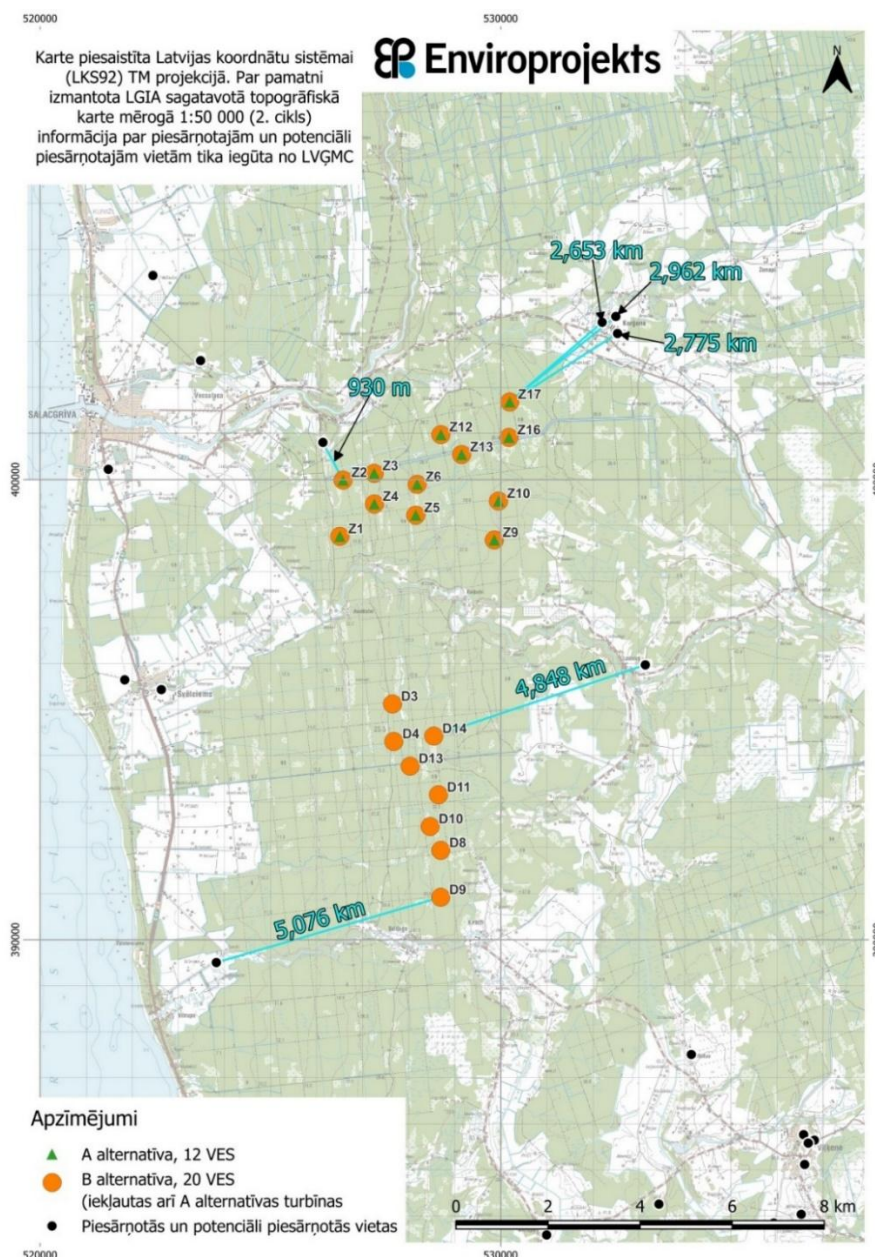


Figure 3.2.3. Contaminated and potentially contaminated sites in the vicinity of a WPP and assembly and maintenance yards (WPP park)

⁹ <http://parissrv.lvgmc.lv/#viewType=pppvMapListView&incrementCounter=1> - viewed. 2024. february 2011.

The nearest potentially contaminated sites are in Korgēne village (WPP park construction study area Z) - former boiler house in Korgēne, reg. 66357/2757 (approx. 2 km away); former fuel storage in Korgēne reg.no. 66357/2756 (2,3 km away); former chemical warehouse in Korgēne, reg. no. 66357/2761 (2 km away). From the site of the Proposed Development in direction A, in Lauvas, there is a former fuel depot, reg. 66357/2755 (approx. 3.2 km from the study area), Salacgrīva municipality, while in the W direction near the village Vecsalaca there is Stienūži landfill site with reg.no. 6357/2754 (approx. 0.85 km) (Figure 3.2.3).

According to publicly available information at¹⁰, hard minerals such as sand, sand-gravel and peat are present in the vicinity of the proposed activity and have been extracted for a long time. Sand and sand-gravel are extracted for construction, road building, maintenance and repair. The peat is extracted for agricultural purposes. Information on mineral deposits is provided in Chapter 6.12.

The location of the proposed activity in relation to other wind farms in the immediate vicinity in the north of Latvia for which EIAs have been carried out or are in various stages of preparation is presented in Figure 3.2.4. The assessment of the cumulative environmental impacts of wind farms is based on publicly available information on these wind farms. The nearest wind park is the Aloja Wind Park, located approximately 25 km from the area of the Proposed Action.

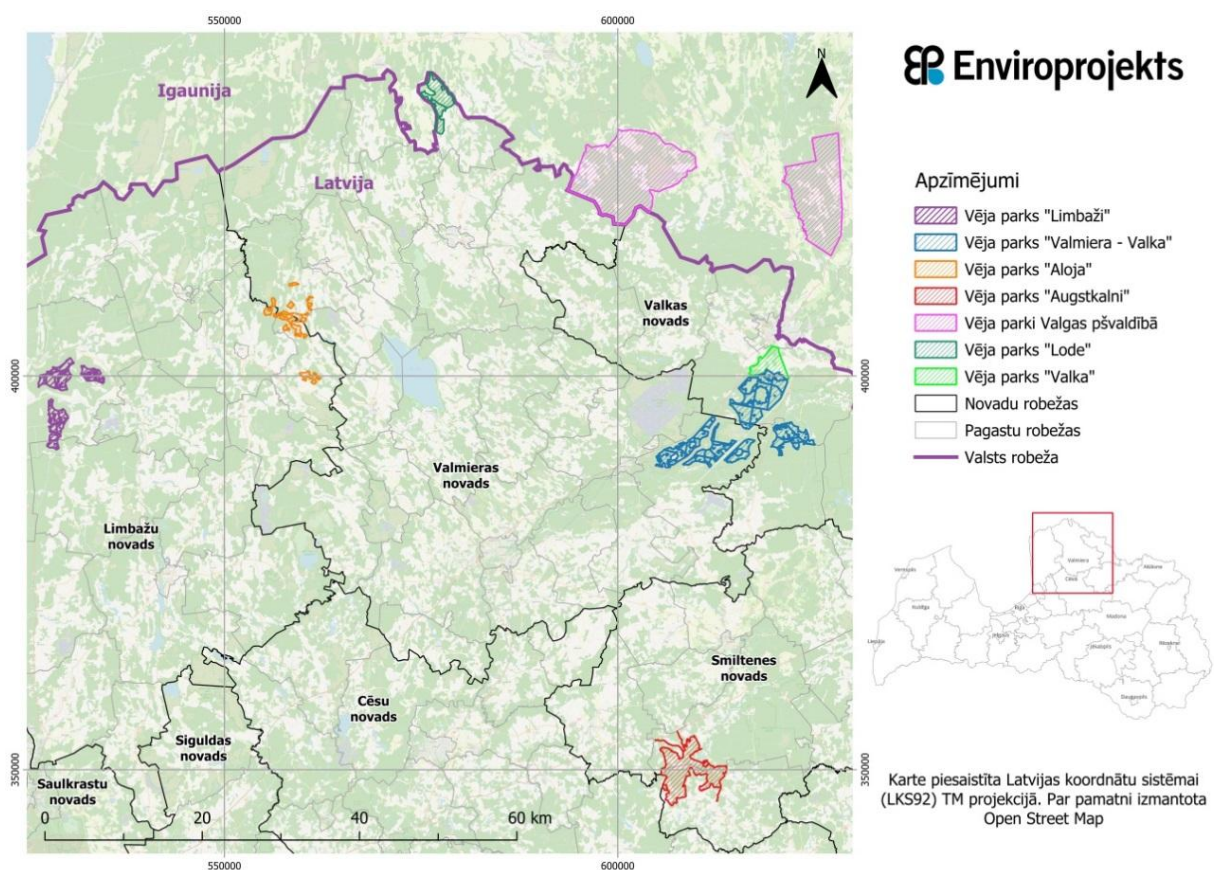


Figure 3.2.4. Location of the proposed activity in relation to other wind parks in the vicinity

¹⁰ <https://videscentrs.lv/gmc.lv/iebuve/zemes-dzilu-informacijas-sistema>

According to the information available on the website of the NRWB¹¹, the decision on the necessity of EIA for the wind park Aloja was adopted on 28 August 2023 and the Environmental Impact Assessment Programme was issued on 14 September 2023. Up to 31 new generation NHPs are planned to be installed in the wind park. No cumulative environmental effects are expected between the two wind farms.

The other wind farms in northern Latvia and southern Estonia are located more than 50 km away, where no cumulative environmental effects are expected to occur. The nearest wind farm in Estonia, in the municipality of Valga, is located more than 70 km from the area of the Proposed Action.

3.3. Characteristics of wind conditions

Wind conditions in the area of the Proposed Action are an important aspect to be taken into account in the siting and environmental impact assessment of WPPs. Information on wind conditions in the area of the Proposed Action is based on long-term observation data.

The EIA uses data from the ERA5 5th generation ECMWF Global Climate Atmospheric Reanalysis¹² for the period 2013-2023: a total of 95304 wind measurement records with 200 m height conversion (WindPRO Meteo Data Export version 7, Geographical coordinates (WGS84): longitude 24.500000, latitude 57.750000, Local coordinates: (LKS92) Y: 529759.57 X: 400986.94).

The wind data used in this EIA describes the wind at a point in the vicinity of the Proposed Action at Vecsalaca (see Figure 3.3.1).

¹¹ <https://www.vpvb.gov.lv/lv>

¹² <https://climate.copernicus.eu/copernicus-regional-reanalysis-europe-cerra>

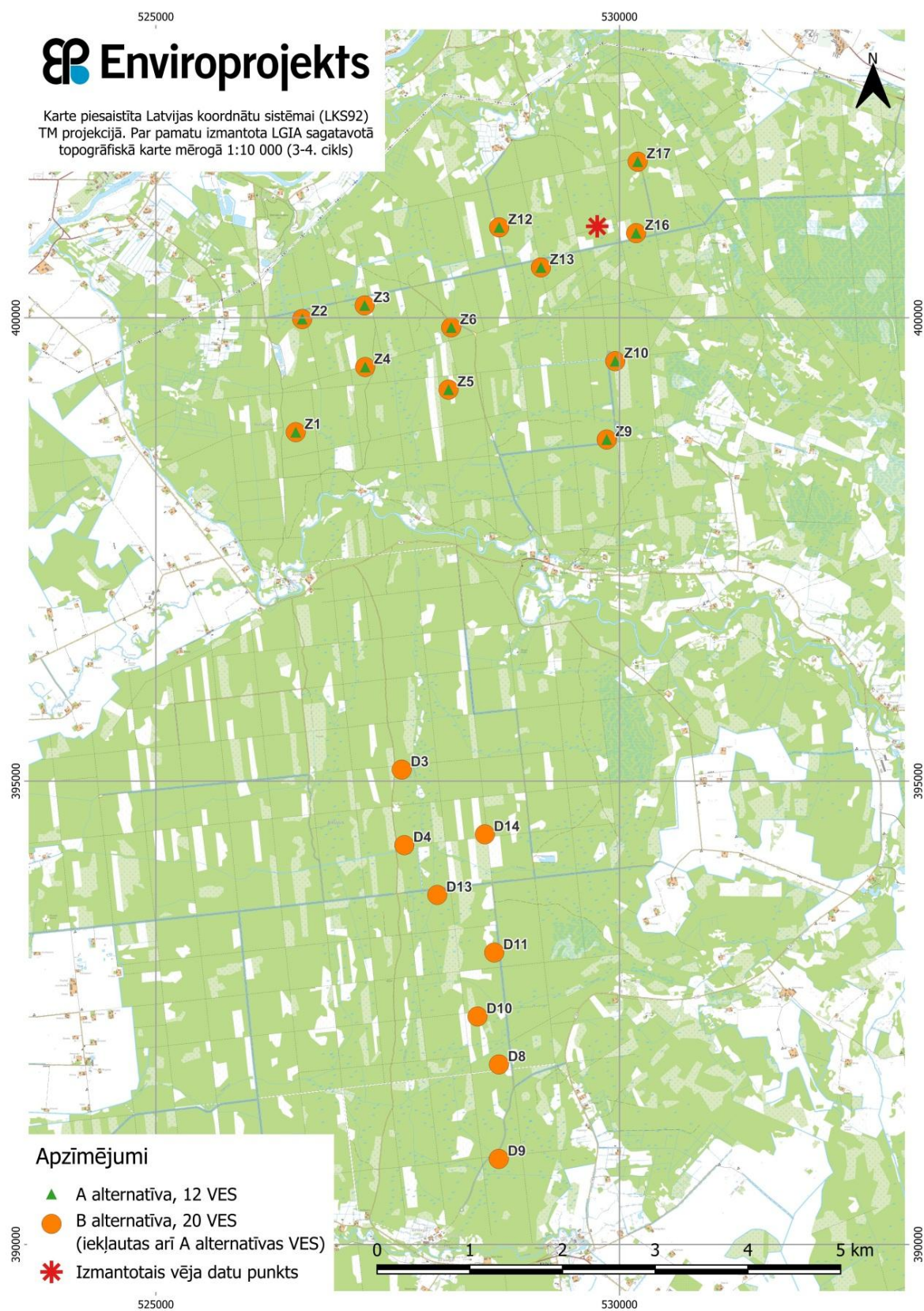


Figure 3.3.1. WPP park with a point characterised by the wind data used

Based on this data, a wind rose with the distribution of wind speeds and directions at 200 m height has been created (Figure 3.3.2).

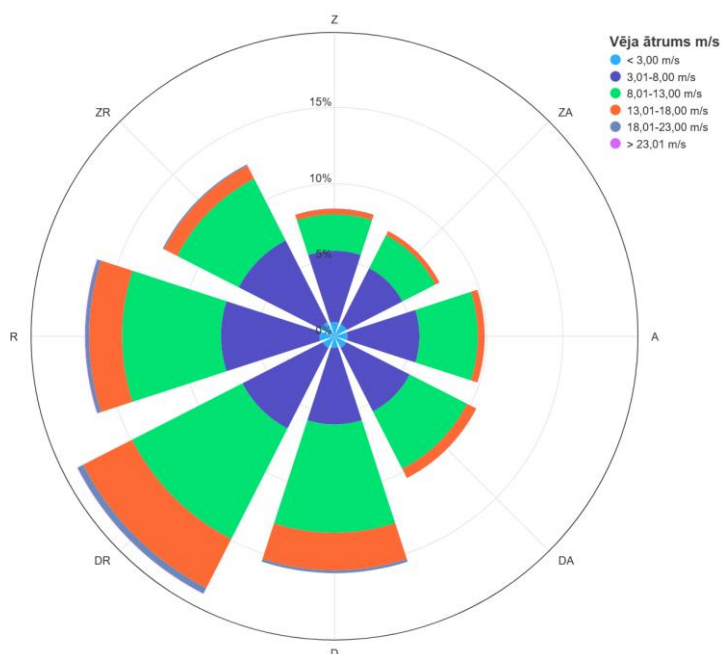


Figure 3.3.2. Wind rose with wind speed and direction distribution at 200 m (ERA5 data)

The distribution of the number of records underlying the wind rose is given in Table 3.3.1 (absolute numbers) and Table 3.3.2 (percentages).

Table 3.3.1. Distribution of wind measurements by speed and direction in absolute numbers

	Z	FOR	A	DA	D	DR	R	ZR	Total
Up to 3,00 m/s	882	855	820	822	738	820	946	976	6859
3,01-8,00 m/s	4456	3914	4498	4460	4785	5649	6157	5745	39664
8,01-13,00 m/s	2278	2308	3648	4025	6763	7756	6183	4324	37285
13,01-18,00 m/s	351	296	424	646	2360	3436	2069	931	10513
18,01-23,00 m/2	16	5	12	9	167	395	235	86	925
23,01-infinity	0	0	0	0	0	25	32	1	58
Total	7983	7378	9402	9962	14813	18081	15622	12063	95304

Table 3.3.2. Percentage distribution of wind measurements by speed and direction

	Z	FOR	A	DA	D	DR	R	ZR	
Up to 3,00 m/s	0,925	0,897	0,860	0,863	0,774	0,860	0,993	1,024	7,197
3,01-8,00 m/s	4,676	4,107	4,720	4,680	5,021	5,927	6,460	6,028	41,618
8,01-13,00 m/s	2,390	2,422	3,828	4,223	7,096	8,138	6,488	4,537	39,122
13,01-18,00 m/s	0,368	0,311	0,445	0,678	2,476	3,605	2,171	0,977	11,031
18,01-23,00 m/2	0,017	0,005	0,013	0,009	0,175	0,414	0,247	0,090	0,971
23,01 - infinity	0,000	0,000	0,000	0,000	0,000	0,026	0,034	0,001	0,061
	8,376	7,742	9,865	10,453	15,543	18,972	16,392	12,657	100

Based on the results of the characterisation of wind conditions, the area of the Proposed Action is suitable for the siting of WPPs designed for areas with low wind speeds (average speed at mast height of at least around 7.5 m/s). According to the international standard IEC 61400-1 "Wind turbines. 1.part: Design Requirements", these are Class III turbines, which have been assessed in detail in the noise and flickering shadow impact assessment.

For noise modelling (subsection 7.2.1) and flickering shadow modelling (subsection 7.3), the following steps shall be taken. chapter 7.2), these wind data are used in the speed range 3-23 m/s, as most of the currently available WPP models do not turn in no-wind (below 3 m/s) and similarly do not automatically stop in excessive wind (above 23 m/s): this is in total 92.7 % of the time throughout the year (assuming that a WPP model is installed in the area of the Proposed Operation that automatically stops at wind speeds higher than 23 m/s).

3.4. Characteristics of adverse meteorological conditions

The meteorological conditions in the area of the proposed operation are suitable for the siting of WPPs complying with the international standard IEC 61400-1 "Wind turbines. 1.part: Design Requirements" as defined in Class III and S (designed for areas with low wind speeds). Class III and S WPP are suitable for installation in areas where the average wind speed at mast height is at least 6 m/s.

Modern WPPs operate mainly in the wind speed range from 3 to 23 m/s: at ~3 m/s the rotor starts to rotate slowly, by ~10 m/s it reaches a rotation speed close to the maximum and continues to operate until wind speeds reach ~23 m/s, with the rotation speed no longer increasing in proportion to the wind speed for safety reasons: excessive rotation speed can damage and even break the WPP or its wings. The rotation speed is technologically limited in two ways:

- 1) as wind speed increases, the orientation of the wing plane becomes more and more inclined to the wind direction, letting some of the wind energy pass by,
- 2) modern WPP with gearboxes combine the above adaptation of the wing orientation with an increase of the gear ratio, bringing more energy to the WPP and consequently braking the rotor more strongly, i.e. extracting more energy from the same rotational speed.

At wind speeds of ~23 m/s, the rotor wings turn parallel to the wind direction, thus letting the wind pass by and not turning again: this is a safety measure to prevent excessive wind energy from breaking the wings. Accordingly, when the wind speed drops below 23 m/s, the wings start to catch the wind again and the rotor starts to rotate again.

Thus, the conditions that are unfavourable for the operation of WPPs are:

- 1) windless (< 3 m/s),
- 2) winds too strong (>23 m/s).

The distribution of wind speeds at the proposed site is described in Chapter 3.3, including Table 3.3.2: adverse wind conditions are expected ~7.3% of the time throughout the year.

Other adverse meteorological conditions include icing on the wings, which can lead to the risk of ice chips detaching and being swept away: this is discussed in Chapter 5.3.

When assessing the environmental impact of WPPs, sunny weather is also considered to be to some extent an adverse meteorological condition: in bright sunshine, WPPs can cause a disturbance to the flickering shadows of the surrounding houses, which is not a nuisance when it is cloudy. The characteristics of solar irradiance are given in Chapter 7.3, including Table 7.3.1.

4. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

4.1. Siting of WPPs, study areas and WPP site alternatives

4.1.1. Location of the WPP study area

The total area of the construction area of the wind park, the use of which has been agreed with LVM for the transfer of land to Ltd "Latvijas vēja parki" (Cabinet Order No 831 of 28 November 2023 "On Approval of the Lump Sum Amount in Connection with the Right to Conclude a Development Right Agreement for the Siting of Strategically Important Wind Parks on State Forest Land") is 1,894 ha. When the study was launched, the area was to be explored for up to 20 WPPs, with a maximum rated capacity of 8 MW per WPP. The study area included a total of 28 land units, where 37 potential sites for the installation of WPPs were identified.

The northern boundary of the operational area is roughly marked by the Salaca, Korģe and the P12 motorways, the eastern boundary by the national roads P12, V143 and V142, the southern boundary by the national road V138 and Vitrupe, the western boundary by the national main road A1, see Figure 4.1.1.

The extensive LVM road network in the area of the proposed activity means that the existing network is very dense and the WPP will require less new road construction, see Figure 4.1.1.

- location of the WPP and the area up to 150 m around it; potential access roads and the area up to 150 m along them, as well as potential power transmission cable routes and the area along them;
- the ornithofauna study area covers a 3 km zone around all WPP assessed;
- the Landscape Assessment Study Area is a 10-kilometre zone around the maximum possible outer boundary of the wind farm (from the outer WPP);
- noise and flicker have been assessed to the extent that the likely effects of the Proposed Action have been calculated.

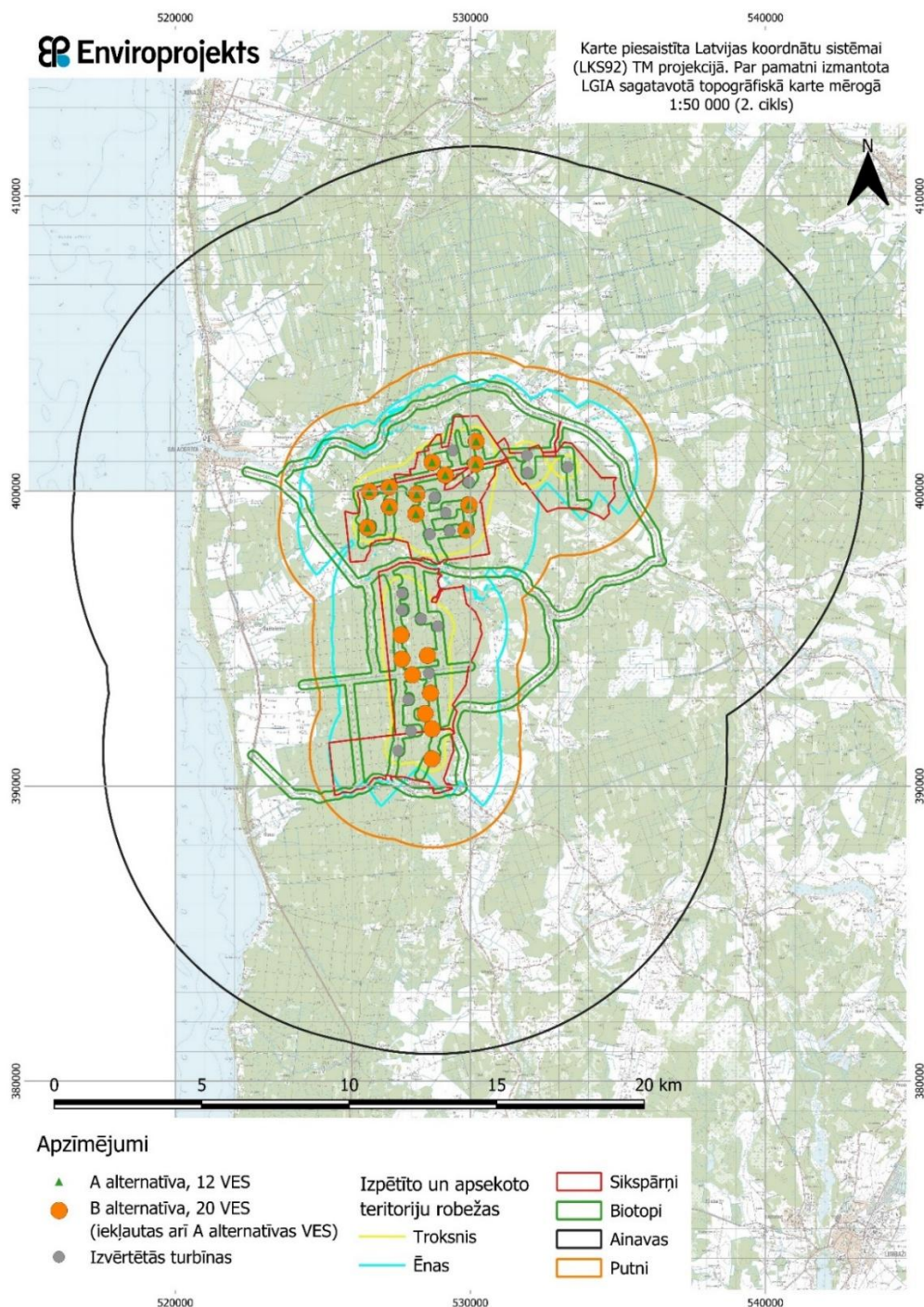


Figure 4.1.2. The boundaries of the surveyed areas in relation to the LVM study area and the 37 WPP assessed

In addition to the watercourses already mentioned, the hydrography of the area of the proposed action is characterised by small rivers: Kulaurga, Ungenurga and Vedemurga. There are no natural water bodies, the largest artificial water bodies are the water reservoirs of the Kulaurga and Stienūži IV quarries. The study area includes several natural and artificial water bodies. The natural water bodies are Priecumu Lake, Primma Lake and Kliķezers, which are located in the subglacial valley between the north-eastern area of the Proposed Action and the Niedrāju-Pilka Swamp. Artificial water bodies include Jaunīši pond, Pāle reservoir, Turmatu pond, Viļķenes mill pond, Viļķenes fish ponds, as well as many unnamed ponds. The Gulf of Riga is about 6 km from Limbaži WPP Park.

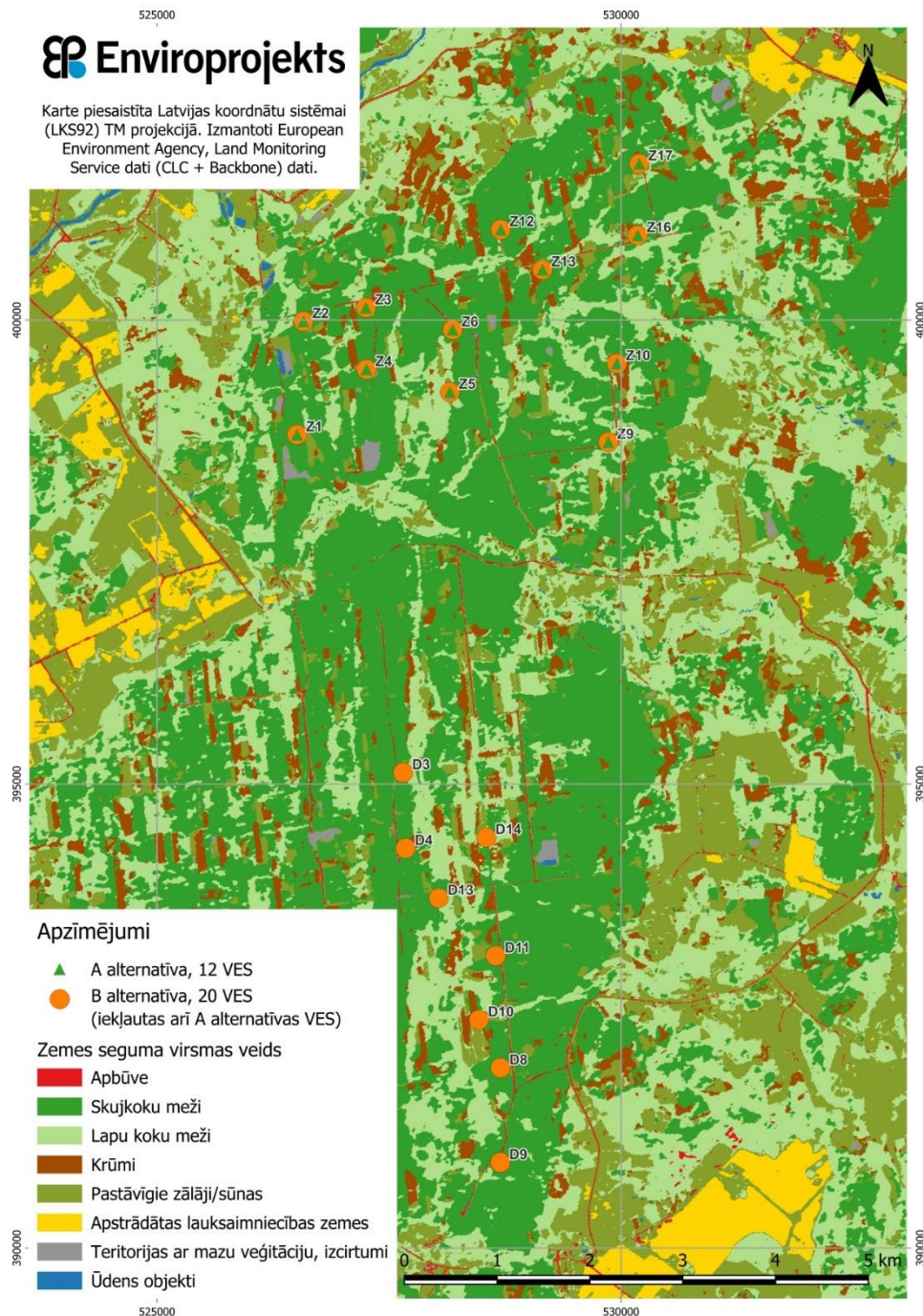


Figure 4.1.3. Distribution of land use types in the territory of the Limbaži WPP Park (source: EEA Land monitoring service)

The western edge of the LVM wind farm study area is located approximately 3.5 km from the proposed *Rail Baltica* railway line.

The area of the proposed activity is mostly covered by forest, with some agricultural land and water areas (rivers, Figure 4.1.3). The study area is surrounded by open areas: agricultural land around the A1 motorway, around Svētupe (between Svētdciems and Avotkalni), Arupīte, Vitrupe, Vilķeni and Korģeni; built-up areas (especially the town of Salacgrīva) and marshes - both natural and developed: Pilkas Bog, Lielpurvs or Zābaku Bog, Ērgļu Bog (developed) and Lūru (Brikmani) Bog.

4.1.2. Study area alternatives

The EIA included an assessment of the nature values and an assessment of the impacts of the Proposed Action on a large study area in Limbaži Municipality, initially: a chamber feasibility study of the area, as well as an expert assessment of species and habitats.

After consultation with NCA - as far as possible, WPP and infrastructure are planned in accordance with the information in the DDPS OZOLS: outside microreserves and their buffer zones, species sites, SPNAs, habitats of EU importance and protection zones around them (NCA recommendation - 40 m from wet habitats of EU importance). 2022. in 2010, information on potential new or expanding SPNAs was received from the NCA and, where possible, WPPs and their infrastructure are planned outside these areas. Also, the NCA recommended in early 2022 that WPPs and their infrastructure should be located as far as possible in clearings and coppice areas.

- **Preliminary alternative for the location of the WPP Park study area.** The assessment of nature values (bird species, bat species and forest habitats) was launched in 2022. Initially, 45 WPP sites were assessed, of which 28 were in the northern area and 17 in the southern area (Figure 4.1.5).

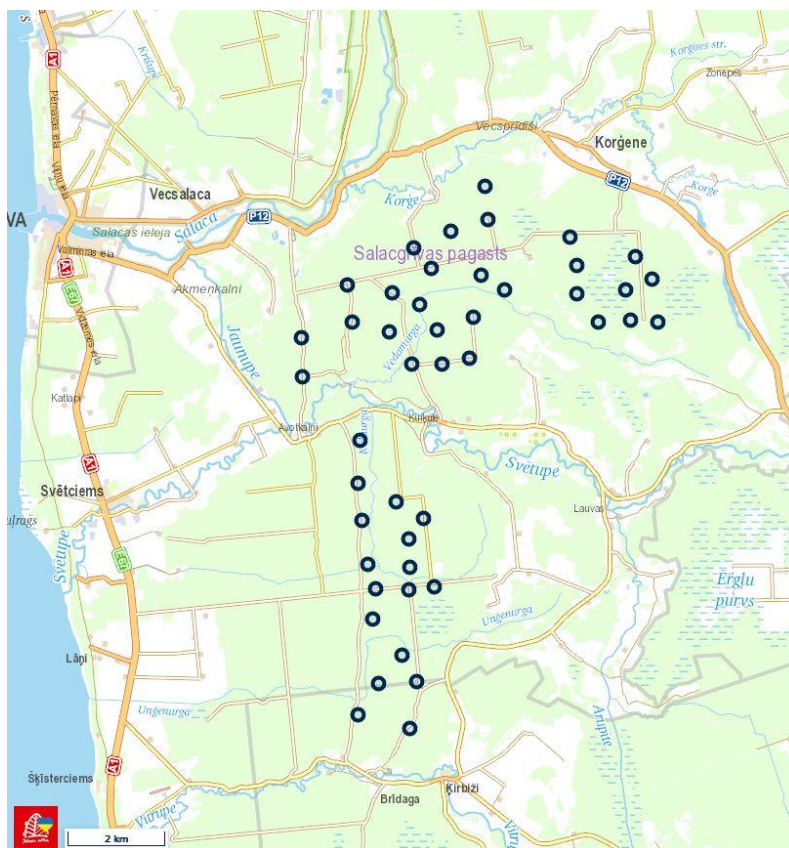


Figure 4.1.5. Preliminary alternative for the location of the study area: 45 WPP installation sites

- A basic alternative for the location of the WPP Park *study area*.

Following initial fieldwork by experts in nature conservation, expert interviews, recommendations and conclusions, the WPP design has been refined several times. The location of the study area in the baseline alternative for which EIA Programme No.5-03/7/2023 (as amended on 10 January 2024 and No.5-02-1/3/2024) was issued on 12 September 2023., 2024. of. 20. November) (Annex 1). The LVM wind farm study area includes a total of 28 land units, where 37 potential sites for the installation of WPPs have been identified (Figure 4.1.6). In contrast to the location of the study area, the 8 WPPs in the original alternative were excluded from further investigation.

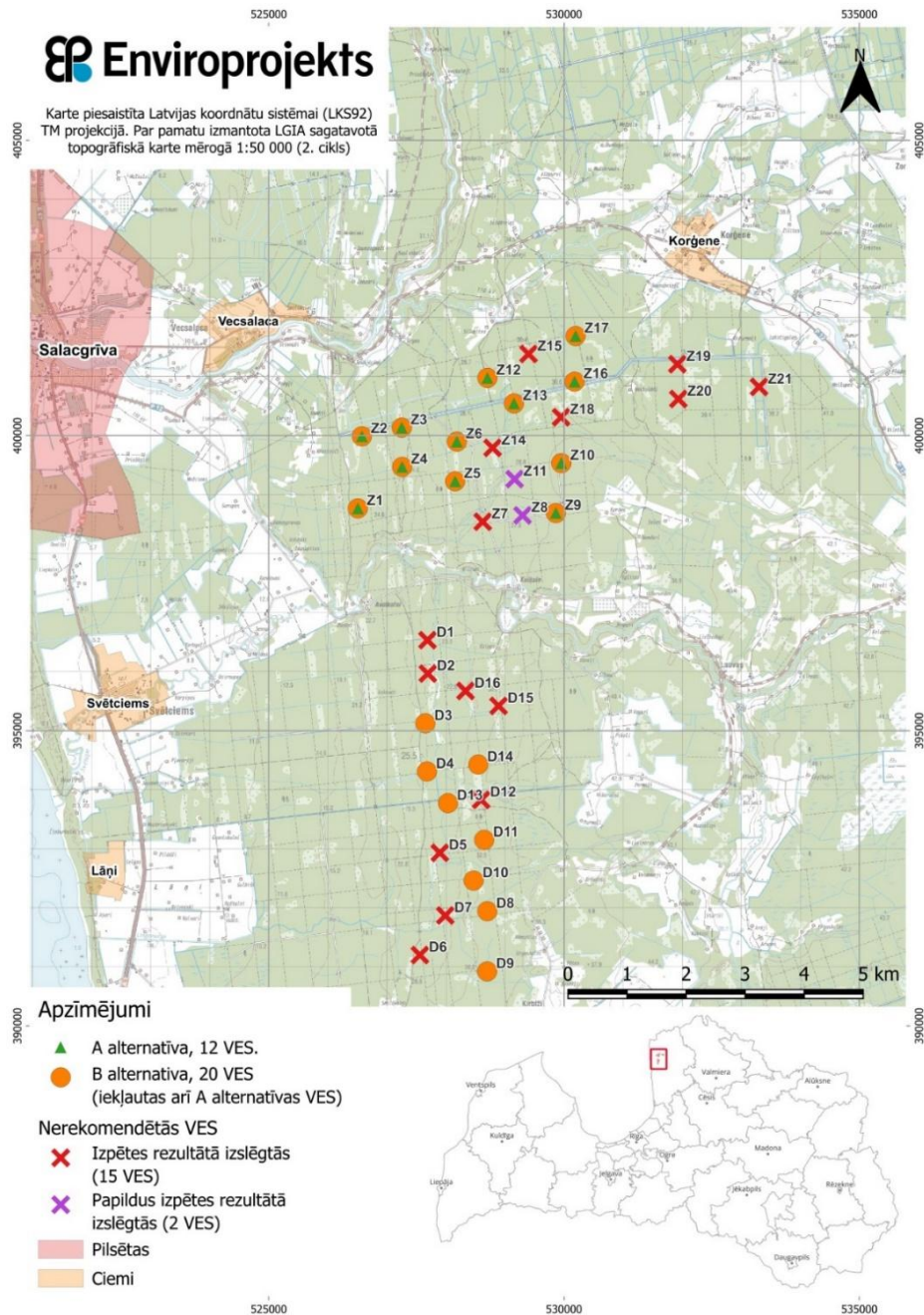


Figure 4.1.6. Basic alternative for the location of the WPP: 37 WPP installation sites and recommended WPPs - Alternative A and Alternative B

4.1.3. Location alternatives for the Proposed Activity assessed in the EIA Report

As indicated above, 45 potential WPP sites were investigated during the initial feasibility phase of the project, but after consultation with certified experts and the NCA, 8 WPPs were excluded from further investigation. The EIA study includes a detailed assessment of 37 potential WPP sites, for which environmental impact aspects have been assessed.

Taking into account the recommendations of an ornithologist, a plant species and habitat expert, a landscape expert, a bat expert and a hydrologist, the location of the WPP and the operating conditions, it was concluded in June 2024 that up to 22 WPPs could be installed. Enviropojekts Ltd, together with certified nature experts, recommended the abandonment of part of the originally planned WPPs in order to mitigate the impact not only on the species (including plants, birds and bats) present in the area of the Proposed Action, but also to reduce the impact on the landscape from the viewpoints of the cultural and historical sites.

The potential WPPs to be installed were grouped into two alternative locations for the WPP park. Limbaži WPP Park location alternative A - 14 WPPs: compact area in the north, and location alternative B - 22 WPPs: area in the north (14 WPPs of alternative A) and the southern part of the WPP study area to be implemented¹³.

For these alternatives, 14 and 22 WPPs respectively, a physical impact assessment was carried out and additional assessment by natural experts was requested. It is important to note that the detailed additional assessment, which included additional habitat and vascular plant, moss and lichen species assessments, was only carried out for Alternative A, as it was prematurely concluded that only Alternative A (northern part of the WPP) would be more viable and feasible at this stage of the project development, and therefore no additional assessment was carried out for the potential locations of the southern part of the WPP. It was also concluded that Alternative A has the advantage of proximity to the 110 kV high voltage line (less deforested area for new AST lines and avoiding a river crossing) and proximity to potential electricity consumers in Salacgrīva.

Following the supplementary expert advice, the assessment of the planned WPPs in the northern part of the site was revised and significant environmental effects - impacts on natural values - were identified for a further 3 WPPs - Z6, Z8 and Z11, of which Z6 could be retained if the location of the WPPs was adjusted. This recommendation was taken into account: The position of Z6 was changed.

According to the additional assessment, the alternative locations defined above have 12 WPPs in Alternative A and 20 WPPs in Alternative B¹⁴.

For the construction of the 17 WPPs, it was concluded that significant adverse changes are expected as a result of the Proposed Action: impacts on bird species, habitats and/or landscape.

The assessment of the final alternatives has been carried out in two stages, following the guidance of the Publications Office of the European Union on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC: 1) site screening (to exclude significant impacts on Natura 2000 to the maximum extent possible) and 2) assessment (to exclude negative impacts on Natura 2000, their integrity and

¹³ No more than 20 WPPs would be built in total in the Limbaži WPP Park; the WPPs that would not be built would be determined by the results of engineering geological studies and other studies during the design phase.

¹⁴ For Alternative B, there is a condition: For potential WPP sites, additional assessment of vascular plant, moss and lichen species and development of a solution for the AST connection, as well as additional freshwater impact studies for the power line crossing over the Svētupe River, are mandatory measures.

connectivity)¹⁵. The assessment of alternatives and the final location of the WPP also assesses cumulative impacts from certified expert opinions and EIA expert assessments.

The chronology of the study of the Limbaži WPP area is presented in Table 4.1.1.

Table 4.1.1. Chronology of the Limbaži WPP site investigation

Chronology of WPP site investigations	WPP park configuration
Initial feasibility phase	45 potential WPP sites identified and investigated. After consultation with certified experts and the NCA, 8 WPP were excluded from further investigation after the first preliminary assessment.
2024 situation at the start of the year	37 WPPs are examined in more detail in the EIA procedure: 15 WPPs were identified as having significant environmental impacts and were excluded from detailed study due to the constraints identified (37 - 15 = 22 WPP). 22 WPPs are being promoted for potential installation.
	It was decided to group the 22 selected WPPs into two alternative ones: Alternative A in the northern part of the study area and Alternative B in both the northern and southern parts of the WPP area*
	<i>*The northern and southern parts are separated by the natural boundary of the Svētupe River: The WPP and the area north of the Svētupe are assumed to be the northern part and the area to the south the southern part.</i>
	Alternative A - 14 WPP: in the W part of the study area
2024 in summer	Alternative B - 22 WPP: 14 WPPs in the N part of the study area + 8 WPPs in the D part of the study area.
	Due to the scenic impact of both alternatives A and B, which originally assessed the height of all WPPs at 300 m, some WPPs have been reduced in height to 250 or 275 m in two different ways, resulting in adjusted alternatives A and B and their complementary alternatives A' and B'.
2024 september 2009	Additional assessment of habitats, vascular plants and moss and lichen species in the northern part of the site (Alternative A), as well as assessment of a new AST and power line.
2024. october 2009	Impact on habitats identified; expert recommendation: abandon 2 more WPPs in N (and relocate WPP Z6).
Intermediate result	37 WPPs assessed in detail: exclusion restrictions for 17 WPPs (20 remain).
	Alternative A - 12 WPP: in the W part of the site
	Alternative B - 20: both parts of Z+D* * Significant preconditions have been identified for 8 WPPs in Part D, which can only be decided after further assessment of vascular plant, moss and lichen species and the development of a solution for the connection to the AST, as well as additional freshwater impact studies for the power line crossing over the Svētupe River.
Result	Recommended Alternative A for construction - 12: Z In total, 12 WPPs are recommended for construction in the N part of the park with reduced height (compared to alternative A'). The EIA report considers the recommendation for a WPP park of this size as part of the assessment of the proposed development alternative B, as a total of 20 potential WPP sites have been

¹⁵ <https://op.europa.eu/en/publication-detail/-/publication/2b6c4b16-e867-42da-b604-f67ee6fe60c3>

Chronology of WPP site investigations	WPP park configuration
	identified in the study area N and D. Of the 20 identified potential WPP sites, 8 sites in Part D are subject to significant pre-conditions: assessment of additional vascular plant, moss and lichen species and development of a solution for the AST connection, as well as additional freshwater impact studies for the power line crossing over the Svētupe River.

See Figure 4.1.7 for alternatives for the location of the WPP:

Alternative A - in the northern part of the WPP Park study area (12WPP).

Alternative B - WPP without exclusion restrictions in the northern part and WPP in the southern part if the condition for additional exploration is met (20 WPP).

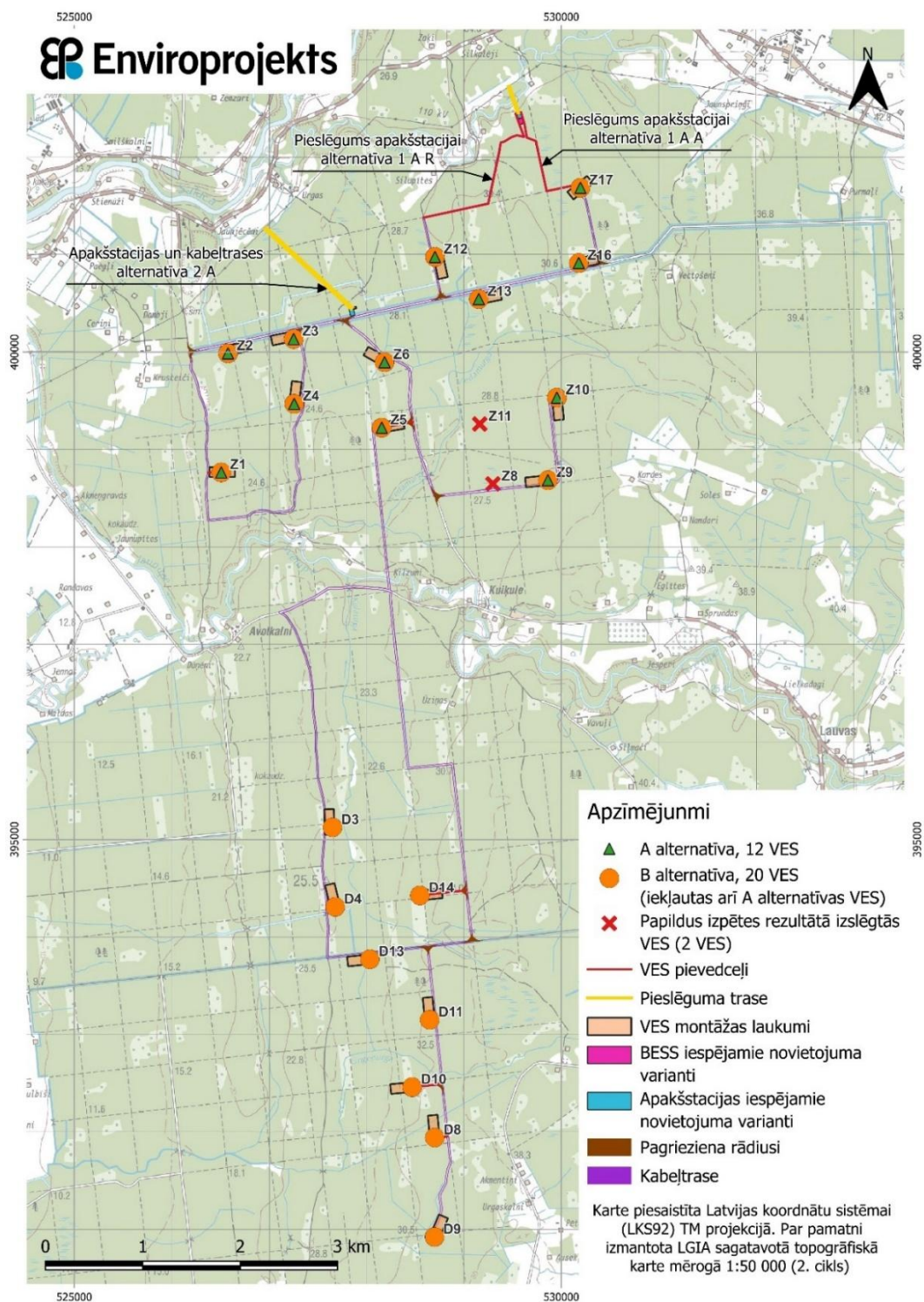


Figure 4.1.7. Limbaži WPP park Location Alternatives A and B before and after additional assessment by nature experts

4.2. Characteristics of WPP technologies and alternative solutions

A CHP generator generates electricity by turning its rotor wings in the wind, which is fed through underground cables to a transformer substation. A WPP converts wind energy into turbine rotational energy, which is further converted into electricity by magnets. The rotor of the WPP turns automatically against the wind, so its orientation changes. In no-wind conditions, the rotor does not rotate as the wind speed increases, while in too strong winds the rotor wings rotate parallel to the wind flow for safety and the rotor stops. This technology has been validated worldwide and is fundamentally safe.

As technology advances, the height of the WPP mast and the rotor diameter (wingspan) increase: the higher above the ground, the stronger and more stable the wind, the larger the rotor diameter (wingspan), the more energy can be extracted from the wind¹⁶.

The model and technical characteristics of the WPP to be installed have not yet been determined and selected, and a number of possible models are being considered, assessing their differences, advantages, including height, wing diameter, capacity and other relevant parameters. Currently available WPP models with a high rated generation capacity, i.e. above 6.0 MW (Table 4.2.1), were evaluated for comparison, but the final decision on the choice of model will be based on the conditions set out in this EIA, assuming that the WPP model from the comparison below or another model with equivalent characteristics is likely to be installed, given the rapid technological development in this sector. The maximum height of the WPP is expected to reach 300 m, with rotor diameters of up to 200 m.

Table 4.2.1. Technical characteristics of commercially available WPP models

Manufacturer	Model	Rotor diameter, m	MW	Mast height, max, m	Wing tip height, max, m	Starting, m/s	End of run, m/s
Nordex ¹⁷	N175/6. X	175	6,0-6,9	179	266,5	3,0	20
Vestas ¹⁸	V172	172	7,2	199	285,0	3,0	25
Enercon ¹⁹	E175	175	6,0	162	249,5	2,0 ²⁰	25 ²¹
Siemens Gamesa Renewable Energy ²²	SG170	170	7,0	185	270,0	3 ²³	25 ²⁴
General Electric ²⁵	Cypress	164	6,1	167	249,0	3 ²⁶	25 ²⁷

According to the technical information provided by the manufacturers, the mast height can be adapted to the customer and location requirements according to current technological possibilities up to 200 m, rotor diameters range from 160 m to 175 m.

¹⁶ <https://www.windpowerengineering.com/calculate-wind-power-output/>

¹⁷ <https://www.nordex-online.com/en/product/n175-6-x/>

¹⁸ <https://www.vestas.com/en/energy-solutions/onshore-wind-turbines/enventus-platform/V172-7-2-MW>

¹⁹ <https://www.enercon.de/en/turbines/e-175-ep5>

²⁰ <https://en.wind-turbine-models.com/turbines/2472-enercon-e-175-ep5>

²¹ Ibid,

²² <https://en.wind-turbine-models.com/turbines/2475-siemens-gamesa-sg-7.0-170>

²³ <https://en.wind-turbine-models.com/turbines/2346-siemens-gamesa-sg-6.6-170>

²⁴ Ibid,

²⁵ <https://www.gevernova.com/wind-power/onshore-wind/cypress-platform>

²⁶ <https://en.wind-turbine-models.com/turbines/2307-ge-vernova-ge-6.0-164-cypress>

²⁷ <https://en.wind-turbine-models.com/turbines/2307-ge-vernova-ge-6.0-164-cypress>

With regard to noise, the frequency levels (50/60 Hz for all models compared) and the maximum noise are equivalent, and the differences are not significant (106.0 dB(A) - 107.0 dB(A)), all the models considered have aerodynamically improved latest generation wings which reduce the noise level when operating and a change of operating modes to optimise noise.

There are various solutions for wing de-icing, such as automatic icing detection systems, automatic wing heating systems and additional warnings.

Several models have built-in bird and bat protection systems, such as stopping the operation of the WPP if there is an increased risk of collision in the vicinity.

The lifetime of the WPP models considered is ~25 years (25-30 years, depending on the manufacturer and the lifetime of the WPP). The latest technologies can have a working life of up to 35 years. According to the information provided by the leading manufacturers of WPP, the wind speed at which the plant starts operating is 3 m/s, while it stops at 23 m/s (however, this may vary slightly from model to model).

WPP are delivered disassembled and consist of several modules, a rotor and wings. The WPP is assembled at the installation site. After the installation of the WPP, the wiring work is carried out and the cables are connected.

Similarly, the masts of the comparable WPP models are mostly made of steel sections, the rotor consists of three fibreglass composite wings with adjustable wing sweep, the nacelle incorporates a generator, transformer, brakes, gear unit, equipment and mechanisms for monitoring and controlling the operation of the station. When steel mast sections cannot be transported to the WPP installation site due to their large diameter, they are divided into several individual mast segments, which are assembled together at the WPP installation site (Figure 4.2.1).



Figure 4.2.1. Multi-segment WPP mast (Vestas LDST²⁸)

This EIA assesses alternatives for the location of the WPP park and the height of the WPP tower. The height alternatives for the WPP tower are defined for the two location alternatives defined above: the different height constraints of the WPP as defined in the landscape expert's opinion are assessed in a comparative way. Technological alternatives for WPP models are not evaluated, but the maximum precautionary principle is used to select the WPP model with the highest noise output.

²⁸ <http://terralwind.com>

For each of the areas assessed during the EIA process, the alternative options - siting and/or technological - for the implementation of the Proposed Action are summarised in Table 4.2.2.

Table 4.2.2. Areas assessed and corresponding alternatives assessed: location and/or technological

Area assessed	Location alternative	Technological alternative
Species and habitats	Alternative A - 12: Z (in full) Alternative B - 20: Z+D* (partial) <i>(*Significant preconditions identified for the 8 WPPs in Part D, to be constructed only after further assessment of vascular plants and moss and lichen species and development of a solution for connection to the AST, and involvement of a freshwater expert for the crossing of the Svētupe)</i>	
Bats	X (both alternatives in full)	
Birds	X (both alternatives in full)	
Landscape	X (both alternatives in full)	X (both alternatives in full)
Cultural history	X (both alternatives in full)	X (both alternatives in full)
Tourism and recreation	X (both alternatives in full)	
Natura 2000	Alternative A - 12: Z (in full) Alternative B - 20: Z+D* (partial) <i>(*Significant preconditions identified for the 8 WPPs in Part D, to be constructed only after further assessment of vascular plants and moss and lichen species and development of a solution for connection to the AST, and involvement of a freshwater expert for the crossing of the Svētupe)</i>	
Noise	X (both alternatives in full)	X (both alternatives in full)
Low frequencies	X (both alternatives in full)	
Vibration	X (both alternatives in full)	
Flicker	X (both alternatives in full)	X (both alternatives in full)
Air	X (both alternatives in full)	
Hydrology	X (both alternatives in full)	
Environmental risks and accidents	X (both alternatives in full)	
Climate	X (both alternatives in full)	

Table 4.2.3. *WPP location alternatives and additional height alternatives A' and B': the compared WPP maximum height limits are given in metres*

Nr.p.k.	Name of the WPP site	Alternative A	Alternative A'	Alternative B	Alternative B'
1	D3			300	300
2	D4			300	300
3	D8			250	275
4	D9			250	275
5	D10			300	300
6	D11			300	300
7	D13			300	300
8	D14			300	300
9	Z1	300	300	300	300
10	Z2	300	300	300	300
11	Z3	300	300	300	300
12	Z4	300	300	300	300
13	Z5	300	300	300	300
14	Z6	300	300	300	300
15	Z9	250	275	250	275
16	Z10	300	300	300	300
17	Z12	300	300	300	300
18	Z13	300	300	300	300
19	Z16	300	300	300	300
20	Z17	250	275	250	275
Total		12	12	20	20

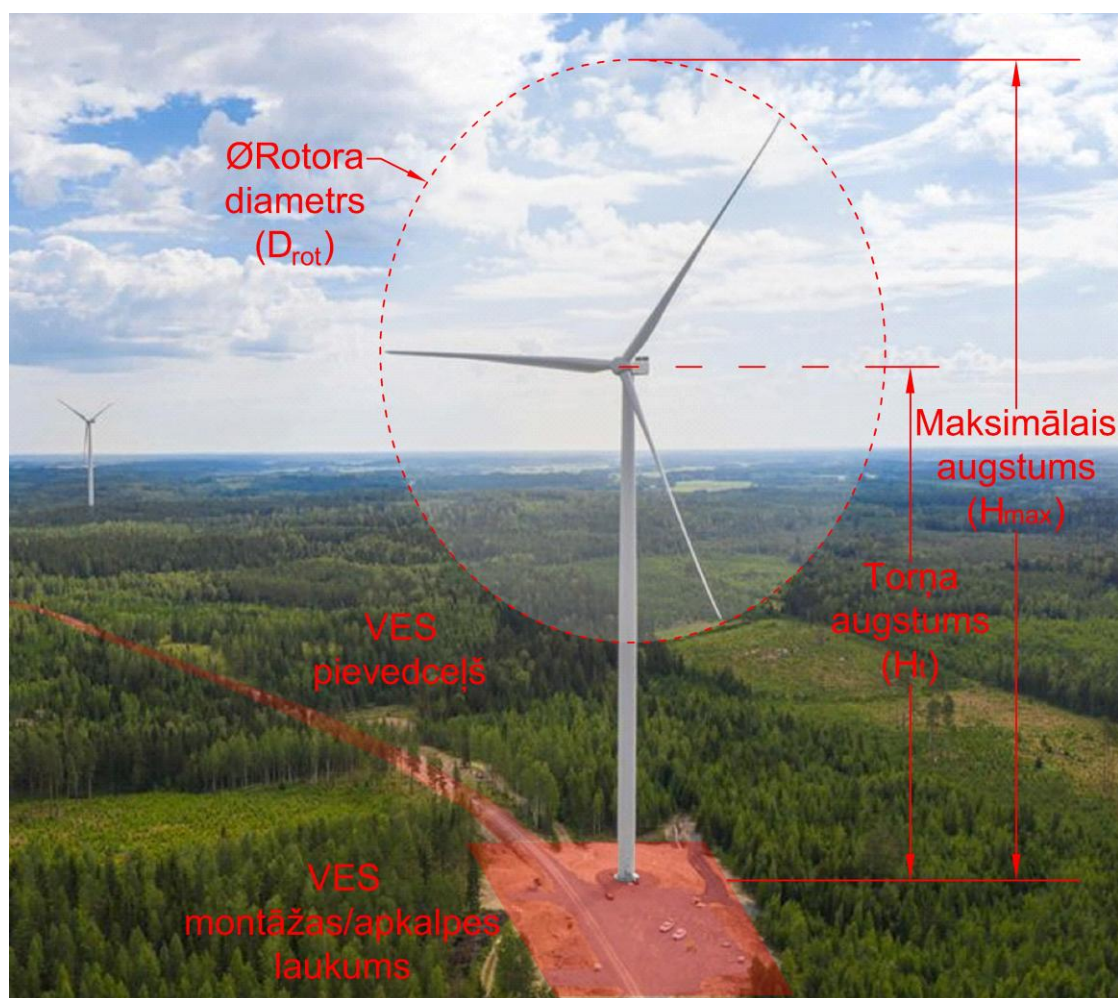


Figure 4.2.2. WPP design parameters

4.3. The process of building a WPP

4.3.1. Description of the construction works and components of the WPP project

The total time required for the construction of the WPP park is expected to be around two years and the construction works will be carried out in accordance with the work organisation and in compliance with the requirements of the regulatory enactments (Figure 4.3.1). During construction, the recommendations of experts, including ornithologists, bat experts, etc., will be taken into account with regard to construction activities and their prohibition during certain periods of time; the activities will be carried out without endangering protected natural values. In the case of changes to the works, these are to be agreed separately with the relevant expert. Meteorological conditions such as strong winds, snow, etc., which may affect the construction process, will also be taken into account.

VES būvniecības etapi - vispārīgi

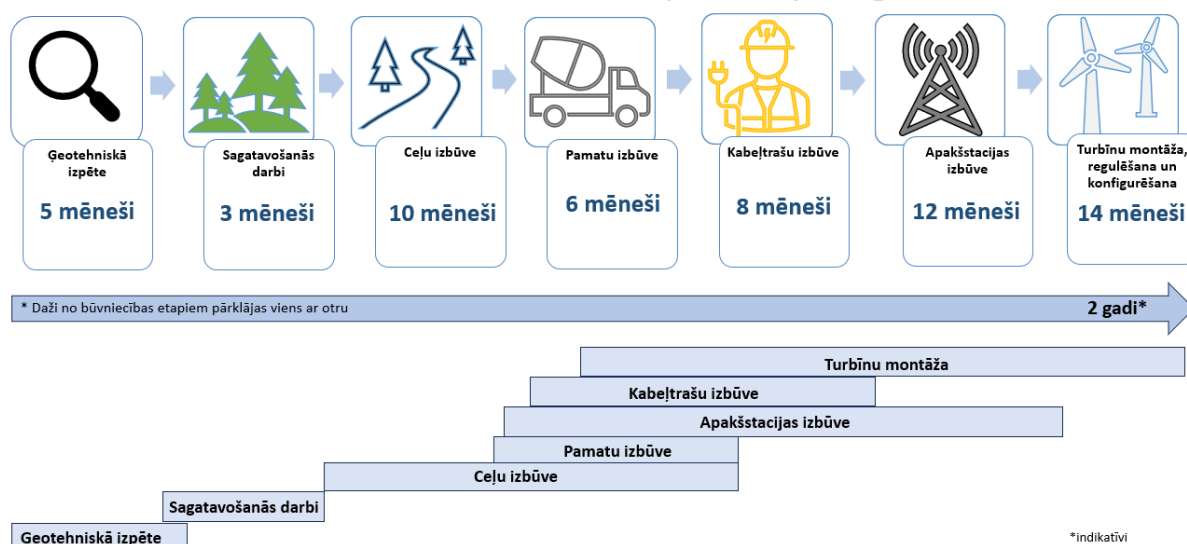


Figure 4.3.1. Preliminary timetable for the phases of WPP construction

Access roads

Assessing the existing road network and making improvements to improve the carrying capacity or dimensions of the road. The project will make maximum use of the existing road network, reinforcing or widening LVM and/or municipal roads where necessary.

Construction of road connections between the existing LVM and/or municipal road and the prospective WPP. Each WPP will be assessed individually.

Construction work service area

Creation of a common service area for the project - to create a temporary area for the temporary storage of bulk materials and earth-moving machinery. The optimal location of this site will be determined during the design process, taking into account the identified constraints and adapting its location for more efficient use of vehicles and construction materials. The site is to be rehabilitated after the construction work is completed.

Electricity connection

The construction of the 35 kV medium voltage electricity cable network in the project area will be carried out in open or closed trenches within the road right-of-way to the extent possible, minimising the impact on adjacent properties.

WPP service (assembly) area

The service area for each WPP can be up to 2.6 hectares, according to the conditions of the WPP manufacturers and designers. After construction, some of these sites are partially reclaimed and can be reused for forestry in parallel with the operation of the WPP, as a smaller site than for construction is usually sufficient for maintenance, depending on the specific location of each individual WPP. However, in this park, it will be assessed whether these sites should be reclaimed after construction and returned to

forestry, as periodic maintenance of the equipment would be required, which would imply re-forestation of the area.

WPP

WPPs with a maximum rated capacity of 8 MW and a total height of up to 300 m are currently under development. The model and technical characteristics of the WPPs to be installed are currently still to be determined and selected, and several possible models are being considered, inter alia in the light of the results of the EIA report. In the Limbaži WPP project area, the location of the WPPs is planned in alternative B in a compact area in the northern part of the site - 12 WPPs and in alternative B - 20 WPPs: the area in the northern part (12 WPPs of alternative A) and the southern part of the study area for the WPPs to be implemented.

High-voltage substation

The construction of the high-voltage substation is being carried out in accordance with AST's technical specifications. For the substation, a high load capacity road will be constructed to ensure the load capacity of the equipment delivery by specialised transport. A standardised solution for the substation is envisaged with a total required substation area of up to 0.5-1 ha. An essential element of a high-voltage substation and the high-voltage network (110 kV) is the construction of overhead transmission lines between the substation and the high-voltage network. The exact technical solution will be worked out in the construction project.

BESS

The BESS will be located on an area of up to 1 ha, adjacent to the high voltage substation site. A more detailed description of the BESS technology is given in Chapter 4.4. For site preparation, hard surfaced areas will be constructed with a suitable surface for the chosen technological solution, comprising a crushed stone or hard surfaced area on which energy storage equipment delivered in standardised transport equipment (container type) will be placed. The water drainage and technological solutions will be adapted to the chosen technology.

4.3.2. Planned site preparation works

The EIA procedure assesses the worst-case scenario, which in this case includes a maximum possible height of 300 m and a maximum possible rotor diameter of 200 m. The choice of the specific WPP model to be built will depend on many conditions for the supply of equipment outside the EIA procedure, such as the availability of manufacturers' models on the market, delivery times, price, etc.

The WPP is planned to be constructed on a monolithic reinforced concrete foundation, following the technical specifications prepared by the WPP manufacturers and taking into account the soil bearing capacity in the area of the Proposed Operation. As part of the technical design, a geotechnical investigation should be carried out to assess the soil bearing capacity at each WPP site. If the engineering geological investigation reveals insufficient soil bearing capacity for the installation of the selected WPPs, the foundation structure will be based on piles at the appropriate locations. The need for piles and the technological solution for their construction will be determined in the construction project. The bearing capacity of the soil at each WPP site will be determined as part of the geotechnical investigation.

The construction of the WPP will start with site preparation works, which will include the establishment of storage areas for equipment, construction machinery and materials, the removal of topsoil and subsoil in

areas where new roads and the WPP are to be built, and the preparation of construction pits for the construction of the WPP foundations.

One area could be created on the site of the proposed activity for temporary storage of machinery, equipment and materials during construction. The site will accommodate construction materials, excluding loose materials for road and site construction, WPP components, construction machinery and waste collection containers. The pitch will be up to 2.6 ha in area and will be constructed of gravel and crushed stone, ensuring a minimum load-bearing capacity of 250 kN/m².

The temporary storage area will also house a construction management centre. This control centre will have a stand-alone electricity and water supply, as well as a mobile wastewater collection solution if needed.

In areas where new roads and sites are planned for the installation of WPPs, as well as where WPP foundations are to be built, deforestation will be carried out before construction work starts.

According to the letter No.4.9/2372/2024-N of the SEA of 17.04.2024, the construction of the planned WPP park is also planned in historical forest massifs, which are now partially fragmented due to the increasing logging in the country, but still contain an important gene pool of rare forest species. Old-growth forests will be significantly more affected by the construction of WPPs and associated infrastructure than if WPP parks were planned on agricultural land, in quarries, etc. Consequently, in view of the request of the NCA, experts not only on forest or swamp habitats, but also on mosses, lichens and vascular plants have been engaged in the area of the Proposed Action affecting old, historical forest massifs.

Estimates of the total deforested area are given in Chapter 7.1.

After deforestation, topsoil will be removed. The removed topsoil will be temporarily placed along the boundary of the construction site. The areas where the new roads and WPPs are to be constructed are not located in waterlogged areas where significant quantities of poor bearing soils would need to be removed prior to construction. It is expected that part of the removed topsoil will be used for reclamation during the final phase of the construction process, while the remainder will be used for the improvement of nearby agricultural land. It is expected that soil not required for the reclamation of the construction area will be removed from the temporary spoil heaps once the access roads and plazas are completed.

During site preparation works, construction pits will be dug in the areas where the foundations of the WPP will be constructed. Indicatively, each construction pit will have an area of up to 1000 m² and a maximum depth of up to 5 m (final solution after geotechnical investigation at the design stage). The spoil removed from the pit will be temporarily placed along its perimeter. Part of the excavated spoil will be used for post-construction reclamation, while the rest will be removed from the temporary spoil heaps once the access roads and plazas are completed (Figure 4.3.2).



Figure 4.3.2. WPP construction (illustrative image)²⁹

An assembly area must be created at each WPP to be built. Its size and configuration depend on the model of the WPP to be built, the machinery used in the assembly process, the location of the site, changes in ground surface elevation, logistical solutions and rotor mounting solutions. The configuration of each assembly area will be designed in cooperation with the selected WPP manufacturer or its authorised construction company. The elements of the assembly site - access roads, the main crane working area and the hard surfaced areas (hard surfacing - compacted gravel material meeting specified load bearing capacity) and the WPP foundation area - will be created during construction and maintained during operation of the WPP within the boundaries of the land unit allocated to each WPP, using only part of its 2.6 ha area. The elements of the assembly area - assembly area, wing stowage area, crane assembly area, equipment/ballast stowage area, auxiliary crane working area outside the access road - will be created during construction and dismantled after the construction of the WPP. The elements of the assembly site - hard surfaced areas, assembly area, equipment/ballast staging area, auxiliary crane work areas, hard surfaced areas in the WPP wing staging area and crane assembly area - shall be constructed of gravel and crushed stone material and shall have a minimum load bearing capacity of 250 kN/m².



Figure 4.3.3. Installation area of the WPP (example - VESTAS 5,6 MW)

²⁹ <https://www.peikko.ae/reference/simo-wind-park/>

4.3.3. Construction solutions for roads and squares

The equipment and components of the WPP will be delivered along the road network identified in the EIA, and the same roads will be used for construction transport. The road network will also be used for maintenance of the WPP after the end of the works: no heavy traffic is planned on the road network after the end of the works.

The sequence of works shall include the construction of access roads in accordance with the designers' instructions. Depending on the design options and the results of the geotechnical investigations, the topsoil will be removed and placed at the edge of the construction area with the aim of returning it after completion (Figure 4.3.2). The necessary engineering structures and drainage will be realigned in accordance with the construction design solutions to be agreed with the relevant road owner (for the existing road network) or in accordance with LVM road construction solutions and equipment manufacturers' conditions (for new roads).

According to the manufacturers, the minimum required road width for transporting equipment and wings is 4.5 m on straight sections and 6.5 m on small curved sections (depending on the assessment and specification of each individual WPP manufacturer after thorough site investigation and survey). No new road infrastructure or deforestation works are planned on the existing road sections, the construction of which was carried out in accordance with the requirements of LVM "Technical Regulations for the Design of Forest Infrastructure Objects, 2015"³⁰.

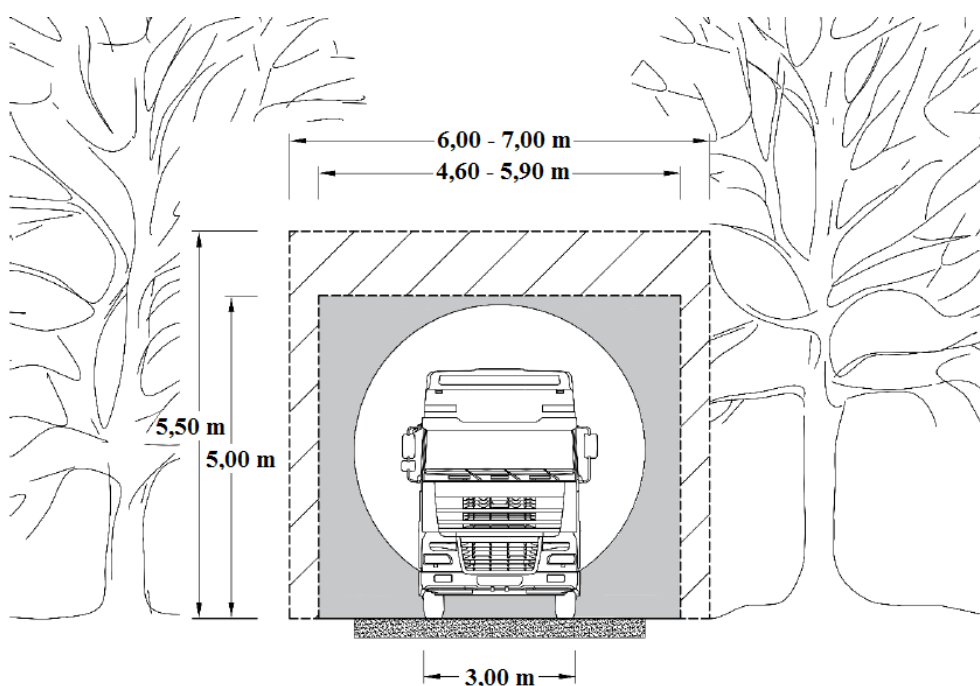


Figure 4.3.4. Access characteristics (example)

Outside Latvia, in countries where equipment and extra-long rotor wings are also transported over mountainous roads with difficult terrain: specialised transport units are also used that can lift the wing at a high angle to the ground, thus reducing the required in-plane turning radius. The specific solution will be

³⁰ https://www.lvm.lv/images/lvm/Profesionaliemi/Infrastruktūra/MIO_TN/MIO_TP_noteikumi_2015.pdf

evaluated during the design of the works, once the specific WPP model and its parameters are known, taking into account cost conditions and the availability of specialised vehicles.

Road carrying capacity and width issues for the substation access road and the BESS site need to be addressed separately. The substation transformer (unfilled with oil) has an approximate mass of 40 tonnes and has non-standard transport dimensions, which place increased demands on it. It is recommended that separate supply designs be developed for the supply of the transformer and other substation process equipment if their dimensions exceed standard transport dimensions (Figure 4.3.5). The BESS site is up to 1 ha and requires the removal and replacement of the fertile soil with a layer of non-load bearing, non-confined pavement to allow vehicular and crane access if the BESS equipment package (container) needs to be replaced.

During the construction process, several technological solutions can be used to raise the existing ground surface without affecting the groundwater flow. This solution is refined during the design process after evaluation of the geotechnical data in order to achieve the required load-bearing capacity. Commercially proven geotextile, geogrid or other solutions to improve the bearing capacity of soils can be used to improve performance.

The WPP service areas will consist of a permanent use area and temporary use areas (Figure 4.3.6).

The construction period is significantly constrained by the climatic conditions in Latvia and, consequently, by the load capacity of the access roads and their limitations during the period in question. In parallel, these periods need to be aligned with an appropriate timeframe for securing supplies from the equipment manufacturer, as well as the availability of the necessary heavy-duty equipment. Given the current high demand for WPP equipment on the world market and especially in the EU, it is necessary to plan the construction period based on the availability of possible supplies and the availability of personnel from the relevant technical supplier, as well as to take into account the weather conditions: it is not possible to assemble the wind farm components in strong winds.



Figure 4.3.5. Road construction solution for the WPP park (photo: Ltd Enviropojekts)



Figure 4.3.6. WPP site base under preparation (photo: Ltd Enviropojekts)

4.3.4. Solution for WPP foundation structures

According to the manufacturers, the WPP mounting areas must have a load capacity of at least 250 kN/m^2 .

As an indication, the foundations of a single WPP will require up to 1000 m^3 of concrete and 125 t of steel on average. Thus, up to $20\,000 \text{ m}^3$ of concrete and 2500 t of steel reinforcement are needed to install the foundations for 20 WPPs (for each WPP and for each soil condition, the solution may vary according to the results of the geological investigation) (Figures 4.3.7 and 4.3.8).



Figure 4.3.7. Part of the WPP foundation steelwork under construction (photo: Ltd Enviropojekts)



Figure 4.3.8. Part of the WPP foundation steelwork under construction (photo: Ltd Enviroprojekts)

4.3.5. Installation of temporary service area, mast structure and WPP

The installation area for the WPP should not exceed 100 x 260 m. Before installation, the WPP is brought disassembled, with the longest part - the wing - being 100 m. At the EIA study stage, a rectangular area was evaluated on a best-caution basis (in reality this area is smaller) to accommodate the assembly areas of the manufacturers of all major WPPs (Table 4.2.1): the approximate configuration of the construction area is shown in Figure 4.3.9.

The installation of the WPP at the site of the Proposed Operation will be carried out by the WPP manufacturer or its authorised construction company. A detailed plan for the installation of the WPP will be developed in the construction project. The time needed to install a single WPP is usually within one week, but weather conditions play an important role in the process. The installation of a WPP may be delayed if there are high wind speeds at the time scheduled for installation, limiting the ability to safely install the WPP.

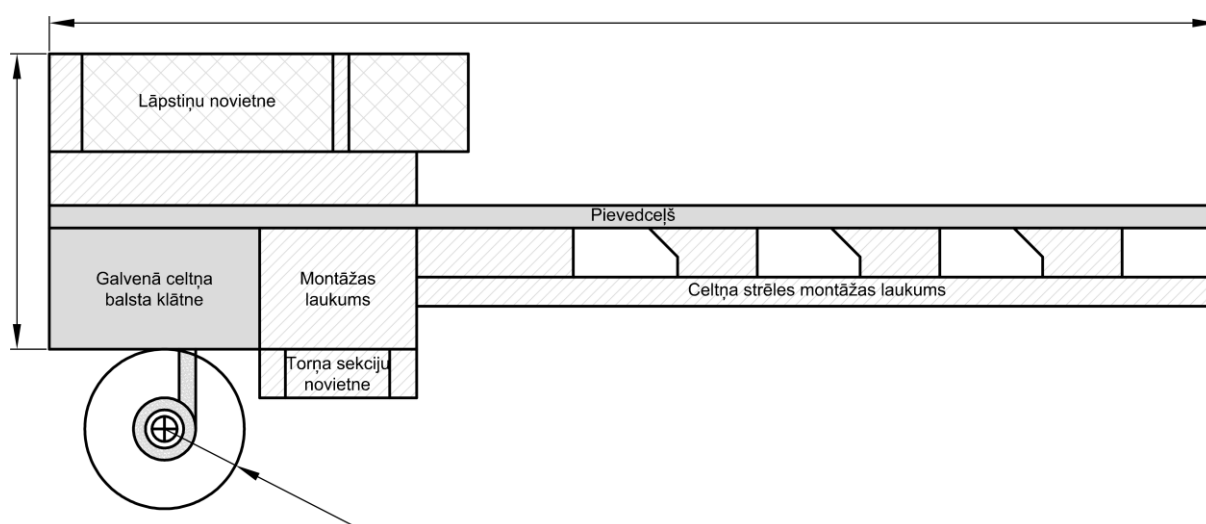


Figure 4.3.9. VESTAS 5.6 MW model site configuration

The 5.6 MW area of the VESTA model (Figure 4.3.9) is indicative. WPP technology for 300 m high terrestrial WPP models has not yet been developed, so information on similar WPPs with an appropriate site margin (plus 20 %) for higher detail dimensions is used (Figure 4.3.10).



Figure 4.3.10. WPP installation in Latvia: Targale project, 2022 (photo: Ltd Enviroprojekts)

4.3.6. Construction of utilities

The electricity utilities in the WPP area are usually constructed using two solutions: overhead transmission lines or cable lines. In this project, it is planned to construct cable lines to connect the WPP to the common electricity grid, as this solution has less impact on the future use of forest land. The WPP cable connection is implemented in a 20-40 kV cable line with a connection to an AST substation, which in turn is connected to an AST overhead line, which will be connected to the common transmission grid in accordance with the technical regulations issued by AST.

Prior to the start of construction, a detailed engineering study will be carried out in the future design process in accordance with the cable routes defined in the EIA report, which have been investigated in the field, in order to determine the optimal final cable route, taking into account the geological conditions and the environmental protection requirements set out in the EIA opinion on the planned activity.

For optimal power supply solutions, the planned location of the WPPs is taken into account, as cables from each WPP must be routed to transformers or collection points. The cables shall be placed at the optimum excavation depth according to the engineering survey data to protect them from environmental influences (mechanical damage, e.g. movement of logging machinery). Special cable conduits or protective structures are laid in the trenches where the cable ducts are installed to protect the cables from water, soil pressure and other environmental factors. Medium-voltage cables (10-30 kV) are typically used to transport electricity from the WPP to the collection points, as well as high-voltage cables (110 kV and above) between the collection points and the electricity grid. After the cables have been laid, they are tested to check their integrity, durability and safety. Tests include both power flow testing and safety tests against surges or other possible malfunctions.

As part of the construction of the WPP Park project, a new substation is to be built and connected to the AST 110 kV network (Figure 4.3.11).

The LVP foresees the location of the substation on a 110 kV high voltage line. The EIA assessed two options for substation locations. The construction of the substation will be agreed with AST. A 20-35 kV network will be constructed to interconnect the WPPs with the substation under construction, the technical parameters of which will be detailed in the electricity network design.

During the construction process, communication networks will also be built for the management and monitoring of the WPP projects. It is expected that the networks to be built (fibre optic and low-current cable lines) will be laid parallel to the electricity transmission networks and that the data networks will be built in parallel to the access roads.



Figure 4.3.11. *High-voltage substation under construction - Tārgale project, 2022 (photo: Ltd Enviroprojekts)*

The connection and substation will also be constructed in accordance with AST's technical specifications, which will be received upon completion of the EIA. It is expected that the substation construction project will be implemented together with the construction of the full set of necessary equipment for the AST and LVP installations. Within the substation area, the main equipment groups will be housed in two small-scale technical application buildings, one for AST technical staff and the other for Latvian wind farms on the medium voltage side. The building on the medium voltage side can also be designed to provide a safe minimum amount of storage space for the safe storage of unscheduled maintenance materials for the operation of the WPP.

A BESS system (up to 1 ha) will be constructed next to the substation, according to the envisaged technical solution for operation, thus making optimal use of the road and cable infrastructure. The site will be surfaced with a non-load bearing material of adequate strength to support the operation of the BESS system and the replacement of process equipment. The technological equipment will be delivered and installed in standardised transport solutions (sea containers) ready for operation, without any additional civil works.

4.3.7. Transport of WPP components

The delivery of the components of the WPP to the area of the Proposed Operation will be carried out by the manufacturer of the WPP or its authorised transport company. A detailed transport plan for the WPP will be developed in the construction project in cooperation with the WPP manufacturer or authorised distributor. The transport plan will take into account the size, mass, road width and load capacity of the components of the WPP to be transported and other constraints (bridges, viaducts, overhead power lines, etc.).

The components of the WPP will be delivered from their place of manufacture to the port (options: Salacgrīva, Skulte, Riga). They will be transported from the port by road: some parts by public road vehicles without special permits, and some parts - the bulky mast sections, nacelle and wings - by specially built and equipped or adapted bulky goods vehicles, each of which requires a special permit. Of these, the undivided wings up to 100 m long will be the real traffic bottleneck, which may require temporary stoppages of other traffic in places during manoeuvring. However, depending on traffic needs and possibilities, the projection of the wing length on roads and access roads on the route from the port to the installation site of each WPP can be reduced by special vehicles carrying the wing half-raised at greater or lesser angles, but the length of the vehicle itself is only ~30 m. Mast sections are ~30 m long, so they may also require additional manoeuvring measures, but to a much lesser extent. The other loads requiring permits will be heavy goods only, not bulky goods, and the traffic complications they cause are negligible, mostly just slow speeds.

Every overweight freight journey on public roads has the potential to cause inconvenience to other road users, but it is the necessary permits that ensure that the journey is planned to minimise this inconvenience. Transport of bulky parts could be planned for weekends, when traffic is significantly less. It is even lower at night, while it is more dangerous to correctly perceive and safely overtake a slow-moving bulky goods carrier in the dark of the day, and more difficult to notice and understand in time a temporary traffic stops for a bulky goods manoeuvre that has been organised ahead.

The delivered components of the WPP will be placed either at the WPP assembly site or at one of the sites constructed for the temporary storage of machinery, equipment and materials.

The approximate mass and number of components of an analogue WPP is as follows (mass and number are indicative and may vary slightly depending on the WPP model chosen):

- basic ring: 20 t (divisible),
- mast: 500 t (each section 40-70 t, number ~8),
- gondola: 50 t (indivisible)
- generator: 100 t (consisting of 4-5 parts of 15-50 t each),
- wings: 3 x 20 t (indivisible),
- total: up to 750 t (including ~13 indivisible bulky and/or heavy loads).

In addition to these details, the literature gives a maximum for the largest WPP with a safety margin: the amount of concrete for the foundations shall not exceed 2500 t (including reinforcement, which is negligible in this mass).

Existing dirt roads will be used as far as possible for access to the WPP, and new roads are planned to allow for construction and operation of the WPP. It is expected that access to the planned WPP park during construction and operation will be provided by the national main road A1 (Riga - Estonian border), regional road P12 (Limbaži - Salacgrīva), state local roads V138 (Lāņi - Ķirbiži - Jelgavkrasti) and V143 (Akmeņkalni - Lauvas - Ķekari), municipal roads, forest roads maintained by LVM, as well as newly constructed or adapted existing access roads.

Site access is planned on the basis of the transport conditions required for construction and delivery of equipment. The projected vehicle volumes during the construction of the WPP in the vicinity of the Proposed Action are presented in Figure 4.3.12.

Estimated number of transport units for each phase of the project works (see Table 4.3.1 for a summary):

- construction of a substation and the necessary new access roads and increasing the carrying capacity of existing roads to deliver heavy equipment: substation area up to 1 ha, preparation of an access road with a carrying capacity >250 kN (up to 350 trucks for the substation and up to 25 trucks for every 100 m of road to be constructed/reconstructed);
- 110 kV grid connection (overhead line): planned length (before obtaining technical regulations from AST) - 300 m, including crossing of the Korge river with the overhead line, up to 50 trucks/m);
- BESS - technology construction and equipment supply. Required area up to 1 ha, (unpaved area to be provided) (up to 370 lorries/m in total);
- construction of access roads to each WPP (up to 25 lorries per 100 km of road to be built/reconstructed);
- construction of service bays for each WPP (300 lorries/m for each service bay to be built);
- WPP foundation and footing construction (average 1100 m³ of reinforced concrete per footing construction - 50 lorries/m per WPP);
- Delivery of WPP equipment (mast, generator and wings) to the sites (up to 20 lorries per WPP);
- Installation of WPP equipment (up to 7 lorries per WPP).

Table 4.3.1. *Number of transport units for each phase of the project works*

Project phase	Number of lorries/m
Substation construction	Up to 350 plus up to 25 for every 100 consecutive metres of road
Connection to high voltage line	Up to 50
Installation of a battery energy storage system	Up to 370
Construction of new feeder roads for each WPP	Up to 25 for every 100 metres of road
Construction of service (assembly) areas	Up to 300 x 20 WPP
WPP foundation construction	Up to 50 x 20 WPP
Supply of WPP equipment	Up to 20 x 20 WPP
Installation of WPP equipment	Up to 7 x 20 WPP

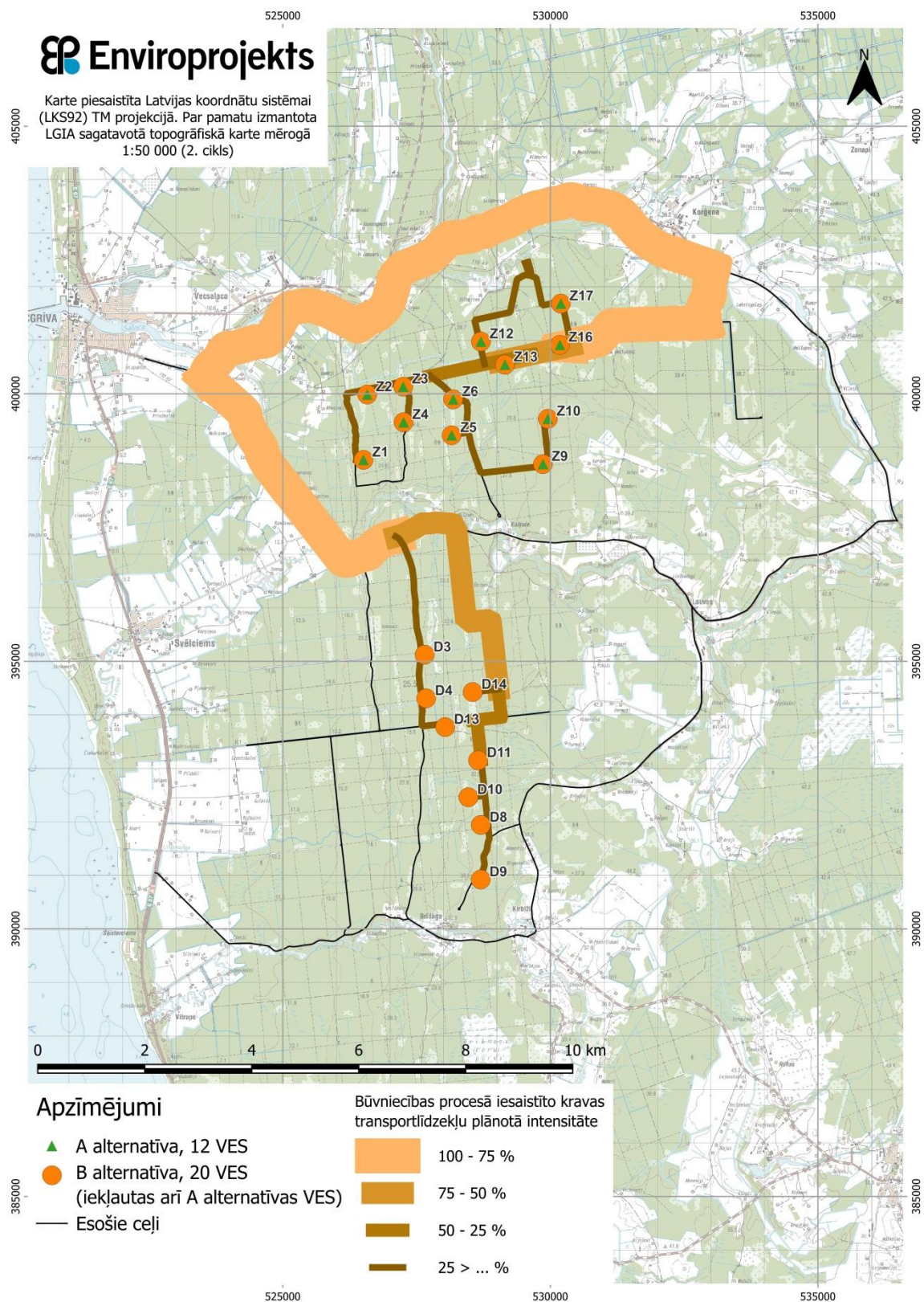


Figure 4.3.12. Projected vehicle volumes during the construction of the WPP



Figure 4.3.13. *Special equipment for transporting WPP wings*



Figure 4.3.14. *Transport of WPP parts in Latvia: Targale project, 2022 (photo: Ltd Enviroprojekts)*

4.3.8. Installation of additional security, lighting and monitoring equipment for WPP

Various auxiliary equipment will be installed to help control, regulate and manage the WPP and network parameters. Equipment manufacturers can offer different solutions depending on the customer's requirements and project conditions. These systems are integrated into the Industrial Process Control and Visualisation System (SCADA).

According to the requirements of nature experts and the NCA, the WPP will be equipped with the necessary digital bird and bat monitoring systems, which will allow the WPP to be stopped at short notice

in case of detection of flying objects. The most appropriate solution for the site of the proposed activity will be determined during the pre-construction monitoring. There are currently several such systems on the market, such as IdentiFlight, Bioseco, etc., but the market is evolving rapidly and the most appropriate solution will be selected for the installation of the WPP in the area of the proposed activity, taking into account the results of the post-construction monitoring.

All potential WPP suppliers also offer in their technology specifications tailored packages of additional equipment for so-called climate (winter) risks, such as de-icing and others. To prevent aviation safety risks, WPP will be equipped with lighting equipment in accordance with the requirements of aviation legislation.

4.3.9. Inspection, testing and acceptance of equipment

After the construction and installation of the wind park and the facilities and equipment related to its functioning in accordance with the technical regulations, a multi-stage commissioning phase will be carried out for WPP, BESS and also for the HV substation to ensure the stable operation of both the wind park as an electricity generator and BESS, as well as the connection and the stability of the HV line.

According to previous practice in similar projects in Latvia, the commissioning programme for a substation can take more than six months.

Experience from similar projects shows that a major benefit of the substation test programme is the temporary connection to the medium voltage electricity grid.

4.3.10. Reclamation of construction sites and WPPs

After the construction of the WPP park, the project area will be reclaimed. At the end of the construction works, the temporary storage areas for machinery and construction materials will be dismantled and the materials used for the delivery and installation of the WPP will be disposed of. If it is intended to return the used site material to another location, contamination analyses will be carried out on the materials concerned. Depending on their results, a decision will be taken on their possible re-use as road or square surfacing material or for the restoration of fertile soils.

During the construction phase, the possibility of reclaiming the site and returning part of the site to forestry will also be assessed. However, this possibility must be assessed against the equipment supplier's conditions for the future maintenance of the WPP. The study areas of the WPP Park project are forest land, so no agricultural use is planned after completion of the construction works.

The lifetime of a WPP is typically 25-30 years. Today, WPP manufacturers are also ready to offer service contracts for a 35-year life cycle. A well-maintained plant can be operated for longer if the benefits of realising the energy generated by the plant outweigh the costs of maintenance and upgrading. Experience from other countries shows that the actual lifetime of a WPP can also be affected by technological developments and industry policies. At the end of its lifetime, the WPP is dismantled or *repowered*. In dismantling, the WPP is completely demolished with all foundations, while in rebuilding, old stations are mostly replaced by new ones on the same or new foundations. Metal structures and equipment from dismantling can be recycled and reused, for example as Refuse Derived Fuel ("RDF") or concrete can be recycled as construction waste³¹.

³¹<https://windeurope.org/newsroom/press-releases/repowering-wind-farms-a-major-opportunity-for-europe/#:~:text=In 2021 the wind industry, and developed blade recycling solutions.>

2021. In 2010, the wind industry called for a Europe-wide ban on the landfilling of WPP wings³² and committed to reuse, recycle or recover 100% of used wings. WPP manufacturers have set the goal of fully recyclable wings and have developed solutions for wing recycling.³³ For example, *Siemens Gamesa Renewable energy* has announced the commercial availability of WPP with fully recyclable blades³⁴. WPP manufacturer VESTAS has also announced that, in collaboration with Aarhus University and the Danish Institute of Technology, it has discovered a new method for breaking down epoxy resin (which has been a major barrier to recycling WPP blades) to facilitate the recycling of WPP blades already manufactured and to be manufactured in the future³⁵. Other WPP manufacturers are also developing this line of research.

Reclamation of the project at the end of the project life cycle (25-30 years) involves several possible options:

- 1) complete site reclamation, dismantling all elements of the WPP, including reinforced concrete structures. Such dismantling work has been carried out in Latvia in the past on former missile sites, such as Zvaigznīte, which are technologically more complex structures. The artists have also published videos and photos from the projects.³⁶
- 2) Reusing equipment foundations with newer and more efficient equipment (so-called *Repowering*). There is a high probability of such renewal already before the end of the project life cycle. The German Wind Energy Project Development Report states that in the first half of 2023, 25% of new installations in Germany were replacements of existing WPPs with more efficient ones³⁷.

4.4. Description of BESS technologies and related infrastructure

BESS is one of the fastest growing technologies for storing electricity. Stationary battery EV energy storage systems are applicable to a wide range of power system applications, such as peak load smoothing, balancing of intermittent power (solar panels, WPP), voltage stability, inertia, *blackstart* and arbitrage (market benefits from electricity price differentials). Thanks to their fast response times, their power is increasingly used in the ancillary services market for frequency regulation. In addition, in line with electricity market price fluctuations, the arrival of large-scale renewable energy sources (RES) and the synchronisation of the Baltic and continental European power systems, fast response electricity storage systems will become an integral part of the power system from 2025 onwards. On a broader scale, Ltd Latvijas vēja parki will not only be able to improve its ability to sell electricity on the market at the highest possible prices and reduce costs for RES balancing, but also to provide services to the Transmission System Operator (hereinafter - TSO) for balancing needs. Primarily, TSOs will need frequency holding reserves (FCR) and frequency restoration reserves (FRR).

Electricity can be stored using several different technologies: mechanical, thermal, chemical, electrochemical and electrical. In total, more than 50 storage technologies are represented worldwide, including various battery technologies, compressed air energy storage, flywheels, hydrogen energy storage, hydro storage, superconducting magnetic energy storage and thermal energy storage.

³²<https://windeurope.org/newsroom/press-releases/wind-industry-calls-for-europe-wide-ban-on-landfilling-turbine-blades/>

³³ <https://windeurope.org/eolis2023/programme/sessions/blade-recycling-projects-i/>

³⁴ <https://www.siemensgamesa.com/global/en/home/explore/journal/recyclable-blade.html>

³⁵ <https://www.vestas.com/en/media/company-news/2023/vestas-unveils-circularity-solution-to-end-landfill-for-c3710818>

³⁶ <https://www.demontaza.lv/>

³⁷ <https://www.wind-energie.de/english/statistics/statistics-germany/>

Batteries are a group of electrochemical storage solutions. Batteries are generally suitable for relatively short storage times and in most cases have a very fast response time. The most important characteristics of functional battery technology are the combination of power and discharge duration and the energy density per unit mass or volume, as this influences the required battery sizes.

Batteries can be divided into three main categories according to their technology:

- 1) conventional cell batteries containing two electrodes (e.g. lead acid, lithium ion, nickel cadmium),
2. high-temperature batteries that store electricity in molten salt (e.g. sodium sulphide_{Na₂S}); and
- 3) flow batteries using electrolyte liquids in tanks (e.g. Zn/Br reduction, Fe/Cr reduction).

Lithium-ion batteries are one of the fastest growing battery technologies and are likely to remain the most approved battery technology over the next 20 years. The advantages of this technology include:

- 1) high energy density,
- 2) relatively low running costs,
- 3) fast charging capability (response time),
- 4) low self-discharge and long shelf life,
- 5) sufficient working life.

Shortcomings may include:

- 1) relatively high capital investment,
- 2) poor performance at high and low temperatures,
3. specific requirements for protection schemes and climate control, including fire risk and performance.

Stationary electric battery energy storage systems are built on the principle of modulation. A key factor for a modular system is said to be reliable, cost-effective systems that are easy to configure with the latest storage component technologies and allow storage systems from 1 MW to more than 500 MW.

Individual *cells* or *blocks* are contained in a single battery module, which in turn form *spacks* or *arrays*. The battery cabinets are fully equipped with a battery management system and the necessary safety systems: temperature maintenance and air ventilation, as well as a fire alarm and extinguishing system. In addition to batteries, energy and storage management systems (SMS), converters (inverters/rectifiers) and transformers for power conversion, low and medium voltage distribution, air handling solutions: heating, ventilation and air conditioning systems are installed. All equipment, except the transformer, is usually in sea containers at a safe distance from each other. A single container can hold batteries with a total capacity of up to 2.8 MWh, while inverters could have a capacity of 1-2 MW.

The battery configuration is selected depending on the application. Frequency control requires a high converter power but not a high energy capacity: 1 MW / 0.5-1 MWh. However, arbitrage and balancing of the WPP/Solar Power Plant (hereafter – SPP) are important for high energy capacity: 1 MW / 2-4 MWh). In the Limbaži WPP Park, the main function of BESS will be balancing.

The efficiency of batteries is typically around 96 % (4% losses), but the efficiency of a BESS must take into account the technological consumption of electricity and losses in other equipment: transformer, cables, converters and auxiliary systems. This could lead to an overall *round trip* efficiency (RTE) of 88-90 %.

Lithium-ion modules have an average lifetime of 10 years or 5,000 charge/discharge cycles, which means an average of 500 cycles per year and 1.5 cycles per day. However, BESS operators intend to use them for longer by reducing the number of cycles per day and by reducing the depth of charge/discharge of the batteries, i.e. only charging the batteries to 90 % and not discharging them below 10 % of the total BESS

capacity, thus extending the normal working life. In the later stages of BESS use, faster battery degradation (i.e. reduction in battery capacity) or replacement of individual battery modules should be planned. This is why BESS usually calculates the total working lifetime to 20 years. Battery degradation is characterised by the so-called State of Battery Performance (SOH) and depends on the frequency of use and the depth of charge/discharge. Partial replacement of the battery modules should be carried out when the SOH drops to 70-80 %. The more a battery is charged/discharged, the faster it degrades.

Starting from the maximum rated capacity, the largest area required is assessed on the basis of the maximum precautionary principle:

- $20 \text{ WPP} \times 8 \text{ MW} = 160 \text{ MW}$, which is the maximum capacity that the Limbaži WPP can develop in one hour, producing 160 MWh.

One container can hold a BESS with a capacity of $\sim 2.8 \text{ MWh}$. $160 / 2.8 = 57$ containers maximum. 1 ha of land is sufficient to accommodate them. The WPP fleet is expected to operate on average 1.5 cycles per day.

1 cycle of BESS is 2-4 h; $1.5 \text{ cycles} \times 4 \text{ h} = 6 \text{ h}$ per day of BESS.



Figure 4.4.1. Close-up of BESS containers (illustration by: Kristīne Eglīte)



Figure 4.4.2. BESS layout on the site (*illustrative image, author: Kristīne Eglīte*)

4.5. Operational characteristics of the WPP

After commissioning, the daily operation, monitoring and control of the WPPs is managed remotely via a SCADA system, ensuring continuous monitoring of operational parameters and electricity production.

Maintenance or fault rectification of the WPP will be carried out by specialised service personnel under contract with the WPP manufacturer. Information signs will be installed at the WPP and the area around the WPP will not be physically cordoned off.

Information signs about the wind park and the preferred safety measures will be installed on the roads passing through the area.

During the operation of the WPP, economic activities outside the WPP site will not be restricted, and it is expected that property holders will continue to use the adjacent areas after the construction of the WPP in the same way as before.

The WPP Park will be managed and monitored throughout its lifetime to ensure its sustainability. The following elements of a monitoring system can be identified:

- monitoring operating parameters and electricity production
- monitoring of ornithology and natural values and an active prevention system that stops WPP during specific conditions (radar or camera and machine vision technological solutions);
- technological (equipment parameters, e.g. "shadow monitoring"): detecting risks of wear or failure of equipment well before the risk of an accident occurs, using a sensor system;
- accounting for potential losses of natural values, in line with the monitoring scope identified by ornithological and bat experts in the EIA report;

- field surveys to assess spatial impacts on specific species, in line with guidance from species and habitat experts.

Specific proposals will be developed for each group of monitoring systems, based on guidance from the environmental and nature experts involved in the EIA or solutions proposed by the technology manufacturer.

In accordance with the requirements of Cabinet of Ministers Regulation No 570 of 21 July 2008 "Regulations on marking and equipping objects with protective lights", each WPP in the area of the Proposed Operation shall be equipped with two protective lights (mounted on the WPP nacelle) so that their position in the horizontal plane provides the pilot of the aircraft with a view of at least one protective light from any direction and the range of the protective light is 360°. As the height of the constructed WPPs will be more than 150 m, they will be equipped with Type A safety lights.

5. EXPECTED BY-PRODUCTS, EMISSIONS, RISKS

5.1. Waste management

The EIA takes into account the requirements of the regulatory enactments listed in Chapter 2 when assessing waste management.

Both municipal and construction waste will be generated **during the construction of the WPP**. Household waste will be collected and temporarily stored in containers in an area for temporary storage of machinery and materials. The collected municipal waste will be handed over to waste managers who have received permits for the management of the waste type.

No maintenance or repair of technical equipment will be carried out in the construction area, except in the event of an accident, hazardous waste such as petroleum products, oils, etc. may be generated. Hazardous waste (used chemical/mixture containers, spills from equipment/filling, machinery, etc.) will be collected, segregated and stored in accordance with hazardous waste storage requirements. Hazardous waste will be transferred to a licensed hazardous waste manager for further management.

Construction waste will be managed in accordance with the applicable national and municipal legislation. Construction waste will be collected using suitable bins, containers and vehicles. Construction waste will be accounted for in accordance with the procedures set out in Cabinet Regulation No 113 of 18 February 2021 "Procedure for Accounting for Waste and its Shipment".

Part of the assembly areas constructed during the construction of the WPP (part of each area) will be dismantled during the final phase of construction. Although all necessary precautions will be taken during the construction process to avoid contamination of the ground, the machinery used may cause contamination of the site with petroleum products. Prior to dismantling the assembly site, soil contamination will be assessed and, if found, the soil will not be used for its intended purpose without remediation: contaminated soil will be transferred to waste managers who have obtained permits for the management of the type of waste concerned.

No waste is expected to be generated **during the operation of the WPP**, except for waste generated during maintenance (WPP equipment that has reached the end of its useful life and needs to be replaced). Waste collection and disposal during operation of the WPP will be carried out by waste management operators that have obtained waste management permits for the relevant waste types.

Waste management in **the post-operational phase of the WPP**: Solutions already exist for the re-use of metal materials used in the construction of WPPs, and the concrete used for the foundations can be re-used in the event of dismantling. WPP wings made of composite materials are considered to be a material group with limited recyclability. Both WPP manufacturers and organisations involved in the wind energy industry are now actively seeking solutions for the re-use of polymer materials related to the wind energy industry. For example, a publication prepared by *Wind Europe, the European Composites Industry Association* and the *European Chemical Industry Council* in 2020³⁸ analyses a range of technologies available for the recycling of WPP wings, looking for the best solutions to promote the reuse of composite materials used in the construction of WPPs. As mentioned in chapter 4.3.9, in 2021 the wind industry called for a Europe-wide ban on landfilling of WPP wings and committed to reuse, recycle or recover 100% of

³⁸<https://windeurope.org/newsroom/press-releases/repowering-wind-farms-a-major-opportunity-for-europe/#:~:text=In 2021 the wind industry, and developed blade recycling solutions>

used wings by 2025.³⁹ WPP manufacturers have set the goal of fully recyclable wings and have developed solutions for wing recycling. For example, *Siemens Gamesa Renewable energy* have already announced that they are able to produce 100 % recyclable rotor wings for commercial use⁴⁰. Other major European and US WPP manufacturers are also working to provide this solution for their own WPPs.

5.2. Possible effects of WPPs on human health, assessment of electromagnetic radiation and permissible levels

Potential impacts from the operation of the WPP are related to localised physical effects: sound levels, including in the infrasonic and low frequency range, vibration, flicker effects and electromagnetic radiation. Transient environmental impacts are also expected during the construction of the WPP (noise, air pollution), but these are not specific to the construction of the WPP and are similar to any other construction activity. The EIA has taken into account the requirements of the regulatory enactments listed in Chapter 2.

Chapter 7.2 of the EIA report provides a detailed assessment of the acoustic pollution from the proposed WPPs at different frequencies, and Chapter 7.3 of the EIA report further discusses the effects of the flicker effect.

As regards electromagnetic radiation, studies⁴¹ show that the electromagnetic field generated by WPPs is negligible and is unlikely to cause adverse effects on public health unless a person is permanently in the immediate vicinity of the WPP (up to 10 m from the mast of the WPP). In 2010, for the planned WPP park in Ventspils, the Institute of Physical Energy of the Academy of Sciences of the Republic of Lithuania, commissioned by "TCK" Ltd, carried out calculations of the electromagnetic field generated by the WPP, and found that the magnetic field generated by the plant at a distance of 150 m from the WPP is 0.70 A/m or 80 times lower than the Earth's magnetic field (55.7 A/m), so even at a short distance it does not affect human health⁴².

Similar studies have been carried out for high voltage power lines⁴³. According to the widely used classification of electromagnetic waves, the 50 Hz frequency is part of the so-called very low frequencies and is characteristic of Latvia's electricity supply, including both the power generated by WPPs and the power carried by high-voltage networks.

Wherever electricity is used, electric and magnetic fields are generated which, at low frequencies, can only exist in close association with the source of the electric or magnetic field, and decrease rapidly with distance from the source. Frequencies of the order of ~30 kHz can already produce an electromagnetic wave, which can separate from its source and propagate over long distances. These frequencies are 600 times higher than 50 Hz.⁴⁴

Cabinet Regulation No 637 of 16.10.2018 "Regulations on the assessment and limitation of exposure of the general public to electromagnetic fields" sets the limits for electromagnetic field radiation (0 Hz to 300

³⁹<https://windeurope.org/newsroom/press-releases/repowering-wind-farms-a-major-opportunity-for-europe/#:~:text=In 2021 the wind industry, and developed blade recycling solutions>

⁴⁰ <https://www.siemensgamesa.com/global/en/home/explore/journal/recyclable-blade.html>

⁴¹ https://ast.lv/sites/default/files/editor/att-projekti/IVN_Zinojums_22_aprilis.pdf

⁴² <https://www.vpvb.gov.lv/lv/media/2779/download?attachment>

⁴³ https://ast.lv/sites/default/files/editor/att-projekti/IVN_Zinojums_22_aprilis.pdf

⁴⁴ Estonia-Latvia third electricity interconnection from Sindi (Kilingi-Nõmme) in Estonia to Salaspils Environmental Impact Assessment, *SIA Eiropojekts*, 2019

GHz) shown in Table 5.2.1, which correspond to the values recommended in EU Recommendation 1999/519/EC.

Table 5.2.1. Electromagnetic field radiation limits (0 Hz to 300 GHz)

Frequencies	[Induced] current density in torso, head, $\text{mA}\cdot\text{m}^{-2}$, rms	SAR whole body, W/kg	SAR local to head, torso, W/kg	SAR local to hands, feet, W/kg	power density, W/m^2
Up to 1 Hz	8	-	-	-	
1-4 Hz	$8/f$	-	-	-	
4 Hz-1 kHz	2	-	-	-	
1-100 kHz	$f/500$	-	-	-	
100 kHz-10 MHz	$f/500$	0,08	2	4	
10 MHz-10 GHz	-	0,08	2	4	
10 GHz-300 GHz	-	-	-	-	10

At 50 Hz, the reference value for the electric field is 5000 V/m and for the magnetic field 100 μT . These values are not threshold values that must not be exceeded, but levels that indicate the need to check that the basic limits (threshold levels) are being met. Calculations using the method according to the standard LVS NE 50499 "Procedure for assessing the exposure of workers to electromagnetic fields" have shown that the actual values of exposure to external fields must be significantly higher for the induced body currents to reach the value specified in the basic limit. A summary of the results for the reference limit at 50 Hz, the reference levels and the field values corresponding to the reference limit is given in Table 5.2.2.

45

5.table 2.2. Calculated values of the electric and magnetic fields corresponding to the reference limit, as well as the reference limit and reference levels at 50 Hz

Basic restriction: 2mA m^{-2} in the central nervous system	
Magnetic field	Electric field
Reference level: 100 μT The external field required to achieve this field strength in a human: 360 μT	Reference level: 5 kV/m The external field required to achieve this current density in a human: 9,2 kV/m

on a 50 Hz power line, even with a voltage of 330 kV and a current of 2000 A, the magnetic field at 1 m above the ground directly below the line is 4-5 orders of magnitude lower than the reference values in the Council of Europe Recommendation and the values given in Table 5.3.1. In Latvia, measurements made by JSC Latvenergo under existing 330 kV lines show that at a distance of 30 m from the lateral conductor, the value is 0.02 μT , while directly under the lowest point of the transmission line (hereinafter - EPL), the value is 0.23 μT , which is practically zero (Figure 5.2.1).

⁴⁵ Environmental impact assessment: Estonia-Latvia third power grid interconnection from Sindi (Kilingi - Nõmme) in Estonia to Salaspils (or Riga CHP-2) substations in Latvia, "Eiropojekts" Ltd, 2016

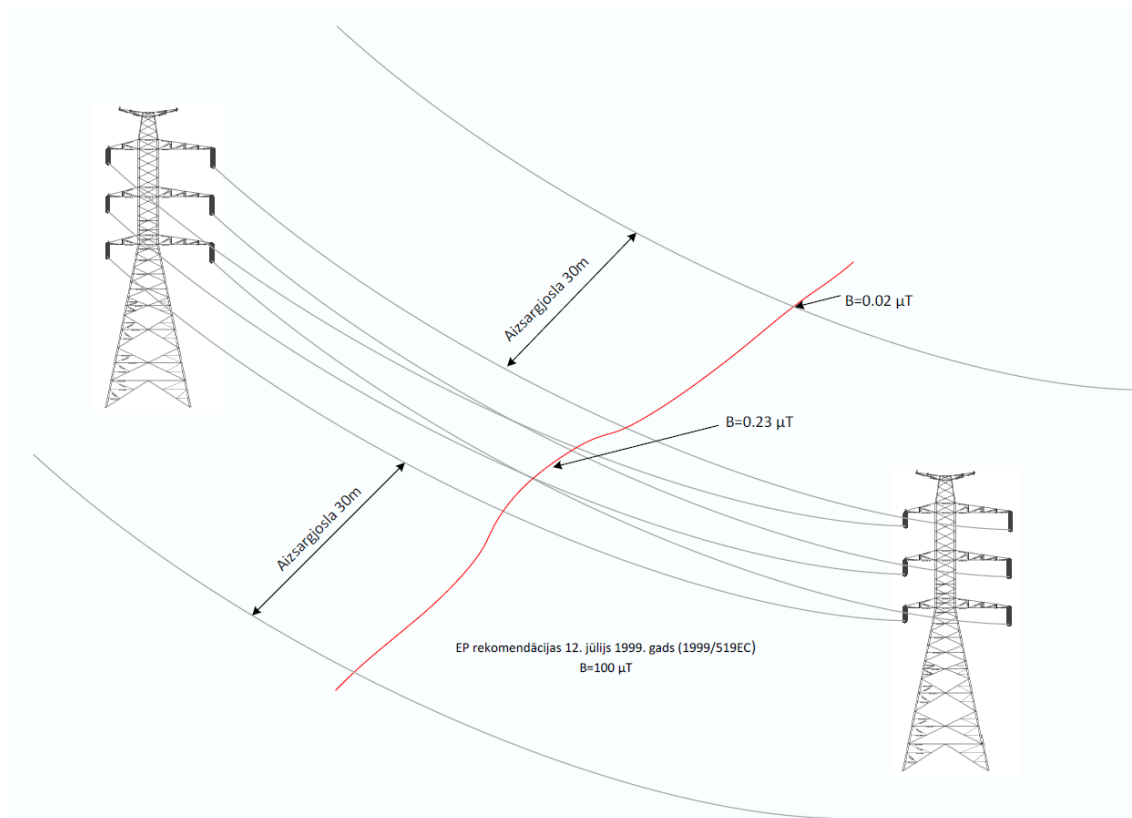


Figure 5.2.1. Results of magnetic field measurements of PPAs in Latvia

Magnetic field measurements were carried out in 2014 for the newly built PPA in Kurzeme by the laboratory⁴⁶, which provides services in the field of diagnostics and expert assessment of the technical condition and characteristics of electrical safety equipment, electrical systems and equipment, and in the field of environmental parameter testing. The laboratory is accredited by the Latvian National Accreditation Bureau LATAK in accordance with LVS NE ISO 17020 as a Type C inspection body (LATAK-I-248) and LVS NE ISO/IEC 17025 as a testing laboratory (LATAK-T-166), which confirms compliance with international standards and the quality of the services provided. However, measurements of the electric field strengths under 330/110 kV lines show that they are below the value of 5 kV/m set in EU Recommendation 1999/519/EC.

As measured in other European countries such as Germany and the UK⁴⁷, electric fields under 110 kV and 400 kV overhead PPAs can range from 2000 V/m to 5000 V/m, while magnetic fields can reach 40 μT . The electromagnetic fields (EMFs) are much lower under medium- and low-voltage PPAs: electric fields can range from 100 V/m to 400 V/m and magnetic fields from 0.5 μT to 3 μT , respectively. As the distance from the centreline of the high-voltage PPA increases, the EMF exposure levels decrease accordingly. All these conclusions apply to voltages of 100 times or more the output voltage of a WPP, up to 1 kV.

⁴⁶ Environmental impact assessment: Estonia-Latvia third power grid interconnection from Sindi (Kilingi - Nõmme) in Estonia to Salaspils (or Riga CHP-2) substations in Latvia, "Eiropojekts" Ltd, 2016

⁴⁷ Environmental impact assessment: Estonia-Latvia third power grid interconnection from Sindi (Kilingi-Nõmme) in Estonia to Salaspils (or Riga CHP-2) substations in Latvia, "Eiropojekts" Ltd, 2016

The magnetic field density directly above the electric cable lines is significant, but decreases rapidly as you move away from the cable line. Electric fields are completely eliminated by cable insulation. 5.table 2.3 summarises the UK calculated magnetic field values at different distances from the cable centreline⁴⁸.

Table 5.2.3. Magnetic fields, μT , off-centre

Transmission lines, kV	Distance from centre line			
	0 m	5 m	10 m	20 m
132 kV	5,01	1,78	0,94	0,47
33 kV	1,00	0,29	0,15	0,07
11 kV	0,75	0,22	0,11	0,06
400 V	0,50	0,14	0,07	0,04

All these data on high voltage transmission lines allow extrapolating that both the WPPs themselves with voltage < 1 kV and their 20 kV substations and cables from the WPPs to the substations and from the substations to the transmission line will not cause significant electromagnetic fields in the nearest built-up areas.

5.3. Environmental risk and emergency forecast

5.3.1. Natural disasters

According to the Cabinet of Ministers Regulation No 563 of 19 September 2017 "Procedure for Identification and Determination of Objects of Increased Danger, as well as for Planning and Implementation of Civil Protection and Disaster Management", power generation facilities with an installed capacity exceeding 100 MW are classified as Category C objects of increased danger and require a Civil Protection Plan.

Both technogenic and natural disasters can threaten the operation of WPPs.

Among the natural disasters that could potentially affect the operation of the Limbaži WPP, the most significant are: storms, lightning, forest fires and icing.⁴⁹

The WPP Limbaži is located entirely within forest land, and therefore there are no other objects of increased hazard, objects of public importance or residential houses in its vicinity that may affect the implementation of the Proposed Action in the selected alternatives A, A` and B, B`.

The accumulated statistics summarise decades of operation of WPPs of different capacities and sizes. The main potential risks are:

- falling ice chunks from icy WPP rotor wings in the vicinity of the plant,
- Mechanical damage/destruction of a WPP by the spreading of debris in its vicinity,
- WPP rollover.

Increased wind speed

According to the international insurance company *FM Global* (USA), excessive wind speeds and loads can contribute to the malfunctioning of WPPs. Wind speed combined with erroneous wind measurements (e.g. wind speed or direction) or malfunctions in the control or safety system of the WPP (e.g. blade pitch, yaw

⁴⁸ Environmental impact assessment: Estonia-Latvia third power grid interconnection from Sindi (Kilingi-Nõmme) in Estonia to Salaspils (or Riga CHP-2) substations in Latvia, "Eiropojekts" Ltd, 2016

⁴⁹ <https://fireprotectionsupport.nl/wp-content/uploads/2022/08/FMDS1310-2022-07-Wind-Turbines.pdf>

or rotor brake) can cause the rotor to exceed its technical parameters, which can lead to damage. Excessive wind speed can cause damage to the rotor blades or can overturn the WPP due to excessive force, causing the support tower to buckle or damaging the tower foundation.⁵⁰

Damaged rotor blades in a WPP can pose a risk to surrounding properties from falling blade debris.

Risk mitigation measures

Equipping the WPP with a safety system that safely stops the operation of the WPP during high winds.

Icing

Ice build-up on the rotor blades can unbalance the rotor and cause vibrations and dynamic loads that can damage the blades and other mechanical components.

There is also a risk of ice on the rotor blades melting and being thrown off while the rotor is spinning, or of ice falling off if the rotor is stopped.

Ice build-up on anemometers can cause erroneous wind speed or wind direction readings, which can cause the WPP to remain operational or to restart when the wind speed exceeds the cut-off speed, or with a significant yaw error that can damage the WPP.⁵¹

Latvian legislation does not provide a methodology for assessing the risk of WPP icing, so the experience of other countries and professional organisations and the methods used for risk assessment have been used.

Potential for human exposure to falling ice chunks⁵²:

- 40-60 J can cause serious injuries by hitting the head;
- >80 J serious injury to the body is possible.

The impact energy depends on the density, mass and velocity of the ice. By comparison, an effect of 40 J can be applied to a 200 g piece of ice falling from a height of 30-50 m, or 500 g of ice falling from a height of 5-6 m.

When a chunk of ice hits a car, 10% of the time the windscreen can be damaged: it takes 140 J of energy to break and puncture it.

Latvian legislation does not specify a methodology for assessing the risk of WPP icing, but other countries do.

In Canada, the probability of ice fall as a function of distance from the WPP up to 140 m is shown in Figure 5.3.1 of⁵³ : 10^{-4} (one ten-thousandth) to 10^{-6} (one millionth) per 1 m².

⁵⁰ <https://fireprotectionsupport.nl/wp-content/uploads/2022/08/FMDS1310-2022-07-Wind-Turbines.pdf>

⁵¹ <https://fireprotectionsupport.nl/wp-content/uploads/2022/08/FMDS1310-2022-07-Wind-Turbines.pdf>

⁵² https://windren.se/WW2015/WW2015_39_521_Refsum_Lloyd_Ice_throw_evaluating_risk.pdf

⁵³ Kipperberg, G., Onozaka, Y., Thi Bui, L., Lohaugen, M., Refsdal, G., Sæland, S., Hassan, G. 2007. Recommendations for risk assessment of ice throw and blade failure in Ontario. Canadian Wind Energy Association.

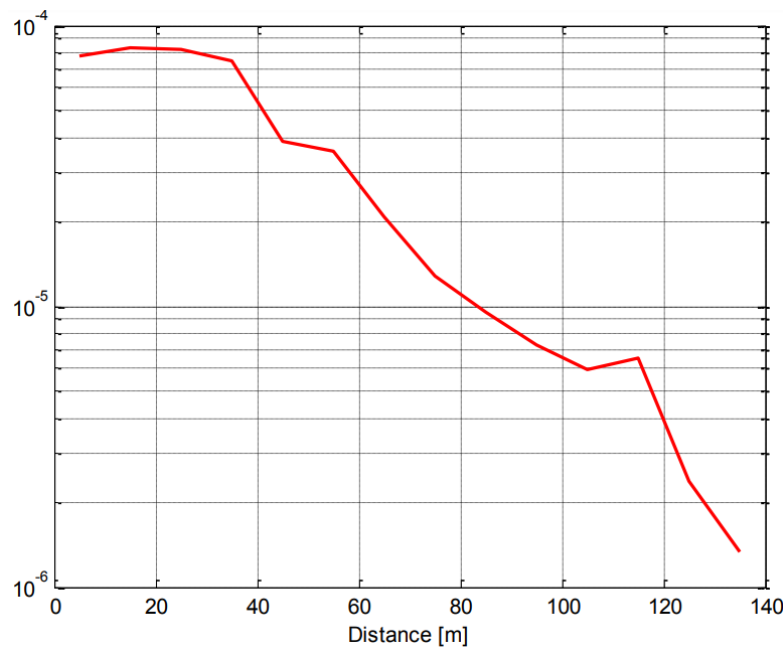


Figure 5.3.1. *Probability of an ice chunk falling per 1 m², based on fieldwork calculations⁵⁴*

By contrast, the probability of an ice chunk falling further than 220 m from the WPP is less than 10^{-8} (one hundred millionth) per 1 m², the average fall distance is 100 m and the mass of ice chunks is less than 1 kg, but much less on average (tiny splinters that still break up in flight). But the Canadian study looked at WPPs with 80 m mast height and 80 m rotor diameter: both 2.5 times smaller than in this EIA. To extrapolate these conclusions to a 200 m mast height and 200 m rotor diameter, it is first necessary to consider that from the largest WPPs, ice chunks can fly on average from 2.5 times the height and at 2.5 times the speed, so a rough approximation can be assumed, to fly 2.5 times further, or ~550 m, which can be rounded up to the 600 m calculated above (as a maximum precaution, since in reality the air resistance will act longer in the longer flight and will not allow the distance to be as large). A square metre at 2.5 times the distance is 2.5² or 6.25 times more, while the area of a wing 2.5 times longer (if both wings are proportional) is also 2.5² or 6.25 times more, so the one hundred millionth probability from the Canadian study in this EIA can be maximised to a distance of 600 m (although in reality air resistance will stop it earlier). This probability increases at shorter distances, there is no methodology to calculate it precisely for this EIA, but it is clear in which range of numbers this probability remains: it reaches about the values shown in Figure 5.3.1, only at longer distances, up to ~140 x 2.5 = 350 m. However, it should be additionally stressed here that this is the probability of being hit by flying ice chunks/splinters in situations where the wings are iced. The overall probability of risk is obtained by multiplying this tiny probability by the rather small probability, or small fraction of the total time of the year, when there is any risk at all of wing icing: such rather specific weather conditions could be on the order of 1% of the total time of the year, so the resulting probabilities are still divisible by 100.

In Germany, the proposed minimum distance between WPPs and people or objects is set out in the recommendation of the European Commission report⁵⁵ : 1.5 * (pole height + rotor diameter)⁵⁶. This criterion is in the list of technical provisions of the German Building Regulations, so if a WPP does not meet

⁵⁴<https://iea-wind.org/wp-content/uploads/2021/09/Lehtomaki-et-al.-2018-Available-Technologies-for-Wind-Energy-in-Cold-Climates-report-2-nd-edition-2018.pdf>

⁵⁵ <https://op.europa.eu/lv/publication-detail/-/publication/9cde4269-9b53-4fd7-b064-5b3caf85aabf>

⁵⁶ <https://windeurope.org/summit2016/conference/allposters/PO337.pdf>

this minimum distance and is in a region with a high risk of icing, additional measures must be taken: a site-specific risk assessment report, mainly based on regional icing frequency, supplemented by an assessment report on ice on the wings of the WPP.

The minimum distance recommended in Sweden is also $1.5 \cdot (\text{pole height} + \text{rotor diameter})$, taken from the European Commission report reviewed by the Swedish Energy Agency through the ICETHROWER project⁵⁷, but with the additional conclusion that the minimum distance can be reduced to $1.0 \cdot (\text{pole height} + \text{rotor diameter})$, as an impact beyond this distance is significantly less likely to cause injury than other societal injury risks. Although this report has no formal regulatory framework, it is used as a guide for wind energy project developers and permitting authorities in Sweden.

Another regulation that affects the use of WPP in icy climatic conditions is Directive 2006/42/EC of the European Parliament and of the Council, which aims to ensure a uniform level of safety for all machinery placed on the market or put into service in all Member States. This Directive requires that the conformity assessment process under the EU Directives requires the manufacturer to carry out a risk analysis and assessment of its product and its intended use, covering design, manufacture, production and use.

Several regulatory authorities require manufacturers and operators to take specific measures to reduce the risk of harm or injury to people, property and the environment. Specific recommendations for manufacturers for cold climates include a range of features including heating systems, as well as special materials and lubricants for low temperatures. Operators should plan a risk mitigation strategy that includes control options such as capacity optimisation, preventive shutdowns, load reduction, anti-icing systems and ice ejection risk reduction⁵⁸.

In this context, in some countries, such as Austria and Germany, wind farm licensing authorities may require WPPs to be systematically shut down during icing to reduce the risk in the vicinity of the WPP. For this purpose, several icing detection methods have been developed that can automatically stop the WPP and restart it when the icing has stopped.

Icing is more likely to occur on stationary rotors than on rotating rotors⁵⁹, while ice chunks can only be expected to break off the blades or mast of a stationary rotor in very high winds and at short range.

The distance over which ice chunks can fly from a stationary rotor shall not exceed 50 m more than the wing length⁶⁰. A wider area of risk is expected in the event of icing of the blades of an operational WPP, when the high-speed wings sweep ice chunks much further away. Icing also degrades the aerodynamic properties of the wing and increases vibration, reducing the efficiency of the WPP, which in turn is the basis for safety systems: today, WPPs are equipped with automatic vibration sensors that shut down the plant at a certain vibration level caused by icing on the rotor blades. However, such equipment cannot completely eliminate the risk of falling ice chunks.

⁵⁷https://winterwind.se/wp-content/uploads/2015/08/3_3_28_Bredesen_IEA_Task_19_-_IceRisk_Review_of_current_knowledge_and_the_way_forward_in_risk_assessments_associated_with_ice_throw_from_wind_turbine_blades_Pub_v1-1.pdf

⁵⁸<https://iea-wind.org/wp-content/uploads/2021/09/Lehtomaki-et-al.-2018-Available-Technologies-for-Wind-Energy-in-Cold-Climates-report-2-nd-edition-2018.pdf>

⁵⁹ Kipperberg, G., Onozaka, Y., Thi Bui, L., Lohaugen, M., Refsdal, G., Sæland, S., Hassan, G. 2007. Recommendations for risk assessment of ice throw and blade failure in Ontario. Canadian Wind Energy Association.

⁶⁰ Ibid,

In Sweden, a study at Uppsala University⁶¹ has found a correlation between wind speed and the flying distance of ice debris (Figure 5.3.2).

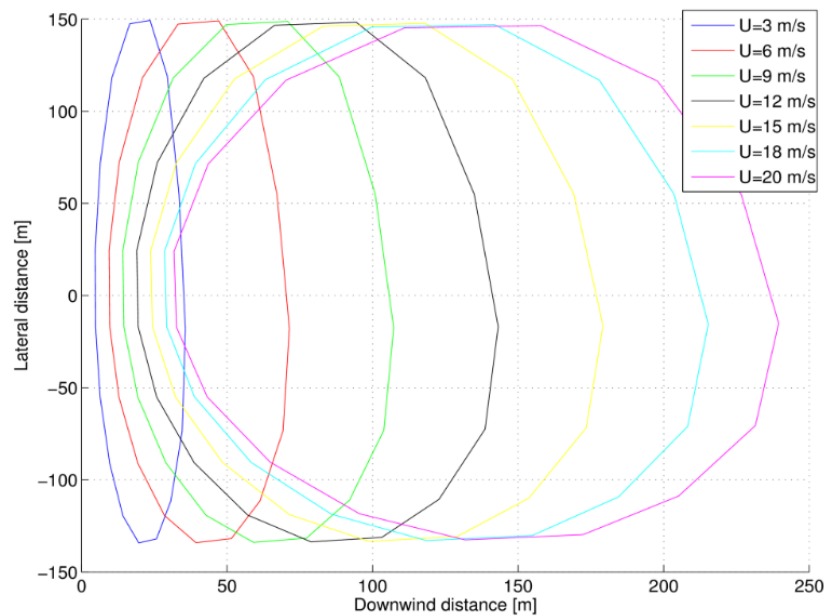


Figure 5.3.2. Ice debris flying distance (modelling data) vs. wind strength (WPP rotor height 125 m, wing height 180 m)⁶²

In order to assess the potential range and impact on the surrounding area of ice chunks caused by icing of the rotor blades, calculations for different rotor operating positions have been carried out in the recommendations published by the International Energy Agency Cooperation Project "Wind Energy in Cold Climates"⁶³.

As already pointed out, ice forms on the WPP blades when the WPP is not running but detaches and falls off when the WPP starts moving again. The following equations are used to estimate the ice debris fall distance:

- operating WPPs

$$d_d = (D + H) \times 1,5$$

- At the time the WPP starts operation:

$$d_u = v \frac{\left(\frac{D}{2} + H\right)}{15}$$

where

dd_u - maximum distance of ice chunks falling from the station during operation or when the rotor starts moving (m),

D - rotor diameter (m),

H - mast height (m),

⁶¹ Renström, J. 2015. *Modelling of Ice Throws from Wind Turbines*. Modelling av iskast från vindkraftverk. Uppsala University.

⁶² Ibid,

⁶³ <https://iea-wind.org/wp-content/uploads/2021/09/Lehtomaki-et-al.-2018-Available-Technologies-for-Wind-Energy-in-Cold-Climates-report-2-nd-edition-2018.pdf>

v - wind speed at mast height (m/s).

As can be seen, the falling distance of ice debris is influenced by the height of the WPP, the rotor diameter and the wind speed: as these increase, the area of influence increases. The maximum ice debris fall distance for the WPP assessed in this EIA according to the formula is as follows:

- $d_d = 600 \text{ m}$ (WPP $h = 300 \text{ m}$)
- $d_u = V \times 20 \text{ m}$, maximum $23 \times 20 = 460 \text{ m}$ (WPP $h = 300 \text{ m}$)

Probability of an event

The probability of icing can vary with climatic conditions, as well as with annual weather variability, and vertically with the absolute and relative height of the WPP.

There are no studies on the frequency of WPP icing in Latvia. Several important studies on WPP icing have been carried out in Norway and Sweden, see Figure 5.3.3. Latvia's terrain is generally lower in elevation than Sweden or Norway, and Latvia is further south with a warmer climate, so the average number of hours of icing is likely to be significantly lower.

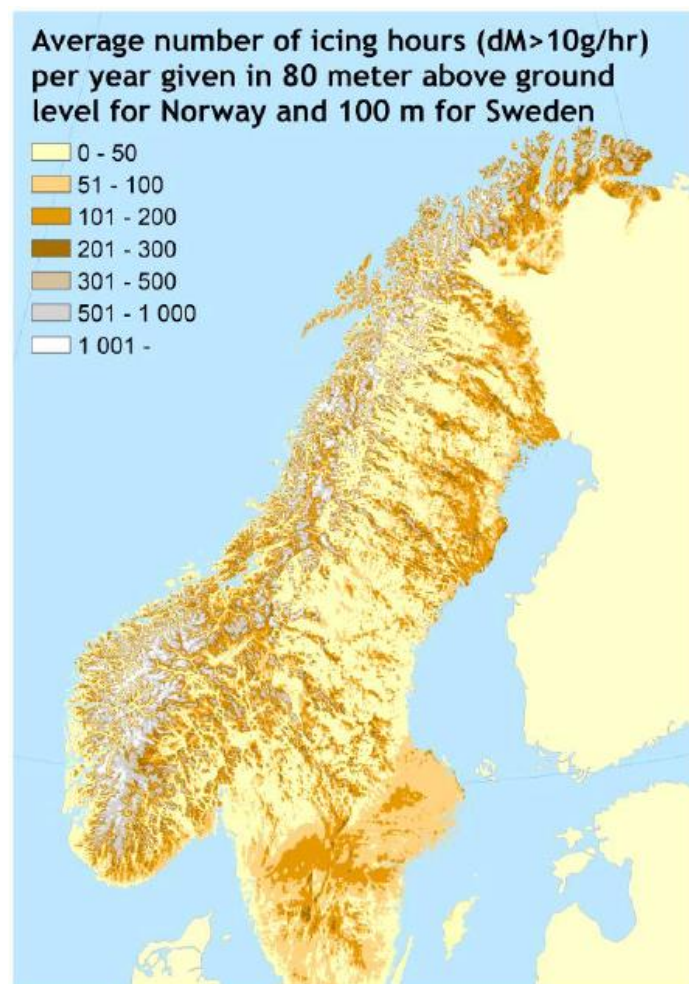


Figure 5.3.3. Average number of hours of icing per year in Sweden and Norway⁶⁴

⁶⁴ Renström, J. 2015. *Modelling of Ice Throws from Wind Turbines*. Modelling av iskast från vindkraftverk. Uppsala University.

Risk mitigation measures

In the EU, many countries do not have clear rules on reducing the risk of WPP icing. In Norway, for example, the operation of WPPs during the winter months is dealt with under general rules, with no specific legal framework. Wind farm operators can also be fined and criminally liable for the damage caused.

A survey conducted by the International Energy Agency in 2019 concluded that, in most countries, restrictions related to mitigating the risk of ice fall are implemented at the permitting stage and are governed by general laws and regulations on infrastructure safety.

In Germany and Austria, WPP ice detection systems are required if public roads or buildings are in the calculated ice debris zone. These countries have a production cap: WPP must stop when icing conditions are present. If ice detection systems are reliable and sensitive enough, the potential danger is more likely to be from falling ice than from smaller chunks being thrown over a greater distance.⁶⁵

The risk of icing and ice fall is usually concentrated on short periods during the year. Predicting and controlling icing⁶⁶:

- based on meteorological forecasts;
- installing WPP ice sensors.

Risk mitigation measures to prevent icing hazards to third parties:

- posting clearly visible warning signs in the potentially affected area;
- fencing off the area, blocking access with gates, barriers;
- restrict social activities
- rerouting of footpaths, location of ski slopes, etc.

Risk reduction measures for service staff:

- protective grilles, roofs or tunnels
- personal protective equipment.

Lightning discharge

Damage to a WPP caused by lightning is a common cause of property damage in wind farms. Lightning damage can occur to WPPs and important parts of the wind farm's electrical system. Direct lightning strikes can cause damage to the WPP blades (most common) and the nacelle, and sometimes ignition. Direct or indirect lightning strikes can also cause damage to electrical systems. Transients or surges caused by lightning strikes can cause gradual damage to the entire electrical system.⁶⁷

Risk mitigation measures

Equipping a WPP park with lightning protection equipment.

Forest and grassland fires (types of fires, conditions contributing to their origin and spread, techniques for assessing and predicting fire development)

⁶⁵https://winterwind.se/wp-content/uploads/2015/08/3_3_28_Bredesen_IEA_Task_19_-_IceRisk_Review_of_current_knowledge_and_the_way_forward_in_risk_assessments_associated_with_ice_throw_from_wind_turbine_blades_Pub_v1-1.pdf

⁶⁶https://windren.se/WW2015/WW2015_39_521_Refsum_Lloyd_Ice_throw_evaluating_risk.pdf

⁶⁷<https://fireprotectionsupport.nl/wp-content/uploads/2022/08/FMDS1310-2022-07-Wind-Turbines.pdf>

Fires can cause thermal radiation damage in onshore WPP parks, especially collector substations, and can also damage rotor blades, which are usually made of fibre-reinforced plastic. There are no known cases of structural damage to the WPP support towers, which are usually made of steel or sometimes concrete.

Forest areas are characterised by planting, maintenance and harvesting activities when the main harvesting age is reached. The forest has the necessary infrastructure for forest management: roads, natural tracks, stiles, etc.

In forest areas, there is a risk of fire, which increases during the warm season of the year. The degree of danger (forest fire danger) of forest fires originating from a potential ignition source and spreading depends on:

- the conditions characterising the forest and peat area, or the type of growing conditions (natural fire risk);
- meteorological conditions (fire risk as determined by meteorological conditions).

The number of recorded forest fires and their main causes are reflected in the statistics (see Figure 5.3.4, Table 5.3.1). The main causes of forest fires in Latvia are not natural disasters, but careless handling of fire, arson and economic activity, and to a much lesser extent, fires of natural origin caused by lightning.

The risk of fire exists both in forest areas and in the area of WPP parks, so these risk factors should be taken into account when planning WPP parks and measures should be taken to mitigate the risk of fire that may arise from the interaction of the two types of economic activity.

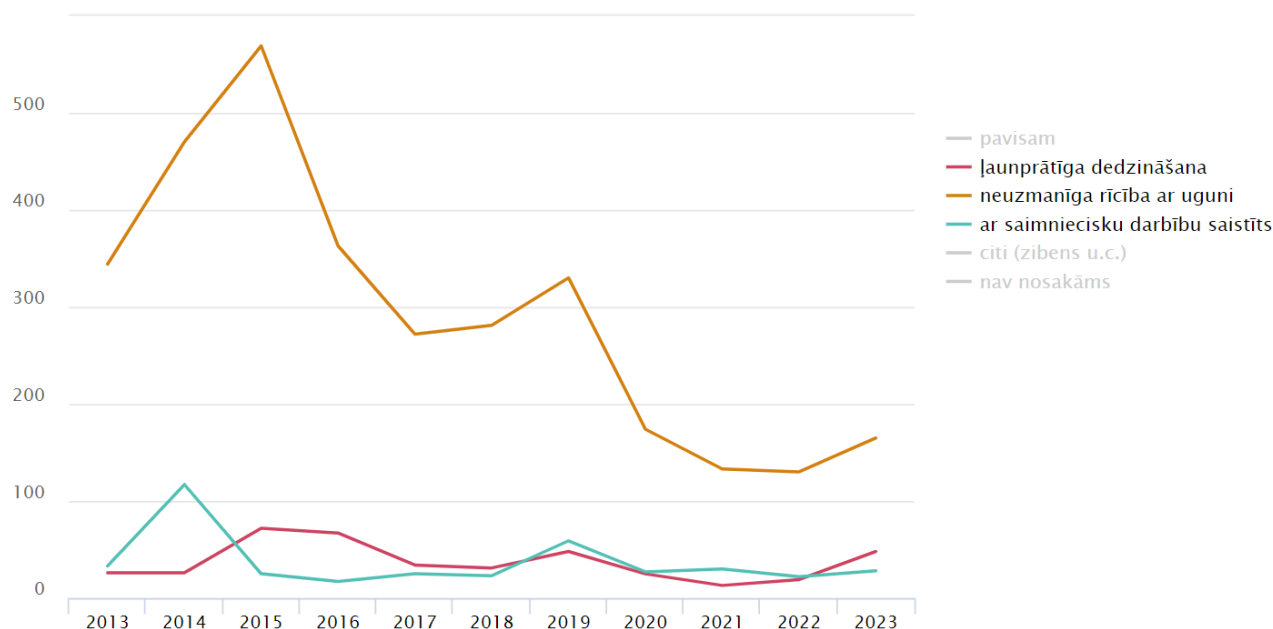


Figure 5.3.4. Number of forest fires by cause Latvia total⁶⁸

The total area of forests in Latvia is 3.305 million ha (2023). Based on forest fire statistics over the last 10 years, the average size of a forest fire is up to 1.09 ha.

⁶⁸ <https://stat.gov.lv/lv/statistikas-temas/noz/mezsaimnieciba/8673-meza-ugunsgreki>

Table 5.3.1. Number of forest fires and total area of fires in Latvia in the last 10 years⁶⁹

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Number of fires	698	704	641	423	972	1110	581	466	391	653
Fire area, ha	591	540	467	265	2864	822	309	505	221	637

Based on the above data, the probability of a forest fire occurring in the vicinity of the WPP can be estimated at 2.18×10^{-4} /ha/year, or 1 ha out of 4577.24 ha of forest area per year.

Risk mitigation measures

External sources of fire are relatively more dangerous for small HPPs, whose rotor and blades are closer to combustible sources. The lower the WPP, the greater the fire safety distances. In comparison, the US insurance company *FM Global*, which assesses and compiles risks of various types, recommends a 150 m tree-free zone around WPPs, or a 60 m tree-free zone if the area is scrub or grass.⁷⁰

It should be noted that the length of some tree species in the USA can reach about 100 m, while in Latvia the length of the largest trees is about 40 m. Consequently, the required tree-free zone in Latvia, if the recommendations of the insurance company are taken into account, should be proportionally smaller: about 60 m, which is recommended to be specified and agreed with forest owners and fire-fighting organisations (SFRS, State Forest Service, etc.).

Another international organisation, *The Confederation of Fire Protection Associations Europe*, recommends that, in order to prevent the risk of a forest fire from the effects of an ignition due to a WPP fire, the area around the WPP site should be cleared of brush and grass within 25 m of the site, which can contribute to the spread of fire in the ROW.⁷¹

5.3.2. Risk assessment of mechanical damage to WPP

For the assessment of the risk of accidents at the Limbaži WPP Park, a quantitative risk assessment method has been selected, which provides a more detailed assessment of the consequences and probabilities of an event.

There are no methodological guidelines or a uniform approach to risk assessment in Latvia, so the experience of other countries has been used: the risk assessment is based on the experience of other countries (the Netherlands, Belgium) that have already developed methodologies for assessing the risks of wind farms.

A WPP overturning is the maximum accident that can be considered an emergency. A partial WPP collapse with debris falling or flying is also exceptional. In the Netherlands, the statistical average frequency of mechanical failures of WPPs has been calculated by analysing accident statistics from the Netherlands, Germany and Denmark, and a methodology for risk assessment of WPPs has been developed. The risk

⁶⁹ <https://stat.gov.lv/lv/statistikas-temas/noz/mezsaimnieciba/8673-meza-ugunsgreki>

⁷⁰ <https://fireprotectionsupport.nl/wp-content/uploads/2022/08/FMDS1310-2022-07-Wind-Turbines.pdf>

⁷¹ https://cfpa-e.eu/app/uploads/2022/05/CFPA_E_Guideline_No_21_2021_F.pdf

scenarios listed in Table 5.3.2 are considered for the assessment of mechanical damage in accordance with the risk assessment methodology⁷².

Table 5.3.2. Risk probabilities of mechanical damage to WPP

Type of damage	Probability (per year)	Single probability
Breaking off the entire rotor blade	$8,4 \times 10^{-4}$	1200 years
Rotor blade part breaking off	$8,4 \times 10^{-4}$	1200 years
Wind station collapses due to mast failure	$1,3 \times 10^{-4}$	7700 years
Rotor and/or nacelle breakage	$4,0 \times 10^{-5}$	25000 years

The guidelines also define the maximum radius of the zone of influence within which the effects of the risks listed in Table 5.3.2 are to be assessed, according to the class and type of WPP, and shall not exceed the maximum height of the WPP.

The Danish study *Risk assessment of wind turbines close to highways*⁷³ assesses the probability of a car travelling on a highway with a WPP directly adjacent (60 m away) every 500 m along its entire length being involved in a fatal collision with parts of a fully or partially collapsed WPP. The resulting probability per kilometre of road was 5×10^{-12} , or one part in two hundred billion. By comparison, the overall probability of a car suffering a fatal collision on each kilometre of Danish motorway was (2009) 2×10^{-9} , or one five-hundred-millionth, or 400 times higher.

The risk assessment methodology develops mathematical equations for accident scenarios to determine the maximum exposure distance and the level of risk, which includes the probability and consequences of an event. The assessment assumes that the effects of an accident are equally likely in all directions around the WPP.

The calculated individual risk distances are defined and visualised by the isolines around each WPP.

The most important parameters that, according to the risk assessment methodology, influence the consequences of accidents in determining the overall level of risk posed by a WPP are:

- Total height of WPP (m),
- rotor diameter (m),
- gondola dimensions - length, height and width (m),
- the diameter of the mast at its top and bottom (m),
- mass of the equipment (t),
- rotor speed (rpm, nominal).

A specific model has not yet been selected for the proposed operation, so the risk assessment uses data and assumptions that are representative of the largest possible installation that could be built in the WPPF (see Table 5.3.3). Figure 3.5 shows that the productivity and size of WPPs in Europe and elsewhere in the world are continuously increasing with technological advances and accumulated operating experience.

Table 5.3.3. Input data (assumed in calculations)

WPP height, m	250	275	300
Mast height, m	150	175	200
Rotor diameter, m	200	200	200

⁷²https://omgeving.vlaanderen.be/sites/default/files/2022-12/2022_12_01_IWT_handboek.pdf

⁷³https://backend.orbit.dtu.dk/ws/portalfiles/portal/7903618/Risk_assessment_of_wind_turbines.pdf

WPP height, m	250	275	300
Gondola dimensions			
Length, m	15	15	15
Width, m	9	9	9
Height, m	7	7	7
Total weight of equipment, t	800	840	880
Upper diameter of mast, m	6	6	6
Lower diameter of mast, m	9	10	11
Rotor speed (max), times min.	8 - 12	8 - 12	8 - 12



Figure 5.3.5. WPP development in recent decades and outlook⁷⁴

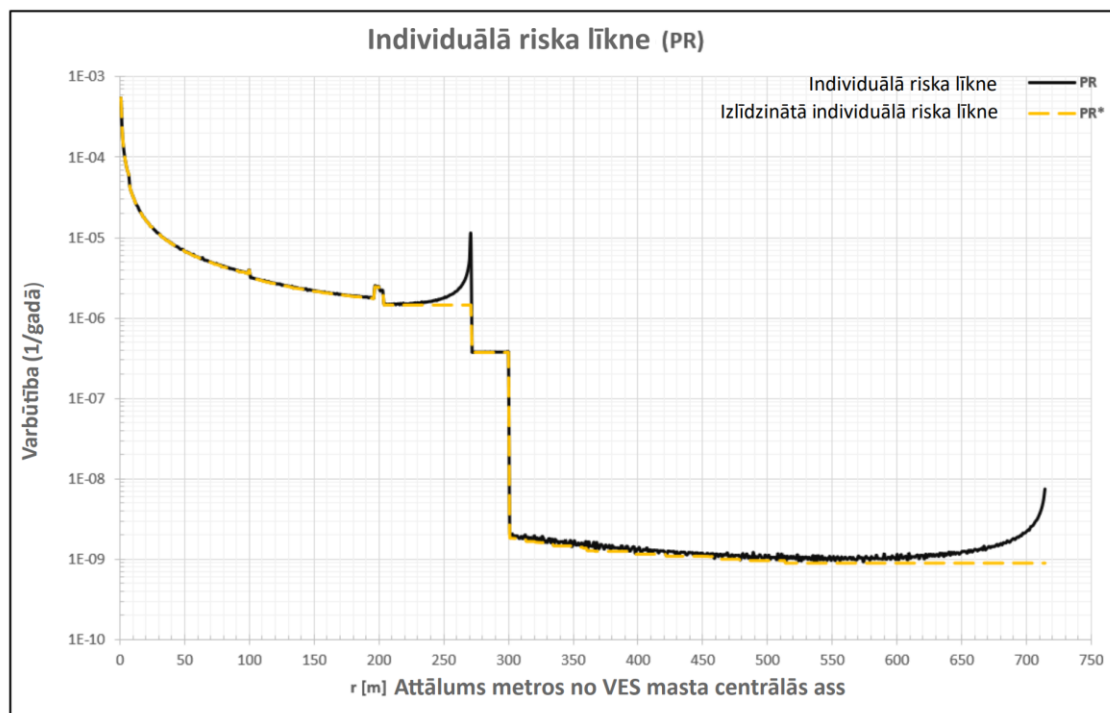
To assess the potential impact of the WPP in the event of an accident, baseline data for accident consequence assessment have been compiled. The assumptions of the calculation output data are based on the world's largest built WPPs (e.g. Vestas V164-8.0 Haliade-X (*General Electric*), V236-15.0 (*Vestas*), SG 14-236 DD (*Siemens Gamesa*), MySE 16.0-242 (*MingYang Smart Energy*)), interpreting the data on WPPs envisaged in the EIA and their planned technical parameters (capacity, WPP height, rotor diameter).

The EIA uses calculation sheets developed in Belgium, resulting in individual risk distances around the stations as well as safety distances to be determined for the location of the WPP in relation to other sites. The results of the calculations for all station modifications are summarised in Table 5.3.4 above. See Figure 5.3.6 for a plot of the worst-case scenario for a WPP with a height of $h=300$ m.

Table 5.3.4. Calculated individual risk and zone distance in metres for different types of WPPs for the WPP Limbaži alternatives A, A' and B, B'

Individual risk level	Individual risk zone size for different WPP modifications (distance in metres from the WPP)		
	WPP h=250m	WPP h=275	WPP h=300
1x10 ⁻⁵ /year	37	35	34
1x10 ⁻⁶ /year	246	260	272
1x10 ⁻⁷ /year	251	276	301

⁷⁴ Pisano, F. 2019. Input of advanced geotechnical modelling to the design of offshore wind turbine foundations. Norwegian Geotechnical Institute



Notes.

PR individual risk curve (the two 'spikes' in the PR curve are related to the rotor blade flying distance at nominal mode of operation and at operating conditions where the rotor speed is 2× the nominal rotational speed).

PR` smoothed individual risk curve According to the Belgian WPP risk assessment manual, these curve jumps can be smoothed to read the determined risk distances.

Figure 5.3.6. Individual risk curve for the worst-case scenario of a WPP accident (WPP height h=300m)

Calculated according to the Belgian methodology *HANDLEIDING REKENBLAD WINDTURBINES Handleiding voor en verduidelijking bij het gebruik van het rekenblad Versie 2.0 dd. 01/10/2019*⁷⁵ For the effects of WPP accidents, not only the individual risk level is determined depending on the technological parameters of the installation, but also the safety distances between the WPP and other objects in the vicinity of the WPP parks, as applicable in the above mentioned EU Member State: sensitive objects, critical infrastructure objects, public and individual buildings, etc., see Table 5.3.5.

Table 5.3.5. Restrictions on the use of the site

Individual risk level	Restrictions on the use of the site	Notes
1x10 ⁻⁵ /year	Work area with more than 5 permanent outdoor workplaces	-
1x10 ⁻⁶ /year	Minimum distance to residential area	Minimum 800 m in Latvia
1x10 ⁻⁷ /year	Minimum distance to sensitive, vulnerable objects	-

In Latvia, the level of risk around industrial facilities and the measures to mitigate the risk in the surrounding area are not specified in the regulatory enactments.

⁷⁵https://omgeving.vlaanderen.be/sites/default/files/2021-10/2019_10_01_-_WT_-_handleiding_rekenblad_0.pdf

If any of the restrictive parameters for the use of the surrounding area in Belgium are different from those applicable in Latvian legislation, the national legislation shall prevail and the restrictions applicable in other countries shall be of a recommendatory nature.

The calculated individual risk level for the worst-case scenario comprising alternatives A` and B` is visualised in Figure 5.3.7. As the result shows, the increased individual risk is concentrated in the immediate vicinity of the WPP, where there is currently an area of forest land with adequate infrastructure, and does not directly affect other economic activities.

To ensure that the surrounding area of the WPP is used according to the risk level, which includes the probability and consequences of an event, the safety distances used in Belgium for the design and construction of new WPP parks have been calculated.

Additional calculations have been made for the flying distance of ice debris, taking into account the technical parameters of the WPP. The data are summarised in Table 5.3.6 and visualised in the cartographic material in order to assess their spatial impact on the surroundings of the WPP under the different alternatives for the proposed activity.

In addition to the mechanical risks from flying debris, an accident at a WPP could also result in an oil spill, given that the nacelle may contain 600-1500 l of oil. Without appropriate secondary containment measures, leakages from WPPs can be released into the environment. Against this, secondary containment liner systems have been developed with a geomembrane around the perimeter of the containment area around the WPP to reliably contain leakages. The geomembrane allows water from rain or snowmelt to flow through unhindered but hardens in the event of an oil leak. The membrane has a non-woven geotextile construction that uses an oil curing compound to instantly prevent oil from leaking through (see example⁷⁶).

Since 27.09.2004, the "Convention on the Transboundary Effects of Industrial Accidents" has been in force, establishing transnational cooperation in the field of industrial accidents. However, the quantity and hazardousness of chemicals at the site assessed in this EIA do not reach the threshold values specified in this convention, and therefore the provisions of this regulation are not applicable to the construction of the Limbaži WPP Park and its associated infrastructure.

⁷⁶ <https://www.basicconcepts.com/news/secondary-containment-solutions-for-the-green-energy-industry/>

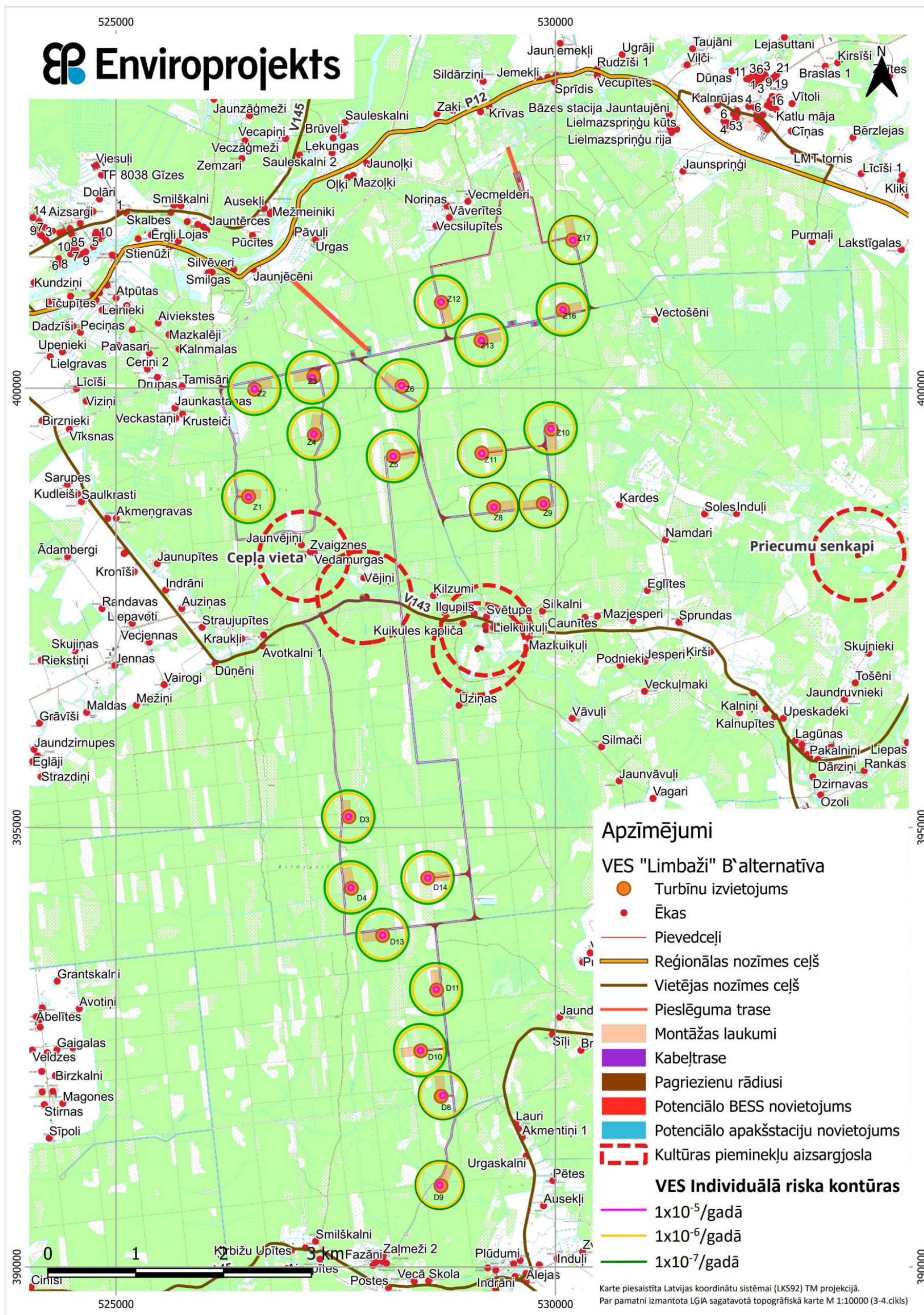


Figure 5.3.7. Individual risk zoning for Alternative B of the Limbaži WPP

Table 5.3.6. *Calculated safety distance in metres for different types of WPPs for Alternatives A, A` and B, B` of the Limbaži WPP*

Object	Calculated safety distance in metres for different types of WPP			Location of another facility in the potential area of influence
	WPP (h=250 m)	WPP (h=275 m)	WPP (h=300 m)	
Sites covered by the SEVESO Directive	747	767	786	Not detectable
Liquefied natural gas (LNG) filling station, Compressed natural gas (CNG) filling station, Liquefied petroleum gas (LPG) filling station, LNG bunkering stations	747	767	786	not detectable
Hydrogen filling stations	747	767	786	Not detectable
Aboveground transport pipelines (hazardous chemicals)	747	767	786	Not detectable
Natural gas supply infrastructure facilities (gas regulation stations)	747	767	786	Not detectable
Underground transport pipelines (hazardous chemicals)	179	204	229	Not detectable
Underground pressure vessels	202	233	263	Not detectable
Public outdoor space where more than 10 people can gather and be endangered at the same time	676	696	715	Not detectable
Public area facilities where people stay indoors	179	204	229	Not detectable
Main national roads	250	275	300	Not detectable
High-voltage transmission infrastructure objects (lines)	700	700	700	WPP - Z2
Nuclear objects	2000	2000	2000	Not detectable
Flying distance of ice debris	525	562,5	600	High-voltage transmission facilities, forest land, local road V260, regional road P24, main road A3, forest roads

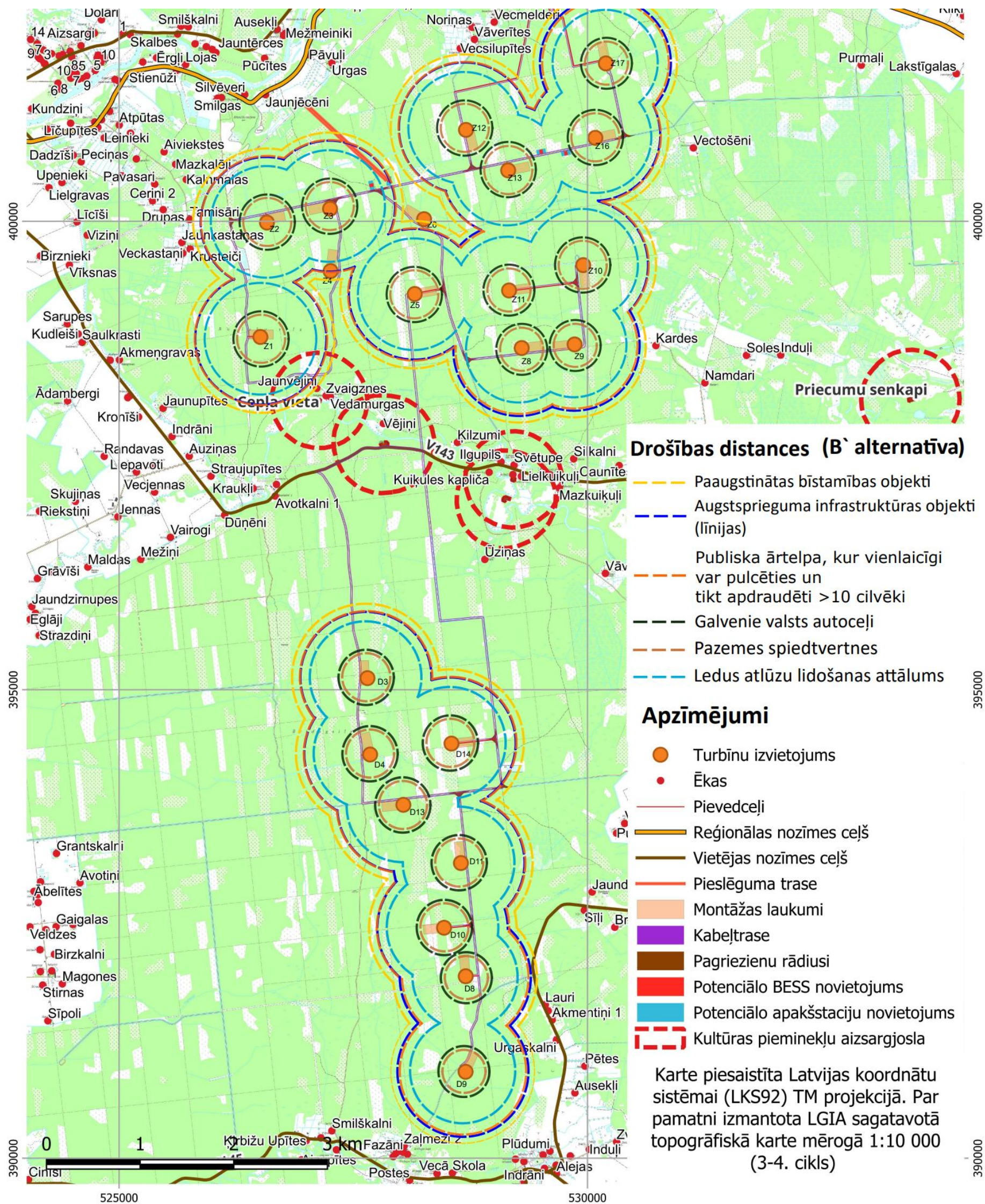


Figure 5.3.8. WPP recommended safety distances and calculated ice debris fall distance zone for Alternative B

Fire

Other possible incidents of technogenic origin associated with the operation of WPPs include ignition of WPPs.

In Denmark, for example, a total of 67 incidents involving the ignition of WPP were recorded between 2010 and 2014. Of these 67 accidents, only 10 involved WPPs with a capacity of more than 1 MW, while two thirds involved WPPs installed in households.⁷⁷

The risk of fire in a WPP can be caused by external factors such as weather, equipment or human error. Maintenance is crucial for fire prevention, as many fires are caused by the failure of worn-out appliances, which should be replaced or repaired in time to avoid the risk of accidents that could result in ignition, see Figure 5.3.9.

Looking at the statistics compiled, there were around 200 000 WPPs in operation worldwide in 2011. According to a report by *the International Association for Fire Safety Science*, one in every 1,710 WPP caught fire in 2011. According to statistics, the probability of ignition of a WPP is 5.85×10^{-4} /year.⁷⁸

Another internationally accredited company, DNV GL, estimates the probability of a WPP fire to be 1 in 2000 per year. DNV GL analysis examines WPP fires regardless of whether the fire results in a total loss of the WPP. The probability of ignition of a WPP is quite similar to the previous figure: 1 of 1710.

In 2020 *wind Power Engineering Magazine* also estimates that 1 in 2,000 WPPs catch fire every year.

Gondola fires cause total loss or significant damage in 90 % of cases.

If a fire breaks out, you usually have to wait for it to burn out. Without fire suppression, significant structural damage and total loss of the WPP occurs in almost all cases (90 %), see Figure 5.3.9.

However, aircraft can also be used to fight a WPP fire, which is the only way to access a fire at an altitude of 200 m. In Latvia, Mi8-MTV helicopters of the National Armed Forces Air Force, equipped with the Canadian-made fire extinguishing device (bag) "Bamby Bucket 5566HD"⁷⁹, have been effectively used in forest fires. The main advantages of a helicopter in WPP firefighting:

- 1) short water-drop-refill cycle times, as any sufficiently deep water source can be used. Usually, the required depth of a body of water is only 2 metres or even less, and there are many such bodies in Latvia,
- 2) water can be dropped anywhere, thanks to the helicopter's ability to stop in mid-air, which is important in the event of a WPP spot fire.

There are no data on WPP ignition incidents in Latvia.

⁷⁷ <http://www.vindmoellegodkendelse.dk/media/1097/egv-årsrapport-2014-jnr-64036-0025.pdf>

⁷⁸ You, F., Shaik, S., Rokonzaman, Md., Rahman, K, S., Tan, W,S.2023. Fire risk assessments and fire protection measures for wind turbines: A review, Heliyon 9 19664

⁷⁹ <https://www.vugd.gov.lv/sites/vugd/files/meza20un20kudras20ugunsgreku20dzesanas20vaditaja20rokasgramata20a52098lpp1.pdf>



Figure 5.3.9. Damage to a WPP caused by fire.⁸⁰

Causes of fire

Possible sources of ignition of WPP are:

- lightning discharge;
- flying sparks during the application of the mechanical brakes;
- short circuit;
- hot surfaces such as bearings, brake discs;
- spontaneous ignition from dirty cleaning cloths (e.g. oil, solvents).

In order to avoid the above potential sources of ignition, components of a WPP shall be designed and operated in such a way that no combustible material is ignited in the event of normal operation or malfunction. To ensure this, demising slabs must be installed: sheets of non-combustible material. Electrical equipment must be insulated. Staff must pick up dirty cleaning rags when leaving the WPP gondola.⁸¹

Today, WPPs are equipped with lightning detectors and special temperature sensors that automatically stop the equipment when it reaches a certain temperature. This equipment significantly reduces the risks of ignition of WPP⁸². However, if a fire does start, the damage caused is usually relatively small, as the station is in close proximity to access roads and squares, which not only slows the spread of the fire, but also allows the fire brigade to start extinguishing work quickly.

⁸⁰ <https://www.windsystemsmag.com/wind-turbine-fire-risk-the-time-to-act-is-now/>

⁸¹ https://cfpa-e.eu/app/uploads/2022/05/CFPA_E_Guideline_No_21_2021_F.pdf

⁸² <https://www.wa.gov.au/system/files/2022-04/PB-67-Guidelines-for-wind-farm-development-2004.pdf>

Safety distances, Infrastructure, other objects in the vicinity of the proposed activity

Residential buildings

According to the requirements of the Cabinet of Ministers Regulation No.240 of 30.04.2013 "General Regulations on Spatial Planning, Use and Construction", the distance from the boundary of a WPP or wind park to residential and public buildings, if the planned capacity is more than 2 MW, is at least 800 m, measured from the outermost tower of the WPP.

Roads, railways

Major infrastructure facilities in the vicinity of the planned WPPs and distances to the nearest planned WPP:

- a1 motorway - 4.5 km;
- 3.5 km of the planned Rail Baltica railway line;
- p12 motorway - 1.2 km;
- v143 motorway - 1.3 km.

The Danish guidelines⁸³ state that WPPs can be sited at a distance of 1-1.7 times the maximum height of the WPP in relation to major roads and railways. Given the maximum height of the WPP of 300 m, the safety distance to roads under the Danish approach is 510 m.

Based on the Belgian method, the safety distance to national roads is 300 m.

The Guidelines for the Preliminary Environmental Impact Assessment of Wind Power Plants in Latvia⁸⁴ state that the minimum recommended distance from a WPP to the State (main roads (A), regional roads (P), local roads (V)) and public railway lines is 300 m, unless technical solutions are implemented to mitigate environmental risks.

However, this EIA report takes into account Article 13 of the Protected Zones Act, which states that in rural areas, the width of the protected zones along roads from the road axis to each side is:

- a) 100 metres for national trunk roads (A),
- b) 60 metres for national regional roads (P),
- c) 30 metres for national and local roads (V).

Based on the level of individual risk of a technogenic disaster, the A1 national trunk road is within the acceptable individual risk zone of $1 \times 10^{-7}/\text{year}$; for comparison, a road user is killed (includes all road users: pedestrians, cyclists and drivers) In Latvia, the risk of injury is $7 \times 10^{-5}/\text{year}$, or 100 times higher than from the operation of a WPP.

Some local and forest roads are in the individual risk zone of 1×10^{-5} to $1 \times 10^{-6}/\text{year}$, but the traffic volume on these sections is low, so the risk of injury to a road user is significantly lower and acceptable according to the *Latvian Risk Management Association guidelines (2017)*.⁸⁵

⁸³ <https://www.retsinformation.dk/api/pdf/229524>

⁸⁴ <https://www.vvd.gov.lv/lv/media/9969/download?attachment>

⁸⁵ https://lvafa.vraa.gov.lv/faili/materiali/petijumi/2016/LVPA_133/Vadlinijas_LVPA_F240217.pdf

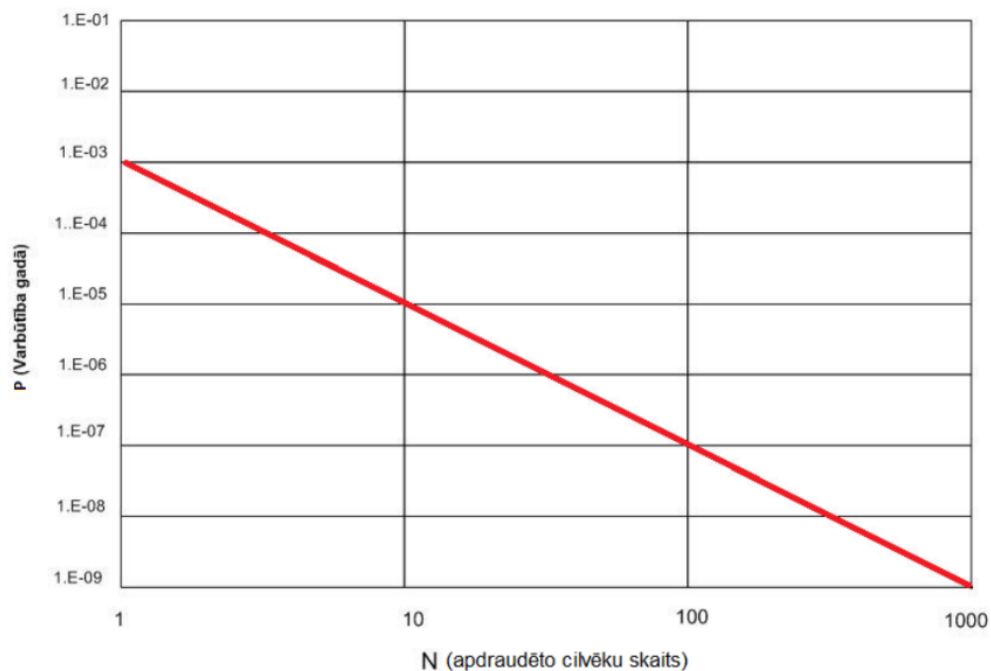


Figure 5.3.10. Acceptable social risk curve⁸⁶

Impacts on electricity transmission facilities (lines, etc.)

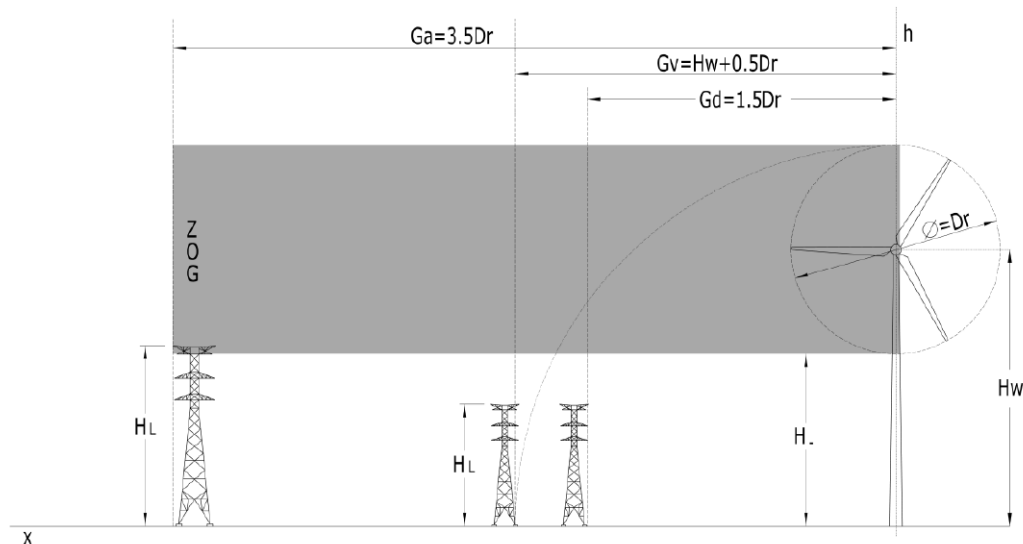
In Latvia, there are no criteria or restrictions for the assessment of the impact of WPPs on transmission lines. Some other countries have requirements for the location of WPPs on transmission lines.

The Belgian electricity grid operator *Elia* points out that WPPs can have an impact (e.g. vibration) within a 500 m radius. WPPs can also pose a risk to high-voltage power lines, pylons and substations: for example, a WPP may tip over, a wing of a WPP may break, or ice debris may be thrown. The operator has developed criteria for assessing the risk of new build WPPs to the electricity transmission infrastructure.⁸⁷

If any of the criteria set out in the methodology are met, the proponent must seek the opinion of the transmission infrastructure owner before installing the WPP, and approval or refusal if the risk to critical infrastructure is unacceptably high. The operator shall determine the actual risk that a new WPP may pose using an approved methodology that includes risk matrices.

⁸⁶ https://lvafa.vraa.gov.lv/faili/materiali/petijumi/2016/LVPA_133/Vadlinijas_LVPA_F240217.pdf

⁸⁷ <https://www.elia.be/en/infrastructure-and-projects/safety-around-our-infrastructure/working-near-high-voltage-facilities>



GA = recommendation limit = 3,5 DR = minimum distance value (L) for which no consultation with the Transmission Infrastructure Company is required

Hv = Gv = Downside risk limit = HW + 0,5 DR

GD = "air movement exposure" limit = 1,5 DR = minimum distance according to international studies below which air movement caused by WPP can cause undesired movement of HV line conductors with risk of damage (including breakage) in the long term.

Zone of Influence (ZOG) = a cylindrical area behind the WPP where turbulence can occur in the air layers and cause vibrations in the high voltage line conductors

HL = height of the upper high voltage conductor/guard cable(s)/rail(s) in the area of influence.

H- = HW-0,5 x DR Lower limit of the WPP rotor influence zone

Hw = height of WPP rotor axis relative to the ground

Figure 5.3.11. Criteria used for assessing the impact of WPP and for coordination with the TSO, Belgium⁸⁸

The Swedish Transport Agency's recommendations⁸⁹ state that WPP and masts with anchorages with a total height of less than 50 metres should be located at least 100 metres from power lines, and WPP and masts with anchorages with a total height of more than 50 metres should be located at least 200 metres from the power line. The distance is calculated from the periphery of the WPP rotor. If the rotor radius is 100 metres, the distance between the tower and the line must be greater than 300 metres.

As can be seen from the above, the approaches are different. Belgium uses a risk-based approach, taking into account the risk of both high-voltage infrastructure and WPP. In Sweden, there are safety distances depending on the mast height.

Taking into account the above calculated methodology that a high voltage infrastructure object (110 kV line) is located within the safety distance zone (700 m) of WPP Z2, it is recommended that the Proponent of the Proposed Action consult with JSC Sadales tikls on the assessment of potential impacts at a specific critical infrastructure section in order to assess the significance of the impacts, if necessary, providing for compensatory measures.

Measures to reduce the risk of accidents at WPPs

⁸⁸ https://www.elia.be/-/media/project/elia/elia-site/infra-and-projects/safety_around_our_infrastructure/working-near-high-voltage-facilities/fr/procedure-elia---avis-eoliennes-fr-v20240201.pdf

⁸⁹ <https://www.svk.se/en/stakeholders-portal/community-planning/when-wind-power-is-planned/>

In general, industrial accident risks affect areas located on forest land. Consequently, no other economic activity or residential and public housing sites are affected.

Given that the Forest Act allows natural persons to stay in forest areas without technical measures to reduce risk, public information, warning signs, restrictive barriers or fencing, where necessary, play an important role.

The causes of accidents in WPPs are studied by the designers, manufacturers, insurers and users of WPP equipment, so that the equipment is continuously improved, and its safety level is progressively increased.

Risk reduction measures include:

- maintenance and repairs to prevent equipment failure;
- installation of automated safety systems (e.g. switching off the equipment automatically if the maximum permissible wind strength is reached, or if vibration has occurred);
- Equipping WPPs with automatic fire detection and alarm systems
- fire-fighting systems and equipment
- continuous monitoring of the plant, etc.

As forest roads and forest paths, boundary lines are located in the potential ice fall zone in the event of icing, it is advisable to provide for risk reduction measures, which include equipping WPP with sensors to detect icing, stopping the operation of equipment during the risk of icing and equipping stations with anti-icing systems.

According to Section (2) of the Law on Roads, "the use of roads may be temporarily prohibited or restricted due to adverse road or weather conditions, or in other cases where driving on roads becomes dangerous". This right can be used to reduce risk where there is a risk of falling ice chunks, for example temporarily on sections of forest roads.

There are also organisational measures to be taken: an international group of experts has issued a technical report⁹⁰, which identifies possible measures to reduce the risk of falling ice, taking into account the actual risk: see Table 5.3.7.

Table 5.3.7. Measures to reduce the risk of falling ice and their effectiveness⁹¹

Security measures	Degree of risk reduction	Suitable for
Warning signs for ice-fall conditions.	1 to 10	Local roads and paths
Warning by light equipment connected to the WPP ice detection system in combination with warning signs.	10 to 100	Local roads and paths
Rerouting, diverting, detouring, monitored by security, to protect against high-risk events.	10 to 100	Local roads and paths
Physical barriers (regional road closures) and signs.	10 to 100	Roads and official and frequently used tourist hiking routes

⁹⁰<https://iea-wind.org/wp-content/uploads/2022/09/Task-19-Technical-Report-on-International-Recommendations-for-Ice-Fall-and-Ice-Throw-Risk-Assessments.pdf>

⁹¹<https://iea-wind.org/wp-content/uploads/2022/09/Task-19-Technical-Report-on-International-Recommendations-for-Ice-Fall-and-Ice-Throw-Risk-Assessments.pdf>

5.3.3. Impact of the WPP on air traffic, navigation equipment

WPP are signal reflectors that are larger than the radars they are transmitting to, so their presence can hide weaker signals from smaller targets. In addition, rotating wings cause a shift in the echo frequency compared to stationary objects. As current radars are not designed to identify and filter WPP signals, they may cause interference to radar information in the vicinity of the wind farm.⁹²

The Ministry of Defence (MoD) in a statement to⁹³ states that the construction of new WPPs in the vicinity of National Armed Forces (NAF) radars may adversely affect air and maritime surveillance capabilities. In order to facilitate the approval process for the construction of wind farms and to show where in Latvia the construction of wind farms is allowed, assessed or not allowed, the Ministry of Defence is developing a map of the Latvian territory divided into three sectors, marked with different colours. In the green zone, construction of WPP parks is allowed and supported, subject only to the approval of the Ministry of Defence. In the yellow zone, the construction of WPP parks is under consideration, but the operator will have to take into account compensatory solutions, such as the purchase of new radars. In the red zone, construction of WPP parks will be prohibited, as it would significantly interfere with national defence tasks.

The Limbaži WPP Park is located in the yellow area of the map (Figure 5.3.12), so the impact on air navigation capabilities needs to be assessed separately and may require compensatory measures, the nature and extent of which need to be agreed with the Ministry of Defence or a subordinate authority during the design process.

⁹² Angulo, I. & de la Vega, D. & Cascón, I. & Cañizo, J. & Wu, Y. & Guerra, D. & Angueira, P. 2014. Impact analysis of wind farms on telecommunication services. *Renewable and Sustainable Energy Reviews*, Volume 32

⁹³ https://tapportals.mk.gov.lv/public_participation/ef12074d-d5b9-434f-bf3b-64e12498c2f6

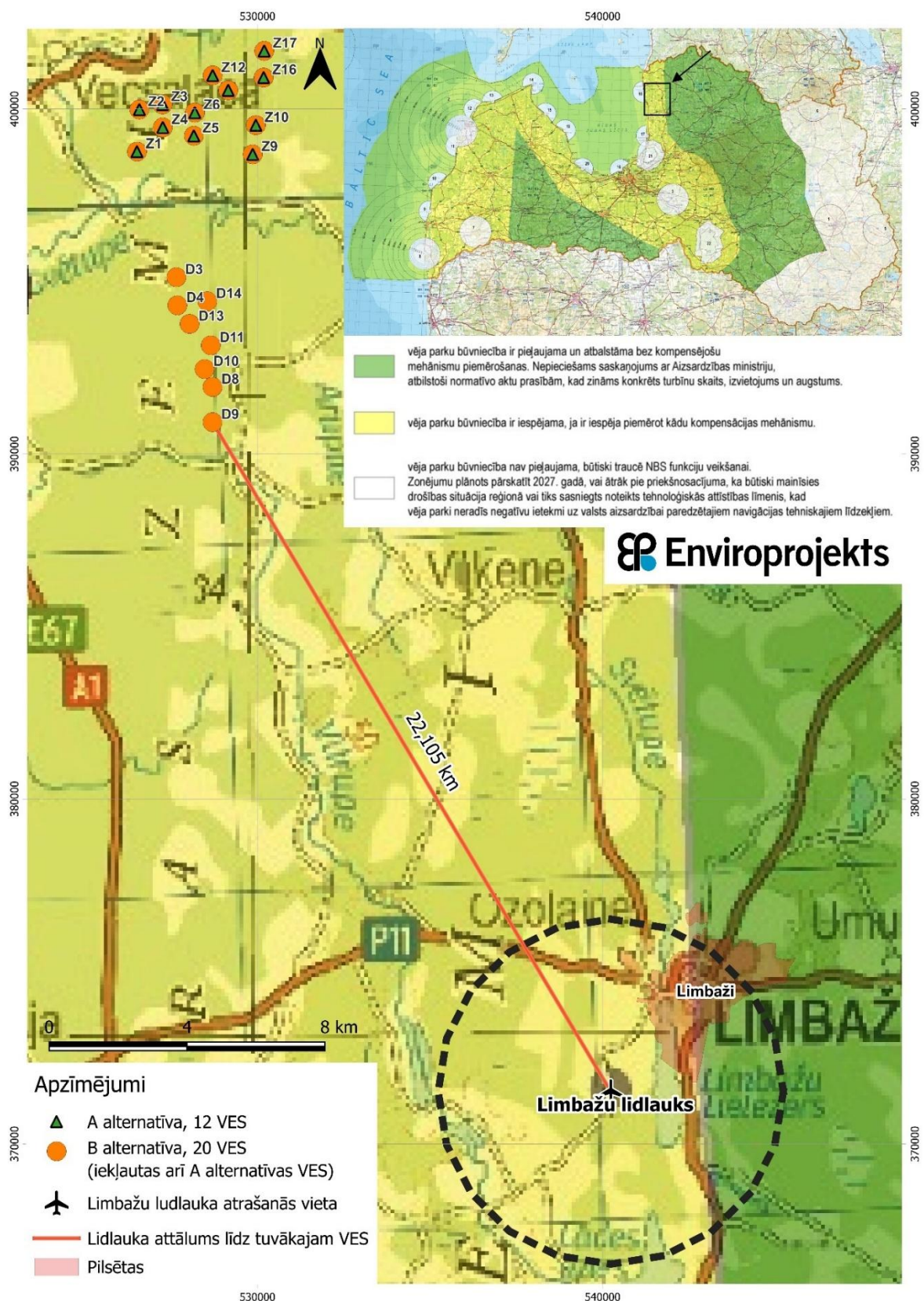


Figure 5.3.12. Location of military navigation facilities and their possible influence on each other in relation to WPP location

Civil air navigation services in the Republic of Latvia are provided using ground-based communication, navigation and surveillance equipment, as well as global navigation satellite systems.

The nearest civil aviation aerodrome to the Limbaži WPP Park is the Limbaži/Vidrižu aerodrome: Ltd Vidrižu Atvari (address: "Atvari", Vidrižu parish, Limbaži municipality, LV-4013) within 22 km (17,5 km from the airfield buffer zone). According to LGS⁹⁴, there is no radio navigation equipment at the aerodrome. The take-off and landing of aircraft is not affected by the proposed action due to the distance between the two sites (Figure 5.3.13).

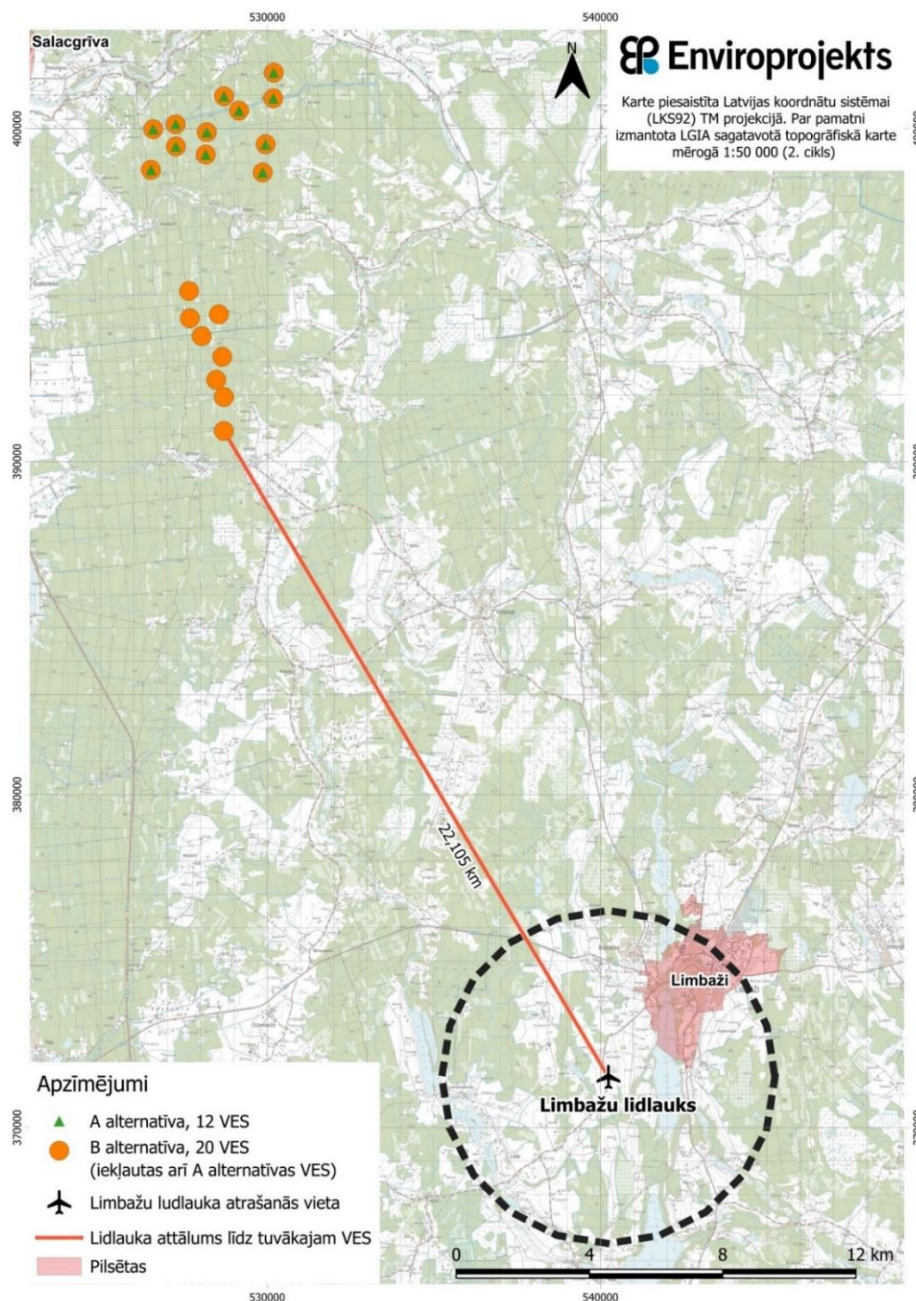


Figure 5.3.13. Limbaži/Vidriži aerodrome location in relation to Limbaži WPP

⁹⁴ <https://www.airspace.lv/lgs>

The second closest is Cēsis Aerodrome: Ltd Forest Owners Consultative Centre (address: "Lidlauks", Priekuli municipality, Cēsis region, LV-4126) 60 km away. It also has no radio navigation equipment.

For the location of radionavigation equipment in other locations in Latvia according to Latvian air traffic data, see Figure 5.3.14.

To assess the potential impact of the WPP on the radio-navigation shown on the map, the guidelines of the professional organisation EUROCONTROL were used. EUROCONTROL is a European civil-military organisation dedicated to supporting European aviation.

According to the criteria for the location of WPPs in relation to radio-navigation aids, 4 zones and impact assessment requirements have been defined (Table 5.3.7). Given that the WPP Limbaži is located more than 15 km from the PSR (*Primary Surveillance Radar*) radionavigation sites and is likely to be within the radar's visibility and operational range, a simplified assessment is required to determine the degree of potential impact in Zone 3.

Table 5.3.8. *Assessment requirements depending on the position of the wind farm in relation to the PSR and SSR (Secondary surveillance radar) radar⁹⁵*

Zone	1. zone	2. zone	3. zone	4. zone
Description	0-500 m (PSR and SSR system radars)	500m -15 km (PSR and SSR system radars)	Beyond 15 km, including radar visibility and range (PSR radars only)	Outside the radar's field of view and range (PSR and SSR system radars)
Assessment requirements	To be protected	Detailed assessment	Simple assessment	Not to be judged

Risk mitigation measures

The Limbaži WPP is not expected to pose any risk to the operation of the radio-navigation equipment, and it is therefore recommended that the LGS be formally agreed to confirm this (Figure 5.3.14). In accordance with consultations with LGS (letter of 29.02.2024, attached as Annex 2), LGS does not oppose the further advancement of the WPP Park project with conditions (in accordance with cooperation agreement No LG-AD/JPN-01/24/14 of 23.05.2024 between LGS and Ltd Latvijas Vēja Parki) and unambiguously formulates: **"No impact assessment required"**.

In addition, the LGS map (Figure 5.3.14) confirms that there are no air traffic radionavigation facilities closer to Latvia than those already identified.

⁹⁵ <https://www.pagerpower.com/news/eurocontrol-radar-wind-turbine-guidelines-v1-2/>

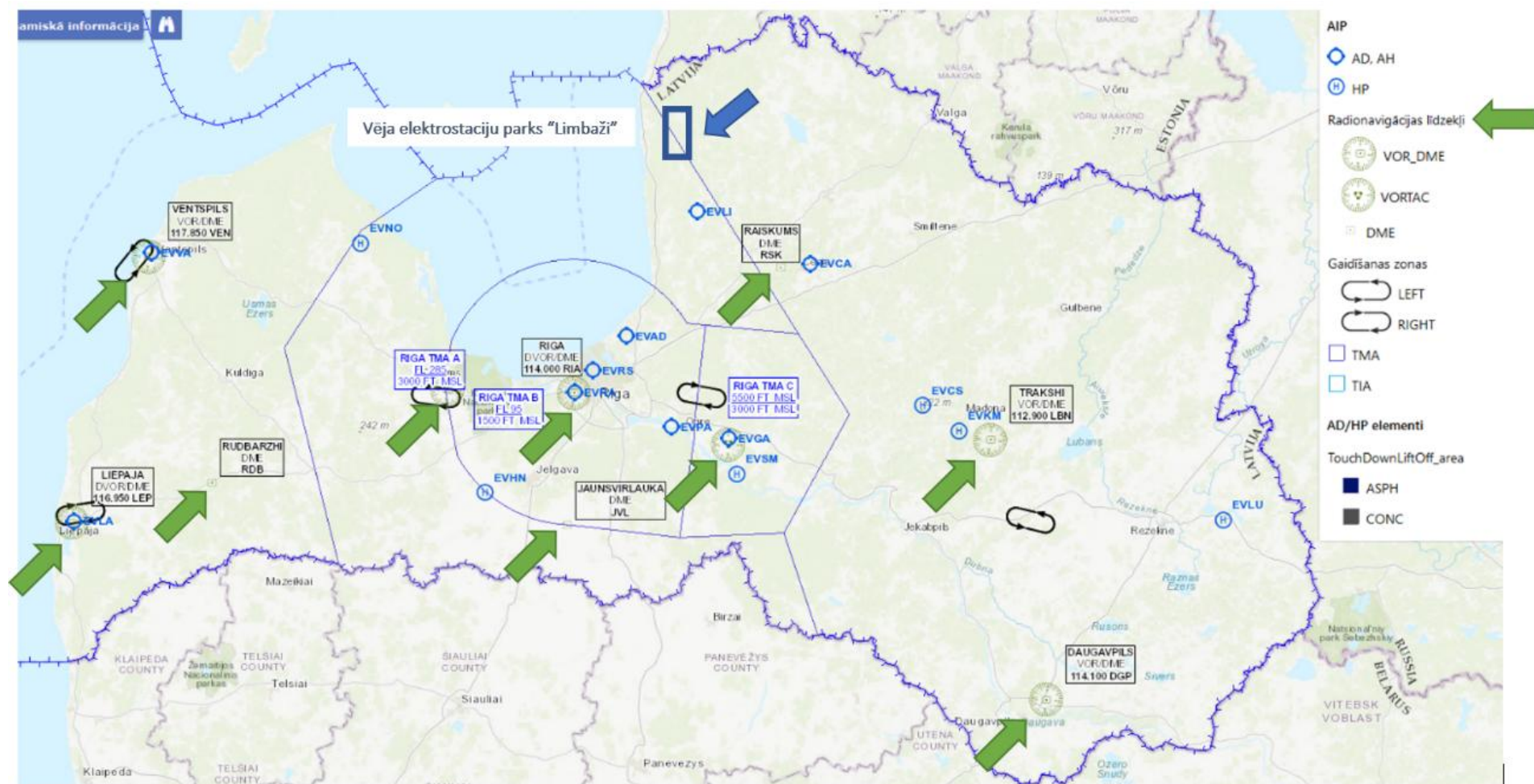


Figure 5.3.14. Radio navigation deployment in Latvia, Source: LGS

5.3.4. BESS container accident risk

BESS (*battery energy storage system*) cells are typically arranged in modules on racks and can be interconnected to increase energy capacity and meet a specific electricity demand at a given time. Modular arrays are usually housed in a room or an external container, which can vary in length, typically from 6 to 18 m. Several types of battery can be distinguished:

- lithium ion,
- lead-acids,
- nickel-cadmium,
- sodium-sulphur,
- fluxes (*Vanadium Redox*)

The most common batteries in the BESS market are lithium-ion, followed by lead-acid and flow batteries.

Fire hazards

The primary hazards of BESS are related to their operation and include electrical failures, electrocutions, flammable gas emissions, explosions, etc., usually associated with battery charging systems. Battery failure also affects the operation of battery-powered equipment.

If lithium batteries are used in the BESS, there is a potential hazard caused by thermal leakage under certain conditions (damage, etc.) resulting in ignition. Such a chemical reaction can occur during battery charging or recharging, as current flows through the cell, raising the cell temperature, which in turn increases the current with a subsequent rise in temperature.

Causes of fire that can lead to lithium-ion battery fires:

- damage caused during transportation, assembly or operation,
- manufacturing defect: can create conditions that cause the battery packs to short-circuit during use,
- battery overcharging: lithium-ion batteries are prone to overheating, which can occur when batteries are left in chargers for too long until the charger exceeds its protection limit or fails,
- short-circuits due to various reasons, including poor installation, product defect and physical damage.

Risk mitigation measures

Safety precautions for operating BESS equipment are provided by the equipment manufacturer in the operating instructions.

Additional information on fire safety requirements for BESS is also provided by the US Professional Firefighters' Organization document *NFPA 855 "Standard for the Installation of Stationary Energy Storage Systems"*. The above document covers systems that can reduce the fire risk associated with battery energy storage and provides industry best practices that should be followed for all new BESS installations in the USA. The document summarises information on safety systems for BESS construction, safety distances between BESS containers, fire compartments, ventilation systems, detectors, fire extinguishing systems, etc.

5.4. Information on climate change impacts

This chapter presents the life cycle impacts of installing and operating a WPP, including both negative (GHG emission increases and removals) and positive (GHG emission reductions and removals) impacts. A detailed calculation is attached in Annex 5.

Increased CO₂ emissions from deforestation

The forest ecosystem is a major contributor to climate, especially in terms of greenhouse gas emissions. The mechanism of climate forcing in this context is based on the ability of trees to sequester atmospheric carbon dioxide through photosynthesis and to store_{CO₂} in their trunks, branches and root systems. Carbon sequestered by photosynthesis in a growing tree is taken out of the cycle and no longer contributes to the production of greenhouse gases that are harmful to the climate.

The necessary amount of deforestation will be carried out for the construction of the WPP infrastructure. Deforestation will stop CO₂ sequestration in the trees growing on these areas.

The total impact of the project is calculated (see Annex 5) over a 50-year period, taking into account GHG emissions and CO₂ sequestration from deforestation and afforestation. After the project, the GHG emissions balance will deteriorate over the next 15-17 years and then improve due to_{CO₂} sequestration in biomass from young trees and other carbon sinks in the afforested areas. The differences between the calculations with and without the biofuel substitution effect appear after the first coppicing 20-25 years after establishment.

Alternative A results in a total increase in GHG emissions of 16.3 Gg CO₂ eq. (see Table 5.4.1). The offsetting effect of afforestation with substitution effect will reduce GHG emissions from deforestation by 6.9 Gg CO₂ eq., while the calculation without substitution effect will reduce GHG emissions by 6.3 Gg CO₂ eq. The residual GHG emissions from deforestation in the 50th year after the start of the project is calculated as 9.4 Gg CO₂ eq. (42 % reduction in emissions from deforestation), and 10.0 Gg CO₂ eq. (39 % reduction in emissions from deforestation).

Table 5.4.1. Increase in GHG emissions over 50 years as a result of the project under Alternative A

Indicator	Unit	With substitution effect	Excluding substitution effect
GHG emissions from deforestation	Tonnes CO ₂ eq.	16 319	
GHG emissions from afforestation	Tonnes CO ₂ eq.	-6892	-6287
Increase in GHG emissions from the project	Tonnes CO ₂ eq.	9427	10032

Alternative B results in a total increase in GHG emissions of 31.3 Gg_{CO₂} eq. (see Table 5.4.2). The offsetting effect of afforestation with substitution effect will reduce GHG emissions from deforestation by 11.1 Gg_{CO₂} eq., while the calculation without substitution effect will reduce GHG emissions by 10.1 Gg_{CO₂} eq. The residual GHG emissions from deforestation in the 50th year after the start of the project are calculated as 20.2 Gg_{CO₂} eq. (35% reduction in emissions from deforestation), and 21.2 Gg_{CO₂} eq. (32 % reduction in emissions from deforestation).

Table 5.4.2. Increase in GHG emissions over 50 years as a result of the project under Alternative B

Indicator	Unit	With substitution effect	Excluding substitution effect
GHG emissions from deforestation	Tonnes CO ₂ eq.	31312	
GHG emissions from afforestation	Tonnes CO ₂ eq.	-11084	-10128
Increase in GHG emissions from the project	Tonnes CO ₂ eq.	20228	21184

The cumulative value of GHG emissions of Alternatives A and B 50 years after the start of the project differs by about a factor of two. Scenario B involves higher emissions and the need for compensatory measures. Importantly, construction activities in both scenarios will also affect existing forest roads and drainage

systems, so the actual area to be deforested and afforested will be smaller than in this report, so this is considered a conservative estimate.

CO₂ emissions increase As a result of the operation of the WPP

The operation of a WPP, including the production of the necessary equipment and components and the construction of the WPP, is linked to CO₂ emissions. According to the website of the international consultancy ICF, the life cycle CO₂ emissions of a WPP are broken down as follows⁹⁶:

- CO₂ emissions from the production phase of WPP: 89,00 %;
- CO₂ emissions during the installation phase of a WPP: 4,00 %;
- CO₂ emissions from the operational phase of a WPP: 7.00 %⁹⁷.

The following assumptions have been used to calculate the life cycle CO₂ emissions of a WPP:

- Total electricity produced by WPPs:
 - A In the case of Alternative: 15 625 GWh;
 - B In case of alternative: 23 750 GWh.
- Average CO₂ emissions from the operation of the WPP: 20 g CO₂ eq./ KWh⁹⁸.

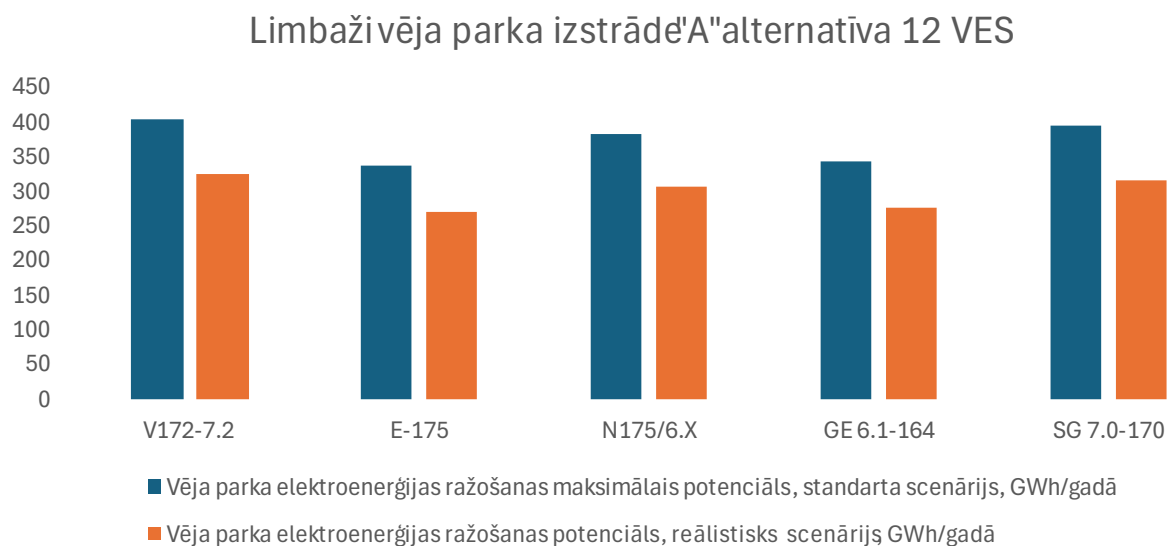


Figure 5.4.1. The WPP Limbaži development: Alternative A - 12 WPP

⁹⁶ <https://www.icf.com/insights/energy/recycling-initiatives-carbon-considerations-wind-energy>

⁹⁷ Ibid,

⁹⁸ <https://www.ipcc.ch/site/assets/uploads/2018/03/Chapter-7-Wind-Energy-1.pdf>

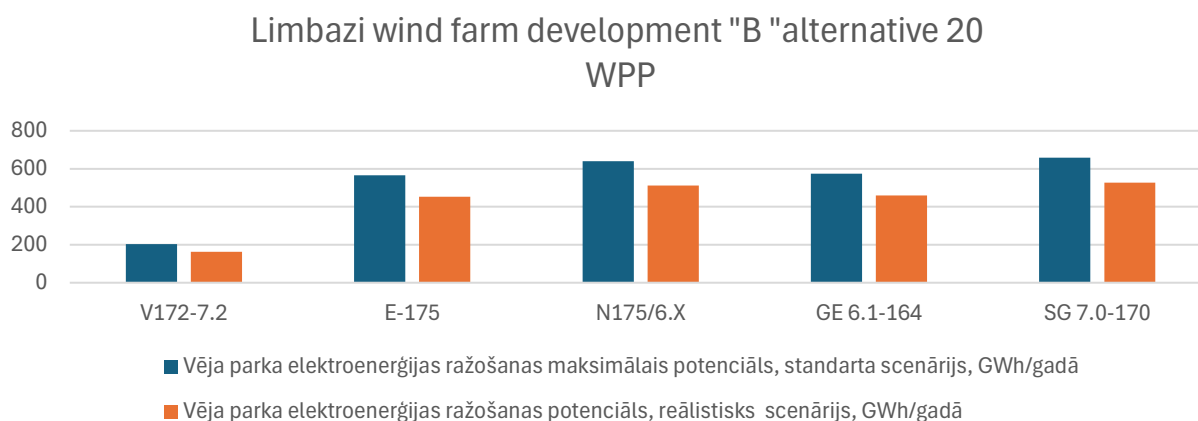


Figure 5.4.2. The WPP *Limbazi* development: *Alternative B - 20 WPP*

According to the calculations (Annex 5) for Alternative A, the total increase in CO₂ emissions from the operation of the WPP, including production and construction, will be 153 600 t CO₂ eq., broken down as follows:

- Total CO₂ emissions during the production phase of WPP: 136 704 t CO₂ eq.;
- Total CO₂ emissions during the installation phase of the WPP: 6 144 t CO₂ eq.;
- Total CO₂ emissions during the operational phase of the WPP: 10 752 t CO₂ eq.

According to the calculations (Annex 5) for Alternative B, the total increase in CO₂ emissions from the operation of the WPP, including production and construction, will be 256 000 t CO₂ eq., broken down as follows:

- Total CO₂ emissions during the production phase of WPP: 227 840 t CO₂ eq.;
- Total CO₂ emissions during the installation phase of the WPP: 10 240 t CO₂ eq.;
- Total CO₂ emissions during the operational phase of the WPP: 17 920 t CO₂ eq.

GHG emission reductions from substitution

The operation of WPPs will replace fossil-fuelled electricity with WPP-generated energy, which has lower GHG emissions from electricity generation. As a result, the substitution of electricity used for consumption will avoid the GHG emissions that would have been produced if fossil fuels were used for energy generation.

The GHG emission reductions resulting from the substitution have been calculated in accordance with the methodology set out in Annex 1 to Cabinet of Ministers Regulation No 42 of 23 January 2018 "Methodology for Calculation of Greenhouse Gas Emissions", using the following assumptions:

- the amount of electricity generated by renewable energy technologies to be fed into the electricity grid to be fed into the electricity grid:
 - Alternative A: 307 200 MWh/year;
 - Alternative B: 512 000 MWh/year.
- CO₂ emission factor for electricity in accordance with paragraph 1 of Annex 1 to Cabinet of Ministers Regulation No 42 of 23 January 2018 "Methodology for Calculation of Greenhouse Gas Emissions": 0.0735 t CO₂/MWh⁹⁹;
- CO₂ emission factor for electricity transmission in the electricity grid in accordance with Annex 1, Paragraph 1 of Cabinet of Ministers Regulation No 42 of 23 January 2018 "Methodology for Calculation of Greenhouse Gas Emissions": 0.0070 t CO₂/MWh.

⁹⁹ <https://www.kem.gov.lv/lv/siltumnicefekta-gazu-emisiju-aprekina-metodika>

According to the calculations (Annex 5), the total amount of substitution of GHG emission reductions resulting from the operation of the WPP will be as follows:

- Alternative A: 510 720 t CO₂ eq.
- Alternative B: 851 200 t CO₂ eq.

GHG emission reductions from successive afforestation of deforested areas

At the end of the WPP development (preparation and construction) phase, partial afforestation of the area required for the WPP development is planned, resulting in additional CO₂ emissions¹⁰⁰.

According to the calculations (Annex 5), the total CO₂ emission reductions from successive afforestation of the deforested area required for the WPP development will be as follows:

- Alternative A: 2 736 t CO₂ eq.
- Alternative B: 4 382 t CO₂ eq.

See Table 5.4.3 for a summary of the GHG savings impact of the WPP.

Table 5.4.3. Summary of the GHG savings impact of the WPP park

<i>CO₂ emission savings</i>	Alternative A: GHG emission reductions, t CO₂ eq.	Alternative B: GHG emission reductions, t CO₂ eq.
Deforestation of the WPP development area	- 16 000	-30 480
Partial afforestation of the WPP development area	2 736	4 382
CO ₂ emissions during the WPP production phase	-136 704	-227 840
CO ₂ emissions during the installation phase of a WPP	- 6 144	-10 240
CO ₂ emissions during the operational phase of a WPP	- 10 752	-17 920
Electricity substitution	510 720	851 200
Total_{CO₂} emissions	343 856	569 102

Overall, each alternative delivers significant GHG savings, with the largest savings in Alternative B with a higher number of WPPs, which overall is a demonstration of WPPs as a green energy source with GHG emission reductions as one of its main objectives.

5.5. Information on the climate resilience of the Proposed Activity and the potential impacts of climate change on the Proposed Activity

WPPs are designed to withstand both extreme weather conditions and to be resilient in the long term. Choosing a suitable wind class ensures that the WPP can withstand extreme wind speeds (extreme heat and torrential rain/hail are also predicted as major climate extremes in Latvia, but it is wind that could threaten the WPP). No significant potential effects of climate change on the WPP in the area of the proposed activity have been identified.

According to the information on wind conditions provided in Chapter 3.3, the area of the Proposed Action is suitable for the siting of WPPs designed for areas with low wind speeds (average speed at mast height of at least around 7.5 m/s). They are class III turbines according to the standard.¹⁰¹

¹⁰⁰ Lazdiņš, A. 2024. Changes in greenhouse gas (GHG) emissions from the Limbaži Wind Farm and associated infrastructure project.

¹⁰¹ <https://i-windenergy.com/content/popularity-class-iii-wind-turbines>

6. ASSESSMENT OF THE EXISTING STATE OF THE ENVIRONMENT

6.1. Hydrogeological conditions

The area of the proposed activity is located in the eastern part of the Baltic artesian basin. The intensity and chemical composition of water exchange in the artesian basin section distinguishes between active (free) water exchange zones (freshwater), slow water exchange zones (brackish water) and passive or slow water exchange zones (saline water), which are isolated throughout Latvia and the study area by two regional aquifers: the Middle Devonian Narva Suite (D2nr) and the Silurian-Ordovician Aquifer (S-O). Both aquifers are composed of impermeable dense sedimentary rocks, which makes interaction between the two aquifers very difficult, although small amounts of water overflow are possible in tectonic fracture zones.

The active water exchange (freshwater) zone includes Quaternary and pre-Quaternary water complexes up to the impermeable rocks of the Narva Suite (D2nr). The waters of the freshwater zone can be divided into two groups: groundwater and pressurised water. The active water exchange (freshwater) zone is 160-200 m thick.

The zone of retarded water exchange includes the Pärnu (D2pr) and Kemerī (D1km) aquifers, which in the vicinity of Salacgrīva contain fresh waters of the calcium hydrogen carbonate type with mineralisation between 0.3 and 0.4 g/l and waters of the sodium hydrogen carbonate or hydrogen carbonate-chloride type. This is determined by the location of the water-bearing rocks in the geological section of the complex, the direction of water exchange with adjacent aquifers or the recharge of aquifers by meltwater from the last glaciation. Saline waters unsuitable for water supply are found in most of Latvia's territory in the distribution area of the Kemerī and Pērnavas aquifers.

According to the LVGMC database "Boreholes" and cartographic information, groundwater aquifers associated with Quaternary sediments and rocks of the Middle Devonian and Lower Devonian sedimentary complex are distributed in and around the area of the proposed WPP (Table 6.1.1).

Table 6.1.1. Stratification of the hydrogeological section in and around the area of the proposed activity

Hydrogeological zone	Water complex	aquifer	Water aquifer	Water-bearing sediments
Active water exchange (freshwater) zone	Quaternary sediment complex (Q)		Swamp(<i>bQ4</i>) sediment aquifer	turf
			Undistributed aquifer of alluvial (<i>aQ4</i>), eolian (<i>vQ3ltv</i>), glaciolluvial (<i>lgQ3ltv</i>) and glaciofluvial (<i>fQ3ltv</i>) sediments	sand, gravel, pebbles, aleurite, loamy sand
			Sporadically irrigated aquifer of intermontane sediments (<i>fQ3ltv</i>)	moraine sandy loam with interbeds of sand-gravel-clay sediments
	Middle Devonian horizon complex		Arukila-Burtņieku (D2ar+br), aquifer	sandstone with clay and aleyrhyllite in between
Slow water exchange zone	Middle Devonian and sub-Devonian horizon complex		Kemerī-Pērnavas (D1km-D2pr) aquifer	sandstone with interbeds of clay and aleutolite

Often, the sand layers associated with groundwater are only a few metres thick. Groundwater provides water for the individual sector: it is widely used in homesteads (wells). Groundwater is extracted at depths between 0.35 and ~10 m from the surface: the further from the sea, the greater the depth. Groundwater levels are influenced by rainfall. Water quality is most often affected by human activities.

Groundwater is mainly associated with sandy Upper Pleistocene Baltic Ice Lake sediments (lgQ3ltv). The groundwater aquifer associated with alluvial deposits (aQ4ltv) is mainly composed of variously grained sands distributed in the valleys of watercourses (Salaca, Vitrupe, etc.). In the depressions and depressions between the hills, the marsh sediments (bQ4) also contain water.

The glacial (gQ3ltv) sediment layer consists of sandy clay or loamy sand with occasional lenses of sandy material and interbeds where groundwater is occasionally present at low pressures. The thickness of the water-bearing lenses and interbeds is very uneven, and groundwater depths vary widely from 1.0 to 10 m. Quaternary waters from sandy sediments are mainly used for water supply to private farms. The waters are of the bicarbonate or bicarbonate-sulphate calcium-magnesium type. The pressures in the sandy lens deposits are of good drinking water quality and are overlain by Baltic Ice Lake sediments (lgQ3ltv) in the WPP Park study area. The rest of the area is covered in places with bog, alluvial and fluvio-glacial deposits.

The thickness of the aquifer and groundwater flow are locally influenced by the weakly permeable clay and aleuritic layers and lenses. At most WPP sites, the water table is 0-2 m below the ground surface. Only in the southern part of the WPP Park, WPP D1, D2, D3 and D6 can the water table reach 5 m (Figure 6.1.1).

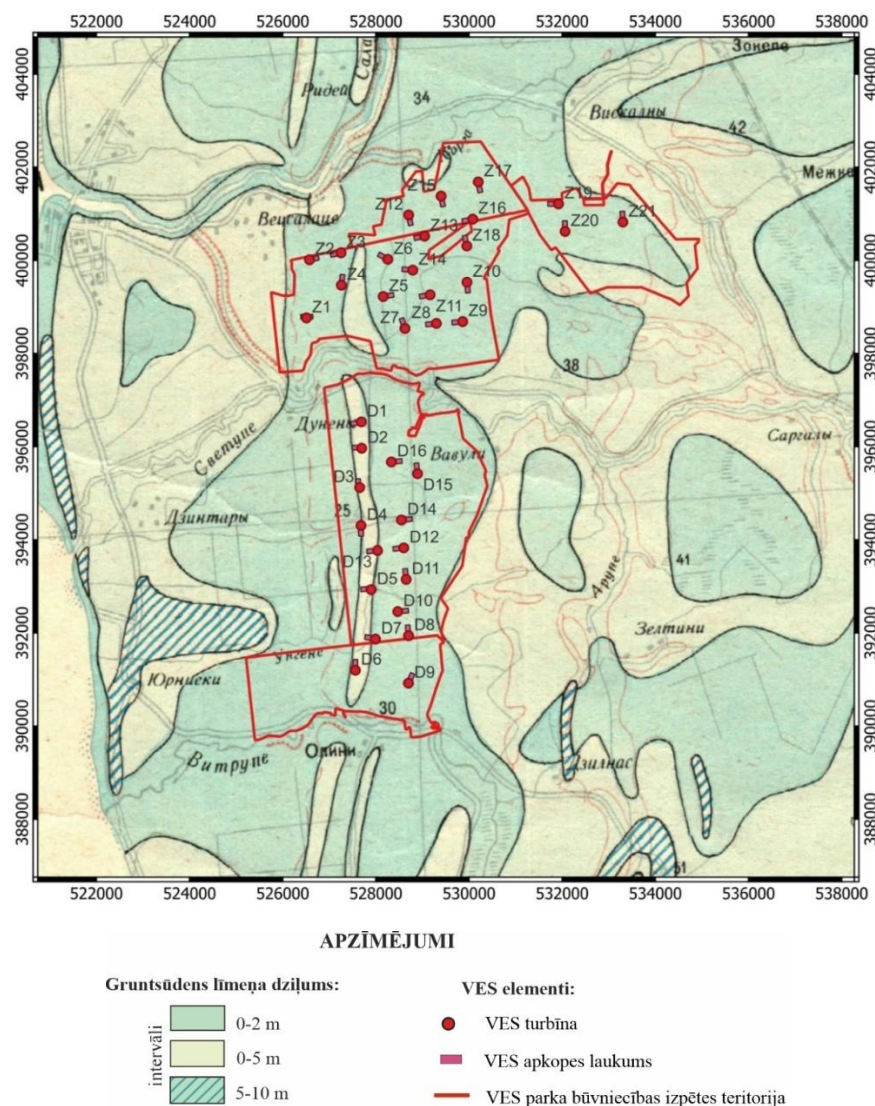


Figure 6.1.1. Extract from a schematic map of the depths of the first of the surface water aquifers ¹⁰²

¹⁰² Tracevski G, Yushkevich V, Polivko J, Bicko A. Report on 1:200 000 scale complex geological, hydrogeological and engineering geological mapping in the territory of site O-35-XIX. Geological Survey, Riga, 1967. ĢF No 07142

In its natural state, groundwater flow in the area of the Proposed Action is directed towards river valleys (e.g. Salaca, Svētupe) and towards the Gulf of Riga to the west and north-west, which is a regional groundwater recharge area. The Salaca, Vitrupe and Svētupe rivers are considered to be local groundwater recharge areas. The groundwater map (Figure 6.1.2) is derived from the Latvian Regional Hydrogeological Model (LAMO) of the Riga Technical University (RTU) Environmental Modelling Centre (EMC). Available geological and hydrogeological information has been used to develop this groundwater level and flow direction model. Unfortunately, due to a lack of data, it is not possible to accurately assess the impact of rivers and drainage systems on groundwater levels and flow directions. The groundwater depth pattern in the WPP study area is presented in Figure 6.1.3.

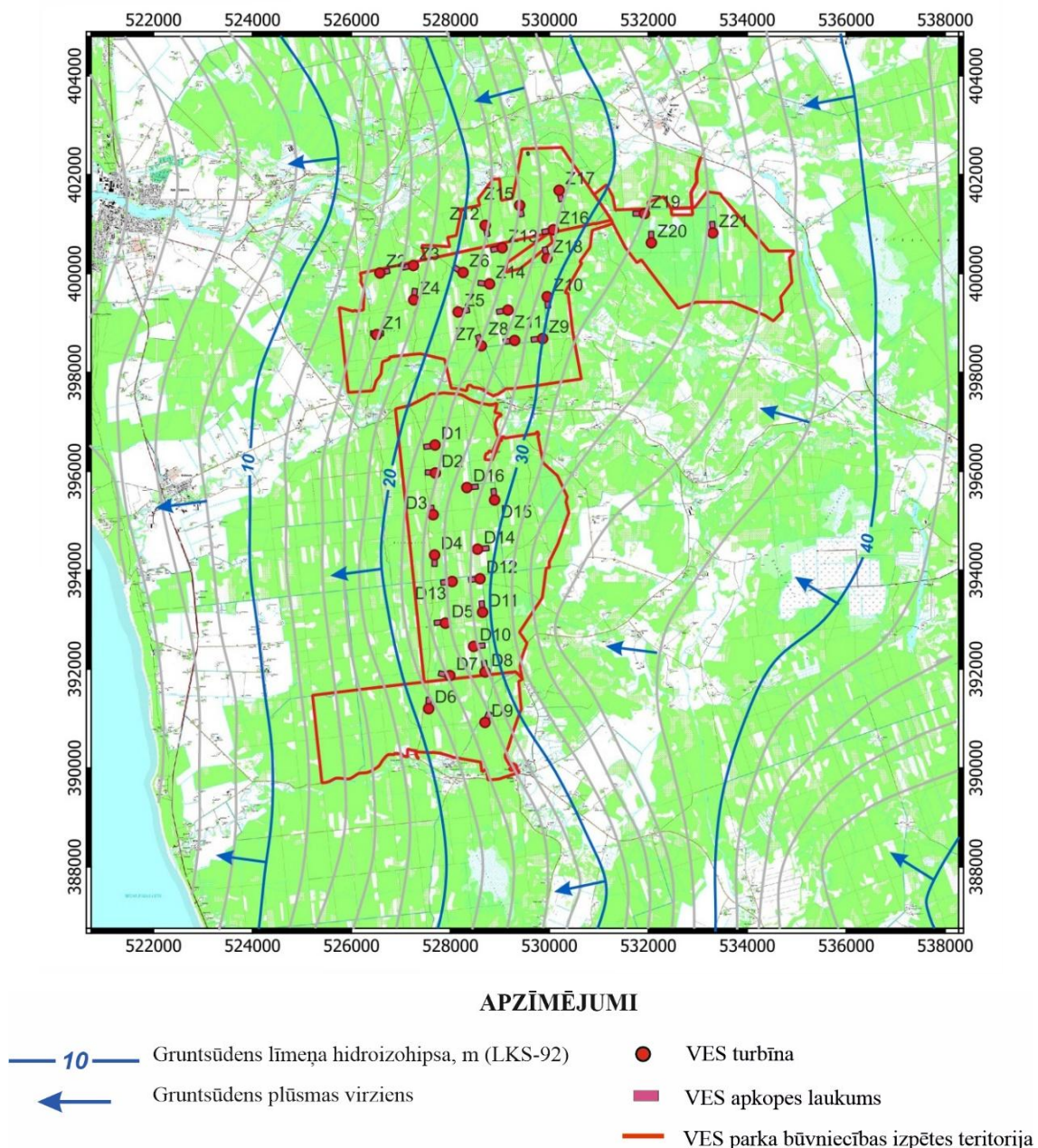


Figure 6.1.2. Groundwater level hydro-isohips map¹⁰³

¹⁰³ Latvian Regional Hydrogeological Model (LAMO) of Riga Technical University (RTU) Environmental Modelling Centre (EMC)

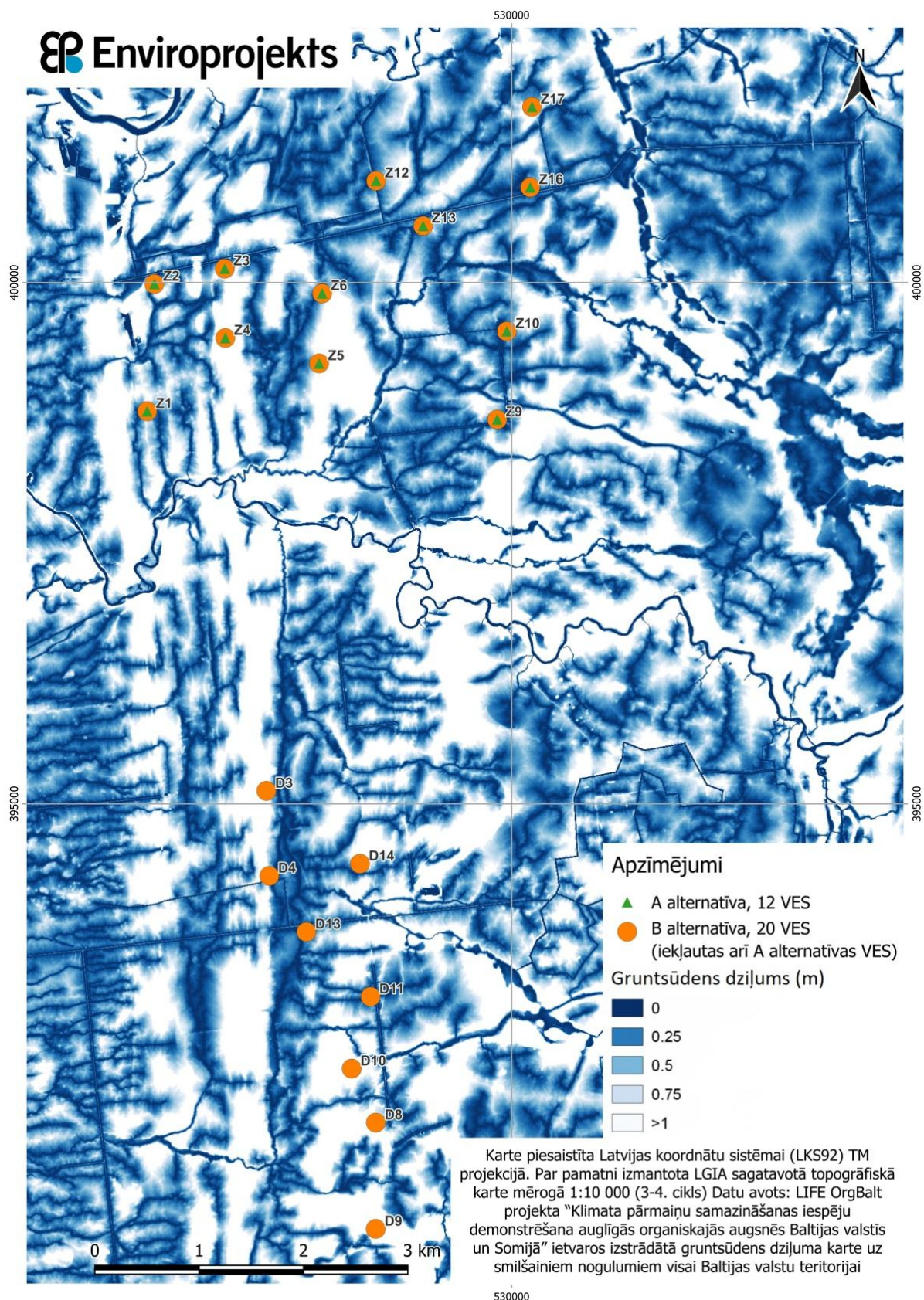


Figure 6.1.3. Groundwater depth model for the WPP study area, map for areas dominated by sandy sediments

Due to the natural vulnerability of groundwater to contaminant infiltration, the Quaternary aquifer complex is not used for centralised water supply but is mainly used for rural water supply.

Beneath the Quaternary aquifer, the middle Devonian Arukil-Burtnieki groundwater aquifer (D2ar+br) is separated from the second widely used Kēmeri-Pārnu water supply aquifer (D1km-D2pr) by the regional weakly permeable Narva aquifer (D2nr). The main water-bearing rock of the Arukila-Burtnieki aquifer (D2ar+br) is sandstone. Localised clastic layers consist of aleurolite and clay. Porous rock material predominates. The thickness of the sediments varies from 0.2 to 154 m, with an average thickness of 79 m. The area is dominated by downward groundwater flow. The water level of the Arukila-Burtnieki aquifer (D2ar+br) is 5-9 m below the surface, or 32-37 m a.s.l. in absolute terms. The aquifer has been widely used for water supply. These waters are separated from higher groundwater and potential contamination by a moraine aquifer, which is highly variable in thickness and can be only a few metres thick, and which provides poor protection from contamination.

The Kēmeri-Pērnavas aquifer (D1km-D2pr) is the main source of artesian water in Salacgrīva municipality. The water-bearing rocks of the Kēmeri-Pērnavas aquifer consist of sandstones, siltstones, aleurolites, aleuric clays, conglomerates and, in places, platy dolomites. The surface of the underground aquifer is 125-315 m below the surface. The Kēmeri-Pērnavas aquifer is well waterproofed and well protected from surface contamination, including contaminated groundwater.

The wells in the Kēmeri-Pērnavas aquifer are self-drilling. The wells can have a self-discharge height of up to 20 m. The absolute mark of the water table is 12-26 m a.s.l. As the Kēmeri-Pērnavas aquifer is very well protected from contamination, no protection zones have been established for these wells.

Analysis of the groundwater model data developed in the Depth-to-water project¹⁰⁴ in the area of the proposed operation shows that the groundwater table at the potential WPP sites is on average 2-5 m.

No significant adverse effects on the water quality of groundwater, surface water, groundwater and water abstraction points are expected from the Proposed Development, as there are no contaminated or potentially contaminated sites in the Proposed Development area and construction activities are being monitored during construction.

6.2. Hydrological conditions

6.2.1. Surface water bodies and ecological quality of water in the area of the proposed activity

According to the classification developed in the Gauja River Basin District Management Plan (GUBA) 2022-2027¹⁰⁵ the territory of the Proposed Action falls within 5 surface water bodies (hereinafter - SWB): Vitrupe_2 (Water Code G266), Ungenurga (Water Code G267), Svētupe (Water Code G268), Salaca_2 (Water Code G301) and Kōrģe (Water Code G302).

Under GUBA, the existing water quality of water bodies is assessed in relation to the requirements of the EU Water Framework Directive (EU Water Framework Directive, 2000). Water quality in water bodies is assessed mainly on the basis of two criteria: chemical and biological water quality. The chemical quality of water bodies is assessed by whether the annual average concentrations of hazardous and particularly hazardous substances exceed the limit values laid down in laws and regulations.

Watercourse Vitrupe_2 from Riebezers to the estuary (G266). The water body has a surface area of 83.56 km² and a catchment area of 198.29 km². The river has a mostly natural bed, between the villages of Ķirbiži and Vitrupe the river is straight. The catchment area is predominantly forested (68 %), with farmland and marshland in the middle reaches. Some anthropogenic pressure from villages without SPNAs is possible.

¹⁰⁴ https://www.lbtu.lv/sites/default/files/projects/LIFE-OrgBalt-1st_Technical-article_final_canva_11.pdf

¹⁰⁵ <https://videscentrs.lv/gmc.lv/lapas/udens-apsaimniekosana-un-pludu-parvaldiba>

There is a monitoring station "Vitrupe, estuary". The ecological quality of the water is assessed as *good*. The Vitrupe_2 MPA is a priority salmonid water.

UO Ungenurga (G267). The water body has a surface area of 21.13 km² and a catchment area of 21.95 km². In the upper reaches it flows through woodland (76 % of the catchment area) and natural stretches alternate with straight stretches. The downstream is almost completely straight, surrounded by farmland and intensive drainage. Possibly a periodically drying watercourse. There is a monitoring station "Unģenurga, estuary". The ecological quality of the water is assessed as *good*.

UO Svētupe (G268). The water body has a surface area of 414.86 km² and a catchment area of 475.55 km². Connected to the Salaca River via the Jaunupe Canal (the outflow is to the Salaca River), the old channel is much smaller than the canal. The water catchment area is rich in forests (64 %) and marshes, the upper reaches are straight. There are several sluice gates on the tributaries of the river, and the Robežnieki HPP is located on the Dzirnupīte (Šķirstiņa). Non-significant impact of Pale and Svētciešs NAI. In the middle reaches, especially in the catchment of the Pearl River, the impact of livestock farming is negligible. There is a monitoring station, "Svētupe, estuary". The ecological quality of the water is assessed as *good*. The Svētupe MPA (G268) is a priority salmonid water.

Salaca_2 (Water Code G301). The water body has a surface area of 280.27 km² and a catchment area of 325 km². The catchment area is largely covered by forests (70 %) and raised bogs (4%), with some agricultural land downstream. The ecological quality of the water is assessed as *medium*.

UO Korģe (G302). The water body and catchment area is 113.28 km². Upstream straight, reclaimed, with a similar proportion of farmland/forest in the surrounding area. Overall, 67% of the catchment area is forested. The proportion of clearcuts in the catchment has increased over the last 10 years. The biggest polluters are the wastewater treatment plant in Korģenes village and 2 farms, but the impact is not significant. In the lower reaches the river is natural, meandering, flowing mainly through woodland, tributary drainage ditches. The monitoring station - "Korģe, estuary", the ecological quality of the water is assessed as *good*. One of the potential reference rivers, corresponding to a priority salmonid water.

Under Directive 2007/60/EC¹⁰¹ of the European Parliament and of the Council, flood risk areas have been identified for each river basin. According to the "Flood Risk Information System"¹⁰⁶ and the "Gauja River Basin District Management Plan and Flood Risk Management Plan 2022-2027" developed by the LVGMC.¹⁰⁷ The site of the proposed activity is not located in a flood risk area.

According to the "Flood Risk and Flood Hazard Maps" developed by the LVGMC¹⁰⁸ the nearest flood risk area is located approximately 60 km to the south of the area of the Proposed Development: Ādaži district, at the mouth of the Gauja River in the Gulf of Riga.

¹⁰⁶ <https://pris.lvgtmc.lv/>

¹⁰⁷ <https://videscents.lvgtmc.lv/lapas/udens-apsaimniekosana-un-pludu-parvaldiba>

¹⁰⁸ <https://videscents.lvgtmc.lv/iebuve/vets/pludu-riska-un-pludu-draudu-kartes>

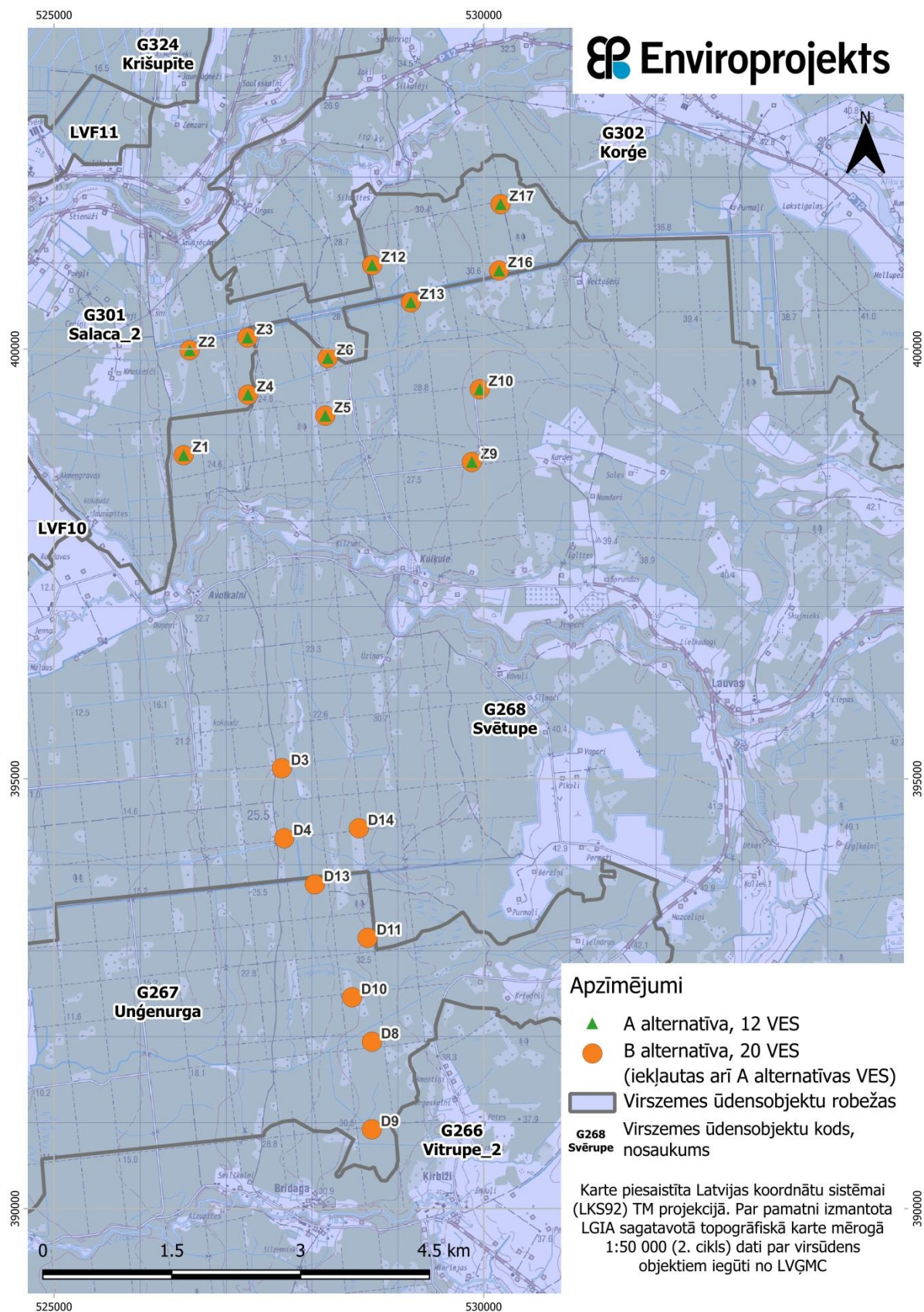


Figure 6.2.1. Surface water bodies location diagram.

6.2.2. Drainage facilities in the area of the proposed activity

According to the Water Management Law, the territory of the Proposed Activity falls within the Gauja basin area and according to the information of the Melioration Cadastre of the Ministry of Agriculture¹⁰⁹ and the Cabinet of Ministers Regulation No 397 of 3 July 2018 "Regulations on the classification of water management districts", is located in two large river basin districts: the small river basin between the Gauja and the Salaca (large river basin code 53) and the Salaca large river basin (large river basin code 54), which are divided into several catchment districts (Figure 6.2.2).

The area of the proposed action is located in the catchment area of small rivers of the Seaside. The nearest watercourses are the Vitrupe, Svētupe, Vedamurga River, Korgē, as well as Kliķu and Prima Lakes. Part of the area of the Proposed Action is crossed by drainage systems of national importance and forest drainage systems.

According to the drainage cadastre information, **the large basin of small rivers between Gauja and Salaca** includes:

- Vitrupe catchment area (drainage code: 5361);
- Ungenurga catchment area from the source to the mouth of the Gulf of Riga (drainage code: 5372)
- Svētupe River from Vedamurga to the mouth of the Gulf of Riga (drainage code: 53811);
- Vedamurga catchment area from the source to the mouth of the river Svētupe (drainage code: 53812);
- Kulaurga catchment area from the source to the mouth of the Svētupe River (drainage code: 53814).

The **Salaca** river basin includes:

- The catchment area of the Jaunupe river (drainage code: 54112);
- Korgē from the Kliķu lake stream basin to the Korgīte stream (drainage code: 54123);
- Korgē from the Korgīte stream basin to the Salaca estuary (drainage code: 54121);
- The catchment area of the Kliķu Lake stream from the outlet to the mouth of the Korgē (drainage code: 54124).

¹⁰⁹ <https://www.melioracija.lv>

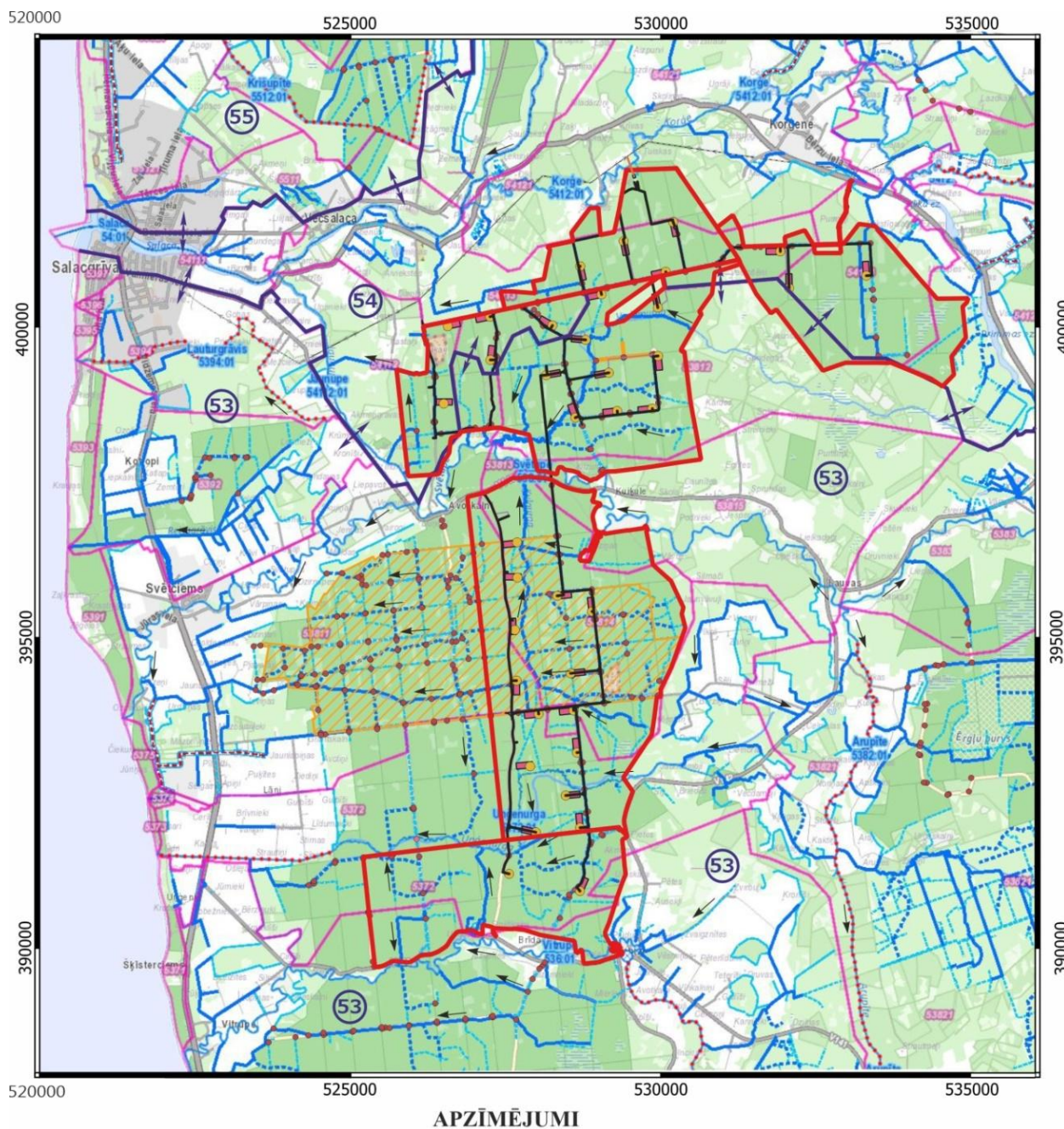


Figure 6.2.2. River catchment areas and reclaimed agricultural land in the vicinity of WPP¹¹⁰

All existing drainage systems will be preserved during the construction of the WPP Park, and if necessary (if a branch of the system is affected), rehabilitated or rebuilt. As these activities will be implemented as designed, respecting the layout and functionality of the drainage systems, the overall quality of the

¹¹⁰ www.melioracija.lv

drainage systems will not be compromised. The construction works will be carried out in accordance with the requirements of the Melioration Law and Cabinet Regulation No 329 "Regulations on Latvian Building Standard LBN 224-15 "Melioration Systems and Hydrotechnical Structures"" and the Limbaži Municipality Territorial Use and Building Regulations.

According to the publicly available information of LVM, in the next 3 to 5 years in the area of the Proposed Action it is planned to carry out rehabilitation of drainage systems as well as construction of forest roads, see Figure 6.2.3.

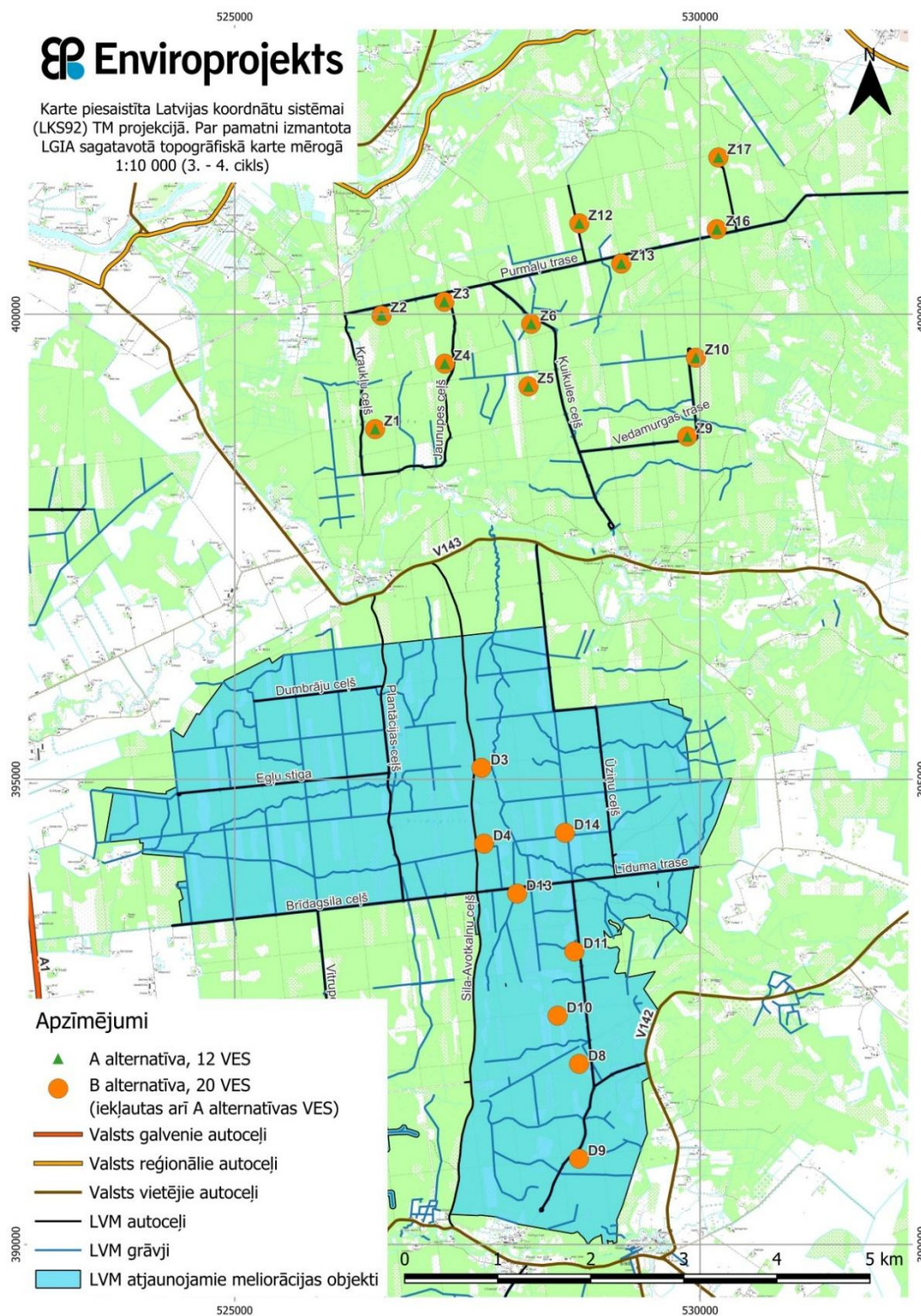


Figure 6.2.3. LVM planned forest drainage system areas to be restored and forest roads to be developed

6.3. Geological structure and engineering geological conditions

The area of the proposed activity is partly located in the Metsapole Plain of the Central Latvian Lowlands and the Vidzeme Coastal Plain (Figure 6.3.1). The surrounding area of the Limbaži WPP Park is characterised by relatively flat topography. The absolute elevation of the terrain on the site and in the immediate vicinity varies between 25 and 40 m a.s.l.

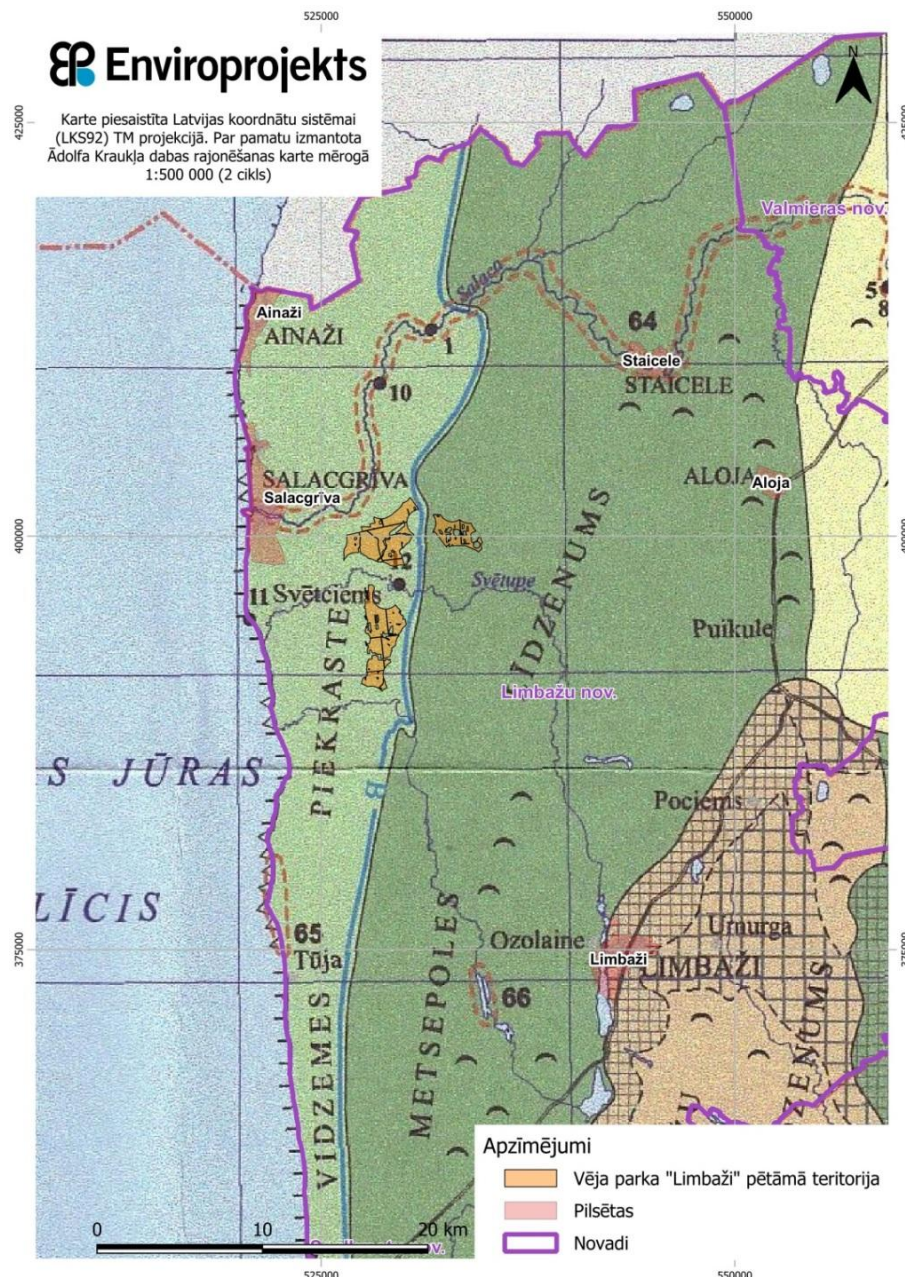


Figure 6.3.1. Location of the area of the proposed activity in relation to the natural zonation areas of Latvia.

6.3.1. Pre-quaternary sediments

The southern regions of Vidzeme are part of the ancient Eastern European platform. The geological section here distinguishes between two elements characteristic of ancient platforms: the crystalline basement

rock and the sedimentary cover. The surface of the crystalline basement is 700-800 m below sea level¹¹¹. According to the tectonic zoning¹¹², the crystalline basement rock corresponds to the Estonian-Latvian monocline of the Baltic syncline. The basement fault is cut north-south from Tūja to Ainaži by the Salacgrīva tectonic fault (Figure 6.3.2).

The sedimentary cover, starting with the oldest deeper-lying rocks, includes sediments from the Vendian (Late Proterozoic), Cambrian, Ordovician, Silurian, Devonian and Quaternary periods. Devonian strata are the most extensive in the sedimentary cover. The oldest sediments forming the Devonian system correspond to the sub-Devonian Kemer Suite (D1km). The Middle Devonian Pärnu Suite (D2prn), Narva Suite (D2nr), Arukil Suite (D2ar) and Burtneki Suite (D2br) sediments are higher (Figure 6.3.2).

The geological structure of the area is best characterised by the well with LVGMC DB No. 11504, located 4.5 km to the west of the WPP Park (Figure 6.3.2), and the well with LVGMC DB No. 11503, located approximately 7.5 km to the north-west of the WPP Park. The geological sections of the boreholes can be seen in Figure 6.3.3, a detailed description of the pre-Quaternary sediments is provided in Annex 10 - Expert Opinion.

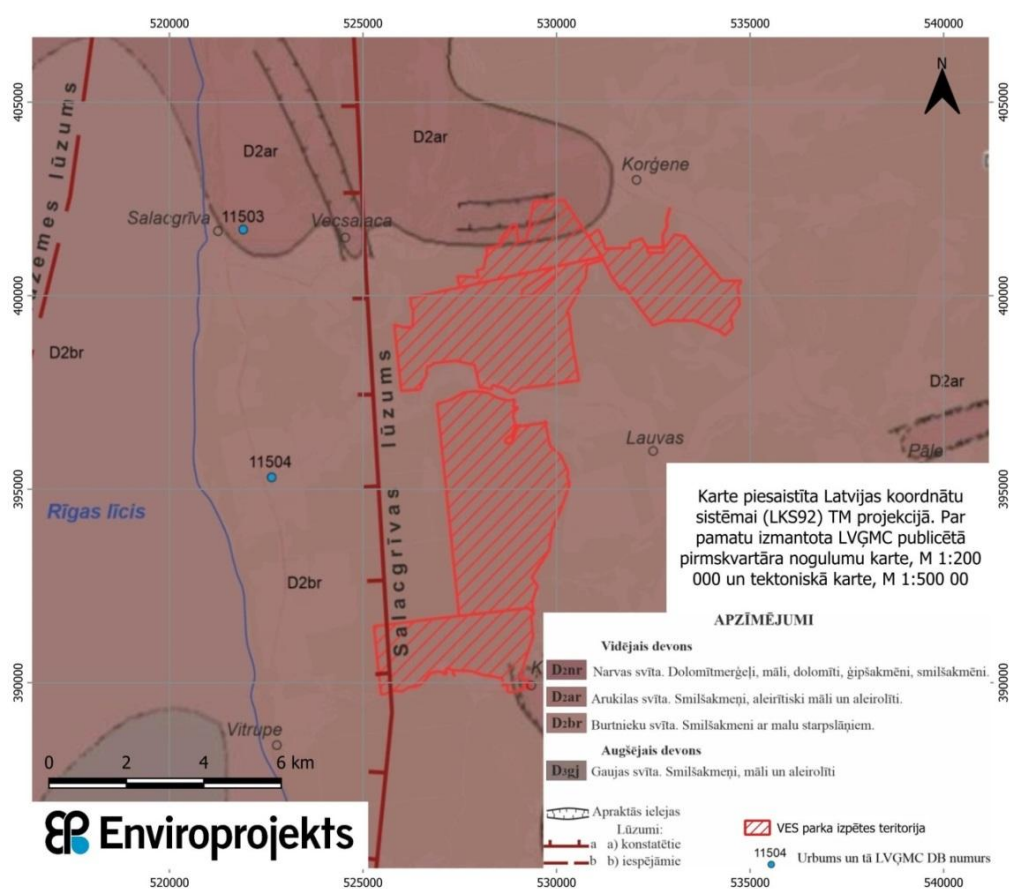
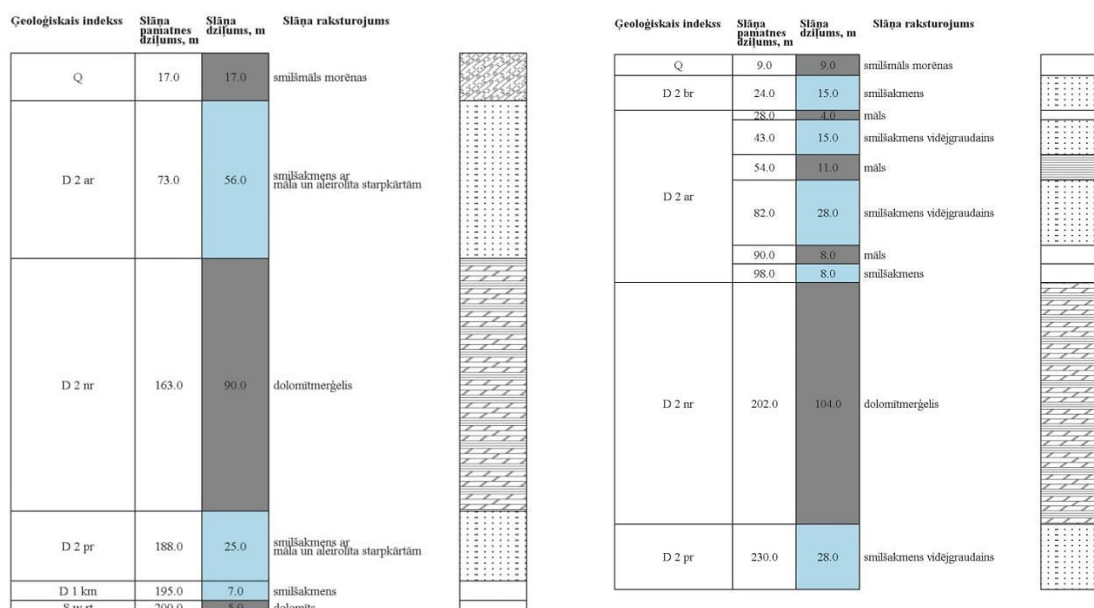


Figure 6.3.2. Map of pre-quaternary sediments of the area of the proposed activity (based on the map of pre-quaternary sediments published by the LVGMC, scale 1:200 000 and tectonic map, scale 1:500 000)

¹¹¹ Ivanova O. and Nulle I., 2003. A structural map of the surface of the base clutter at a scale of 1 : 500 00

¹¹² Brangulis, A. J., Kuršs, V., Misāns, J. & Stinkulis Ģ. 1998. Geology of Latvia. 1:500 000 scale geological map and description of pre-Quaternary sediments.



DB-11503 geological section

coordinates: X(E) 521026, Y(N) 405565 (LKS-92)

DB-11504 geological section

coordinates: X(E) 522290, Y(N) 395580 (LKS-92)

Figure 6.3.3. Geological sections of boreholes in the LVGMC DB "Boreholes"

6.3.2. Quaternary sediments

Quaternary sediments form an almost continuous blanket of uneven thickness, consisting of layers of different age, genesis and composition. They cover the eroded surface of pre-Quaternary rocks. The thickness of the Quaternary sediments varies from 6 m to 35 m (decreasing towards the west). However, in river valley cuts, the Quaternary sediments can be up to 90-100 m thick.

The **sediments of the Baltic Ice Lake** (glQ3ltvb) - sand, gravel, pebbles and aleurite - dominate in the area of the proposed activity. Thickness ranges from a few metres to 20 metres or more (Figure 6.3.4).

Marsh deposits (bQ4) cover some of the lower parts of the plain. The sediments of the marshes consist of high and low peat types. In general, the surroundings of the proposed WPP site are slightly waterlogged. Marsh sediments occur only in a few small areas in the immediate area of the proposed activity (Figure 6.3.4).

Fluvial or **alluvial deposits** (aQ4) occur in river floodplains.

The oldest Quaternary sediments occur in places in the area, directly overlying pre-Quaternary rocks of the Upper Pleistocene **Latvian Ice Age moraine formation** (gQ3/tv). The predominantly moraine sandy loam, often with gravel and pebbles, ranges from 3 to 96 m thick (Figure 6.3.4).

Small areas of **Upper Pleistocene aeolian sediments** (vQ3/tv) - fine dusty sand. The thickness of the deposits varies - up to 10 m.

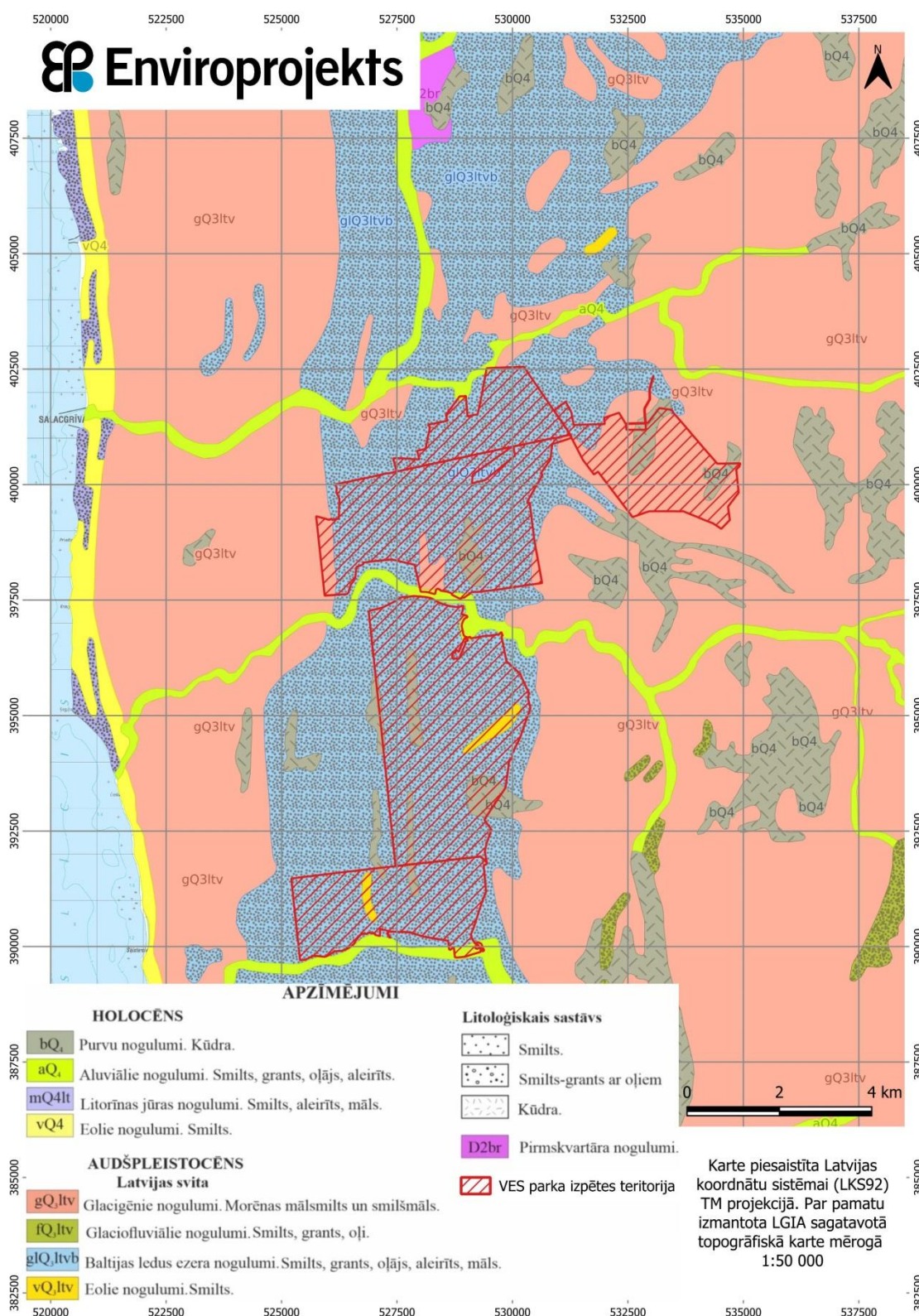


Figure 6.3.4. Quaternary sediment map of the area of the proposed activity (based on the quaternary sediment map published by the LVGMC, scale 1:200 000)

6.3.3. Engineering geological conditions and modern exodynamic processes

The engineering geological conditions of the area of the proposed operation will be assessed as a result of the engineering geological investigations to be carried out during the construction phase of the WPP. Consequently, the description of the engineering geological conditions in the EIA report is based on publicly available geological information¹¹³.

The upper part of the geological section of the WPP Park is basically characterised as a complex of Quaternary soils. According to the geotechnical classification (LVS 437:2002 "Civil Engineering. Primer. Classification"), Quaternary soils belong to non-clayey soils without strong structural links or crumbles (sandy), non-clayey cohesive soils or clays (sandy loam and moraine loam) and weak biogenic soils (peat). Their total thickness, according to the literature, varies from 6 m to 35 m and can reach 90-100 m in valley cuts.

The surface of the ground is made up of easily compressible soils - soil, peat in places, and, deeper down, sand, gravel, aleurite, loamy sand, sandy clay, which is mostly water-saturated.

The assessment of potential hazards from hazardous geological processes indicates that no hazardous modern exodynamic processes, such as karst or sufosion, landslides, slumping, gully formation, or active aeolian processes, are present in the area of the Proposed Development. Swamping and fluvial erosion are possible in small areas in the vicinity of the proposed action area.

River erosion or accumulation is not pronounced in the area of the proposed action and mainly affects the banks of the Salaca, Svētupe and Vitrupe rivers, which are located outside the area of the WPP Parks and do not pose geological risks to the WPP Parks.

Potential swamping processes are limited to isolated locations and are not expected to develop during the construction and operation of the WPPF.

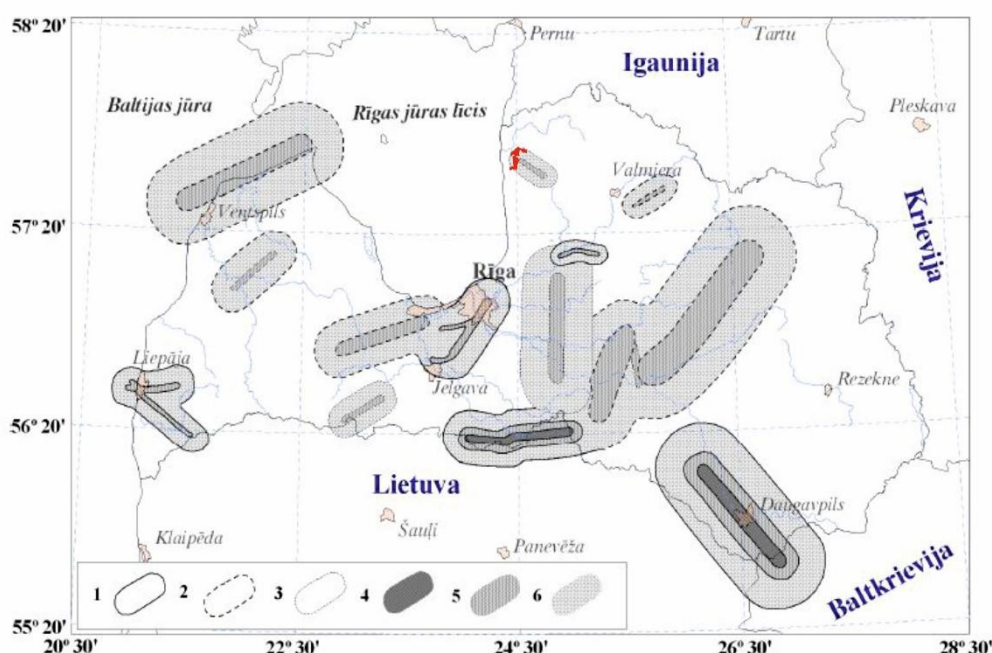
If, as a result of the engineering geological investigations to be carried out prior to the implementation of the Proposed Action at the construction design stage, areas are identified where the soil bearing capacity is insufficient for the construction of the selected WPP and where the peat is less than 3 m thick, peat removal will be carried out. The peat is overlain by moraine sediments, the moraine is made up of sandy loam and clayey sand, which is a stable substrate that can serve as a base for the WPP structures.

If the peat is thicker, the foundation will be based on piles. The need for piles and the technological solution for their construction will be determined during the preparation of the construction project.

According to V.Nikulin's Latvian seismic zoning¹¹⁴, the area of the Proposed Action is located north of the Svētupe Seismogenic Zone (ST), where future earthquakes with an intensity of 6 magnitude at epicentre (on the MSK-64 scale) may occur (Figure 6.3.5).

¹¹³ Juškevičs, V., Āboltiņš, O. 2000. Geological map of Latvia. Quaternary sediments, Riga-43 and Ainaži-53. Scale 1:200 000 [Book]. - Riga : National Geological Survey, ISBN 9984-9299-6-5.

¹¹⁴ Nikulin, V. 2007. *Seismotectonic conditions and seismic hazard of Latvia*. University of Latvia, Riga.



Designations: 1 - limit of influence of the ZCR zone; 2 - limit of influence of potential ZCR zones; 3 - limit of potential seismotectonic zones; 4 - seismic intensity 7 (MSK-64 scale); 5 - seismic intensity 6 (MSK-64 scale); 6 - seismic intensity 5 (MSK-64 scale).

Figure 6.3.5. General seismic zoning map of Latvia (LVSR-98) (the area of intended operation is marked in red)¹¹⁵

Seismological monitoring in Latvia is carried out by the LVGMC. The aim of seismological monitoring is to detect, record and localise seismic events of natural or tectonic (earthquakes) and technogenic (as explosions) origin, as well as to determine the parameters of seismic events in the Baltic region.

Data from 11 broadband seismological stations in Lithuania, Poland, Estonia, Russia, Denmark and Finland are used to record seismic events. In Latvia, measurements are made at the Slītere (SLIT) observation station. Seismological data are collected from the global GEOFON seismological monitoring network using the Seiscomp4 open-access seismic processing and download software.

The results of annual seismic monitoring are summarised in monitoring reports, which are available on the LVGMC website ¹¹⁶.

The seismic monitoring data indicate that seismic events of magnitude 2.0-2.4 are possible in the immediate vicinity of the proposed development area. The epicentres of seismic events could be approximately 4-6 km from the area of the Proposed Action. The genesis of these seismic events is unknown, but there are some tectonic faults in the area. There is a possibility that tectonic earthquakes could be among them. Overall, the seismicity of the proposed area of operation is very low. Earthquakes with a magnitude of 2.0-2.4 can be rated as weak on the earthquake intensity scale. The fluctuations are only felt by some people inside buildings, especially on upper floors. No damage to buildings or serious damage is observed for an earthquake with magnitude <2.9. The earthquake hazard is therefore assessed as having a very low probability.

¹¹⁵ Strategic Environmental Assessment. Updated version. RP Alianse Ltd, 2019.

¹¹⁶ <https://videscentrs.lvgmc.lv/lapas/seismological-monitoring>

6.4. Characteristics of the natural values of the surroundings

6.4.1. Special areas of conservation and Natura 2000 sites

The study area and its surroundings contain several SPNA and micro-reserves, species sites and their areas, habitats of European Union importance and specially protected trees. The Proposed Action is located in the NVBR (Neutral Zone) area (part of the Proposed Action study area is also located in the Landscape Protection Zone, but no WPPs are proposed). An overview of nature conservation values is summarised in Figure 6.4.1 and a map of SPNA is provided in Figure 6.4.2.

The nearest SPNA (within 3 km from the boundary of the LVM wind farm study area land units) are summarised in Table 6.4.1.

Table 6.4.1. *Specially Protected Nature Areas in the vicinity of the territory of the Limbaži WPP Park¹¹⁷*

Name	Status	Minimum distance from the nearest WPP under assessment	Minimum distance from the nearest recommended WPP	Establishment criteria
No.1407	Microreserve	0,3 km	1,5 km	For the protection of specially protected species and habitats
No 385	Microreserve	0,3 km	0,3 km	For the protection of specially protected species and habitats
No 1406	Microreserve	0,6 km	1,1, km	For the protection of specially protected species and habitats
No 1377	Microreserve	0,8 km	1,5 km	For bird conservation
No.3118	Microreserve	1,1 km	1,5 km	For the protection of specially protected species and habitats
No 3119	Microreserve	1,1 km	1,5 km	For the protection of specially protected species and habitats
No.3120	Microreserve	1,1 km	3,5 km	For the protection of specially protected species and habitats
Vitupes ieleja	NATURA 2000	0,9 km	0,9 km	For the protection of specially protected species and habitats
Salacas ieleja	NATURA 2000	1,8 km	1,8 km	For the protection of specially protected species other than birds and specially protected habitats
Niedrāju-Pilka purvs	NATURA 2000	2,7 km	5,3 km	Specially protected species other than birds and for the protection of specially protected habitats
No 1405	Microreserve	3,0 km	4,0 km	For the protection of specially protected species and habitats
No 1754	Microreserve	2,6 km	2,6 km	For bird conservation

¹¹⁷ Data corresponds to DDPS "Ozols" (25.09.2024.)

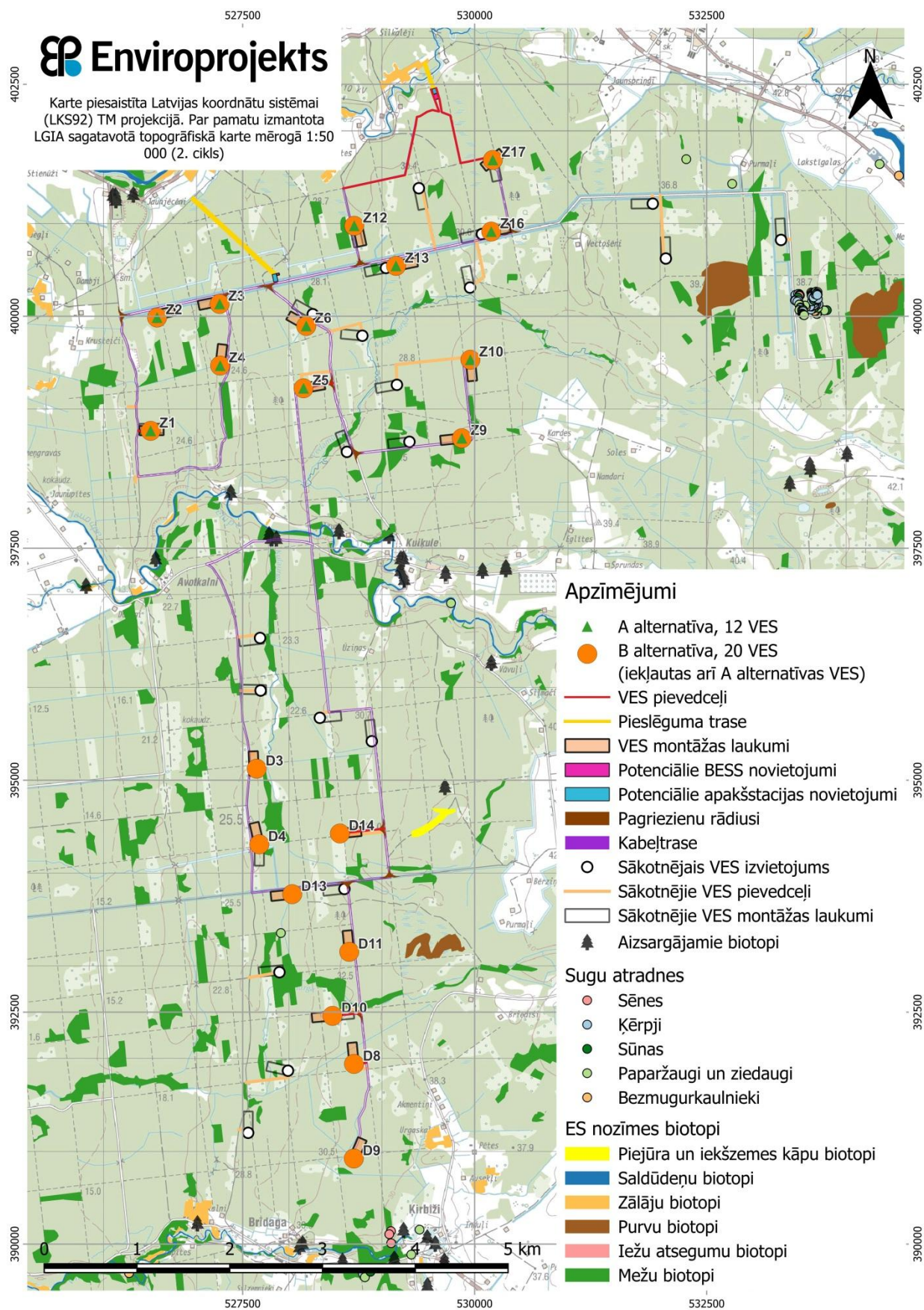


Figure 6.4.1. Natural values in and around the Limbaži WPP

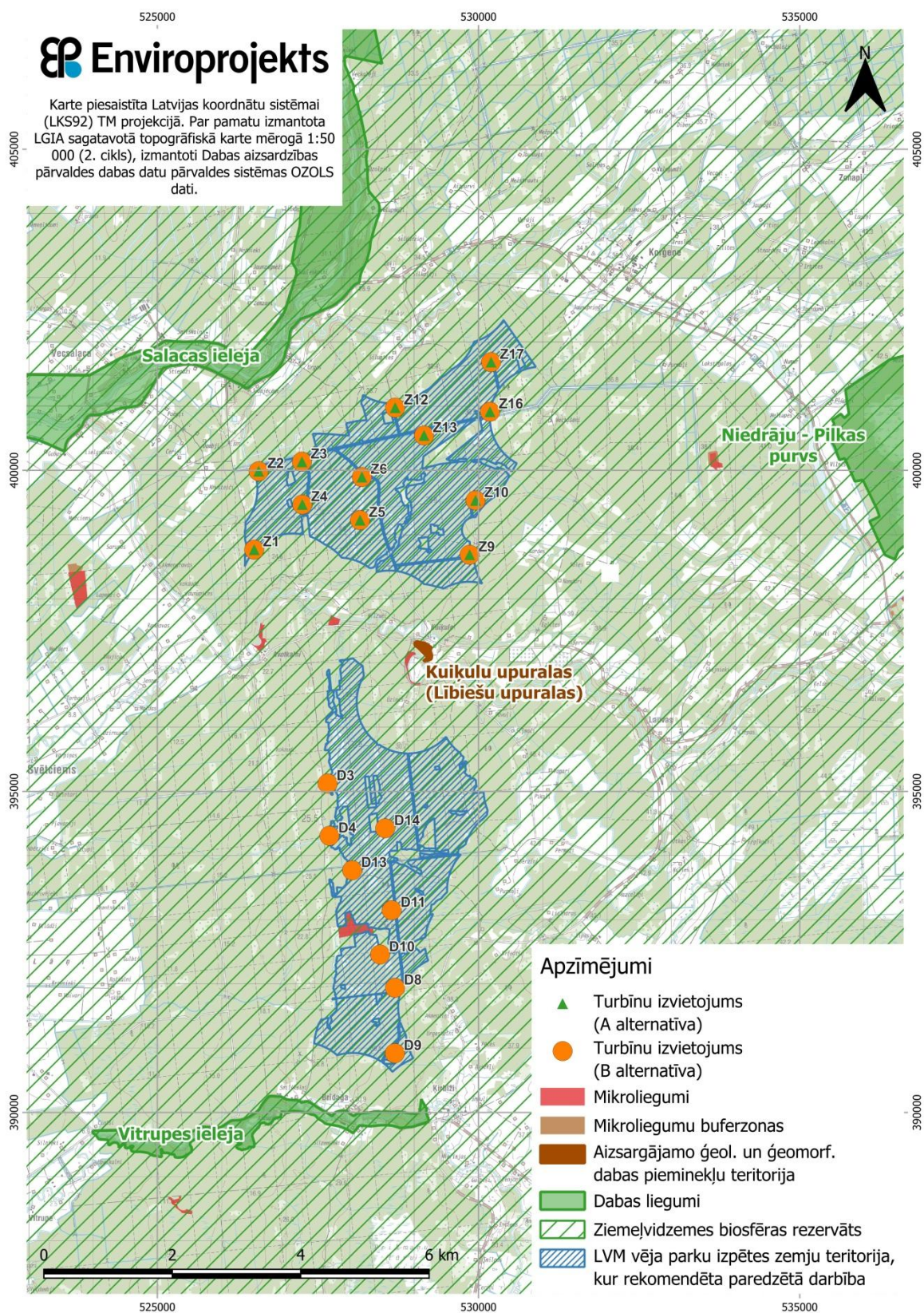


Figure 6.4.2. Protected natural areas in the vicinity of the location of the proposed activity.

There are 3 Natura 2000 sites in the vicinity of the LVM WPP park study area:

- “Vitrupe ieleja” (area code: LV0530500) 0,8 km from the boundary of the land units, distance to the nearest WPP - 0,9 km, distance to the nearest WPP in Alternative A - 8,7 km;
- “Salacas ieleja” (area code: LV0302200) 1,6 km from the border of the land units, distance to the nearest WPP - 1,8 km, distance to the nearest WPP in alternative A - 1,8 km;
- “Niedrāju-Pilkas purvs”, (area code: LV0509800) 1,2 km from the border of the land units, distance to the nearest WPP - 5,3 km, distance to the nearest WPP in alternative A - 5,3 km.

“**Vitrupe ieleja**” is an important site for the conservation of hillside forests and for the conservation of a rare species of Annex 2 of the EU Habitats Directive - the *Vertigo genesii*, for which the site is one of only four known in Latvia. Two protected plant species have been recorded in the area: the *Allium ursinum* and the *Lunaria rediviva*, and 9 protected invertebrate species. The hillside forests of the Vitrupe valley are one of the three sites of the *Helicigona lapicida* in the country. Many of the forest stands meet the criteria for key forest habitats.

According to the Cabinet of Ministers Regulation No.254 of 24 March 2009 "Individual Rules for the Protection and Use of the Nature Reserve "Vitrupe ieleja"", the nature reserve was established to ensure the protection of specially protected invertebrate and plant species, sandstone outcrops, forests and freshwater habitats, as well as to promote sustainable management of the area. The site has four zones: regulated, nature reserve, landscape protection and neutral. The regulations stipulate that the landscape protection zone is established to preserve the landscape characteristic of the reserve (Vitrupe floodplain with terraces) and the coastal biodiversity, while allowing economic activities based on the principles of sustainable development, while the neutral zone is established to ensure economic activities based on the principles of sustainable development in the area of the reserve. Construction in the neutral zone shall be permitted in accordance with the spatial plan of the local municipality, observing the procedures and restrictions established in these Regulations and other regulatory enactments.

“**Salacas ieleja**” is an important area for the protection of several EU Habitats Directive habitats: sandstone outcrops, undisturbed caves, hillside forests, oxbow lakes, stream channels and dry meadows on calcareous soils, etc. It has outstanding scenic value in many parts of the river, especially in the Skaņākalns area near Mazsalaca, downstream of Staicele, at Mērnīeku krāce and Sarkana cliffs. The area is also geologically significant: Pietraga Red Rocks, Daugēnu Rocks and Caves, Neļķu Rocks and Caves, Silmaču Rock and Caves, Swallow Rocks and Caves, Dzelveskalns Outcrops and Caves, etc.

In accordance with Cabinet Regulation No 228 of 10 March 2009 "Individual Rules for the Protection and Use of the Nature Park "Salacas ieleja"", the Nature Park was established to ensure the protection of habitats of species specially protected in Latvia and in the European Union, in particular - the protection of salmonid and lamprey spawning and habitats, to ensure the protection of habitats specially protected in Latvia and in the European Union (including slope and ravine forests, sandstone outcrops, river floodplains) and to preserve the territory for public recreation and education and to ensure sustainable development of the territory.

“**Niedrāju-Pilka purvs**” is an important site for the conservation of the priority habitats of the EU Habitats Directive Annex 1 - raised bogs and swamp forests. A large number of protected bird species can be found: Black stork, Bean goose, Greater white-fronted goose, European honey buzzard, lesser spotted eagle, Black grouse, Hazel grouse, European golden plover, common gull, Whooper swan, etc.

A summary of the objectives for the establishment and protection of the Natura 2000 sites adjacent to the area of the Proposed Action, the patterns and interactions that determine the existence of natural values in these Natura 2000 sites, and the factors that are already adversely affecting them prior to implementation of the Proposed Action is provided in Table 6.4.2.

Table 6.4.2. Assessment of Natura 2000 sites in Latvia adjacent to the area of the proposed activity

Nature Reserve "Vitrupe ieleja"	
Objectives for creation and protection (habitats)¹¹⁸	The site has been designated to protect the following habitats of EU importance: freshwater, grasslands, marshes, rock outcrops and forests ¹¹⁹ 3260, 6270*, 6450, 7160, 8220, 9010*, 9020*, 9050, 9160, 9180*, 91F0
Objectives for establishment and conservation (species)¹²⁰	Spined loach, Eurasian pygmy owl, White-backed woodpecker, Thick shelled river mussel, Red-backed shrike, Corn crake, Salmon, Large copper, Black woodpecker, Hazel grouse, European bullhead, Woodlark, Round-mouthed whorl snail, Brook lamprey, Eurasian three-toed woodpecker, European river lamprey, Ural owl, Eurasian otter, European nightjar, Middle spotted woodpecker, Common kingfisher.
The patterns and interactions that determine the existence of natural values in these areas¹²¹	The reserve was established to ensure the protection of specially protected invertebrate and plant species, sandstone outcrops, forests and freshwater habitats, as well as to promote sustainable management of the area.
Factors affecting nature values prior to implementation of the Proposed Action¹²²	<ul style="list-style-type: none"> - Forestry activities - Vitrupe riverbank development, bank reconstruction - Water pollution - High number of beaver dams and chokes in the river - Removal of dead wood - Overgrowing meadows - Spontaneously created waste dumps on the coastal strip - Agricultural activities - Concession - Problem native species
Nature park "Salacas ieleja"	
Objectives for creation and protection (habitats)¹²³	The site has been designated to protect the following habitats of EU importance: freshwater, grasslands, marshes and forests ¹²⁴ 2180, 3260, 6210, 6270*, 6410, 6430, 6450, 6510, 7110*, 7150, 7160, 7220*, 8220, 8310, 9010*, 9020, 9050, 9160, 9180*, 91D0*, 91E0*, 91F0
Objectives for establishment and conservation (species)¹²⁵	Spined loach, Eurasian pygmy owl, white stork, White-backed woodpecker, Thick shelled river mussel, Brown bear, Red-backed shrike, Geyer's whorl snail, Pond bat, Common crane, Corn crake, Sichel, Golden eagle, hermit beetle, salmon, Common merganser, Lesser Spotted Eagle, Red-breasted flycatcher, Western capercaillie, Black stork, Black woodpecker, Eastern pasqueflower, Hazel grouse, Western marsh harrier, Grey-headed woodpecker, weatherfish, European bullhead, Woodlark, Narrow-mouthed Whorl Snail, European bitterling, hairy agrimony, Brook lamprey, Eurasian three-toed woodpecker, European river lamprey, Ural owl, Eurasian otter, European nightjar, Middle spotted woodpecker, Green snaketail, Osprey, Common kingfisher.
The patterns and interactions that determine	The Nature Park was established to ensure the protection of habitats of species specially protected in Latvia and in the European Union, especially salmonid and lamprey spawning and habitat protection, to ensure the protection of habitats specially protected in Latvia and in the European Union (including slope and ravine

¹¹⁸ <https://biodiversity.europa.eu/sites/natura2000/LV0530500>

¹¹⁹ Here are the EU Habitat Codes, for detailed descriptions of the habitats see

https://www.varam.gov.lv/sites/varam/files/es_biotopi_latvija_rokasgramata_lv_2_izdevums.pdf

¹²⁰ <https://biodiversity.europa.eu/sites/natura2000/LV0530500>

¹²¹ <https://www.daba.gov.lv/lv/vitrupe-ieleja>

¹²² <https://biodiversity.europa.eu/sites/natura2000/LV0530500>

¹²³ <https://biodiversity.europa.eu/sites/natura2000/LV0302200>

¹²⁴ Here are the EU Habitat Codes, for detailed descriptions of the habitats see

https://www.varam.gov.lv/sites/varam/files/es_biotopi_latvija_rokasgramata_lv_2_izdevums.pdf

¹²⁵ <https://biodiversity.europa.eu/sites/natura2000/LV0302200>

the existence of natural values in these areas ¹²⁶	forests, sandstone outcrops, river floodplains) and to preserve the territory for public recreation and education and to ensure sustainable development of the territory.
Factors affecting nature values prior to implementation of the Proposed Action ¹²⁷	existing and potential negative influencing factors and threats in the "Salacas ieleja": <ul style="list-style-type: none"> – Overgrowing meadows – Concession – Agricultural activities – Diffuse pollution of surface water from agricultural and forestry activities – Erosion – Forestry activities – Invasive alien species – Problem native species – Motorised water sports – Other outdoor sports and activities – Anthropogenic reduction of habitat connectivity
Nature reserve "Niedrāju pilkas purvs"	
Objectives for creation and protection (habitats) ¹²⁸	The site has been designated to protect the following grassland habitats of EU importance ¹²⁹ : 3160, 7110*, 7120, 7140, 7150, 9010*, 9020*, 9050, 9080*, 91D0*, 91E0*
Objectives for establishment and conservation (species) ¹³⁰	White-backed woodpecker, Greater white-fronted goose, Red-backed shrike, European golden plover, Common crane, European honey buzzard, Lesser Spotted Eagle, Red-breasted flycatcher, Black stork, Black woodpecker, Hazel grouse, Black grouse, Bean goose, large white-faced darter, Ural owl, Eurasian otter.
Factors affecting nature values prior to implementation of the Proposed Action ¹³¹	The main factors and threats affecting the site are established waste sites, land reclamation and drying out.

6.4.2. Protected habitats

In the entire habitat study area, covering both the northern and southern parts of the Proposed Action study area, specially protected habitats cover approximately 7 % of the total area: they are found scattered throughout the LVM wind farm study area (see figure 6.4.3), also forming larger concentrations along small rivers (Vedamurga, Kulaurga, Urgenurga, etc.), which in some places correspond to the habitat *Stream courses and natural river reaches* 3260. Along them, mainly occur *alluvial riparian and floodplain forests* 91E0*, which cover the largest areas in the study area, i.e. 106.5 ha (Figure 6.4.3). There is also some *Old Mixed Broadleaved Forest* 9020* (17.6 ha) along the streams and in the NE part of the site. The second largest habitat group, which occurs most frequently in scattered patches throughout the site, is *Old or natural boreal forest* 9010* (66 ha). Typically, habitats that are highly dependent on moisture conditions - *Swamp forests* 91D0* and *Conifer forests* 9080* - are more concentrated in the north-eastern part of the study area, where adjacent areas are also surrounded by swamp habitats. Coniferous forest and swamp forest habitats also survive in small patches in other parts of the site. The area also has a fragmentary occurrence of *broadleaved spruce forests* 9050 (13.6 ha). Along the Svētupe River, which corresponds to

¹²⁶ <https://www.daba.gov.lv/>

¹²⁷ <https://biodiversity.europa.eu/sites/natura2000/LV0302200>

¹²⁸ <https://biodiversity.europa.eu/sites/natura2000/LV0509800>

¹²⁹ Here are the EU Habitat Codes, for detailed descriptions of the habitats see https://www.varam.gov.lv/sites/varam/files/es_biotopi_latvija_rokasgramata_lv_2_izdevums.pdf

¹³⁰ <https://biodiversity.europa.eu/sites/natura2000/LV0509800>

¹³¹ Ibid,

the biotope 3260 *Streams and natural stretches of rivers*, there are also 9180* *Slope and ravine forests*, 7.2 ha in area. Just to the east of the quarry, in the southern part of the study area, there is a *wooded coastal dune* 2180 habitat of 4.3 ha.

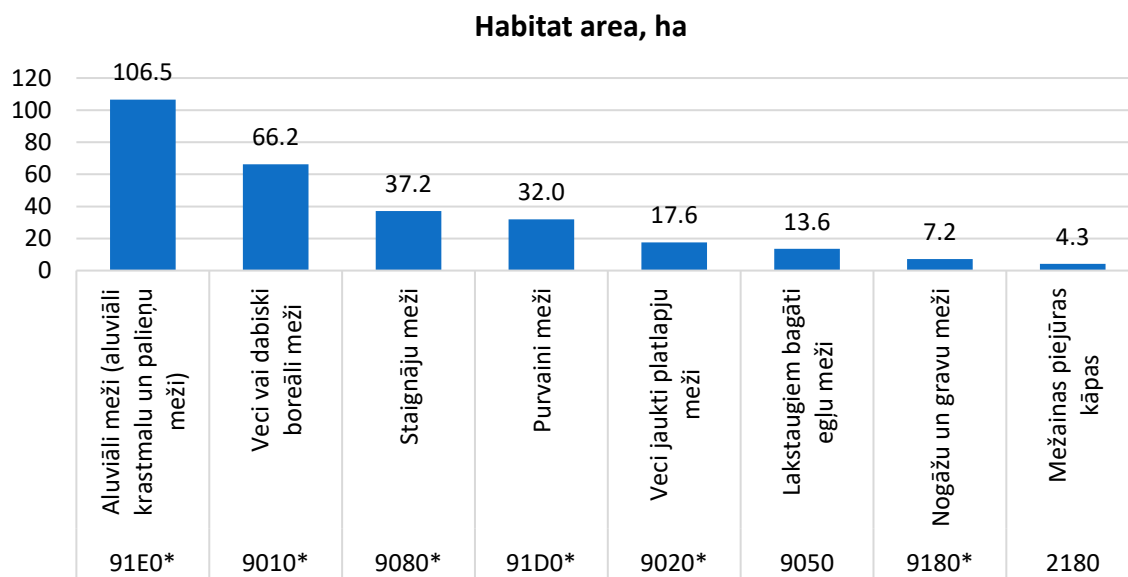


Figure 6.4.3. *Habitat area in the area of LVM wind farm study lands of WPP park Limbaži*

Overall, when habitats are analysed according to biodiversity quality, almost half (48%) are of good or excellent quality; the same proportion are of medium or poor quality (Figure 6.4.4).

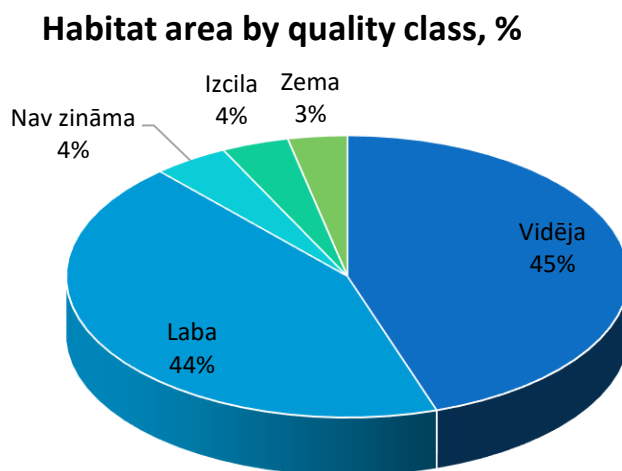


Figure 6.4.4. *Habitat area by quality class in the area of LVM wind park study lands of WPP park Limbaži*

All forest habitats of EU importance in the surveyed area require a non-interference regime to achieve and/or maintain a favourable conservation status¹³², including for some of them not only the protection of the habitat itself, but also the microclimate and natural hydrological regime provided by the surrounding forest stands (e.g, for biotopes 9080* Coniferous forests, 91D0* Swamp forests, 91E0* Alluvial forests, also 9010* Old or natural boreal forests in dry and wet vegetation types).

¹³² Ikauniece S. (ed.) 2017. Guidelines for the conservation of protected habitats in Latvia. 6. volume. Forests. Nature Conservation Agency, Sigulda. 167 pp.

The surveys also re-identified several habitats of EU importance throughout the study area: information and questionnaires are included in the Habitat Expert Reports.

6.4.3. Special-status species or groups of species and their distribution features

Specially protected species (SSPs) identified in the study area (northern part of the WPP Park), for which the impact of the Proposed Action on both forest and swamp habitats and on vascular plant, moss and lichen species has been assessed (BD II - species listed in Annex II of the European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora; SPA I, II - according to the number of the Annex to the Cabinet of Ministers Regulation on the List of Protected Species), species for which a micro-reserve (MIR) is to be established are marked 6.4.table 3, grouped in alphabetical order according to their Latin name and indicating their occurrence in the study area, as well as in Figure 3 of the expert opinion of 07.11.2024 attached as Annex 6. Where the name of a species in the scientific literature differs from the name used in the legislation on species conservation, this is indicated in brackets. The table includes only protected species and other rare species (e.g. specialist species of natural forest habitats) whose habitats are located in the area of potential impact of the northern part of the WPP Park.

Table 6.4.3. Protected habitats of EU importance found in the northern part of the WPP Park

Species, No on map	Species group	Conservation status, IUCN ¹³³	Accessibility in the area
1. <i>Huperzia selago</i>	vascular plants	IR II, LC	Some occurrences throughout the WPP Park, most likely outside the surveyed area.
2. <i>Zygodon baumgartnerii</i> (<i>rupestris</i>)	son	I, MIK, NT	In the plot near parking lot Z11.
3. <i>Ceruchus chrysomelinus</i>	invertebrates	SHORT I, MIK, EN	In the plot along Jaunupe Road.
4. <i>Lejeunea cavifolia</i>	son	I, MIK, LC	In some good quality forest habitats along the Vedamurga track and Aivara road, as well as along the 1A connection track.
5. <i>Dactylorhiza fuchsii</i>	vascular plants	IAS I, LC	Single specimens throughout the study area in wet forest patches.
6. <i>Lycopodium annotinum</i>	vascular plants	IR II, LC	Frequent throughout the study area, especially in the dry forest patches.
7. <i>Neckera (Alleniella) complanata</i>	son	IAS I, LC	In some areas around site Z11.
8. <i>Jungermannia leiantha</i> (<i>Liochlaena lanceolata</i>)	son	I, MIK, NT	Two deposits, at Sites Z11 and Z16.
9. <i>Anastrophyllum hellerianum</i> (<i>Crossocalyx hellerianus</i>)	son	I, MIK, LC	In the vicinity of site Z12.
10. <i>Odontoschisma denudatum</i>	son	IAS I, LC	Scattered throughout the area, occurring in greater abundance on suitable slopes. More common in the northern part of the study area.
11. <i>Arthonia leucopelleae</i>	lichens	I, NT	Several plots in the north-eastern part of the study area, including near site Z8. Found both in EU protected forest habitats and

¹³³ Assessment according to IUCN (International Union for Conservation of Nature) criteria, based on LIFE FOR SPECIES project materials. <https://sarkanagramata.lu.lv/par-projektu/materiali/> LC - Least Concern - Secure, NT - Near Threatened, VU - Vulnerable, EN - Endangered, CR - Critically endangered

Species, No on map	Species group	Conservation status, IUCN ¹³³	Accessibility in the area
			outside them in mature stands with suitable microclimates.
12. <i>Arthonia spadicea</i>	lichens	IAS I, LC	It is relatively common throughout the site in areas of high humidity.
13. <i>Gyroporus castaneus</i>	mushrooms	SHORT I, VU	One site in the vicinity of Z11.
14. Scaphopods <i>Scapania</i> spp. (not traceable to species in the field, but almost all species of the genus occurring in Latvia are protected)	son	SHORT I, VU or NT	One site in the massif to the east of Aivars Road, one along the 1A R connection to the high voltage line.
15. <i>Phellinus (Phellopilus) nigrolimitatus</i>	mushrooms	IAS I, MIK	One site to the west of N13.
16. <i>Platanthera</i> spp	vascular plants	IAS I, LC/NT (<i>P.bifolia/P.chlorantha</i>)	Some deposits throughout the area.
17. <i>Dactylorhiza maculata</i>	vascular plants	IAS I, LC	On the route of the 1A R connection.
18. <i>Bazzania trilobata</i>	son	IAS I, MIK, NT	Close to the 1A A connection route.
19. <i>Phellinus ferrugineofuscus (Phellinidium ferrugineofuscum)</i>	mushrooms	I, NT	Near the Z6 car park.
20. <i>Lycopodium clavatum</i>	vascular plants	IR II, LC	Two sightings: at Z6 and 1A on the R track.
21. <i>Arthonia vinosa</i>	lichens	I, NT	Some occurrences in good quality protected forest habitats of EU importance, more in the vicinity of site Z11.
22. <i>Buxbaumia viridis</i>	son	IAS I, MIK, BD II, VU	Some occurrences both within and outside protected forest habitats of EU importance, near Raven's Road, Aivars Road, track 1A R.
23. <i>Thelotrema lepadinum</i>	lichens	I, MIK, NT	One site near the Kuikule road.

The specially protected species found are associated with forest habitats. Most of them are indicator or specialist species of natural forest habitats, so these species need stands that are little affected by economic activities, have a stable microclimate, a natural hydrological regime, and ensure the production of dead wood. In the study area and in the wider area, the most significant factor is forestry, which has led to the destruction of habitats and reduced their quality by affecting the microclimate through clear-cutting adjacent to the habitat. As the site is part of a long-standing forest stand, species characteristic of natural forest habitats occurs relatively frequently and also in younger stands, indicating the longevity of the forest and the resilience of the ecosystem to disturbance from economic activities. The area is affected by drainage, including from road side ditches (e.g. in areas along the Vedamurga track, where the former swamp forest has been converted to dry forest), but much of the forest is still under a natural moisture regime: both wetland and swamp types, which not only have elevated ground humidity but also a humid microclimate favourable for rare moss and lichen species (e.g. arthonia, Baumgartner's tooth, naked round-leaved fern, etc.).c.).

Species that are not threatened in the area because they have sufficient habitat and do not have high requirements for habitat characteristics include night violets, Fuchs' cuckoo, cuckoo and annual pipistrelles, and the common pipistrelle.

07.11.2024. the site survey also revealed new records of specially protected plant species: information on the records is provided in the species habitat expert reports (Annex 6). Each site identified has a mapped habitat of EU importance or a designated habitat of a specially protected species.

Some vascular plant species have low habitat requirements and population maintenance is sufficient if surrounding forest areas are not transformed for other uses (night violets, annual creeping bentgrass, common spicebush); others require a stable hydrological regime with increased humidity (cuckoo pondweed). The specially protected species of mosses, lichens, fungi and invertebrates found in the area require the same conditions as protected forest habitats: a constant microclimate, undisturbed dead wood formation and an undisturbed hydrological regime.

6.4.4. Bird species in the area

The methodology used for the survey of bird species is attached in the opinion of the Certified Naturalist DU/2024/01 (Annex 6, Appendix "Survey Methodology"). Methodology agreed with NCA on 30 September 2022.

The area of the proposed activity, the LVM wind farm study area and the study area including it have been surveyed and observations recorded 19 times on 13 dates in 2022 and 62 times on 46 dates in 2023, as well as in 2024 in a random manner, with particular attention paid to the survey of the vicinity of the observation of a hoopoe (near Korgene) in 2023 and the installation of passive acoustic monitoring devices.

The most significant economic activity in the area of the proposed action is related to forestry, which is clearly the most significant impact prior to the establishment of the WPP Park. During the ornithofauna inventory of the site in the 2023 season, there are no signs that intensive forestry activities (i.e. many new clear-cuts and 'thinned' forest patches) have ceased in the area. It is therefore quite safe to assume that the overall value of the site for many protected bird species is only declining. At the same time, these species reliably choose to survive in resource-limited environments, but an objective assessment of this capacity and feasibility would require a long-term and resource-intensive study, including nest success.



Figure 6.4.5. View of the Svētupe River near the Kuiķuļi River in the central part of the study area of the planned WPP park, photo taken on 02.08.2023, coordinates X:529052, Y:396767, author: Dāvis Ūlands.

Field surveys in the study area, as well as for particularly sensitive species (Eurasian eagle-owl and Black Stork) in and around the 2 km study area, recorded a total of 54 species (53 species and an unknown bird nest - the Great Crested Newt), of which 38 are protected species) (Table 6.4.4).

explanation of abbreviations used in Table 6.4.4:

PD I - Annex I to the Birds Directive;

SPEC 1 - Specially Protected Species Annex 1;

SPA 2 - Specially Protected Species Annex 2;

ML - Microreserve species

Species in grey are not on the protected species lists.

The degree of threat of the species in Latvia is described according to the internationally recognised criteria of the International Union for Conservation of Nature (IUCN)¹³⁴

Table 6.4.4. Species recorded during the survey.

Latvian name of the species	Latin name of the species	Observations	PD I	SHORT 1	SHORTML 2	IUCN EN
Zosis	<i>Anser spp.</i>	22				
Vistu vanags	<i>Accipiter gentilis</i>	6			v	EN
Zvirbuļu vanags	<i>Accipiter nisus</i>	12				LC
Krūmu ļauķis	<i>Acrocephalus dumetorum</i>	2				LC
Zivju dzenītis	<i>Alcedo atthis</i>	1	v	v		LC

¹³⁴ Ķerus, V., Dekants, A., Auniņš, A., & Mārdega, I. 2021. *Breeding bird atlases of Latvia 1980- 2017. Bird numbers, distribution and changes*. Latvian Ornithological Society.

Latvian name of the species	Latin name of the species	Observations	PD I	SHORT 1	SHORTML 2	IUCN EN
Lielais baltais gārnis	<i>Ardea alba (Egretta alba)</i>	1	v			LC
Zivju gārnis	<i>Ardea cinerea</i>	2				LC
Ausainā pūce	<i>Asio otus</i>	2				VU
Baltvaigu zoss	<i>Branta leucopsis</i>	1	v			
Ūpis	<i>Bubo bubo</i>	3	v	v	v	CR
Gaigala	<i>Bucephala clangula</i>	1				LC
Peļu klijāns	<i>Buteo buteo</i>	8				VU
Gugatnis	<i>Calidris pugnax (Philomachus pugnax)</i>	1	v	v		CR
Vakarlēpis	<i>Caprimulgus europaeus</i>	165	v	v		LC
Baltais stārķis	<i>Ciconia ciconia</i>	10	v	v		LC
Melnais stārķis	<i>Ciconia nigra</i>	3	v	v	v	CR
Niedru lija	<i>Circus aeruginosus</i>	10	v	v		LC
Mazais ērglis	<i>Clanga pomarina (Aquila pomarina)</i>	24	v	v	v	LC
Meža balodis	<i>Columba oenas</i>	26		v	v	LC
Grieze	<i>Crex crex</i>	45	v	v		NT
Mazais gulbis	<i>Cygnus columbianus bewickii</i>	1	v	v		
Ziemeļu gulbis	<i>Cygnus cygnus</i>	5	v	v	v	NT
Baltmugurdzenis	<i>Dendrocopos leucotos</i>	10	v	v	v	LC
Dižraibais dzenis	<i>Dendrocopos major</i>	3				VU
Mazais dzenis	<i>Dryobates minor (Dendrocopos minor)</i>	3				CR
Melnā dzilna	<i>Dryocopus martius</i>	47	v	v		LC
Bezdelīgu piekūns	<i>Falco subbuteo</i>	2				LC
Lauku piekūns	<i>Falco tinnunculus</i>	1		v		NT
Mazais mušķērājs	<i>Ficedula parva</i>	19	v	v		LC
Žubīte	<i>Fringilla coelebs</i>	1				LC
Apodziņš	<i>Glaucidium passerinum</i>	15	v	v	v	VU
Dzērve	<i>Grus grus</i>	23	v	v		LC
Jūras ērglis	<i>Haliaeetus albicilla</i>	5	v	v	v	VU
Tītiņš	<i>Jynx torquilla</i>	1		v		LC
Brūnā čakste	<i>Lanius collurio</i>	11	v	v		VU
Lielā čakste	<i>Lanius excubitor</i>	2		v		NT
Sudrabkaija	<i>Larus argentatus</i>	1				LC
Vidējais dzenis	<i>Leiopicus medius (Dendrocopos medius, Picoides medius)</i>	5	v	v	v	LC
Priežu krustknābis	<i>Loxia pytyopsittacus</i>	1				CR
Sila cīrulis	<i>Lullula arborea</i>	11	v	v		LC
Rubenis	<i>Lyrurus tetrix (Tetrao tetrix)</i>	2	v		v	LC
Lielā gaura	<i>Mergus merganser</i>	3		v		LC
Kuitala	<i>Numenius arquata</i>	2		v		VU
Zivju ērglis	<i>Pandion haliaetus</i>	3	v	v	v	NT
Ķīķis	<i>Pernis apivorus</i>	9	v	v		LC
Trīspirkstu dzenis	<i>Picoides tridactylus</i>	28	v	v	v	CR
Pelēkā dzilna	<i>Picus canus</i>	22	v	v		LC

Latvian name of the species	Latin name of the species	Observations	PD I	SHORT 1	SHORTML 2	IUCN EN
Ormanītis	<i>Porzana porzana</i>	5	v	v		LC
Sārtgalvītis	<i>Regulus ignicapilla</i>	5				LC
Meža pūce	<i>Strix aluco</i>	13				LC
Urālpūce	<i>Strix uralensis</i>	31	v	v		VU
Mednis	<i>Tetrao urogallus</i>	82	v		v	DD
Mežirbe	<i>Tetrastes bonasia (Bonasa bonasia)</i>	17	v		v	EN

Information available from other sources on protected bird species in the area of the Proposed Action has also been compiled. In the period since 2015, 140 records (designated as records) have been recorded in the study area of the "Ozols" SPA for a total of 29 bird species (28 species and an unknown bird nest), of which 27 are protected species, some of the records recorded by the "Ozols" SPA are duplicates. Of the species mentioned in other sources of information, only two were not found in this area during the survey: Seifer Warbler *Locustella luscinioides* and Northern Shrike *Perdix perdix*.

Table 6.4.5. Summary of protected bird species observations in the study area and assessment of potential impacts

No.	Bird species	Accessibility in the study area	Recommendations for the WPP Park
1.	<i>Accipiter gentilis</i>	Six records of the species and two occupied nests have been recorded, no records of the species have been recorded in the study area of DDPS "OZOLS". Accordingly, six breeding districts have been identified: three proven and three probable. The radius of the breeding area is assumed to be 1500 metres, based on the ecology of the species.	It is recommended not to construct WPP within 1000 m around known nests in the NE part of the study area, and to equip WPP with rotor braking and/or stopping camera systems in the SE and SW parts of the area at least 1000 m around the observation sites. Potentially affected species, mitigation measures required.
2.	<i>Alcedo atthis</i>	During the survey one individual was observed in a small tributary of the Kulaurga River in the central part of the study area, attributed to feeding in these watercourses, the site is not suitable for breeding.	No negative impacts on the breeding population of the species in the study area are expected from the implementation of the WPP Park.
3.	<i>Ardea alba</i>	The species was observed once in the study area during the survey, no records were recorded in DDPS OZOLS. During the survey one individual was observed outside the study area in Niedrāju-Pilka purvs. The observation is considered to be casual and is not assessed further.	No impact is foreseeable.
4.	<i>Bubo bubo</i>	The presence of the species has been detected in the micro-reserve established for the protection of the Osprey at Svētiems, but successful breeding has not been observed in 2023. Given that the species has nested successfully in this area over the last five years, it is assumed that the breeding site is assessed as a proven breeding site. Considering the distance of the site from the WPP Park, it is fairly certain that it will not be adversely affected by the Park, and it should be noted that it	Based on the recommended buffer zone distances (1-2 km to the nearest WPP site), even with only a possible nesting at this site, the condition is fulfilled. On the other hand, the ecological and behavioural aspects do not clearly suggest that impacts are unforeseeable. The species is also unlikely to be present episodically, as no typical feeding sites for the species have been identified in the WPP area, unless the wood grouse <i>Tetrao urogallus</i> is used as an important prey item.

No.	Bird species	Accessibility in the study area	Recommendations for the WPP Park
		is located on the heavily used A1 motorway.	
5.	<i>Caprimulgus europaeus</i>	The species occurs and breeding is likely throughout the study area. The survey identified 47 breeding sites (all rated as likely) and a further 35 sites where breeding is possible. However, only three records of the species have been recorded in the study area, which is likely due to its specific occurrence and activity during the dark hours of the day.	No significant negative impacts on the breeding population of the species in Latvia are expected from the implementation of the WPP Park. Some of the breeding population will change the location or density of the breeding sites used, especially within 350 m of the WPP. The species is not assessed in the context of the impact of WPP parks, based on information in the literature, similarly to the known practice in Latvia. No information is available on the potential risks to it during the breeding season, it is assumed that the expected impacts are minor or not significant. Therefore, no specific measures are needed to restrict the operation of the WPP outside the potential construction period.
6.	<i>Ciconia ciconia</i>	In the study area, suitable habitats for the White Stork are found mainly in the periphery. The WPP is planned to be located in a forest landscape that is considered sub-optimal for both nesting and foraging habitat. The nearest occupied nest is approximately 850 m from the WPP. A total of 40 White Stork nests were recorded in or near the study area during the survey.	No negative impacts on the breeding population of the species in the study area are expected if the proposed WPP Park is implemented. This is mainly due to the lack of suitable habitats for the species in the WPP area.
7.	<i>Ciconia nigra</i>	The species was recorded three times during the survey: once in 2022 and twice in 2023. All observations are considered to be attributable to feeding site visits only. Historically, only one nest has been known in this area, which was successful every year from 1982 to 1985. The nest was not checked for a long time afterwards and in 2005 it was found to have perished, presumably in a windstorm. Since the nest was destroyed by natural causes, the bird has probably moved somewhere else (nearby). The most likely feeding rivers are located in the study area: Svētupe and Korge.	The presence of the Stork and the location of potential nest sites should be a focus of future monitoring in the area. A 500 m free zone should be maintained along Svētupe and Korge (but this does not affect any WPP), a 100 m zone along Vedamurga would be preferable.
8.	<i>Circus aeruginosus</i>	DDPS "OZOLS" records five sightings, one of which is a duplicate. During the survey, however, ten records were recorded with at least some evidence of grouping near suitable nesting habitats. Breeding sites identified include a complex of long-lived beavers in the periphery of the NE part of WPP Park and an abandoned and flooded gravel pit in the NW part of the park, as well as, based on observations recorded by	In general, the species is only likely to occur in the WPP Park episodically during transit or migration. A possible mitigation measure is to restrict or completely suspend the operation of the smart chamber WPP.

No.	Bird species	Accessibility in the study area	Recommendations for the WPP Park
		DDPS "OZOLS", Kliķu Lake in the NE part of the park near Korgene. The main foraging habitats of the species in the area are agricultural land and secondary wetlands.	
9.	<i>Clanga pomarina</i>	<p>In the study area, the species is regularly found in the open landscapes that encompass the area of the proposed WPP park.</p> <p>In the study area, 24 observations of the species were recorded, and eight breeding districts were identified: three of them were considered successful breeding (one nest found, two young birds observed), three were considered probable breeding districts (birds observed repeatedly during both spring and summer surveys) and two were considered possible breeding districts. The distance between the centres of adjacent areas varies from 1.5 km to 3 km. 11 records have been recorded for the species in DDPS "OZOLS", 9 of them are assessed as the lowest breeding probability group - possible breeding. Two records, which are actually one duplicate record, are recorded as proven breeding. A micro-reserve for the protection of the species (MRCODE 1754) has been established in the study area.</p>	<p>Given the location of the proposed WPP in a forested landscape, it is expected that the presence of Lesser Spotted Eagles will be relatively low, as potential feeding sites are mainly located in the open landscape on the periphery of the park.</p> <p>The construction of WPP (if equipped with mitigation technology) at distances of less than 2000 m from the centre of an accepted nesting site or an occupied nest, but not less than 1500 m, is permitted.</p> <p>A prerequisite is the application of mitigation camera systems in WPP within 3000 m of the adopted centres of the breeding colonies and the occupied nest.</p> <p>Taking into account these precautionary recommendations, the predicted impact on the Lesser Spotted Eagle population nesting in the Study Area is considered to be low.</p>
10.	<i>Columba oenas</i>	In the study area of DDPS "OZOLS" 5 records of the species were recorded, 26 records were recorded during the study. Based on these, 6 probable breeding sites were identified and a further 8 were assessed as possible.	No measures are required to protect the species and mitigate impacts. In the case of the WPP Park, there is no objective impact prediction.
11.	<i>Crex crex</i>	In the DDPS "OZOLS", 16 records of Ospreys were recorded, and 45 records were recorded during the survey. They are mainly concentrated in low-use grasslands: floodplains, pastures or abandoned farmland.	No restrictions required: it is likely that no adverse effects on the population of the species in the study area are foreseeable from the implementation of the proposed activity.
12.	<i>Cygnus cygnus</i>	During the survey, one breeding pair was recorded in the territory of the WPP park in the NW part of the park in a flooded mineral quarry. Three records (two of them duplicates) have been recorded at DDPS "OZOLS", and these are assessed as probable breeding.	If overhead cable lines are planned in the proposed WPP park, it is recommended that they are marked with bird deterrent markers. However, the expert himself has pointed out that no significant bird migration routes have been observed in the area of the proposed activity, so such a claim is not justified. No other impacts are foreseeable.
13.	<i>Dendrocopos leucotos</i>	During the survey, 10 records were recorded, of which 4 are traces of activity: species-specific forgings. Taking into account the clustering of observations and suitable habitats for the species, 2 probable and 1 possible breeding sites were identified. No records of the species have been recorded in DDPS "OZOLS".	The primary critical impact for the species is the reduction of suitable habitat areas - biologically valuable forest stands, which in most cases are habitats of EU importance - in the breeding area through deforestation. Not recommended for WPP D4, D5 and Z21, the construction of which may result in the

No.	Bird species	Accessibility in the study area	Recommendations for the WPP Park
			destruction of habitats of EU importance through deforestation.
14.	<i>Dryocopus martius</i>	During the survey, 47 sightings or traces of species-specific activity were recorded. Based on the replicate observations and their grouping, 8 probable breeding sites and 3 possible breeding sites were identified in the study area. 14 sightings have been recorded in DDPS "OZOLS".	The species is not assessed in the context of the impact of WPP parks, based on information in the literature, similarly to the known practice in Latvia. No mitigation measures are required.
15.	<i>Falco tinnunculus</i>	The survey recorded one individual that can be confidently identified as a migrant. DDPS "OZOLS" recorded one record in 2022, defined as a possible breeder.	Given that the site is more than 2 km from the nearest WPP, the impact on it cannot be predicted with any certainty.
16.	<i>Ficedula parva</i>	13 records of the species have been recorded in DDPS "OZOLS", 19 records of the species have been recorded in the study area, mainly in mature or overgrown forest stands with a significant amount or dominance of spruce.	No special measures are required to restrict activities outside the potential construction period of the WPP farm. The species is not assessed in the context of the impact of WPP parks, based on information in the literature, similarly to the known practice in Latvia.
17.	<i>Glaucidium passerinum</i>	The species was recorded 15 times during the survey, and based on these observations, 2 probable breeding sites and 2-3 possible breeding sites were identified. DDPS "OZOLS" recorded 2 records of the species, both with possible breeding status.	In the context of the impact of WPP parks, the species is mostly not assessed, similarly to the known practice in Latvia. No information is available on the potential risks to it during the breeding season, it is assumed that the expected impacts are minor or not significant. The Species Conservation Plan for the owl species group ¹³⁵ gives quite specific recommendations for the protection of the species in relation to noise pollution and recommends that the WPP model should be as quiet as possible in order to comply with them.
18.	<i>Grus grus</i>	17 records of the species have been recorded in DDPS "OZOLS", during the survey the species was recorded 23 times, of which 11 records were considered as at least possible breeding. Based on their grouping, there are at least seven occupied breeding territories. The optimal breeding area for the species is the concentration of Great Bitterns in the NE part of the WPP Park study area, where there are no records of the species.	As a possible mitigation measure, smart cameras should be used to limit or completely stop the operation of the WPP.
19.	<i>Haliaeetus albicilla</i>	During the survey period, the species was observed sporadically: 5 records, while one record in 2022 was recorded in the data imported by DDPS "OZOLS" from dabasdati.lv. Taking into account the breeding peculiarities of the species in	Overall, the presence of the species in the study area (within 3000 m of the nearest WPP) can be reliably described as occasional. Despite the fact that the species has not been proven to breed in the area, it is recommended that, as a precautionary

¹³⁵ Avotiņš jun. A. 2019. *Conservation plan for the Barn Owl Glaucidium passerinum, the Short-eared Owl Aegolius funereus, the Barn Owl Strix aluco, the Barn Owl Strix uralensis, the Long-eared Owl Asio otus and the Barn Owl Bubo bubo*. Latvian Ornithological Society, Riga.

No.	Bird species	Accessibility in the study area	Recommendations for the WPP Park
		Latvia, the entire study area is characterised as suitable for breeding (especially taking into account possible long-distance foraging flights of the species), as it contains a large amount of clearings with ecological trees. It should also be noted that the NE part of the study area contains a concentration of wetlands, mainly consisting of perennial beaver grasses, which is considered a potential feeding area. However, the species was not recorded in this area during the survey.	measure, the closest WPPs to a given observation group (at least 1000 m from the nearest observation) should be equipped with rotor braking and/or stopping camera systems.
20	<i>Jynx torquilla</i>	DDPS "OZOLS" recorded 8 records for the species, of which 4 are duplicates. The species was recorded 1 time in the periphery of the study area during the survey.	No impact is foreseeable.
21.	<i>Lanius collurio</i>	The species has been recorded 7 times in DDPS "OZOLS", 2 of the records are duplicates, the records were mainly recorded in the periphery of the study area. The species was recorded 11 times throughout the study area during the survey, of these records 3 were assessed as confirmed breeding, 2 as probable breeding and 6 as possible breeding.	No impact predicted.
22.	<i>Lanius excubitor</i>	DDPS "OZOLS" recorded the species 2 times, the observations are considered as a probable breeding site. The species was recorded 2 times during the survey, one of the records on agricultural land was assessed as a migrant or wintering individual, the other record was assessed as a possible breeder.	No impact predicted.
23.	<i>Leiopicus medius</i>	DDPS "OZOLS" recorded 7 records of the species, including 1 confirmed breeding at Kuikule River. During the survey, 5 records of the species were recorded, and given the relatively small size of the area, it is assumed that there are up to 5 possible breeding sites in part D of WPP Park, however, it is possible that some of the birds observed have flown considerable distances or that the area occupied by them is larger than typically expected in the mosaic of different forest vegetation types.	The expected impact is minor or not significant. There are several priority protected area cells within the study area, but these are not affected by the Proposed Action.
24.	<i>Lullula arborea</i>	DDPS "OZOLS" has 8 records for the species, of which 2 are duplicates. 11 records of the species have been recorded in the study area; the species has been observed in suitable breeding habitats. It is assessed to occur sporadically throughout the study area.	Outside the time-limited period of the potential construction of the WPP, no specific mitigation measures are foreseen to limit its operation.
25.	<i>Pernis apivorus</i>	DDPS "OZOLS" has 4 records for the species, 2 of them are duplicates. The	Potentially affected species: equip WPP with collision mitigation solutions for cameras.

No.	Bird species	Accessibility in the study area	Recommendations for the WPP Park
		species was recorded 9 times during the survey. No grouping or repeated sightings have been recorded, nor has its breeding been detected by monitoring known large nests. At the same time, it should be noted that the species is likely to breed in the study area.	
26.	<i>Lyrurus tetrrix</i>	No records have been recorded for the species in DDPS "OZOLS". No records of the species were recorded in the study area during the survey, the species was observed in the Niedrāju-Pilka marsh.	No impact predicted.
27.	<i>Mergus merganser</i>	The species has 23 records in DDPS "OZOLS" and was recorded twice during the survey.	No impact predicted. Outside the time-limited period of the potential construction of the WPP, no specific mitigation measures are foreseen to limit its operation.
28.	<i>Pandion haliaetus</i>	The species has not been found breeding, may forage in quarry water bodies as well as in the Salaca River, highest risks for migratory birds, however, overall numbers are expected to be low in the area.	No or low impact predicted.
29.	<i>Picoides tridactylus</i>	1 record of the species has been recorded at DDPS OZOLS, 1 record of the species has been recorded during the survey, as well as traces of its activity at 27 sites. One probable breeding site has been identified, but the species is likely to be present throughout the entire WPP area. The mainly alluvial forests that surround small watercourses are an important feeding area.	No or low impact predicted.
30.	<i>Picus canus</i>	Only 4 records of the species have been recorded in DDPS "OZOLS", 22 records of the species have been recorded during the survey. Based on these, 5 probable breeding districts and 4 possible breeding districts were identified.	No or low impact predicted.
31.	<i>Porzana porzana</i>	1 record of the species has been recorded in DDPS "OZOLS", 5 records of the species have been recorded during the survey period, 2 of them can be reliably identified as migratory or non-breeding individuals in the territory of WPP Park. Using passive audio recording systems, the species was detected again in the vicinity of the record at DDPS "OZOLS".	No impact predicted.
32.	<i>Strix uralensis</i>	4 records have been recorded for the species in DDPS "OZOLS", 31 records have been recorded for the species during the survey. Based on the observations, 1 proven breeding site, 6 probable breeding sites and 5 possible breeding sites have been identified. In the forest landscape, the species can be safely assessed as the most common protected owl species in the study area.	The entire area of the WPP Park falls within the inventoried areas, some also within the cells of priority protected areas, with a total of six WPP designed in priority protected areas for this species. The species' conservation plan identifies the effects of noise pollution. Significant recommendations for the protection of the species against noise pollution, and to

No.	Bird species	Accessibility in the study area	Recommendations for the WPP Park
			implement this it is recommended to install the quietest possible WPP turbine model.
33.	<i>Tetrao urogallus</i>	6 observations were recorded in the DDPS "OZOLS", 7 bird observations and 31 activity traces were recorded in the database provided by LVM, 12 species observations and 70 activity traces were recorded during the survey. The number of huns in the study area should be estimated to be at least 8-12 birds. In the study area, according to the information received from LVM, there are three known rookeries/zones for the protection of the roe deer habitat.	In the context of WPP parks, the species is considered very sensitive in the literature, however, despite the relatively long movements of the capercaillie outside the breeding season (1 April to 15 May), the literature mainly recommends a buffer zone of 1000 m, which in the case of Scandinavia is applied to breeding events where five or more breeding birds are assessed. In addition to collisions with WPP, which could be considered as a direct negative factor for the local population, there are also negative effects of noise and possible flicker from WPP operations, as well as distances between WPP and the infrastructure road network, which may further contribute to disturbance caused by the direct presence of humans, including during maintenance work for the functioning of the WPP park.
34.	<i>Tetrastes bonasia</i>	10 records of the species have been recorded in DDPS "OZOLS", 17 records of the species have been recorded during the survey, some of them outside the breeding season. Based on the observations, 1 probable breeding site and 5 other possible breeding sites have been identified.	No information is available on the potential risks to the species during the breeding season and the expected impacts are minor or not significant.
35.	<i>Locustella luscinioides</i>	In the study area of DDPS "OZOLS" 2 records (duplicate) were recorded in a habitat suitable for nesting: In the Lake Kliķu inflow system.	No impact is expected.
36.	<i>Perdix perdix</i>	DDPS "OZOLS" recorded 3 records of the species, of which 2 are duplicates.	No impact is expected.
37.	<i>Aegolius funereus</i>	Of the species for which priority protected area layers were prepared, only the Bitter apple was not detected during the survey. Also, no records of the species have been recorded in the study area.	Given that the priority and inventory layers essentially overlap with the breeding areas of the Barn Owl, the same mitigation measures apply as for the Barn Owl: the recommendations for the protection of the species with regard to noise pollution recommend installing the quietest possible WPP model to comply with them.

Large nests

During the survey, available information on large nests within the study area and its immediate surroundings was collected, including information on large nests received from the proponent (essentially at the end of the survey), as received from LVM. The group of nests to be surveyed also includes all newly found nests.

A total of 33 large nest sites were checked in or near the study area. Of these, 14 do not exist in the wild: most are not found (in such situations, the nearest vicinity of the nest site is walked, checking the most suitable trees and slopes up to about 100-150 m away), some are located in felled forest stands, and some have fallen down due to various circumstances. One of them has been wrongly identified as a large nest.

Of the occupied or visited nests, eight were identified as breeding species by the *Buteo buteo*, two by the *Accipiter gentilis* and one by the *Clanga pomarina*, with a further eight nests assessed as undetermined to species: of these, four were assessed as unoccupied during the survey, while three were visited (some nest material was added) and one was occupied. These previously undetectable nests are most likely to have been visited by *Buteo buteo* during the spring period, however, given that no detectable signs were found, they are retained as undetectable.

Four of the large nests surveyed are within 500 m of the nearest WPP site, one of which was successfully nested by a *Buteo buteo*. The other three are at least visited, although no breeding attempt has been detected.

Migratory birds

Migratory birds are often perceived as being strongly negatively affected by WPP parks: migratory birds are killed or forced to change their traditional flight paths and expend more of their limited available energy on longer and longer journeys^{136 137 138 139}.

Potentially the main migration directions in the area should be NE-SW and vice versa¹⁴⁰. As regards the effectiveness of visual observations in assessing migration, it should be noted that they are largely unrepresentative of migration, as a large proportion of birds make their migratory flights at dusk, when visual observations are not possible: at best, migration can be detected as a fact - from bird calls - rather than its intensity¹⁴¹; for diurnal birds, migration is mostly characterised as variable in magnitude, but in any case a minor part of the total migratory flow, as most migratory flights take place at altitudes where birds are no longer observable by eye¹⁴².

No significant and long-lasting stopover sites (feeding or roosting areas) for migratory birds have been identified in the WPP study area. As for potential bird migration routes, these can vary from year to year and are influenced by many factors that change from year to year. The available information on GPS transmitter-equipped individuals of different bird species crossing the territory of Latvia demonstrates quite a wide variability throughout the Northern Vidzeme region during different years¹⁴³.

During the study period, migrant observation sessions were carried out in the autumn seasons of 2022 and spring season of 2023. Open landscape lands on the periphery of the study areas were also surveyed on several occasions for potential feeding sites for migratory birds.

¹³⁶ Newton, I. 2023. *The migration ecology of birds*. Elsevier.

¹³⁷ Pearse, Aaron & Metzger, Kristine & Brandt, David & Shaffer, Jill & Bidwell, Mark & Harrell, Wade. 2021. *Migrating Whooping Cranes avoid wind-energy infrastructure when selecting stopover habitat*. Ecological Applications. 31. 10.1002/eap.2324.

¹³⁸ Cabrera-Cruz, S.A.; Cohen, E.B.; Smolinsky, J.A.; Buler, J.J. 2020. *Artificial Light at Night is Related to Broad-Scale Stopover Distributions of Nocturnally Migrating Landbirds along the Yucatan Peninsula*. Mexico. Remote Sens. 12, 395.

¹³⁹ Rydell, J., Ottvall, R., Pettersson, S., Green, M. 2017. *The effects of wind power on birds and bats*. Swedish Environmental Protection Agency, Sweden.

¹⁴⁰ Schwemmer, P., Mercker, M., Haecker, K., Kruckenberg, H., Kampfer, S., Bocher, P., Fort, J., Jiguet, F., Franks, S., Elts, J., Marja, R., Piha, M., Rousseau, P., Pederson, R., Duttmann, H., Fartmann, T., & Garthe, S. 2023. *Behavioral responses to offshore windfarms during migration of a declining shorebird species revealed by GPS-telemetry*. Journal of Environmental Management, 342, 118131.

¹⁴¹ Newton, I. 2023. *The migration ecology of birds*. Elsevier.

¹⁴² Ibid,

¹⁴³ <https://laji.fi/en>

Of the migratory species, individuals or groups of the following species have been observed in the territory: *Branta leucopsis*, *Calidris pugnax*, *Cygnus columbianus bewickii*, *Cygnus cygnus*, *Numenius arquata*, *Grus grus*, *Anser albifrons*, *Anser fabalis*.

In the NW periphery of the study area, approximately 1400 *Anser sp.* geese were recorded on 19 April 2023 in agricultural land near Upmali House on the ground; no more birds were recorded when the same site was visited later that day.

Intensive migration *Anser sp.* and *Cygnus sp.* in the study area were only observed on 22 October 2022, starting at dusk and approximately 2 h after local sunset.

During the 2023 breeding season, in other survey types, relatively low migration intensities (migratory flocks of a few tens of *Anser sp.*) were recorded during the normal migration period in both March and April, but this is not characteristic of a highly intensive migration flow of many birds (several thousand individuals).

The design of the WPP Park fulfils essentially the main conditions: The WPP shall not be located within 500-1000 m of the shoreline of the Gulf of Riga and the WPP shall not be planned in areas where long-term feeding or roosting sites for migratory birds have been identified or are known to exist.

Changing conditions in the area may result in the localised but temporary presence of relatively large numbers of migratory species during their overflights. Objectively, the most effective solution to reduce the risk of collisions with overflying birds in such situations is to use smart camera technology to limit or stop the speed of WPP.

6.4.5. Bat species in the area

The area of the proposed activity was surveyed seven times per season, using a previously validated methodology in Latvia, with two nights in May, June and July and four nights in August and September (2x2 nights, 2 weeks apart). The number of survey nights and the locations of survey points and routes were chosen according to the bats' biological cycle (breeding, migration/mating). In the planned WPP Park area, surveys at eight recording stations (D1-D8, see Figure 6.4.6) yielded 5619 recording files, of which 2824 files contained bat sound recordings with a total of 3242 individual bat passes recorded (Table 6.4.6).

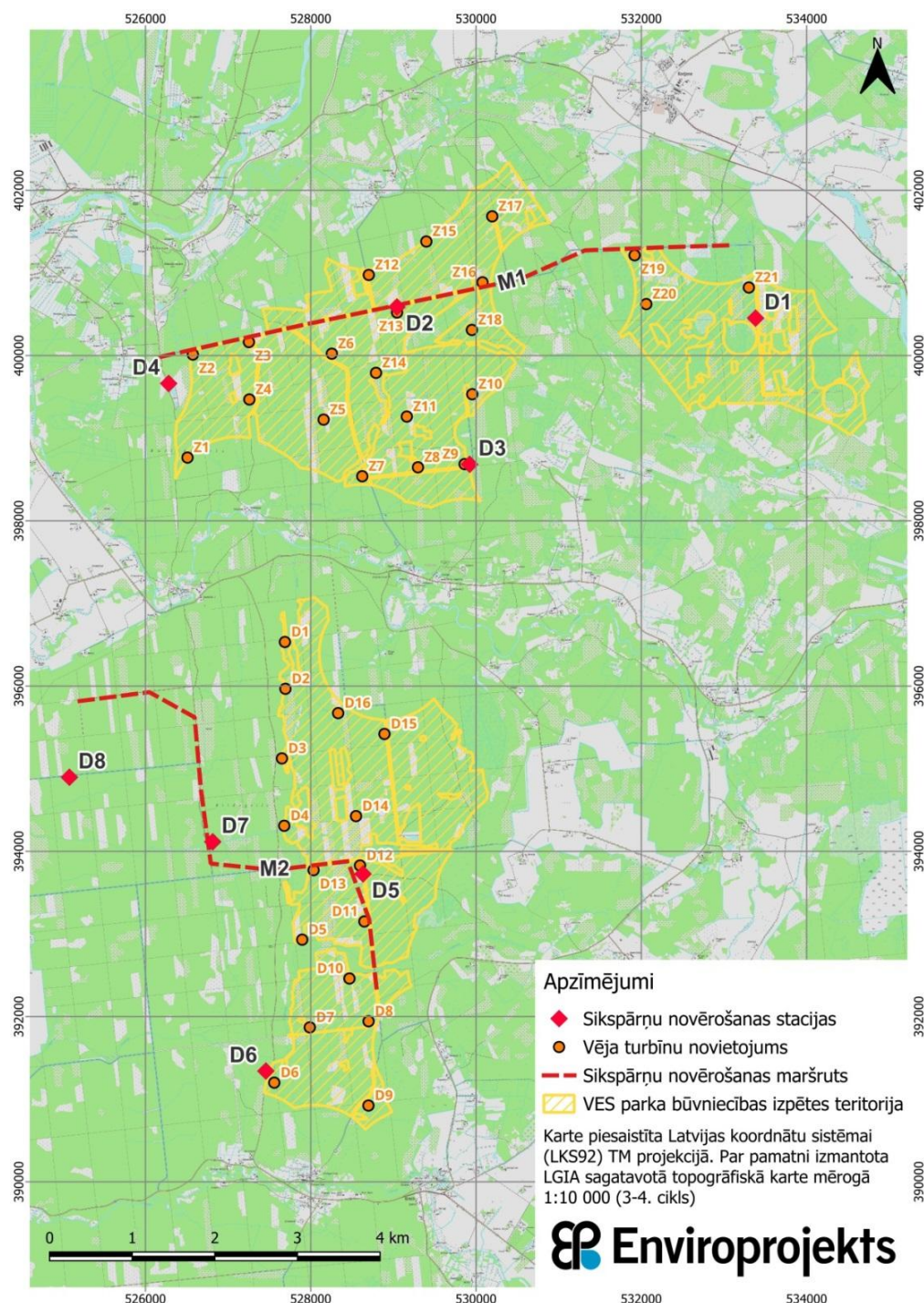


Figure 6.4.6. Observation stations D1-D8 and the routes M1 and M2 (red lines) in the WPP study area in the 2022 season. D1-D4 stations are located in the northern area, D5-D8 in the southern area

The aim of the route surveys on routes M1 and M2 (Figure 6.4.6) was to assess overall bat activity in the study area and surrounding landscape, but not specifically in the vicinity of the proposed WPP. Apart from the habitat aspect, the possibility to follow the route by road using a car was also important for the route choice. In forest habitats, the so-called vagrant species that are most often killed in collisions with WPP usually hunt in various openings: above forest roads, stigmas, clearings and forest edges, so that routes along roads were more likely to record potentially threatened species that might also use WPP access roads as feeding sites in the future.

Table 6.4.6. Bat species or species groups detected by automatic detectors at 8 observation stations (D1-D8) in the territory of the Limbaži WPP Park in May-September 2022, their status in Latvia and the number of recorded overflights

Bat species in Latvian	Bat species in Latin	Migratory or wintering species	Number of overflights
Ziemeļu sikspārnis	<i>Eptesicus nilssonii</i>	Wintery	2821
Rūsganais vakarsikspārnis	<i>Nyctalus noctula</i>	Migratory	101
Divkrāsainais sikspārnis	<i>Vespertilio murinus</i>	Wintering/ migratory	64
"Niktaloīdi"	<i>Nyctalus/ Vespertilio/ Eptesicus</i> genus group	Migratory or semi-migratory	24
Natūza sikspārnis	<i>Pipistrellus nathusii</i>	Migratory	170
Pigmejsikspārnis	<i>Pipistrellus pygmaeus</i>	Migratory	3
Garausainais sikspārnis	<i>Plecotus auritus</i>	Wintery	4
Naterera naktssikspārnis	<i>Myotis nattereri</i>	Wintery	1
Naktssikspārņu ģints	<i>Myotis</i> spp.	All species wintering	52
Nenoteiktas sugas sikspārnis	Chiroptera		2
Total			3242

A total of seven bat species were identified in the analysis of bat calls. Some records could not be traced to a species with certainty, but could be assigned either to the species group *Myotis* (ecologically mostly a "thicket" group) or to the species group "nictaloids", which includes bat species of the genera *Nyctalus*, *Vespertilio* and *Eptesicus* (all "roost" species).

In the species group *Myotis*, there are a total of five possible species of this genus: *Myotis dasycneme*, *M. daubentonii*, *M. brandtii*, *M. mystacinus* and *M. nattereri* (the last species was identified in one case by a record also at species level). The species group *Nyctalus/Vespertilio/Eptesicus* comprises five species belonging to the genera mentioned in the title: *Nyctalus noctula*, *N. leisleri*, *Vespertilio murinus*, *Eptesicus nilssonii* and *E. serotinus*. In some cases, the recorded calls could not also be identified to a species group and the bat was marked as "species undetermined".

All the records resulted in a total of 248 bat call files with 309 recorded bat flights (Table 6.4.7). Four species of bats reliably identified to species level were detected along the routes, as well as calls of bats belonging to the noctule group.

Table 6.4.7. Bat species or species groups detected in the area of Limbaži WPP during May-September 2022 at 18 points along two routes in 10-minute sessions, their membership of the migratory or hibernating bat group and the number of recorded overflights

Bat species in Latvian	Bat species in Latin	Migratory or wintering species	Number of overflights
Ziemeļu sikspārnis	<i>Eptesicus nilssonii</i>	Wintery	292
Natūza sikspārnis	<i>Pipistrellus nathusii</i>	Migratory	2
Rūsganais vakarsikspārnis	<i>Nyctalus noctula</i>	Migratory	4
Garausainais sikspārnis	<i>Plecotus auritus</i>	Wintery	3
Naktssikspārņu ģints	<i>Myotis</i> spp.	All species wintering	8
Total			309

Several of the species most frequently found in the area - *Eptesicus nilssonii*, *Pipistrellus nathusii*, *Nyctalus noctule* and *Vespertilio murinus* - are species at highest risk from WPP. According to EUROBATS statistics on bat fatalities from WPP in Europe in 2003-2014, *Nyctalus noctule* was the first bat, *Pipistrellus nathusii* was the third, and *Eptesicus nilssonii* is the most frequent victim of WPP in Scandinavia. In Latvia, the

Pipistrellus nathusii ranks first among recorded WPP victims and *Eptesicus nilssonii* second¹⁴⁴. Noctule bats are generally not considered to be a high-risk species, as they usually fly and hunt close to landscape structures and are relatively rarely seen at higher altitudes. Thus, the noctule bat group and the long-eared bat are less relevant for this study.

The overall average bat activity at all 8 stations in the 7 censuses in the planned wind park area is **6.73 passes per hour**. The results can be compared with other bat species surveys carried out in 14 other potential WPP parks using identical methodology. The overall bat activity recorded in the Limbaži WPP Park is assessed as high, as it is well within the fourth quartile (Table 6.4.8). This result was also to be expected, as the expert assessments carried out so far for the planned wind farms were carried out in more open and less suitable areas for bats.

Table 6.4.8. Total bat activity thresholds for three activity classes - low, medium or high (assessed at 14 different sites in Latvia)

Activity class	Quartile	Average number of flights per hour
Zema	below 1st quartile	≤1,29
Medium	2.-3rd quartile	>1,29 - 2,35
Growing	above 3rd quartile	>2,35

6.4.6. Mammals

Within the framework of the EIA, an expert on the species group "mammals" (LVMI Silava lead researcher J. Ozoliņš, NCA certificate No 160) prepared an assessment of the impact of the WPP on terrestrial non-flying mammals (the opinion is attached as Annex 6). The wind parks "Limbaži" and "Valmiera-Valka" were assessed as part of the opinion.

The information provided in the opinion is based on data obtained within the framework of monitoring of the status and damage caused to large wild mammal populations (ungulates, carnivores), which the Latvian State Forest Research Institute (LVRI) "Silava" has been carrying out for some species for 20 years, visiting the area in different seasons and meteorological conditions. The study area and its surroundings have been visited and mammal occurrences have been recorded on numerous occasions in the framework of several projects, which are listed in the expert opinion (attached as Annex 6).

Almost all species of terrestrial non-flying mammals found in Latvia occur in the area, with the exception of the marmots, whose distribution is restricted to some known localities outside the study areas. An overview of the species, together with their relative importance scores, is given in Table 6.4.9. Observations in the vicinity of the two WPP parks studied show that up to 10 % of the Latvian brown bear population has visited the areas of WPP Limbaži and WPP Valmiera-Valka so far¹⁴⁵.

Brown bears are also a species for which little or no scientific research in Europe has examined the impact of wind farms. Their dispersal in Latvia has been N-S, and currently the highest population densities and most successful breeding occur in northern Vidzeme. The proportion of the population of other mammals, both specially protected and economically exploited, in the area where the wind farms are planned to be established does not exceed 1% of the total population and range of Latvia.

Extensive literature studies on the impact of WPP parks on terrestrial wild mammal and domestic animal species have been carried out in Sweden¹⁴⁶. The source also provides basic requirements for monitoring

¹⁴⁴ <https://tethys.pnnl.gov/sites/default/files/publications/EUROBATS-2015.pdf>

¹⁴⁵ <https://www.silava.lv/images/Petijumi/2023-Lacu-monitorings/2023-Lacu-monitorings-Parskats.pdf>

¹⁴⁶ Helldin J.O., Jung J., Neumann W., Olsson M., Skarin A., Widemo F. 2012. *The impacts of wind power on terrestrial mammals*. A synthesis - SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 6510, 52 pp.

impacts and evaluating the results of monitoring. It is believed that results should not be extrapolated from one area to another. The construction and maintenance of additional access roads to WPP may cause additional disturbance to large mammals if they are used for increased traffic and forest visits. The existence of roads as such does not threaten large mammals. For more specific information on canids and carnivores, see¹⁴⁷. According to the WPP, impacts are related to the interest of killed birds in the vicinity of the installations as food or background noise that interferes with the hearing of approaching predators¹⁴⁸. Separate studies have been devoted to the impact of wind farms on wolves¹⁴⁹¹⁵⁰. These studies show the impacts and suggest ways to refine and mitigate them. Wolf breeding middens and meeting places in and around wind farms are expected to change.

A frequency comparison between the sounds produced by WPP and those perceived by wild mammals and humans shows that animals perceive the noise of WPP operations in a similar way to humans¹⁵¹. There is no evidence of adverse effects of electromagnetic fields on the body. Studies in Poland do not confirm the effects of WPP operation (sound, vibration, lighting changes) on small rodents and insectivores¹⁵². Some studies have also produced contradictory results. The density and activity of roe deer and hare tracks decreases in the vicinity of WPP, as does fox activity¹⁵³. Field voles living in the vicinity of the WPP have markedly higher levels of the stress hormone corticosterone, but this was not observed in the field mouse. The question of what exactly causes the increase in corticosterone levels and whether it also occurs in animal species living in other countries has not been answered¹⁵⁴. WPP causes increased stress levels in badgers, as evidenced by several times higher blood cortisol levels in badgers living near wind farms. Chronic stress can lead to many health and psychological problems in badgers¹⁵⁵. In Scandinavia, there is a negative correlation between the construction of wind farms and the number of moose hunted. The construction of wind farms and additional gravel roads should also be taken into account as negative factors.¹⁵⁶

In essence, the effect of WPP on mammalian behaviour will depend on the interaction of two processes: reaction to a new object in the environment and habituation to that object.

There are no micro-reserves in the WPP Park to protect mammals or their habitats.

Table 6.4.9. Mammal species and species groups in the study area

Species	% of LV population*	Species value: points 0-4				Status in Latvia and the EU (Annex to the Species and Habitats Directive)
		economic**	ecological ***	recreational and aesthetic ****	scientific *****	
Small mammals (insectivores,	<1	0	3	1	3	to be saved

¹⁴⁷ <https://doi.org/10.1016/j.biocon.2021.109037>

¹⁴⁸ <https://doi.org/10.1016/j.biocon.2023.110382>

¹⁴⁹ https://doi.org/10.1007/978-3-319-60351-3_5

¹⁵⁰ Miltz C., Eriksen A., Wikenros C., Wabakken P., Sand H., Zimmermann B. 2024. *Will future wind power development in Scandinavia have an impact on wolves?* - WILDLIFE BIOLOGY

¹⁵¹ Helldin J.O., Jung J., Neumann W., Olsson M., Skarin A., Widemo F. 2012. The impacts of wind power on terrestrial mammals. A synthesis - SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 6510, 52 pp.

¹⁵² Łopucki R. & Mróz I. 2016. An assessment of non-volant terrestrial vertebrates response to wind farms-a study of small mammals. - Environ Monit Assess 188: 122. DOI 10.1007/s10661-016-5095-8

¹⁵³ <https://doi.org/10.1007/s10661-017-6018-z>

¹⁵⁴ <https://doi.org/10.1016/j.ecolind.2017.08.052>

¹⁵⁵ <https://doi.org/10.7589/2015-09-231>

¹⁵⁶ <https://www.diva-portal.org/smash/record.jsf?pid=diva2:1887676&dswid=1545>

Species	% of LV population*	Species value: points 0-4				Status in Latvia and the EU (Annex to the Species and Habitats Directive)
		economic**	ecological ***	recreational and aesthetic ****	scientific *****	
rodents, carnivores)						
<i>Sicista betulina</i>	<1	0	1	1	3	special Protection Area (BD V)
<i>Castor fibre</i>	<1	3	4	3	4	game, specially protected, restricted, (BD V)
<i>Sciurus vulgaris</i>	<1	0	3	4	3	to be saved
<i>Lepus timidus</i>	<1	1	3	3	3	game, specially protected, restricted, (BD V)
<i>Lepus europaeus</i>	<1	1	3	3	2	prey
<i>Ursus arctos</i>	1-10	0	3	3	4	Special Protection Area (BD II,IV)
<i>Canis lupus</i>	<1	2	4	3	4	game, specially protected, restricted, (BD V)
<i>Vulpes vulpes</i>	<1	1	3	3	2	hunt
<i>Nyctereutes procyonoides</i>	<1	1	2	1	2	prey
<i>Lynx lynx</i>	<1	0	4	4	4	Special Protection Area (BD IV)
<i>Lutra lutra</i>	<1	0	4	4	4	Special Protection Area (BD II,IV)
<i>Neovison vison</i>	<1	1	2	1	2	Prey, to be restricted as an invasive species
<i>Meles meles</i>	<1	1	3	3	2	prey
<i>Martes martes</i>	<1	1	2	2	2	game, specially protected, restricted, (BD V)
<i>Martes foina</i>	<1	1	2	2	2	hunt
<i>Mustela putorius</i>	<1	1	2	2	3	game, specially protected, restricted, (BD V)
<i>Alces alces</i>	<1	4	3	4	4	prey
<i>Cervus elaphus</i>	<1	4	3	4	3	prey
<i>Capreolus capreolus</i>	<1	4	3	4	3	hunt
<i>Sus scrofa</i>	<1	3	3	2	4	Prey, to be restricted due to ASF

*the share is estimated on the basis of the approximate share of the area covered by wind farms (WPP "Limbaži" and WPP "Valmiera-Valka") (i.e. 136 km²) compared to the species' area in the whole country;

**based on importance in the game farm;

***based on impacts on other species, habitats, capacity to affect forestry, agriculture, fish farming;

****based on the possibility of being observed during visits to the forest related to tourism or other non-management activities;

*****based on research, monitoring or education-related demonstration opportunities

6.5. Scenic and cultural heritage significance

6.5.1. Landscape characteristics

In terms of landscape, the study area of the Proposed Action falls within the Northern Vidzeme and the Maritime area. In terms of geomorphological zoning, the study area of the Proposed Action falls within the Metsepole Plain of the Central Latvian Lowland and the Vidzeme Coast of the Maritime Lowland. These conditions determine the flat (average altitude about 25 m) topography, the main contributors to which are the river valleys: Salaca, Korge and Svētupe, which divide the WPP massifs in the A-R direction; also Jaunupe and Vitrupe.

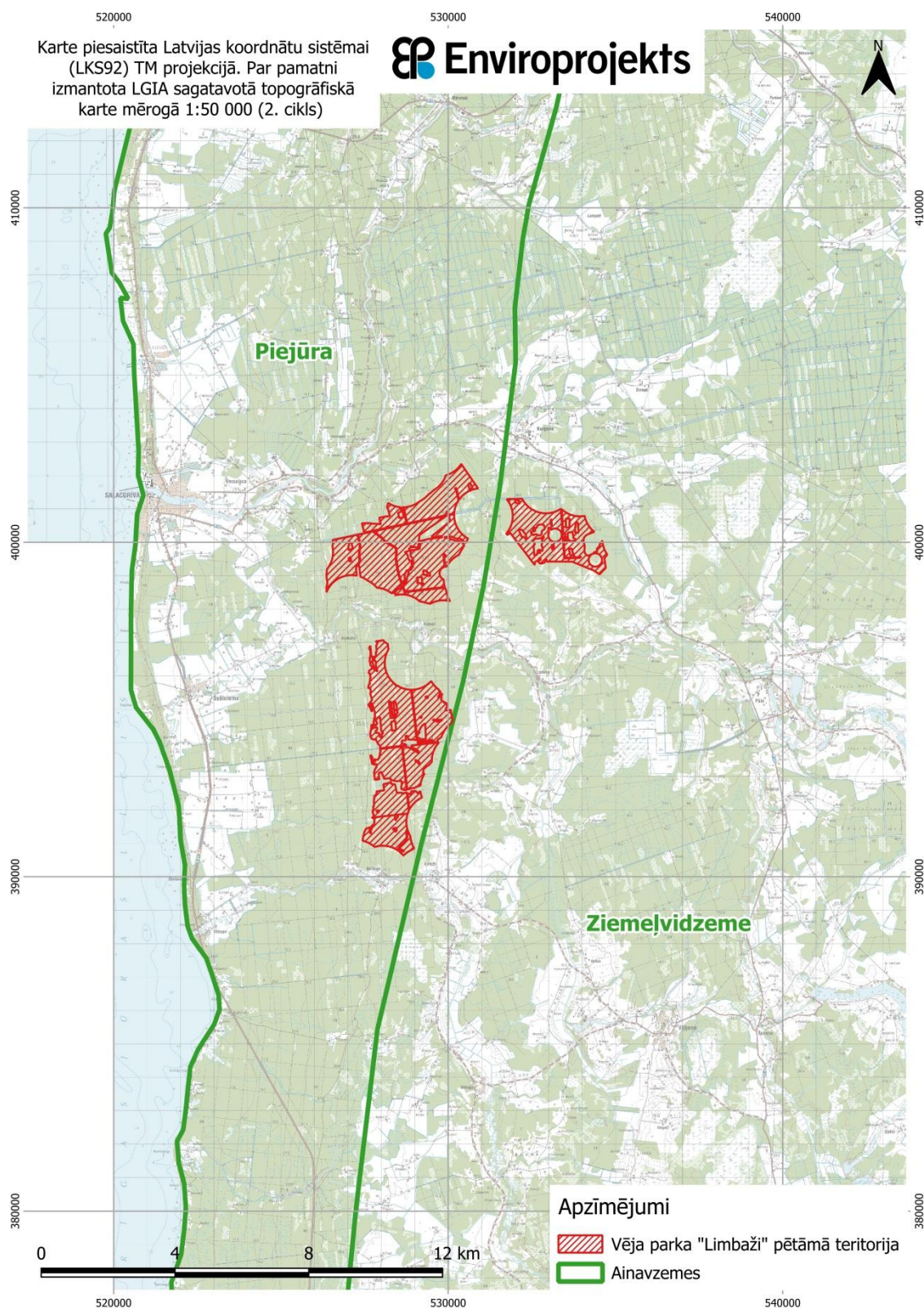


Figure 6.5.1. *Compatibility of the site of the proposed activity with the landscape division*

The visibility of WPP is affected by distance, colour, sunshine and the angle at which the sun's rays fall on them and the angle from which they are viewed. On clearer days, they will be more visible due to the colour contrast, but on cloudy days, the WPP will blend into the sky and be less visible, thus having less impact on the surrounding landscape. In order to reduce their visual impact on the surrounding area, the landscape expert considers that the rotors of the WPP should be painted in light colours and the supports

in earth tones (green), creating a transition to light, thus blending them into their surroundings and further reducing their volumetric impact on the landscape. However, only one turbine manufacturer offers such a solution, so it cannot be guaranteed that it will be possible to install such a solution on the wind farm site.

Landscapes change objectively as a result of the interaction between man and nature, and the appearance of new elements in the landscape is the result of modern human activity and the exploitation of natural opportunities. WPP is not a new element in the surrounding landscape: it is gradually becoming familiar and familiar, especially in Kurzeme. The WPPs assessed in this EIA differ in size from the existing ones in Latvia. The perception of landscape is subjective, so there is no reason to argue that WPP will reduce the overall value of the landscape: they will also exploit the potential of the landscape, creating a new dominant feature and place marker in the existing landscape. The inhabitants of the surrounding farmsteads and villages will experience a significant change in the landscape, as their everyday landscape will acquire new landscape elements that are unprecedented in this particular location, although already familiar elsewhere. Every new element in the landscape may seem out of place at first, but as time passes and the landscape changes, it takes on a life of its own and becomes an element of the local landscape, characterising it and making it recognisable.

Building on the Landscape Policy Plan: in the light of the EU's climate neutrality objectives, the priority actions of the Plan are activities that contribute to moving towards climate neutrality, such as planning and developing green infrastructure networks at different spatial scales, in particular in urban areas. Landscape assessment at regional and local scales is an important task for landscape management, in order to identify areas of landscape value and conditions for their use in different scales of spatial development planning documents, which should be taken into account in the planning and construction of energy supply and other large-scale industrial facilities. In line with the objectives of the European Green Deal and Latvia's energy independence, landscape assessment at regional and local scales should take into account that energy independence and security are equally important and should be taken into account alongside tourism and environmental protection.

The planned WPPs will be visible from various locations in the surrounding area, regardless of the chosen alternative, and will attract people's attention as WPPs of this size are a relatively new element in the Latvian landscape.

The landscape that will be affected is important for the local population, whose opinions, arguments and preferences can influence the development of the site, but as technology develops, environmental policies change and overall priorities for electricity generation change, the construction of a WPP is both welcome and necessary to increase the use of wind energy in Latvia. As identified in the Strategic Environmental Assessment Environmental Report (September 2024 version) of the 2024 update of the Latvian National Energy and Climate Plan 2021-2030:

"The perception of a landscape is subjective: there are no objective criteria for whether a WPP as a landscape element has a positive or negative impact. However, as evidenced by decades of practice in the world, where WPPs are already a common element of the landscape, and by recent practice in Latvia, where very few WPPs still exist in nature, but there have been quite a few public consultations on the possible installation of WPPs, public attitudes towards the impact of WPPs on the landscape range from strongly negative to neutral, while positive attitudes (a desire to see WPPs as an enriching element in the landscape) are considered virtually unheard of. Overall, the public's subjective perception of the landscape impacts of the WPPs is negative.

In the developed countries of the world, where WPPs have been a common feature of the landscape for decades, society has accepted them both as an element of the industrial landscape and as a compromise element of the natural and resort landscape, which is inevitable due to both the far-reaching landscape

impact of WPPs and the presence of wind more suitable for energy production on elevated terrain (which extends the landscape impact of WPPs) and in open areas, especially along the coast (a widely used environment for recreation).

The Latvian public is also expected to accept this subjective inconvenience as a trade-off for the sake of necessary energy sustainability, but for the time being, the planned rapid development of wind energy in Latvia can be assessed as having a negative impact on the landscape, and this impact can reasonably be assessed as significant. For these significant adverse impacts to be acceptable, the WPP parks should be built in locations where they do not significantly affect the SPNA with the landscape as the profiling protected asset, each project should be subject to an EIA and the project should only be implemented if no significant adverse impacts are identified."

The WPP is an example of modern architecture, differing from many other landscape elements in shape and scale of height. Given their size and rotor movement, they can become visually dominant elements in the landscape. It should be borne in mind that the use of wind energy will expand and increasingly impact on the landscape, but these changes must be made in a deliberate way, taking into account the unique landscape, landscape values and significance. Some landscapes may be particularly sensitive to wind energy, while WPPs can add new values to other landscapes. When designing and siting elements of this scale, great care and respect for the territory and its value must be taken, both in the creation of large parks and in the siting of individual WPPs.

WPP are controversial elements of the visual landscape, which have different impacts on the visual values of the landscape at different angles and distances. Landscapes are very important in people's daily lives, forming the identity of places, so it is important to pay attention to how they change and what they mean. Public involvement in the creation of such sites and in landscape change is essential, as new uses and new landscape elements are often difficult to get into people's consciousness.

A field survey of the study area and its surroundings has been carried out of the most significant landscape features (within a 10 km radius around the outer WPPs) whose views may be affected. the 10 km assessment area is defined in accordance with *the Guidelines for the Preliminary Environmental Impact Assessment of the Construction of Wind Power Plants*¹⁵⁷ from the outer WPP of the wind park (such boundary is defined by the Cabinet of Ministers Regulation No.240 "General Regulations on Planning, Use and Construction of the Territory", paragraph 163.5). As the WPPs are planned in a forested area and at the same time there are sites to be assessed for impacts that do not allow the construction of WPPs in their immediate vicinity, the surroundings outside the potential WPP area have been assessed.

Although WPP will be visible at distances of more than 20 km in clear weather,¹⁵⁸ has not assessed their impact on the landscape at such distances, as the surface area of the viewshed covered by them would be proportionally small. However, it is noted that in this case - the wind farm - the WPP will have a cumulative effect.

Landscape assessment follows the guidelines for local landscape planning approved by the MoEPRD.¹⁵⁹

A large part of the landscape study area is considered to be part of the Latvian landscape canon, which includes the Seaside and Latvian forest landscapes.¹⁶⁰ According to the Landscape Canon, "forests are Latvia's most important natural treasure. Not only do they have great economic value, but forests also provide habitat for many [...] species and an important social function, providing recreational and leisure opportunities for people." Forests are defined as one of the main contributors to the Latvian landscape. In

¹⁵⁷ <https://www.vvd.gov.lv/lv/media/9969/download?attachment>

¹⁵⁸ Ibid,

¹⁵⁹ https://www.varam.gov.lv/sites/varam/files/content/files/vadlinijas_viet_limenim_2019.pdf

¹⁶⁰ <https://kulturaskanons.lv/list/?l=8#landscapes>

the context of the study area, it is the forest massifs that "make up the forest landscape characteristic of Latvia", but the description of the canonical landscape does not forget that the landscape has been and continues to be shaped by anthropogenic processes,¹⁶¹ in this case - the construction of the wind farm.

According to the visibility model, 26.3 % of the total area of the landscape study area (if 37 WPPs were built) or 143.6 km² out of 544.9 km² would be visible to the WPPs. It should be noted that in places - especially further away from the WPPs - they will only be visible to a limited extent, and not all 37 WPPs are planned to be built; up to 20 WPPs will be built.

Within the framework of the European Landscape Convention (ELC), **a landscape is an area as perceived by people and as a result of natural and/or human activities and interactions.** According to the methodological material for landscape studies¹⁶² "a **cultural landscape** is the result of the interaction of various human and natural factors. It illustrates the evolution of humanity through time and space, has acquired a socially recognised value and, through the physical evidence in the landscape, reflects certain traditions, historical events or their representation in works of literature and art."

It is important to stress that landscape is not just a scenic (panoramic) view with a distant perspective, but that such a view is one of the ways in which landscape can be perceived and appreciated.

Landscape conservation is about actions to preserve and maintain the remarkable and distinctive qualities of a landscape, based on its heritage value, as determined by its natural form and/or human activities.

According to the EAC, **landscape planning is the consistent, forward-looking action to improve, restore or create new landscapes.**

Landscape planning at national level

In Latvia, landscape planning is determined at the highest level, however superficially, by national planning documents: Latvia's National Development Plan 2021-2027 (NDP2027) and Latvia's Sustainable Development Strategy Latvia2030. Also, during the preparation of this EIA, the **Landscape Policy Implementation Plan 2024-2027 (LIP2027)** was adopted, which deals **specifically with landscape planning.**

Latvian Landscape Atlas linked to APIP¹⁶³ identifies proposals for Areas of National Landscape Value (AHNVs). **One of these areas - "Piejūra un Lībiešu krasts" - is partly included in the landscape study area.** The impact on this is discussed in Chapter 7.8.1. It should be noted that a governance and support model and integrated guidelines for the development and planning of specific NNAVts are planned to be developed by 2027, but currently no such plan exists.

Landscape planning at local level

Spatial planning in the landscape study area is determined by the planning documents of the modern Limbaži municipality, the historical Limbaži municipality (including Viļķenes and Pāles parishes) and Salacgrīva municipality (including Salacgrīva parish, Salacgrīva town, Ainaži parish), as well as the Salacgrīva parish plan, which is still in force.

Limbaži municipality sustainable development strategy

¹⁶¹ <https://kulturaskanons.lv/archive/latvijas-mezu-ainava/>

¹⁶² Stokmane, I. u.c. 2023. *Approaches to landscape research and assessment in Latvia*. Methodological material with examples.

¹⁶³ <https://experience.arcgis.com/experience/32051c63871a47f1a6446a04f8ade1c2/page/Ainavas-kartes/?views=Nacionālās-ainavas>

Limbaži Municipality Sustainable Development Strategy 2022-2046 landscape and culturally significant areas (Figure 6.5.2). The Strategy states that the **construction of infrastructure facilities that significantly alter the landscape and its elements and change the characteristics of the cultural and historical environment is not supported in the landscape-valuable areas of the municipality**. The Baltic Sea and Gulf of Riga coastal dune protection zone, the entire NVBR landscape protection zone, parks, ancient monuments, cultural and historical landscapes, groups of buildings and individual buildings designated as cultural monuments of national importance in the current spatial plan, as well as the protection zones of surface water bodies, also designated for landscape conservation and protected areas of local importance, are considered to be areas of scenic value.

The Landscape Study Area includes the following areas of scenic value: The coastal dune protection zone of the Gulf of Riga and the following SPAs with a small buffer zone – Vitrupe ieleja, Niedrāju-Pilka purvs, Salacas ieleja, Randu Meadows, Lielpurvs. The strategy emphasises the development of unique natural treasures - water bodies: lakes, the Gulf of Riga, major rivers (Salaca, Vitrupe, Svētupe and their valleys) - landscapes for tourism and recreation.

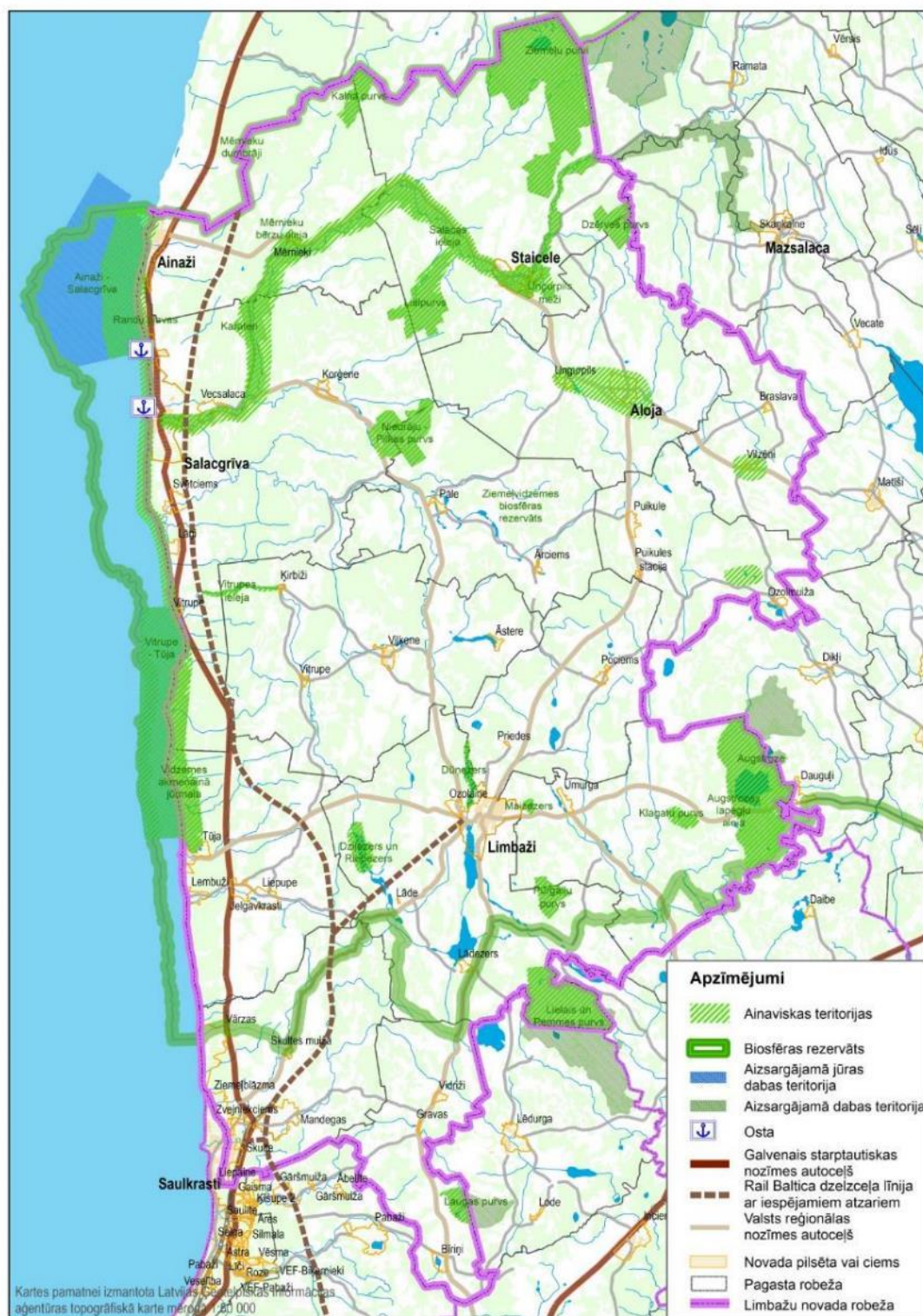


Figure 6.5.2. Areas of scenic value and cultural and historical significance in Limbaži municipality (map from Limbaži municipality development strategy 2022-2046)

Salacgrīva town and rural spatial plan

The current spatial plan, which covers the town of Salacgrīva and the municipality of Salacgrīva (formerly a rural area), was approved in 2009. The explanatory memorandum does not have a separate landscape section but describes the landscape for individual sites. Lībiešu upurals and the cliffs near it have been identified as an object of scenic value in the area of the Proposed Action and landscape study. More generally, seascapes and river valley landscapes are also characterised in this way.

The plan singles out biodiverse sites "where certain tourism and recreation-related activities can be developed and the work to be carried out on these sites to provide the specific functions". These are the Korgīte river valley, Jaunupe, Svētupe, Salaca valley, Vitrupe, Karateru sand toad deposit, Vedamurga (Ungenurga is shown on the planning map), Arupīte, Primma Lake, Kliķu Lake, Svētcieks stone islets, Riga Bay coast, Kuiķule, Niedrāju-Pilka swamp, Mangrāvis (Kulaurga), Norēnupīte (Noriņa), Vitrupe - dune-vigra micro-complexes, dune mound complexes of the Vitrupe-Lāņi section, coastal meadow fragments of the Lauteri-Svētcieks section.

The creation of a nature trail, valley landscaping, recreation areas and signage is recommended for the Svētupe and Salaca rivers. It has been described as an excellent place for infantry tourism. Similar recommendations have been made for Vitrupe, where a nature trail has already been created. Vedamurga has been described as scenically interesting. The area of the left bank of the Salaca River (from Norēnupīte to Ķieģeļnieki) is characterised by scenically interesting topography.

Spatial plan of Salacgrīva municipality

Salacgrīva municipality spatial plan up to 2030 **has not been approved and is used as an informative source** in this EIA. It defines the following areas of scenic value: Coastal dune protection zone of the Gulf of Riga and Special Protection Area in [then] Salacgrīva municipality. Separately named, but without further specification, are the "scenically important areas": near the towns of Ainaži and Salacgrīva and near the villages, as well as the coastal areas.

Landscape assessment in other documents

The landscape is also assessed in the nature management plans of the SACs. For example, in the nature management plan, it is mentioned that although in the "Salacgrīva-Vecsalaca" section economic development should be considered a priority, in the area from Vecsalaca to the municipal border the conservation of nature and scenic values would be more important, however, the prevention of existing conflicts and balancing nature conservation and development are equally important in the whole Salacgrīva section.¹⁶⁴

6.5.2. Characteristics of cultural heritage

According to the cartographic information of the information system "Heritage"¹⁶⁵ there are 16 cultural monuments in the study area. Of these, 11 are archaeological monuments and 5 are monuments of art. As the monuments are located indoors - in three churches - the churches are indicated in the cartographic material.

By status, 4 monuments are of national importance, 8 monuments are of regional importance, and 4 monuments are of local importance. These are summarised in Table 6.5.1. Cultural monuments further than 5 kilometres have not been assessed in depth, except for the Salaca Castle Hill or the medieval castle of Salacgrīva, which is a high-quality viewpoint.

Table 6.5.1. State-protected cultural monuments in the territory of the Limbaži WPP

No. ¹⁶⁶	Name	Meaning of	Typology	Distance to the nearest assessed WPP, km	Distance to the nearest recommended WPP, km
1477	Cepļa vieta	local	archaeology	0,93	0,93
1473	Kilzumu senkapi (Zviedru kapi)	region	archaeology	1,09	1,7

¹⁶⁴ <https://www.daba.gov.lv/lv/media/10664/download>

¹⁶⁵ <https://karte.mantojums.lv/>

¹⁶⁶ State protection number of the cultural monument.

No. ¹⁶⁶	Name	Meaning of	Typology	Distance to the nearest assessed WPP, km	Distance to the nearest recommended WPP, km
1476	Lībiešu Upuralas - kulta vieta	country	archaeology	1,41	1,41
1475	Kuiķuļu svētozolu birzs vieta - kulta vieta	local	archaeology	1,52	1,65
1472	Priecumu senkapi	local	archaeology	2,71	3,6
6152	Zviedru ceļš	region	archaeology	4,27	4,27
1473	Krogkalnu senkapi (Baznīkalns)	country	archaeology	4,37	4,37
1478	Salacgrīvas viduslaiku pils	country	archaeology	5,09	5,09
3932, 3934, 3935	Kancele, altāris, interjera dekoratīvā apdare (4 ciļņi) (Lielsalacas luterāņu baznīcā)	region	art	5,17	5,17
3929	Altārglezna "Kristus svētī bērnus" (Pāles luterāņu baznīcā)	country	art	6,94	11,0
6150	Jaunkadagu viduslaiku kapsēta (Mironkalniņš, Bikšu stilbs)	region	archaeology	7,2	7,2
6151	Kalnazu senkapi	local	archaeology	7,89	7,89
1502	Viļķenes Baznīcas kalns	local	archaeology	9,39	9,39
3961	Ērģeles (Viļķenes luterāņu baznīcā)	region	art	9,66	9,66

Other cultural heritage

Other sites or objects of cultural or historical importance within the study area have also been identified (Table 6.5.2). They include four churches or their ruins, three manor complexes, an industrial heritage site and an archaeological (cult) site. Closer sites are assessed in depth.

Table 6.5.2. Other sites of cultural and historical value in the study area.

Name	Typology	Distance to the nearest WPP, km
Brīdagas baznīca	architecture	1,08
Ķirbižu muiža	architecture	1,21
Vecsalacas muižas apbūve	architecture	2,61
Annasmuižas tilts	industrial heritage	2,82
Svētciema (Svētupes) muiža	architecture	5,37
Lāņu muiža	architecture	5,69
Viļķenes bļodakmens	archaeology	6,93
Pāles luterāņu baznīca	architecture	6,96
Viļķenes pareizticīgo baznīcas drupas	architecture	7,47
Viļķenes Sv. Katrīnas luterāņu baznīca	architecture	9,66

6.5.3. Tourism and recreation opportunities in the area

The construction of WPPs and the associated changes to the landscape affect both tourism and recreation. Tourism in this sub-section refers to trips outside the permanent place of residence for various purposes (including business trips, sightseeing, attending or participating in sports and cultural events, etc.), while recreation refers to various (primarily) outdoor activities close to the place of residence (e.g. walking, playing sports, mushroom picking, fishing, sunbathing, etc.). Sometimes, however, these lines can be blurred.

The study area has several tourist attractions, is crossed by hiking routes of European and regional importance, has several rivers used for water tourism (Salaca, Svētupe, Jaunupe, Vitrupe), as well as several other types of recreational sites and areas.

Nature tourism attractions

There are two nature trails maintained by LVM in the study area relatively close to the proposed WPP: Ķirbiži forest nature trail and Niedrāju-Pilka purvs footbridge. Further afield are sites such as Muižuļa dižakmens and the Sarkanās kilintis.

Water tourism

The Latvian water tourism route website "Upesoga" includes four watercourses in the study area: Jaunupe, Salaca, Svētupe, Vitrupe.¹⁶⁷ When contacting the Salacgrīva boat rental company "Lāču laivas", it was found out that apart from the Salaca, boating on other rivers is very dependent on the water level and the cleanliness of the river (presence of obstacles) and is therefore not so popular. Boating is also offered on the Korge, but this is aimed at a very small group of people and only a few take advantage of this opportunity.

Hiking/cycling routes

Seafront: Part of the European Long Distance Hiking Route E9 in the Baltic States. In Latvia, it stretches along the entire coastline. As the study area also includes the shore of the Gulf of Riga, this also implies the presence of the Jurtakas. It stretches for 29 km in the study area. The closest location to the wind park - in Salacgrīva, near the Salaca Bridge - Jūrtaka is 5.3 kilometres from the planned WPP (Z2).

Green railway "Ainaži-Valmiera". Green railways are cycling and hiking routes along former railway lines in Latvia and Estonia. The 20.8 km study area includes the route of the Ainaži-Valmiera green railway, which has a total length of 84 kilometres. The WPP will be located up to 9.9 km away from the route in this section.

¹⁶⁷ <https://upesoga.lv/lv/marsruti/>

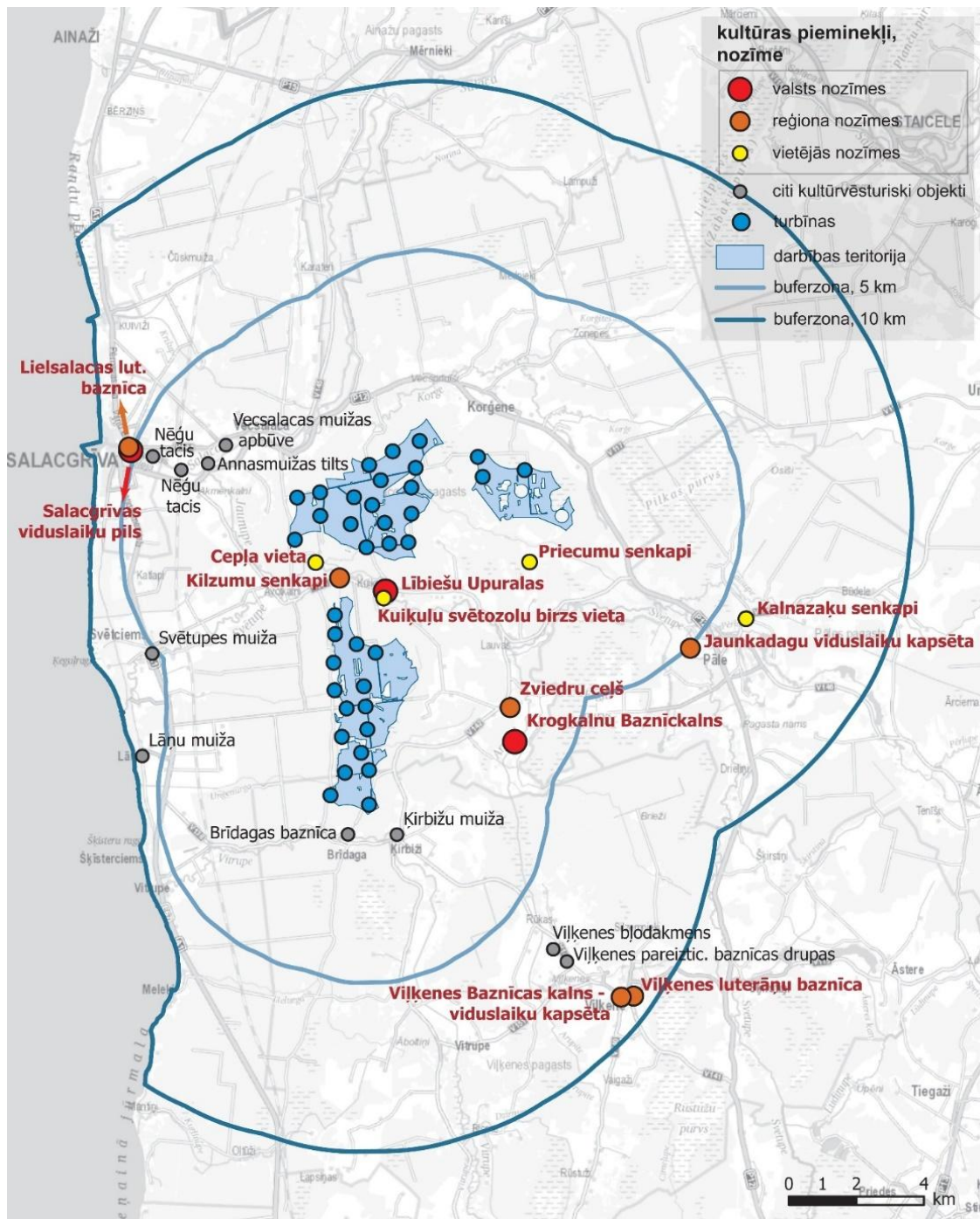


Figure 6.5.3. Tourism and recreation sites and routes and a model for the location of the maximum number of WPPs in the study area. Basic: Līd Jāņa sēta

EuroVelo13 cycle route: the EuroVelo13 or Iron Curtain cycle route is located in the study area. EuroVelo13 is part of the EuroVelo network of European cycling routes. In Latvia, it mostly follows the coastline, and in the study area it also follows the roads closest to the Gulf of Riga for 28.7 km.

Recreational opportunities in the area of operation

The area of the proposed activity falls entirely within state forest land managed by LVM. The company's medium-term strategy for 2022-2027¹⁶⁸ states that one of its objectives is to "provide natural diversity,

¹⁶⁸ https://www.lvm.lv/images/lvm/demo/lvm_videja_termina_darbibas_strategijas_kopsavilkums.pdf

recreational opportunities and other ecosystem services important to society from forests and related ecosystems."

Recreational opportunities include mushroom picking and other natural resource gathering, fishing, physical activity (jogging, Nordic walking, cycling, etc.), walking, sunbathing, relaxing by the water, etc.¹⁶⁹

According to the LVM Forest Management Plan (FMP), LVM defines Individual Planning Territories (IPT), i.e. forest areas that "require individual planning for the provision of forest values (ecosystem services - e.g. regulating, supporting and cultural) of importance to the local community within the goals and objectives set by the LVM Strategy and Tactical Plan". The MDP states that such areas should be created in places of concentration of natural and/or recreational assets.¹⁷⁰ Elsewhere in LVM materials, such as their spatial data browser LVMGEO, it is stated that these areas should also be designated for the conservation and enhancement of landscape values. According to these data, there are 79 different sizes of ISPs in the country.¹⁷¹

The area of operation is directly adjacent to one IPT "Burlaku sils" (440 ha), mostly located in Salacgrīva municipality. Of the LVM forest land of various statuses in the study area (9 889 ha in total), approximately 4.45 % is defined as IPT, which can be considered as valuable recreational potential, although there is no information on how actively this area is used for recreation in practice and whether its configuration is suitable for it. the "Burlaku sils" has two parts, divided by the V143 road: the northern part between Avotkalni and Kuikuli (mostly on the left bank of the Svētupe, but a smaller area also on the right bank near Ķilzumi - virtually unconnected to the rest in nature) and the wedge-shaped southern part - on the V143 in a wider strip between Avotkalni and Kuikuli, but to the south in a narrow strip around the Sila-Avotkalni road approximately to the border of Vilkenes parish.

6.6. Residential houses and residential areas

The proposed WPP site is located in a forested area with several settlements in the immediate vicinity (Table 6.6.1). Outside settlements and forest areas, there is a scattered, regular settlement pattern, but no settlement is within 800 m of a potential WPP site. The densest population density is found approximately 5 km to the W of the potential WPP site, in Salacgrīva (2624 inhabitants) and Svētdciems (331 inhabitants). The closest potential WPPs are located in the small village of Ķirbiži and the extreme village of Brīdaga to the S of the proposed WPP area (Figure 6.6.1), as well as a number of individual farmsteads throughout the potential WPP Park, some of them also less than 1 km away.

¹⁶⁹ Institute for Social, Economic and Humanitarian Studies (VIA HESPI) 2022. Monitoring of visitors to specially protected areas. Report on the survey results.

¹⁷⁰ LVM 2023. LVM Forest Management Plan 2022. - 2026 Public part.

¹⁷¹ <https://www.lvmgeo.lv/dati>

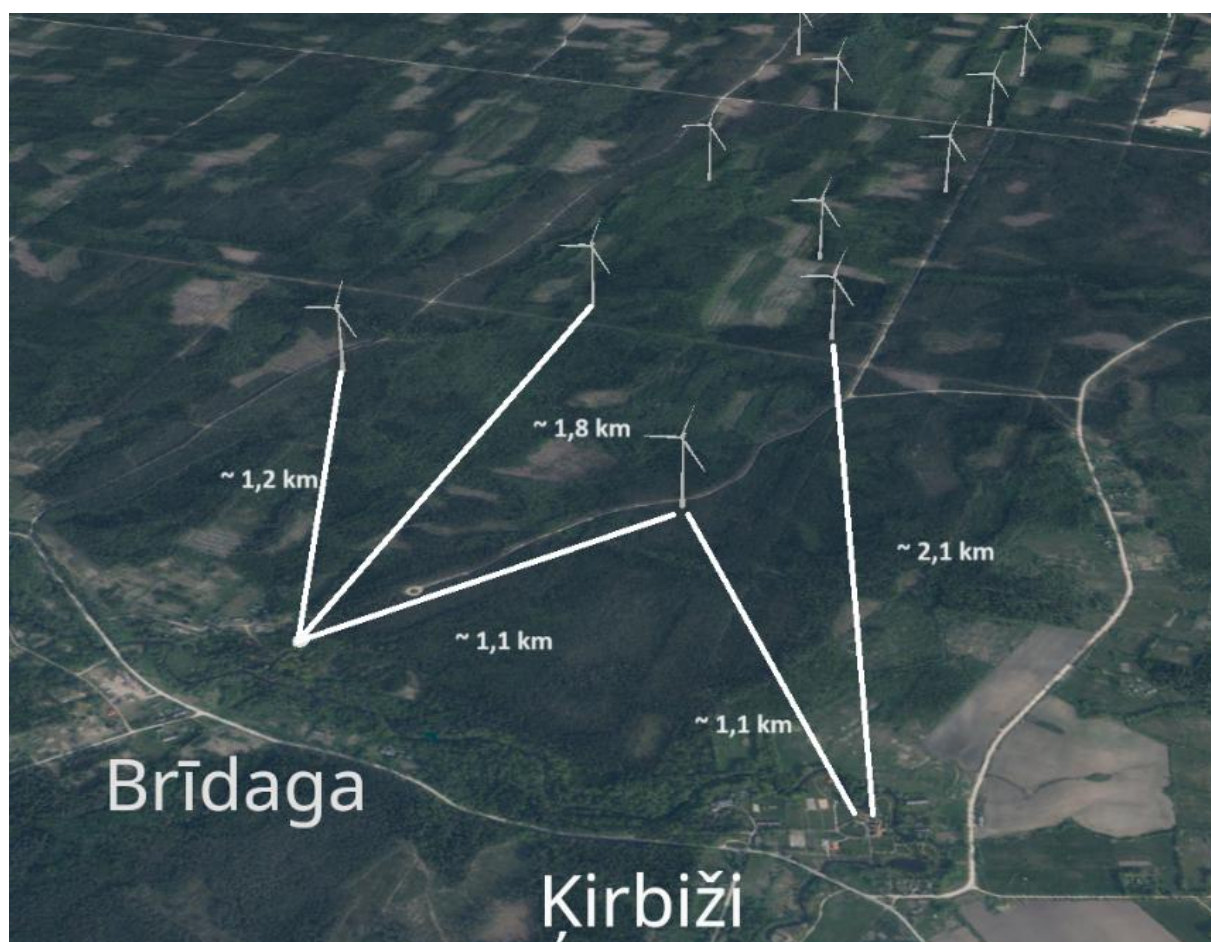


Figure 6.6.1. Location of planned WPPs closest to Brydaga and Kirbiziai, visualisation shows all WPPs initially assessed in the southern part of the study area

Table 6.6.1. Major settlements within 10 km around the potential WPP site

Settlement	See. population (2022, PMLP)	Distance from roundabout from the centre of the site to the nearest assessed WPP, km	Distance from roundabout from the centre of the site to the nearest recommended WPP, km
Ķirbiži	15	1,1	1,1
Brīdaga	36	1,1	1,1
Korģene	189	1,8	2,4
Vecsalaca	185	2,4	2,4
Svētciems	331	5,4	5,4
Salacgrīva	2624	5,4	5,4
Lāņi	20	5,7	5,7
Vitrupe	63	7,4	7,4
Pāle	220	8,4	10,0
Vilķene	465	9,5	9,5

According to the population distribution model developed by Ltd Jāņa sēta, where the Central Statistical Office (hereinafter - CSO) data on population density are linked to the data on residential addresses, there are 826 registered residences in the 3 km surrounding the WPP area, and 5,818 residences in the 10 km

surrounding area. These figures may be inaccurate, as information on the true population at specific addresses is not publicly available. It should also be mentioned that, in accordance with Cabinet Regulation 163 of 23 April 2002. 5. as the wind park boundary is defined from the edge of the WPP, the decision not to install individual WPPs may affect the potential buffer zone, resulting also in a change of the potential total population in each area.

6.7. Noise assessment

The planned locations of the individual WPPs are mainly forest stands or clearings from recent years. The nearest rural farmsteads are >800 m from the nearest WPP (see Figure 6.7.1). The noise-regulated areas are certain areas close to detached houses and, in the settlements of Kuikule, Kirbiži and Korgene, the detached house regulated areas. The settlement Kuikule is ~1.5 km from the nearest WPP, Kirbiži is ~1.2 km from the nearest WPP, the settlement Korgene is ~2 km from the nearest WPP. Throughout the planned WPP area, which is quite large, there are some small apparently private quarries. There are three lightly used local roads in the area: V143 - 111/11, V142 - <100/27, V138 - <100/17, further away - municipal road P12 - 770/6 (total cars/day / freight transp. %). The A1 and the railway are ~4.5 km further away and do not affect this WPP park. All roads are in or around the WPP area, local roads have low traffic volumes and their traffic noise does not affect the noise pollution of farmsteads exposed to the WPP.

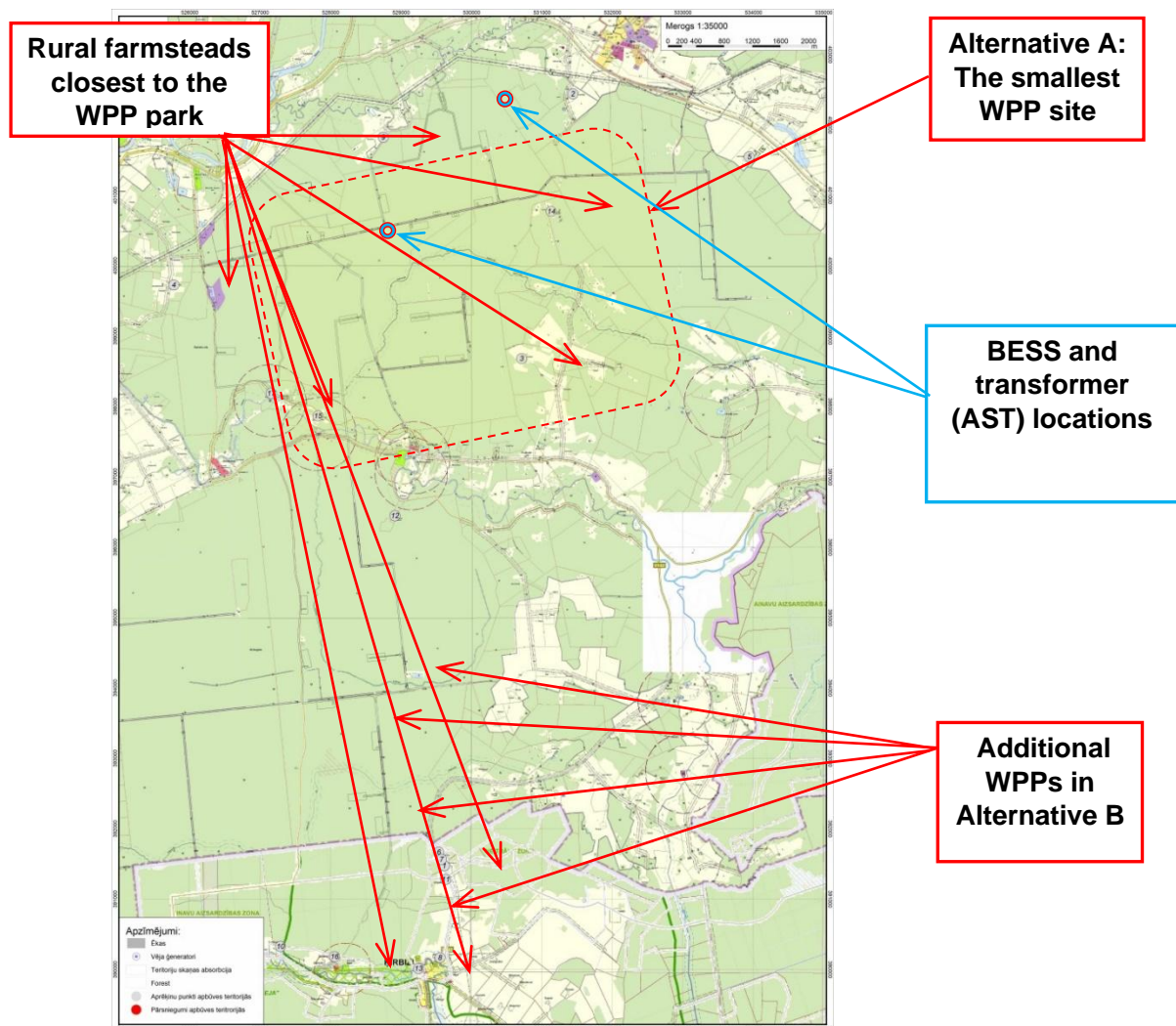


Figure 6.7.1. Homesteads closest to the WPP park where noise assessment has been carried out

The existing farmsteads are mainly close to roads, the traffic noise from which causes discomfort to these houses.

There are no businesses within the planned area of the WPPF that generate noise from their activities that would add to the noise generated by the WPP at the individual farmsteads. Other industrial sites are located in the surrounding settlements, but all of them are outside the area of the proposed WPP park.

The existing noise level in the area of the proposed WPPF is determined by traffic noise on nearby roads, which is modelled to assess the existing noise situation in the area of the proposed WPPF. The proposed Rail Baltica route is 3.5 km from the nearest recommended WPP. According to the noise modelling maps for the Rail Baltica route¹⁷², the calculated limit to which the noise level of the railway without noise abatement measures exceeds 45dB (A) at night in the recommended railway alignment option is no closer than 2.8 km to the nearest recommended WPP. This distance is approximately 3.4 km, taking into account noise abatement measures.

6.8. Air quality assessment

Wind is a clean, renewable natural resource. The operation of WPPs does not emit pollutants into the air, which is one of the main arguments for the development of WPPs in Latvia as a "green" energy solution.

Construction equipment and transport for the construction of the WPP will cause insignificant, local, temporary and episodic air pollution, which will be localised in the construction zone, which is not located in the immediate vicinity of a residential area. The construction process, such as the use of machinery and access roads, including gravel roads, can cause air pollution with dust particles_{PM10} and _{PM2.5}, as well as nitrogen dioxide, and the concentration limit values for these substances are set by Cabinet of Ministers Regulation No 1290 of 3 November 2009 "Regulations on Air Quality".

Table 6.8.1. Air quality standards

Pollutant	Determination period	Threshold
Carbon monoxide	8 hours	10 mg/m ³
Nitrogen dioxide	1 hour (19th highest value)	200 µg/m ³
	Calendar year	40 µg/m ³
PM ₁₀	24 hours (36th highest value)	50 µg/m ³
	Calendar year	40 µg/m ³
PM _{2.5}	Calendar year	20 µg/m ³

Cabinet of Ministers Regulation No 1082 of 30.11.2010 "Procedure for Application and Issuance of Permits for Polluting Activities of Category A, B and C" does not provide for a permit for wind power plants to carry out polluting activities. Annex 2 to the Cabinet of Ministers Regulation No 1082 of 30.11.2010 lists "wind power plants or power plant parks with a total capacity greater than 125 kilowatts" as category C polluting activities (equipment) that require registration, but the types of pollution they may cause (e.g. spills of lubricants during maintenance) do not include air pollution and do not require the preparation of emission limit projects in accordance with Cabinet of Ministers Regulation No 182 of 02.04.2013 "On Preparing Emission Limit Projects for Stationary Sources of Pollution".

The latest five-year *Air Quality Assessment of Latvia 2014-2018*, prepared by the LVGMC¹⁷³, concludes that air quality problems in relation to human health are mainly concentrated in large cities, regardless of their location:

¹⁷² <https://edzl.lv/projekta-norise/izpete>

¹⁷³ https://videscentrs.lv/gmc.lv/files/Gaiss/Gaissa_kvalitate/Gaissa_kvalitates_novertejums_2014_2018.pdf

- In the observation period from 2014 to 2018, exceedances of the hourly lower pollution assessment threshold of $100\mu\text{g}/\text{m}^3$ **for nitrogen dioxide** have only occurred in a few years. The most frequent cases were recorded at the observation station "**Liepāja**".
- The annual mean lower pollution assessment threshold value for PM_{10} for the protection of human health was exceeded at the **Liepāja** and **Rezekne** monitoring stations (impact stations for road traffic sources) from 2014 to 2018, as was the **World Health Organisation'** s recommended level ($20\mu\text{g}/\text{m}^3$).
- At the **Liepāja** and **Rezekne** monitoring stations, exceedances of the daily PM_{10} upper ($35\mu\text{g}/\text{m}^3$) pollution assessment threshold for human health protection were also recorded.
- Exceedances of the lower daily PM_{10} ($25\mu\text{g}/\text{m}^3$) assessment threshold for the protection of human health were also recorded **at all monitoring stations**.
- The annual mean upper ($17\mu\text{g}/\text{m}^3$) and lower ($12\mu\text{g}/\text{m}^3$) pollution assessment thresholds for **$\text{PM}_{2.5}$** for the protection of human health were exceeded at the observation station **Rezekne**. The **World Health Organisation'** s recommended level of $10\mu\text{g}/\text{m}^3$ was also exceeded at all monitoring stations "**Liepāja**", "**Rezekne**" and "**Ventspils**".

The latest LVGMC report on air quality in 2023¹⁷⁴ concludes similarly:

- 2023. in 2010, the daily average upper pollution assessment threshold value for PM_{10} ($35\mu\text{g}/\text{m}^3$) for the protection of human health was exceeded at the monitoring station Rezekne - Atbrīvošanas 115A.
- The annual limit value for PM_{10} recommended by the World Health Organisation ($15\mu\text{g}/\text{m}^3$) was exceeded at all stations except the field background monitoring station "Rucava".
- 2023. in 2010, the limit value for $\text{PM}_{2.5}$ recommended by the World Health Organisation guidelines of $5\mu\text{g}/\text{m}^3$ was exceeded at all monitoring stations.

The air quality in the study area of the WPP Park has been assessed taking into account the requirements of Paragraph 40 of the Cabinet of Ministers Regulation No 182 of 2 April 2013 "Regulations on the Development of Emission Limit Projects for Stationary Sources of Pollution", which requires an official statement from the LVGMC on the existing pollution level (background concentrations of air pollutants) for the potential impact area of the polluting activity, for which air quality standards are in force.

The existing pollution levels are described in the letter No 4-6/1433 of the LVGMC of 26 September 2024 (Annex 2) on the concentrations of air pollutants in the potential area of influence of the activity, excluding the contribution of the polluting activity. The area of potential effect for the determination of background concentrations is the area around the location of the polluting activity at a distance equivalent to the 20 highest emission source heights, but not less than 2000 m.

According to the information provided by the LVGMC, to obtain the annual average concentrations in the area of influence without operator activity (background concentrations), modelling was performed in EnviMan (perpetual licence No 0479-7349-8007, version 3.0) using a Gaussian mathematical model. The software is developed by OPSIS AB (Sweden). The calculations take into account the local topography and built-up area characteristics. For the meteorological characterisation, long-term observation data from the Ainaži observation station for the period 2019-2023 were used. A calculation step of 100 m was used to model the existing pollution levels. This calculation step was used to allow the calculation of the existing

¹⁷⁴https://videscentrs.lv/gmc.lv/files/Gaiss/Gaisa_kvalitate/Gaisa_kvalitates_novertejums_2014_2018.pdf

pollution level in the area of influence of Ltd Latvijas vēja parki according to the indicated corner coordinates.

Table 6.8.2. Annual mean background concentrations ($\mu\text{g}/\text{m}^3$) in the area of the proposed activity

Viela	Annual mean concentration ($\mu\text{g}/\text{m}^3$)
PM ₁₀	13.90
PM _{2.5}	7.78
Carbon monoxide (CO)	307.45
Nitrogen dioxide (NO ₂)	5.83

As can be seen in the figures below (Figures 6.8.1. - 6.8.4), the concentrations of pollutants in the vicinity of the area of the Proposed Activity are low and do not even approach the limit values for pollutants specified in the Cabinet of Ministers Regulations. The annual mean concentrations for nitrogen dioxide, PM₁₀ and PM_{2.5} are below even the lower pollution assessment threshold (65% of the limit value or $26\mu\text{g}/\text{m}^3$ for nitrogen oxides, 50% of the annual limit value or $20\mu\text{g}/\text{m}^3$ and $10\mu\text{g}/\text{m}^3$ for PM₁₀ and PM_{2.5}, respectively). In conclusion, the existing air quality in the area of the Proposed Action is good and there is no need to develop measures to improve air quality. As the pollutant plots show, the highest concentrations of air pollutants are found in the vicinity of Vecsalaca and the roads.

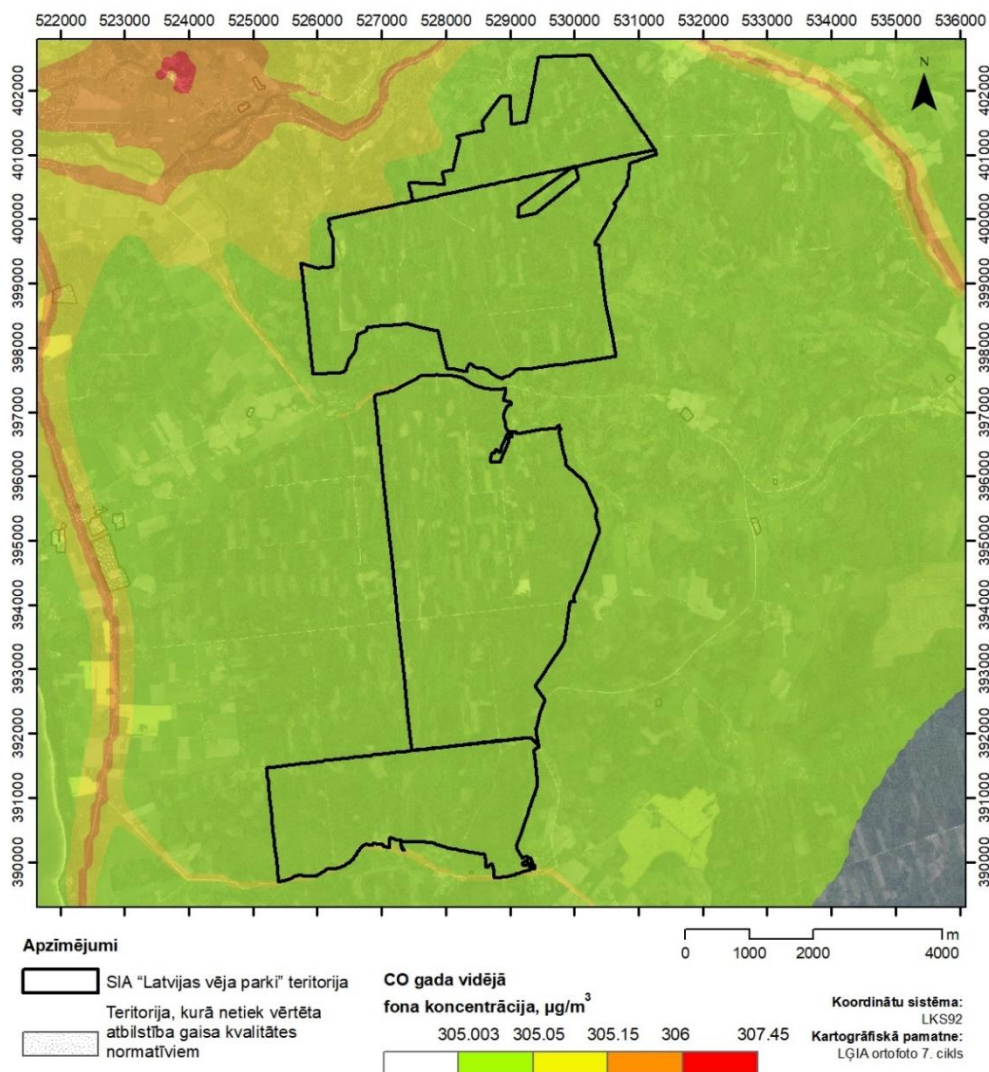


Figure 6.8.1. CO (carbon monoxide) background concentrations in the WPP Park study area

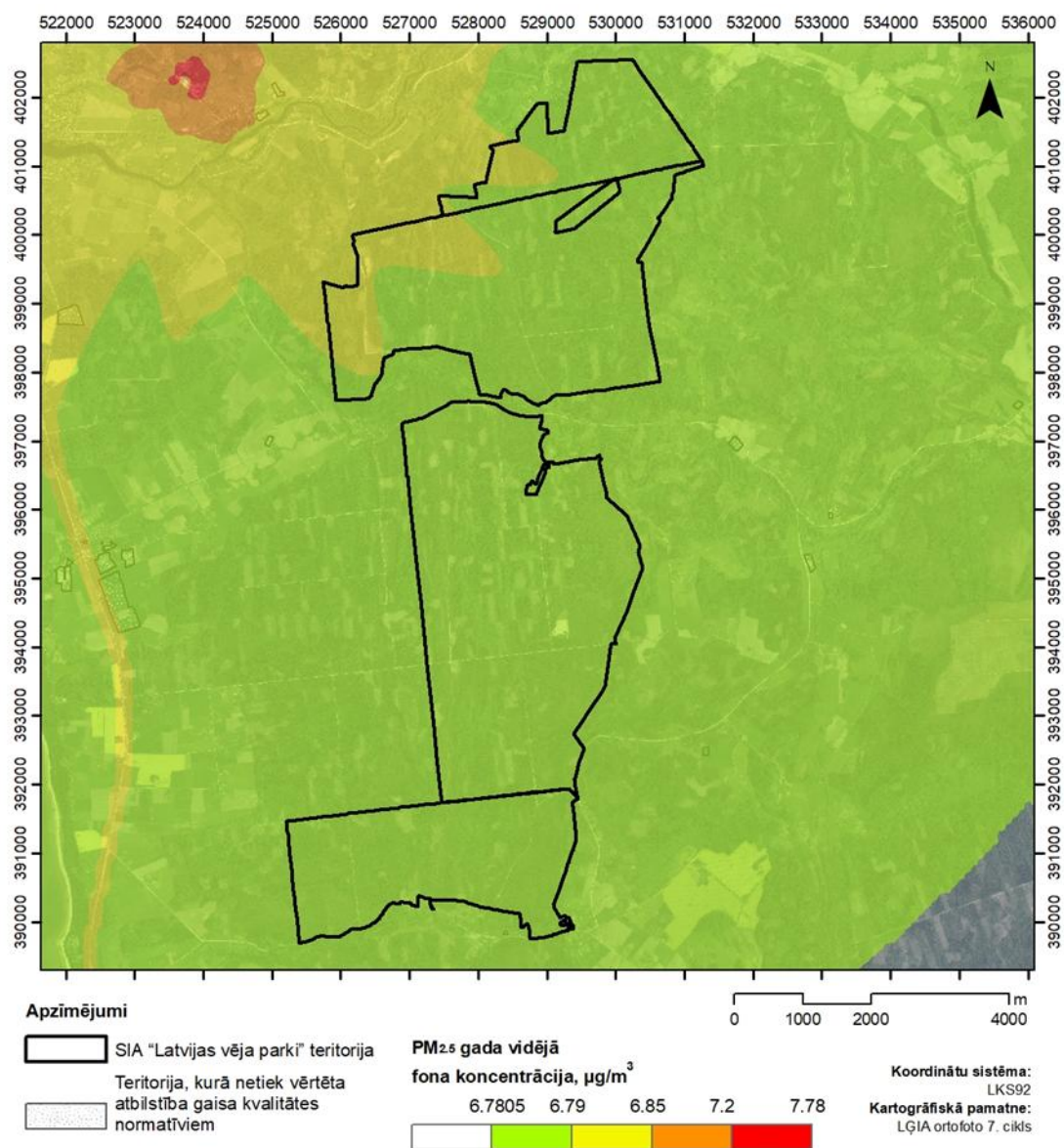


Figure 6.8.2. *PM_{2.5} background concentrations in the WPP Park study area*

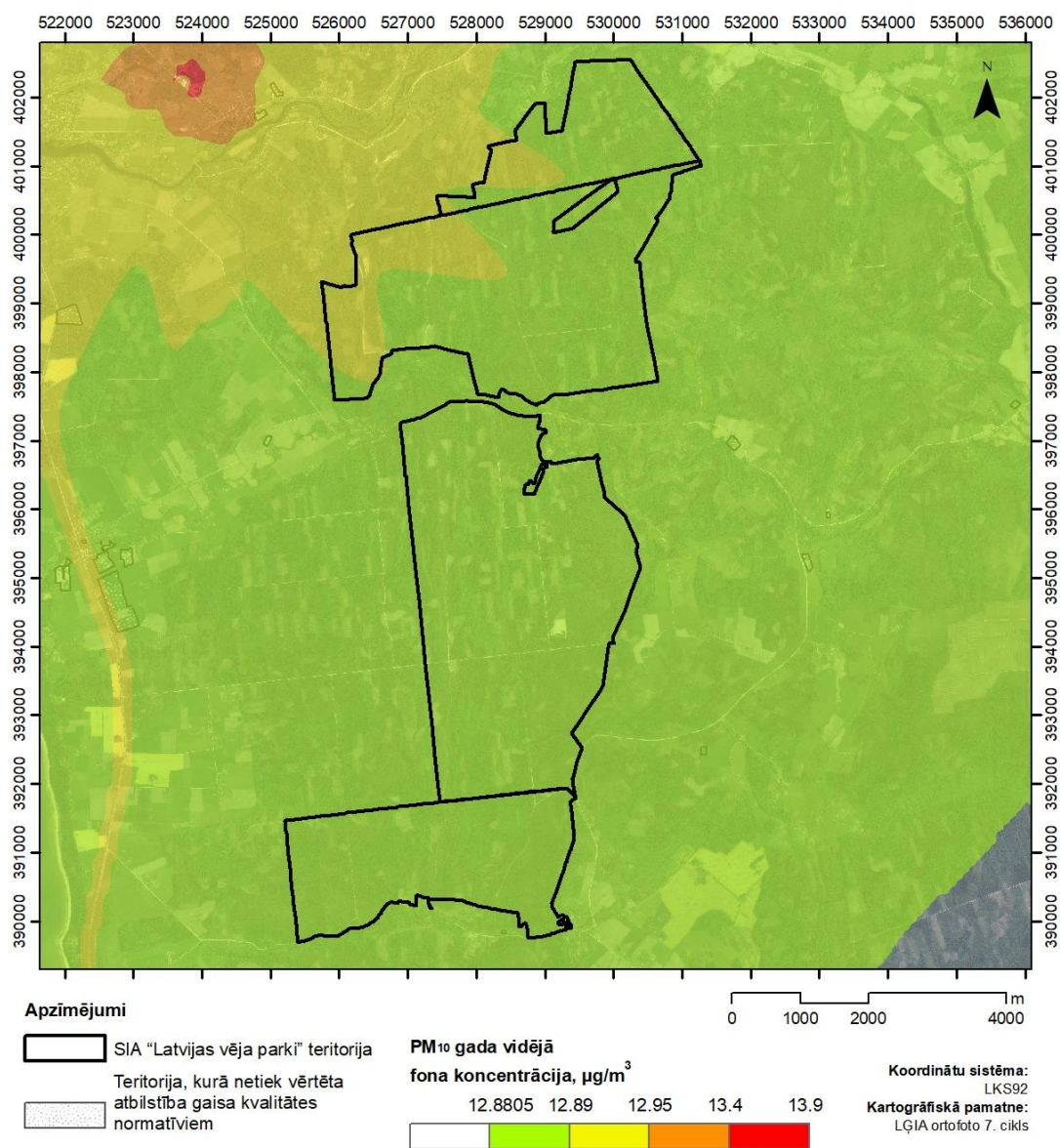


Figure 6.8.3. PM_{10} background concentrations in the WPP Park study area

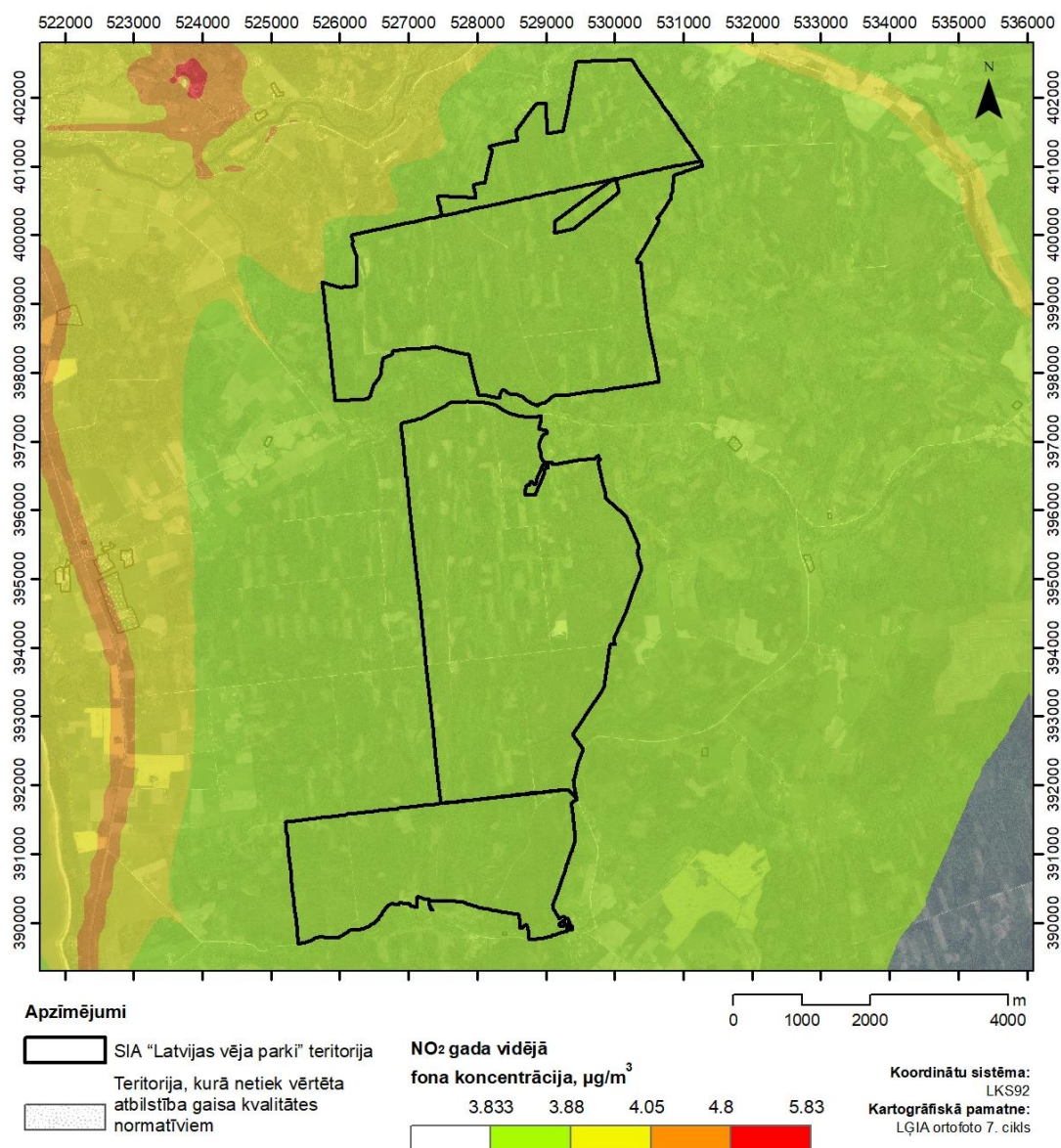


Figure 6.8.4. NO₂ (nitrogen dioxide) background concentrations in the WPP Park study area

6.9. Information on forthcoming economic activities

Three LVM sand deposits "Stienūži IV", "Stienūži V" and "Ķūlaurga" are located in the territory of the WPP Park; these quarries are used for economic activities: extraction of natural resources.

For further information on mineral sites in the vicinity of the Proposed Action, see Chapter 6.12.

The Port of Salacgrīva, the Port of Kuiviži and the Yacht Harbour are located approximately 7 km from the area of the Proposed Action.

The Port of Salacgrīva does not tranship hazardous materials. Forestry and wood products are the dominant cargo types: paper wood, firewood and peat. The volume of cargo handled in the port varies depending on the economic situation in Europe. Stevedoring services in the Port of Salacgrīva are provided

by the stevedoring company "Salacgrīva Nord termināls" Ltd. The port and the adjacent area are home to the fish processing plant "Brīvais vilnis"¹⁷⁵.

The port of Kuiviži is used for fishing, fish processing, yachting, tourism and private property management. Fishermen carry out their economic activities in the port of Kuiviži: Ltd Bankis, ZV/S "Bute", IK "Kuivižkrasts", Ltd Barka MK2, etc., including private individuals engaged in coastal fishing. Fishing vessels and boats use 3 fishing piers. The fish is processed in a freezer and sorting workshop built by Bankis Ltd. Kuivižu osta Ltd has developed a leisure and yacht complex Kapteiņu osta Ltd, which includes a hotel, camping, restaurant¹⁷⁶.

The Kapteiņu osta yacht port is developed in the Salacgrīva port area in Kuiviži, 3 km north of Salacgrīva port, ~200 m from the VIA Baltica road. This marina offers a full range of services for yachts and yachtsmen, except refuelling. The marina has a 90-metre long berth with a depth of up to 3 metres. The port can accommodate up to 35 yachts at a time. The marina is open to yachts with drafts up to -2.5 m, length up to 35 m. A 3.5 metre wide slipway is provided for customers to retrieve/launch their boats¹⁷⁷.

There are no contaminated or potentially contaminated sites in the area of the proposed activity. For further information on contaminated or potentially contaminated sites in the vicinity of the Proposed Action, see Chapter 3.2.

The implementation of the proposed action is expected to improve access to forest land for recreational use through new construction, improvement and reconstruction of access roads to the WPP.

The rehabilitation of existing access roads and the construction of new access roads will significantly improve forest drainage systems along the roads, which will also have an indirect effect on improving forest growing conditions.

The air quality assessment and the air quality impacts of the Proposed Action are described and assessed in Chapter 7.4 of the EIA Report.

6.10. Consistency with Limbaži municipality planning documents

The Limbaži Municipality Sustainable Development Strategy 2022-2046 states that the future specialisation of the municipality is related to the use of the opportunities offered by the sea for the production of renewable energy sources. The guidelines for spatial planning and development need to move towards a competitive and climate-neutral economy: development of renewable and green energy infrastructure, including offshore wind farms; maximising the practical use of renewable energy and electricity; and taking advantage of the bioeconomy.

The Limbaži Municipality Development Programme 2011-2028 supports the use of renewable energy sources and innovation: already now the children's playground in Salacgrīva near the library, Kaiju, Zāles and Gatves streets in Ainaži, Līvānu, Ceriņu and Lazdu streets in Jelgavavkrasti, Pārupes street and the children's playground in Liepupe are illuminated with alternative energy.

The Strategic Environmental Impact Assessment for the Limbaži Municipality Sustainable Development Strategy 2022-2046 and the Limbaži Municipality Development Programme 2011-2028 identifies that the current focus should be on increasing the share of renewable energy sources. It is concluded that these planning documents will not create additional environmental problems, but will help to solve existing

¹⁷⁵ <https://www.limbazunovads.lv/lv/media/20414/download?attachment>

¹⁷⁶ Ibid,

¹⁷⁷ Ibid,

ones, as they contain the basic principles of sound and sustainable development of the territory, take into account the requirements of environmental legislation and public interests.

The planning documents implement the development directions of the hierarchically higher long-term development planning documents, i.e. the Latvian Sustainable Development Strategy 2030, the National Development Plan 2021-2027 and the Vidzeme Planning Region Sustainable Development Strategy 2014-2030, as well as European-level planning documents such as the European Union Green Deal, which is defined as the new European Union Growth Strategy. The Action Plan for the Development of the Riga Metropolitan Area (approved in 2020) has also been taken into account, as have the spatial development planning documents of neighbouring municipalities.

According to the requirements of the Cabinet of Ministers Regulation No.240 of 30 April 2013, WPPs with a capacity greater than 20 kW are allowed to be located in the industrial construction area (R), technical construction area (TA), agricultural area (L) and forest area (M), in accordance with the conditions of the spatial plan.

According to the Limbaži municipality spatial plan, the construction area of the WPP park includes land units or their parts, the planned (permitted) use of which is basically defined as a forest area. Relatively small areas of the WPP construction area are covered by water.

Part 3 "Rules for the use of the territory", Chapter 3.11 "Engineering and technical support", Section 3.76 of the Limbaži Municipality Spatial Plan 2012-2024, Volume III "Rules for the use and construction of the territory" states that it is not allowed to locate WPP in the Special Protection Areas, except for those areas specified in the NVBR normative acts, villages and town areas. In residential areas it is allowed to locate WPP with maximum power up to 20 kW, it is allowed to locate in the construction zone of a detached house area, if the height of the WPP mast does not exceed 12 m and it is possible to provide a WPP protection zone equal to - mast height x 1.5 within the land plot or if an agreement has been reached with the owner of the adjacent real estate about the imposition of a burden - a protection zone on the land plot, registered in the Land Register

In accordance with the Law on Protective Zones, the following protective zones have been established in the spatial plan of Limbaži municipality:

- 1) environmental and natural resource protection zones
- 2) operational protection zones
- 3) sanitary protection zones
- 4) safety buffer zones.

More detailed information on buffer zones is provided in Chapter 7.4.

6.11. Information on nearby airports and aerodromes and the impact on communication systems

The closest airport to the WPP Park is the private general aviation certified Limbaži Aerodrome (EVLI) at a distance of 20 km, and the closest international commercial airport is Riga International Airport (EVRA) in Mārupe Municipality at a distance of 85 km (see Figure 6.11.1): The Limbaži WPP Park is located in the airspace of Riga Airport at its north-eastern border.

Both the current directly produced by the WPP and the current transformed by the substation are at a low frequency of 50 Hz and at such low voltages that their electromagnetic field is very localised to weak and should normally have no effect on communication systems. If the receiving equipment is very close to the WPP, it can theoretically still induce 50 Hz currents. Because most amplifiers are inefficient at such low frequencies, people cannot hear these distortions. The EU has a directive on electromagnetic compatibility, the requirements of which have only been implemented in Latvia by Cabinet Regulation No.483 of 20 June 2006 "Regulations on Electromagnetic Compatibility of Equipment" and continue to be maintained by Cabinet Regulation No.208 of 12 April 2016 "Regulations on Electromagnetic Compatibility of Equipment", which is currently in force. These documents require that electrical and electronic equipment must, on the one hand, not cause electromagnetic interference to other equipment and, on the other hand, be capable of operating to the required quality for its intended purpose, even in the presence of electric and magnetic fields likely to be present in a normal environment. Therefore, modern communication equipment manufactured in compliance with EU and Latvian requirements should not be subject to interference from WPPs, even in close proximity. The second factor that determines the ability of modern communication systems to operate normally, without interference, in the vicinity of a WPP is that modern public communication systems use digital technology, while digital signals cannot be distorted by electromagnetic fields (only interrupted at high field strengths). In addition, it should be recalled that the electromagnetic fields generated by WPPs are still many times smaller than the magnetic fields of the high-voltage transmission lines to which these conclusions apply. It follows that WPPs will not affect communication systems in their immediate vicinity as such, but there are no communication systems in their immediate vicinity either (except e.g. mobile phones of maintenance staff during working hours directly at the WPPs).

Studies on the impact of WPP have shown that WPP can still affect the quality of TV broadcasting and mobile communications: while digital signals cannot be distorted, they can block (obscure), fragment and reflect the signals transmitted by these communications equipment, simply by temporarily interrupting the transmission. Studies by the International Telecommunication Union (ITU) on the impact of WPPs on the quality of TV broadcasting, including digital terrestrial television, have found that interference may occur in the vicinity of WPPs, but that it is insignificant: it may only occur in areas with low broadcast signal quality (very weak signals).

Also, the quality of mobile communications, including mobile internet traffic, could only be affected by WPPs in areas with very poor communications quality. Looking at the information provided by the largest Latvian mobile operators - LMT, Tele2 and Bite - on the quality of communications in the vicinity of the Proposed Development, it is evident that both 3G and 4G mobile internet are provided in high quality, with a sufficiently dense network of base stations in the wider vicinity of the Proposed Development. The height of transmitters and receivers is an important aspect to consider when assessing the potential impact of the Proposed Action on the quality of mobile or *radio link* communications. The towers on which mobile transmission equipment is located in the vicinity of the Proposed Action are much lower than the WPP: up to 50 m. The lowest downward position of the WPP wing tip will be 100 m or 50 m higher than the mobile transmission towers constructed in the vicinity of the Proposed Operation. The moving parts of the WPP, which can fragment the communication signal, will therefore be higher than the line connecting the communication tower to the service receiver.

Studies around the world have shown that WPP can affect the performance of telecommunications transmitters and receivers, causing signal interference in air traffic control radars, weather radars,

maritime navigation radars, aeronautical navigation systems such as very high frequency circular beacons (VOR) and instrument landing systems (ILS), fixed radio networks and analogue TV broadcasting¹⁷⁸.

Aviation security, meteorological and maritime navigation radars are electromagnetic systems used to identify specific objects by transmitting an electromagnetic signal and receiving a reflected signal from the target object. The received signal is used to characterise the size and position of the object. Radar equipment that also uses the Doppler effect to observe an object identifies not only the size and position of the object, but also its speed of movement. WPP in the vicinity of radar systems function both as blocking devices and as large reflective objects whose strong reflected signals can be misinterpreted and mask weaker reflected signals. The same effect can be produced by any other high-rise structure located within radar "line of sight". The radar systems currently in widespread use are not able to recognise the signals reflected by WPP.

Land-based WPP are not considered a potential threat to the operation of maritime navigation systems, but their impact on aviation safety and weather radars has been demonstrated. For example, the Spanish National Meteorological Agency (*Agencia Estatal de Meteorología*) has recorded weather radar reflections from WPP parks that are identified as precipitation zones on a day when no precipitation is observed in the radar area. Although the potential impacts of WPPs have been identified, there is currently no common methodology for assessing these impacts, which is hampered by the variety of radar systems used and the fact that the method of assessment may depend on the nature of the area where the WPP park is to be built.

The World Meteorological Organisation (WMO) and the European Meteorological Services Network (EUMETNET) recommend certain distances from the weather radar where it is preferable not to build WPP (up to 5 km for C-band and 10 km for S-band radars), or where the WPP construction should be agreed with the weather radar owner (up to 20 km for C-band and 30 km for S-band radars)¹⁷⁹. More recent studies suggest that the upper limit for C-band radars, 20 km, should be increased, as impacts can be observed at greater distances¹⁸⁰. An important factor that can affect the performance of a radar is the position of the WPP within the radar's field of view.

The European Organisation for the Safety of Air Navigation (EUROCONTROL), taking into account the International Civil Aviation Organisation (ICAO) guidance on the regulation of construction in restricted areas around air navigation facilities¹⁸¹, has developed guidance for air navigation service providers on the need and procedures for assessing the impact of WPP on navigation facilities¹⁸². The guidelines define 4 zones in the vicinity of a primary surveillance radar (PSR) and a secondary surveillance radar (SSR) where the impact of a WPP should be assessed: as shown in Table 6.11.1, also for air traffic surveillance radars, the location of the WPP within the radar's line of sight is an important aspect.

Table 6.11.1. Assessment areas for WPP impacts on primary and secondary surveillance radars

Zone	Description	Impact assessment conditions
1. zone	0-500 m from radar	Safety zone for PSR and SSR installations, in which construction of WPPs would not be allowed

¹⁷⁸ Angulo, I. & de la Vega, D. & Cascón, I. & Cañizo, J. & Wu, Y. & Guerra, D. & Angueira, P. 2014. *Impact analysis of wind farms on telecommunication services*. Renewable and Sustainable Energy Reviews, Volume 32

¹⁷⁹ Finnish Meteorological Institute. 2007. *EUMETNET OPERA PROGRAMME (2004-2006) - Operational programme for the exchange of weather radar information*. Final report.

¹⁸⁰ VINDRAD. Project report v1.0, A tool for calculation of interference from wind power stations to weather radars, 2011

¹⁸¹ International civil aviation organisation. 2015. *European guidance material on managing building restricted areas: 3rd ed.*

¹⁸² <https://www.pagerpower.com/news/eurocontrol-radar-wind-turbine-guidelines-v1-2/>

Zone	Description	Impact assessment conditions
2. zone	500 m - 15 km radar visibility	Detailed assessment area for PSR and SSR radars in which air navigation service providers should object to the construction of WPPs unless a detailed impact assessment is carried out, the results of which are acceptable to the air navigation service provider
3. zone	Beyond 15 km but within the radar's maximum range and radar visibility	Indicative assessment area for PSR radars
4. zone	In the radar's maximum range outside its visibility zone or outside the radar's maximum range	Acceptance zone for PSR and SSR radars where no assessment is required

The closest meteorological radar to the territory of the proposed activity is the radar operated by the LVGMC installed near the territory of Riga Airport. The distance from the radar to the nearest WPP in the area of the Proposed Action is 85 km. According to the information published by the LVGMC, the radar installed is a C-band device with a range of up to 250 km and the lowest scan angle of 0.3°.

The nearest PSR and SSR radars to the area of the proposed activity are installed at Riga Airport: STAR 2000 PSR radar with a maximum range of 80 NM (148 km), RSM970S SSR radar with a maximum range of 240 NM (445 km). Both have the lowest sounding angle of 0.25°. The distance from the radar to the nearest WPP in the proposed wind farm is 85 km.

Simple trigonometric calculations are sufficient to ensure that WPPs up to 300 m high will not be in the line of sight of meteorological and air traffic surveillance radars. At a distance of 85 km, at the lowest scan angle of 0.25°, the beam height on a flat Earth would not fall below 370 m, significantly higher than the maximum height of the wingtip of the nearest WPP. This margin would be sufficient to include the finer details: the height of the radar's emitting point above the ground (only increasing the beam height by a few metres) and the difference in absolute height between the terrain of the wind park and Riga Airport (the WPP site is a maximum of 40 metres higher). But the curvature of the Earth's surface makes all these calculations unnecessary: at a distance of 85 km, the point at sea level is 1.13 km below the horizon. Therefore, there is no possibility of negative impacts of the planned WPPs on the operation of the radar installations.

According to ICAO guidelines, the impact of WPP planned to be constructed closer than 15 km to radio navigation and landing aids such as VOR, Instrument Landing Systems (ILS) on these air navigation systems shall be assessed by identifying the significance of the impact and the interference to the system. Distant WPP should not have an impact on radio navigation and landing aids. Radionavigation and landing facilities are located at Riga Airport and possibly (now or in the future) also at Limbaži Aerodrome, but both are much more than 15 km away.

To avoid any potential negative impacts, all electrical equipment in the WPP will be certified and CE-marked, guaranteeing that the WPP itself cannot cause any adverse effects over such a long distance.

6.12. Nearest water abstraction and mineral extraction sites

6.12.1. Characteristics and use of nearby water abstraction points and groundwater deposits

Based on the data from the LVGMC Unified Environmental Information System¹⁸³, where information on water supply boreholes is maintained and updated, there are no registered water supply boreholes in the

¹⁸³ <https://www.meteo.lv>

territory of the proposed WPP park, but there are 10 boreholes within a 1 km radius around the study area that are or have been used for water supply (Figure 6.12.1 and Table 6.12.1).

Table 6.12.1. Known water supply boreholes in the vicinity of the area of the proposed activity

Urbum no.	Address	Year of drilling	Borehole depth	Water aquifer	Boreholes status
17087	"Jennas", cad. No 6672 007 0177	1963	80,4	D2ar+br	unknown
17098	"Stirnas", cad. No 6672 010 0149 (former farm "Rožkalni")	1966	80	D2ar	unknown
20186	Pheasant farm "Brīdaga" of Vitrupe Forestry	1983	80	D2ar	unknown
21842	Ķirbiži, "Ķirbižu muiža" cad.No. 6688 002 0110	2007	120	D2ar	unknown
24637	"Pīkoļi", cad. No 6672 009 0010	2008	79	D2ar	unknown
20295	"Priedes", cad. No 6672 008 0035 (ex. Kuikule 8 - yrs. school)	1985	100	D2ar	unknown
18454	"Ezerkrogs", cad. No 6672 005 0072 (former farm "Ezerkrogi")	1967	66	D2ar+br	unknown
18704	"Jaungraudiņi", cad. No 6672 005 0101 (former farm "Bērlejas")	1975	120	D2ar	unknown
17088	"Lielmazspringu rija", cad. No 6672 005 0308 (former farm "Springi")	1965	105	D2ar	unknown
18656	"Sprīdis", cad. No.6672 005 0165 (Korgene 8-year school)	1974	100	D2ar	unknown

According to the data of the Unified Environmental Information System of the LVGMC, 2 underground water deposits (hereinafter – GWD) have been registered in the vicinity of the area of the Proposed Action: GWD "Salacgrīva" and GWD "Salacgrīva krasts". Information on the deposits and their location can be found in Figure 6.12.1 and Table 6.12.2 respectively. The planned area of the WPP Park is not located within the protection zones of the UWD.

Table 6.12.2. Groundwater deposits in the vicinity of the area of the proposed activity

Site and its LVGMC DB number	Location	Type of groundwater	Water aquifer	Use of the site	Accepted stocks	Water protection zones	Status
Salacgrīva No 612660	Salacgrīva, Limbazi region	freshwater	D2pr	Salacgrīva centralised water supply	Category A – 400 m ³ /day	Strict regime - 10 m, bacteriological - not required, chemical (area) - 164 ha (zone of influence)	operational

Site and its LVGMC DB number	Location	Type of groundwater	Water aquifer	Use of the site	Accepted stocks	Water protection zones	Status
Salacgrīva - right bank No 612663	Ostas iela 1 and Transporta iela 16, on the right bank of the Salaca River	freshwater	D2pr	Drinking water production, decentralised water supply (for the company "Brīvais vilnis" AS, as well as for individual residential water supply)	Category A – 849 m3/day	Strict protection zone - 10 m, bacteriological - not required, chemical - 36.65 ha	operational

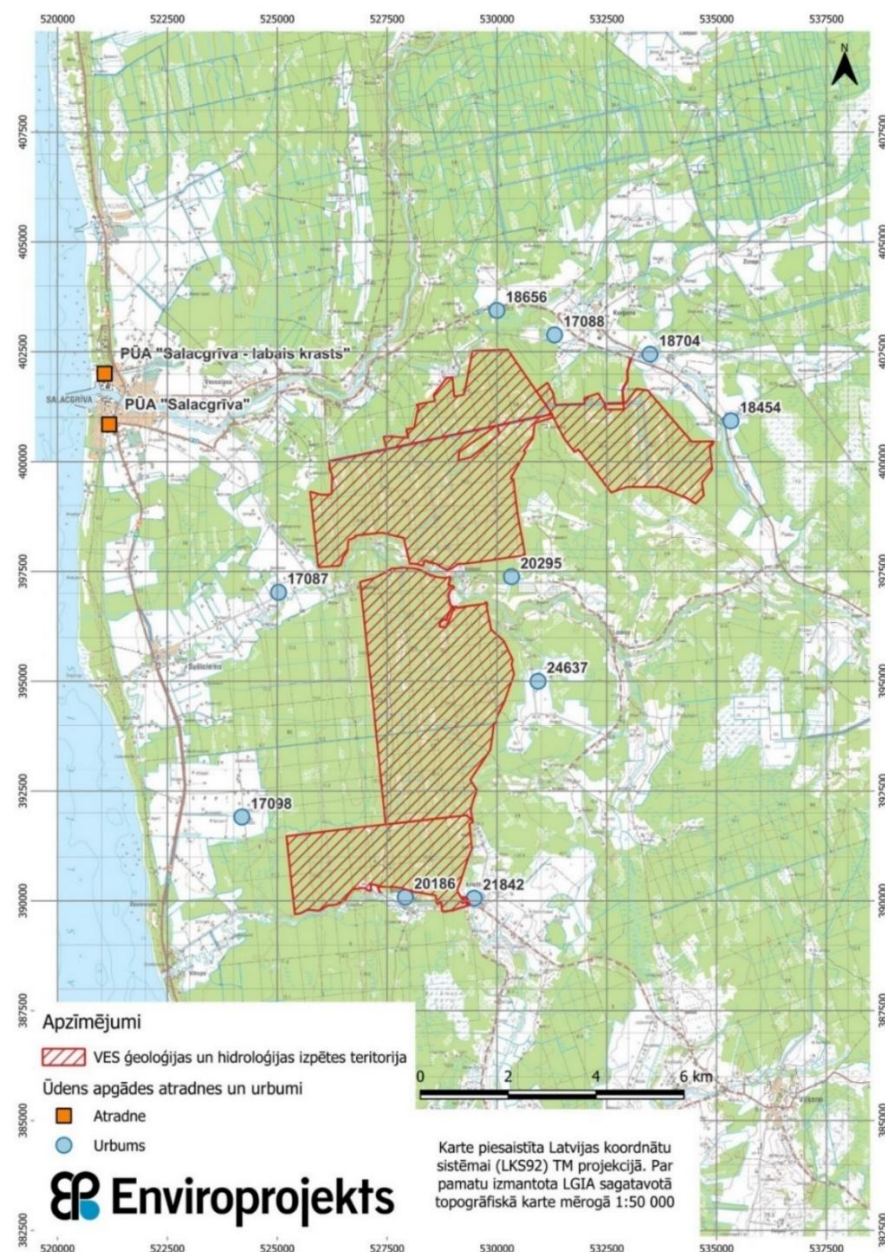


Figure 6.12.1. Water supply boreholes and underground water deposits in the vicinity of the proposed action area

6.12.2. Mining sites

There are 3 LVM sand deposits "Stienūži IV", "Stienūži V" and "Kūlaurga" in the territory of the WPP Park (Figure 6.12.2), where sand extraction takes place. The sand deposits "Stienūži IV" and "Stienūži V" are located in the northern part of the town of Stienūži. with cadastral No 6672 008 0069, sand deposit 'Kūlaurga' - z.v. with cadastral No 6672 008 0070. Table 6.12.3 summarises the mineral reserves and extraction volumes in the sand deposits over the last 3 years.

Table 6.12.3. Sand deposits in the area of operation

Name	Year of start of development	Category	Remaining stocks on 1 January 2023, thous. tonnes	Extraction volume, thous. tonnes		
				2020.g.	2021.g.	2022.g.
Stienūži IV (B2068)	2004	A	58,48	2,38	0	0
Stienūži V (B2788)	2015.	A	398,57	0,25	1,73	2,36
Kūlaurga (B2515)	2013	N	229,19	2,0	5,89	3,95

The land unit with cadastral No 6672 005 0195 contains two peat deposits of high type - "Purmaļu" (peat fund No 1081, deposit area 62 ha) and "Niedrāju" (peat fund No. 1084, deposit area 88 ha). Peat reserves have not been accepted and no peat extraction is taking place.

In the vicinity of the proposed WPP, peat extraction has only taken place at the "Lielais Ērgļu bog" deposit in Pāle municipality, located approximately 5.5 km east of the proposed area of operation (Figure 6.12.2).

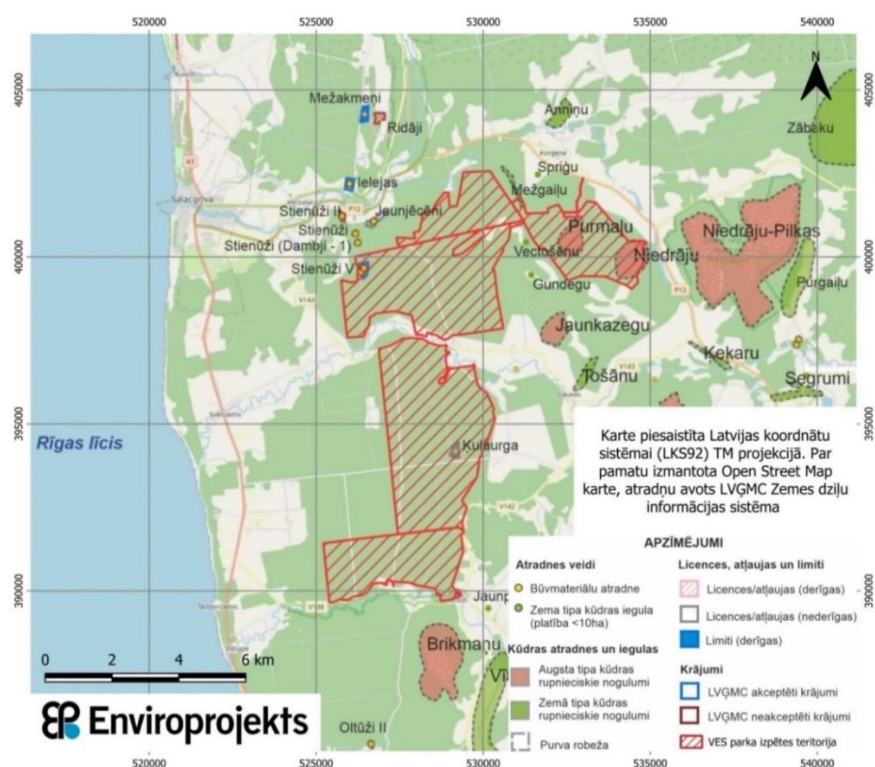


Figure 6.12.2. Deposits in the vicinity of the area of operation (based on Open Street Map, source of deposits LVGMC Deep Earth Information System¹⁸⁴)

¹⁸⁴ <https://videscentrs.lv/mc/iebuve/zemes-dzilu-informacijas-sistema>

7. ASSESSMENT OF THE SIGNIFICANT ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION AND POSSIBLE ALTERNATIVES

DIRECTIVE (EU) 2023/2413 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL sets the EU the target of becoming climate neutral by 2050 at the latest and an interim target of reducing net GHG emissions by at least 55 % below 1990 levels by 2030. Achieving climate neutrality requires an energy transition, increased energy efficiency and a significantly higher share of renewable energy in an integrated energy system.

Renewable energy, including wind energy, has an important role to play in achieving these goals. The transition to an economy based on renewable energy will contribute to achieving the objectives of Decision (EU) 2022/591 of the European Parliament and of the Council: to protect, restore and enhance the environment, inter alia by halting and reversing biodiversity loss. Compared to fossil fuels, renewable energy is less exposed to potential price impacts and can therefore play an important role in the fight against energy poverty. Renewable energy can also bring wide-ranging socio-economic benefits, creating new jobs and boosting local industries, while taking into account the growing domestic and global demand for renewable energy technologies. The EU targets a share of at least 32% of gross final energy consumption from renewable energy sources by 2030.

According to EU Directive 2023/2413, the planning, construction and operation of renewable energy installations, including WPPs, their connection to the grid and the associated network and storage assets themselves are of overriding public interest and serve public health and safety, in order to promote the use of renewable energy (RES). The implementation of RES projects is a prerequisite for achieving the EU and Latvian climate goals.

The general situation, influenced by the Russian invasion of Ukraine and the effects of the Covid-19 pandemic, has led to energy prices rising across the EU. Achieving the long-term goal of an energy system independent of third countries requires a focus on accelerating the green transformation and ensuring an energy policy that reduces emissions, reduces dependence on imported fossil fuels and promotes affordable prices for EU citizens and businesses in all sectors of the economy.

Directive (EU) 2018/2001 streamlines the requirements to simplify the administrative authorisation procedures for renewable energy installations by introducing rules on the organisation and maximum duration of the administrative phase of the authorisation procedure for renewable energy projects, covering all relevant authorisations for the construction, capacity renewal and operation of renewable energy installations, as well as for the connection of such installations to the grid. Some of the most common problems faced by renewable energy project developers are related to complex and lengthy administrative, permitting and grid connection procedures. State and local authorities do not have the staff and technical expertise to assess the environmental impact of proposed projects. It is therefore desirable to streamline certain environmental aspects of the authorisation procedure.

Member States should support the accelerated development of renewable energy projects by identifying and defining, in cooperation with local and regional authorities, land, surface, underground and marine or inland water areas required for the installation of renewable energy plants for the production of energy from renewable sources and related infrastructure to ensure the achievement of the 2030 renewable energy target and to support the achievement of the climate neutrality target by 2050 at the latest in accordance with Regulation (EU) 2021/1119.

A detailed description of the construction process for the planned WPPs is provided in Chapters 4.3 and 4.3 of the report. The construction process is divided into the following stages:

- site preparation;
- construction of access roads and squares

- realigning drainage systems;
- construction of utilities;
- WPP foundation construction;
- WPP supply;
- WPP installation;
- site reclamation.

The assessment of the construction process has identified the following potential negative impacts on the environment and society during construction:

- road traffic restrictions;
- impact on drainage and drainage systems
- contamination of soil and groundwater
- increasing air pollution
- increase in noise pollution

The proposed action does not require the reconstruction of sections of national roads. The adequacy of the pavement of the roads owned by the municipalities will have to be checked and, if necessary (which will certainly be the case for at least part of the route), reinforced according to the requirements of the WPP manufacturers: access roads must be approximately 5.5 m wide (depending on the turbine model chosen, width may vary) and have a bearing capacity of more than 250 kN/m² (achieved with gravel-crushed stone pavement, nominal pavement thickness 600-800 mm).

Unauthorised access to construction sites and material storage areas will be restricted. Such restrictions are imposed on all construction sites and are necessary for the safety of persons. The restrictions will only affect construction sites and temporary storage areas for materials on the Proposed Development's property, and therefore their disturbance to the public is not a consideration.

During construction activities in the area of the Proposed Action, spills of fuel or lubricants from construction equipment could lead to contamination of the ground or groundwater. Sites for temporary storage of equipment and materials and WPP construction sites are more likely to be contaminated. However, such pollution should not occur, and in any case should be negligible, if the construction works are organised in a way that ensures that the equipment and machinery used are in good working order: it is comparable to the pollution caused by agricultural machinery on cultivated land, which is also not excluded.

There is no reason to expect that antiquities will be found in the area of the Proposed Operation, however, in such an event, construction activities will be suspended and all necessary procedures will be undertaken to ensure that the finds are properly removed and handed over to the State. The possibility of finding unknown burial sites of the fallen in World Wars in Latvia can never be ruled out. Again, the proper procedures for reburial of the deceased will be carried out (most likely by the soldiers' search party "Legenda").

However, the Law on the Protection of Cultural Monuments, which states that natural and legal persons who discover archaeological or other objects of cultural and historical value as a result of their economic activities must immediately notify the National Heritage Board and temporarily suspend further works, must be taken into account.

Construction equipment and transport will cause insignificant, local, temporary and episodic noise and air pollution. At present, it is not possible to accurately predict the number of machinery units to be used during the construction process and their working hours in certain areas, so it is not possible to make detailed estimates of air and noise pollution during the construction process, but the small scale and limited time of the construction works and the absence of residential development in the vicinity mean

that these transient disturbances are not worth assessing as they cannot lead to any conclusions on unacceptable impacts and necessary restrictions.

Overall, the impacts arising from the construction process are assessed as insignificant and are considered to be temporary interference with certain activities and insignificant harm to the environment and society.

Once the WPPs are built, they will be operated in accordance with procedures developed and approved by the WPP operating company, based on the operating rules developed by the WPP manufacturers. WPPs, like any other equipment, must be operated in accordance with the manufacturers' rules, observing safety requirements, carrying out timely maintenance and replacing plant parts and equipment that are no longer usable.

All waste arising from the construction and operation of the WPP and its management arrangements will be transferred for future management to companies that have obtained permits for the management of that type of waste. This will have no negative impact on the environment.

7.1. Total deforested area

The exact size of the total deforested area will be determined during the construction design phase, and the maximum possible area will be estimated during the EIA.

The calculations in this chapter are for the potential WPPs to be built, corresponding to the WPP Limbaži location alternative A with 12 WPPs and location alternative B with 20 WPPs.

It is envisaged that during the public consultation of the EIA report, the WPPs that are currently recommended for construction may be refined, taking into account the proposals submitted by the public and other institutions and the results of the public consultation. In the updated version of the EIA report, which will be submitted to the NEB for its opinion, the calculation of the total deforested area will be updated according to the number of recommended WPPs.

The approximate area to be deforested if the recommended alternative A is implemented will be up to 46.64 ha. Of which approximately 1/3 will be young stands, middle-aged stands and mature stands, see calculations in Table 7.1.1. 6 % of deforested areas are currently clear-cut.

However, if the recommended alternative B is implemented, the deforested area will be up to 69.05 ha. Of these, young stands account for about 30 %, middle-aged stands for 34% and mature stands for 25 %, see calculations in Table 7.1.2. 4 % of deforested areas are currently clear-cut.

The estimated area to be deforested is a maximum, which will be refined during the design process and will be considerably smaller because, for example, the cables will be laid on one side of the road instead of both sides, which will be refined in the design. There will be sections where the punch-through method will change the side of the road or avoid other obstacles.

Table 7.1.1. Total deforested area under Alternative A

Alternative A							TOTAL (ha)
	New yield (ha)	Middle- aged stand (ha)	Briestaudze (ha)	Growing stand (ha)	Overgrown stand (ha)	Deforestation (ha)	
Total	11,80	16,36	14,76	0,73	0,24	2,75	46,64
%	25,30	35,08	31,65	1,57	0,50	5,90	

Table 7.1.2. Total deforested area under Alternative B

Alternative B							TOTAL (ha)
	New yield (ha)	Middle-aged stand (ha)	Briestaudze (ha)	Growing stand (ha)	Overgrown stand (ha)	Deforestation (ha)	
Total	20,41	23,42	16,98	2,75	2,45	3,04	69,05
%	29,56	33,91	24,60	3,98	3,55	4,40	

According to the Central Statistical Office, in 2024 there will be 3 607 thousand ha of forest land in Latvia¹⁸⁵, so the area deforested by Ltd Latvijas vēja parki for the WPP park Limbaži in alternative A will be approximately 0.0013 %, while in alternative B approximately 0.0019 % of the total forest area in Latvia. The impact is assessed as not significant.

More detailed information on the deforestation areas required for the construction of maintenance yards per WPP and for the recommended construction of Alternatives A and B, based on currently feasible calculations, is summarised in Tables 7.1.3 and 7.1.4.

The required deforestation areas for the construction of new roads for one WPP and for the recommended alternatives A and B, based on currently feasible calculations, are summarised in Tables 7.1.5 and 7.1.6. 7.tables 1.7 and 7.1.8 provide comparative information on deforested areas for turning extensions to existing roads.

Table 7.1.3. Area to be deforested for the construction of WPP maintenance yards under Alternative A

WPP No.	Forest land use and age groups in the area of the assembly site to be transformed (incl. access roads, turns in the assembly site), ha (Alternative A)						Area to be deforested, ha
	Excerpt	Age group					
		Young	Middle-aged stand	Briest-audze	A mature grove	Overgrown stand	
Z1	0	1,374	1,228	0	0	0	2,602
Z2	0	0	1,13927	1,46277	0	0	2,60204
Z3	0	0,95274	0,46698	1,01599	0,16633	0	2,60204
Z4	0	1,05227	1,27617	0,27361	0	0	2,60205
Z5	0	1,38434	0,69587	0,52159	0,00022	0	2,60202
Z6	0	0	0,718	1,884	0	0	2,602
Z9	0	0,70868	0,13081	1,63911	0	0,12343	2,60203
Z10	0,92547	1,67656	0	0	0	0	2,60203
Z12	0	0,1665	2,43553	0	0	0	2,60203
Z13	0	0	2,01286	0,58918	0	0	2,60204
Z16	0	0	2,138	0,463	0	0	2,601
Z17	0	1,414	0,573	0,595	0,02	0	2,602
Total	0,92547	8,72909	12,81449	8,44425	0,18655	0,12343	31,22328

¹⁸⁵https://data.stat.gov.lv/pxweb/lv/OSP_PUB/START_NOZ_ME_MEP/MEM010/table/tableViewLayout1/

Table 7.1.4. Area to be set aside for the construction of WPP maintenance yards under Alternative B

WPP No.	Forest land use and age groups in the area of the assembly site to be transformed (incl. access roads, turns in the assembly site), ha (alternative B)						Area to be deforested, ha
	Excerpt	Age group					
		Young	Middle-aged stand	Briest-audze	A mature grove	Overgrown stand	
D3	0	1,18367	1,28441	0	0,13396	0	2,60204
D4	0	0,43511	0	0	0,00449	2,16245	2,60205
D8	0	1,66121	0	0,94082	0	0	2,60203
D9	0	0	2,60203	0	0	0	2,60203
D10	0	2,57791	0,00225	0,02186	0	0	2,60202
D11	0	0,55977	2,04225	0	0	0	2,60202
D13	0,28921	0	0,76499	0	1,54783	0	2,60203
D14	0	0,82579	1,34643	0,17978	0,25004	0	2,60204
Z1	0	1,374	1,228	0	0	0	2,602
Z2	0	0	1,13927	1,46277	0	0	2,60204
Z3	0	0,95274	0,46698	1,01599	0,16633	0	2,60204
Z4	0	1,05227	1,27617	0,27361	0	0	2,60205
Z5	0	1,38434	0,69587	0,52159	0,00022	0	2,60202
Z6	0	0	0,718	1,884	0	0	2,602
Z9	0	0,70868	0,13081	1,63911	0	0,12343	2,60203
Z10	0,92547	1,67656	0	0	0	0	2,60203
Z12	0	0,1665	1,86064	0,57489	0	0	2,60203
Z13	0	0	1,31179	1,29025	0	0	2,60204
Z16	0	0,414	2,187	0	0	0	2,601
Z17	0	1,414	0,573	0,595	0,02	0	2,602
Total	1,21468	16,38655	19,62989	10,39967	2,12287	2,28588	52,03954

Table 7.1.5. Area to be deforested for the construction of new access roads under Alternative A

WPP No.	New access roads to be built, m	Forest land use and age group of new roads to be built area of land to be transformed, ha (alternative A)						Area to be deforested, ha
		Excerpt	Age group					
			Young	Middle-aged stand	Briest-audze	A mature grove	Overgrown stand	
Z1	134,082	0	0,001	0,032	0	0	0	0,033
Z2	95,832	0	0	0,035	0	0	0	0,035
Z3	63,622	0	0,063	0	0	0	0	0,063
Z4	97,412	0	0,108	0	0	0	0	0,108
Z5	322,607	0	0	0	0,213	0	0	0,213
Z6	75,076	0	0	0,045	0	0	0	0,045
Z9	38,761	0	0	0	0	0	0	0
Z10	78,557	0,066	0	0	0	0	0	0,066
Z12	27,245	0	0	0,028	0	0	0	0,028

WPP No.	New access roads to be built, m	Forest land use and age group of new roads to be built area of land to be transformed, ha (alternative A)						Area to be deforested, ha
		Excerpt	Age group					
			Young	Middle-aged stand	Briest-audze	A mature grove	Overgrown stand	
Z13	88,124	0	0	0	0,092	0	0	0,092
Z16	57,987	0	0	0,007	0,006	0	0	0,013
Z17	78,184	0,059	0,041	0	0	0	0	0,1
substation	3140,343	1,319	1,707	1,858	2,608	0,184	0	7,676
Total	4297,832	1,444	2,462	3,516	0,484	0,21	0,356	8,472

Table 7.1.6. Area to be deforested for the construction of new access roads under Alternative B

WPP No.	New access roads to be built, m	Forest land use and age group of new roads to be built area of land to be transformed, ha (alternative B)						Area to be deforested, ha
		Excerpt	Age group					
			Young	Middle-aged stand	Briest-audze	A mature grove	Overgrown stand	
D3	74,91	0	0	0	0	0	0	0
D4	88,992	0	0	0	0	0	0,084	0,084
D8	135,085	0	0,195	0	0	0	0	0,195
D9	78,819	0	0	0,054	0	0	0	0,054
D10	310,327	0	0,605	0	0,001	0	0,02	0,626
D11	58,627	0	0	0,02	0	0	0	0,02
D13	64,304	0	0	0,033	0	0	0	0,033
D14	481,56	0	0,175	0	0,228	0,176	0	0,579
Z1	134,082	0	0,001	0,032	0	0	0	0,033
Z2	95,832	0	0	0,035	0	0	0	0,035
Z3	63,622	0	0,063	0	0	0	0	0,063
Z4	97,412	0	0,108	0	0	0	0	0,108
Z5	322,607	0	0	0	0,213	0	0	0,213
Z6	75,076	0	0	0,045	0	0	0	0,045
Z9	38,761	0	0	0	0	0	0	0
Z10	78,557	0,066	0	0	0	0	0	0,066
Z12	27,245	0	0	0,028	0	0	0	0,028
Z13	88,124	0	0	0	0,092	0	0	0,092
Z16	57,987	0	0	0,007	0,006	0	0	0,013
Z17	78,184	0,059	0,041	0	0	0	0	0,1
substation	3140,343	1,319	1,708	1,858	2,754	0,038	0	7,677
Total	5590,456	1,444	2,896	2,112	3,294	0,214	0,104	10,064

Table 7.1.7. Area to be deforested for turning extensions under Alternative A

Forest land use and age groups of turning radius plots in the area to be transformed (incl. access roads in radius plots), ha (Alternative A)						Area to be deforested, ha
Excerpt	Young	Middle-aged stand	Briestaudze	A mature grove	Overgrown stand	

0,003	1,146	1,552	2,397	0,357	0,114	5,569
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Table 7.1.8. Area to be deforested for turn extensions under Alternative B

Forest land use and age groups of turning radius plots in the area to be transformed (incl. access roads in radius plots), ha (Alternative B)						Area to be deforested, ha
Excerpt	Young	Middle-aged stand	Briestaudze	A mature grove	Overgrown stand	
0,003	1,131	1,676	2,283	0,412	0,064	5,569

7.2. Changes in noise and vibration levels

7.2.1. Assessment and significance of changes in noise levels

The planned location of the WPP is a large area (about 45 km²) in the municipalities of Salacgrīva and Vilķene parish; there are about 20 farmsteads in the vicinity of the WPP park.

An overview of the noise propagation forecast is attached in Annex 7 of the EIA Report. The Nordex 175-6.8 WPP model was selected to model the noise level changes, as it has a high noise power level and very low dependence on wind speed (compared to other high noise WPP models which are more dependent on wind speed) (Table 7.2.1). Given that, on average, a statistical wind speed of 3-8 m/s (when this pattern is loudest and noise levels increase significantly) is expected 50 % of the time, while higher wind speeds (when other patterns become louder, and not significantly so) are expected only 42% of the time (Section 3.3).

Noise propagation is modelled with the three-dimensional noise propagation prediction licensed software "SoundPLAN 9.1", Braunstein+Berndt GmbH / SoundPLAN LLC, November 2023 update (doc. No ID1038/05 of 18.09.2005, user No 10578 HL4496), which ensures the calculation of noise indicators in accordance with the provisions of the Cabinet of Ministers of the Republic of Latvia No. 16 "Noise assessment and management procedures".

In accordance with the Cabinet of Ministers of the Republic of Latvia Regulation No. 16 'Noise Assessment and Management Procedures', Annex 1, paragraph 5, the input data for the calculation models produced by the noise calculation software used are attached as Annex 7 to the EIA report.

The WPP as a noise source is modelled as a point source at the gondola height (hub height) according to the sound pressure specified in the WPP Noise Technical Specification: the technical specification takes into account that the WPP generates noise not only in the nacelle but also in the entire wing sweep, which is much lower than the nacelle in the lower position (less noise reaching the ground) and much higher than the nacelle in the upper position (less noise reaching the ground), and is therefore averaged at the nacelle height.

Table 7.2.1. Comparison of noise levels of three WPP models as a function of wind speed

Wind speed, m/s WPP model	3	4	5	6	7	8	9	>10
Vestas V172-7.2 dB	97,8	97,8	98,4	101,8	105,4	108,8	110,1	110,1
Nordex 175-6.8 dB	98,2	102,4	107,3	108,9	108,9	108,9	108,9	108,9
Nordex 163-6.8 dB	97,5	97,5	97,5	100,8	100,8	105,7	109,2	109,2

The noise levels from the WPPs have been modelled for the whole calendar year, for both planned WPP siting alternatives. The modelling was carried out taking into account the prevailing wind direction, speed and associated noise power of the WPP, with daily average wind speeds showing no statistically significant differences between day, evening and night (Table 7.2.2), resulting in noise maps showing the constant

noise level at all times of the day, and applying the nighttime thresholds, which are the lowest, to the assessment. Under the regulations, the limit values for ambient noise are set at annual average noise levels. The values of the noise indicators are plotted in increments of 5 dB(A). Noise performance was assessed at 4 m above ground level.

Table 7.2.2. *Ambient noise limits for industrial sites in functional zones with the specified permitted land uses in accordance with MC No 16*

No.	Land use function	Noise limit values		
		Lday (dB(A))	Levening (dB(A))	Lnight (dB(A))
1.	Territory for individual (detached, low-rise or farmstead) dwelling houses, children's institutions, medical, health and social care institutions	55	50	45
2.	Multi-storey residential area	60	55	50
3.	Public buildings territory (territory of public and administrative facilities, including cultural institutions, educational and scientific institutions, state and municipal administrative institutions and hotels) (with residential buildings)	60	55	55
4.	Mixed development territory, including the territory of commercial and service buildings (with residential development)	65	60	55
5.	Quiet neighbourhoods in urban areas	50	45	40

Noise propagation has been modelled for both alternatives, where B fully includes A. For sub-alternatives A' and B', the only difference between which is the increased mast height of part of the WPP, noise propagation has not been modelled separately, as the higher mast reduces the noise level from the WPP operation in the built-up area near the ground by about 1 dB. An increase in wind speed of about 0.2 m/s for every 25 m of altitude does not practically increase the noise level. The main alternatives are therefore slightly louder than the sub-alternatives, but this difference is less than 1 dB (see Annex 7) and is considered to be insignificant and only noise-reducing compared to the modelled alternatives.

In addition to the planned WPPs, a BESS is planned to be installed in the south-eastern part of the WPP Park, as described in Chapter 4.4 of the EIA Report, and the noise from these installations is also included in the noise modelling. The batteries themselves do not make noise, but the ancillary HVAC equipment associated with the BESS does.

Noise propagation has been modelled separately for WPP without background noise, and the results have then been summed with background or traffic noise (Section 6.7) and analysed (at the end of this chapter). Since the last amendment of 3 November 2023 to Cabinet Regulation No 16 of 7 January 2014 "Procedures for the assessment and management of noise", which increased the threshold values for traffic noise, there has been no methodology for comparing the cumulative noise from different noise sources with different threshold values, such as the WPP + motorways in the case of this project, and therefore no threshold values for the cumulative noise.

Separately, infrasound is not considered in this prediction because according to the standard LVS ISO 389-7:2007 "On thresholds for assistive listening", hearing sensitivity in this range (below 20 Hz) is more than 60 dB lower than in the basic hearing range (160-14000 Hz). In addition, according to LVS ISO 1996-2:2018 "Acoustics. Ambient noise characterisation, measurement and assessment. 2. part: For the purposes of paragraph 10.4 of the 'Determination of sound pressure level', if the difference between two noise sources is greater than 10 dB, the noise contributing to the cumulative noise shall be the greater of the two and the contribution of the lesser shall be negligible. In this case, when the difference between a person's hearing sensitivity (sound perception level) in the infrasound range and in the basic hearing range is about 60 dB, this part of the noise (infrasound) cannot be perceived. The noise spectrum of the WPP model also includes most of the infrasound: 6.3-20 Hz.

7.figure 2.1 provides a noise propagation map for Alternative B with 20 WPPs, which also includes Alternative A with 12 WPPs.

No potential problems with exceedances of noise limits are expected as a result of the noise calculations: five conclusions are listed below.

1. In the existing situation, the noise level (traffic noise only) fully complies with the Cabinet Regulation No 16 of 7 January 2014 "Noise assessment and management procedures" (Table 7.2.2): the traffic noise limit values are not exceeded (and the low traffic noise does not reach the noise limit values for industrial sites);
2. In the existing situation (traffic noise), all farmsteads meet the WHO guidelines for road traffic noise, recommended daily LDV values < 53 dBA¹⁸⁶ (Table 7.2.3)
3. Calculation of the noise level at night with 12 WPPs in operation together with 2 BESS and AST units (Alternative A): compliance with the permissible noise level in the homestead areas at all times of the day (see Table 7.2.4) is ensured, in accordance with the Regulation of the Cabinet of Ministers No 16 of 7 January 2014 "Noise Assessment and Management Procedure".
4. Calculation of the noise level at night when operating 20 WPP with 2 BESS and AST units (Alternative B): compliance with the permissible noise level in the homestead areas at all times of the day (see Table 7.2.5), in accordance with the Regulation of the Cabinet of Ministers No 16 of 7 January 2014 "Noise Assessment and Management Procedure".
5. In some homestead areas (Alternative B, measuring points 1, 6, 7), the WHO guidelines for WPP noise do not meet the recommended daily_{LDV} value of <45 dBA¹⁸⁷.

In order to comply with the daily_{ADI} values recommended in the WHO guidelines, Alternative B for WPP D8 includes mitigation measures: select WPP models with noise emissions that comply with the WHO recommendations, install WPPs with the lowest possible noise emissions or aerodynamically improved wings.

¹⁸⁶ <https://www.who.int/publications/i/item/WHO-HEP-ECH-EHD-22.01>

¹⁸⁷ Ibid,

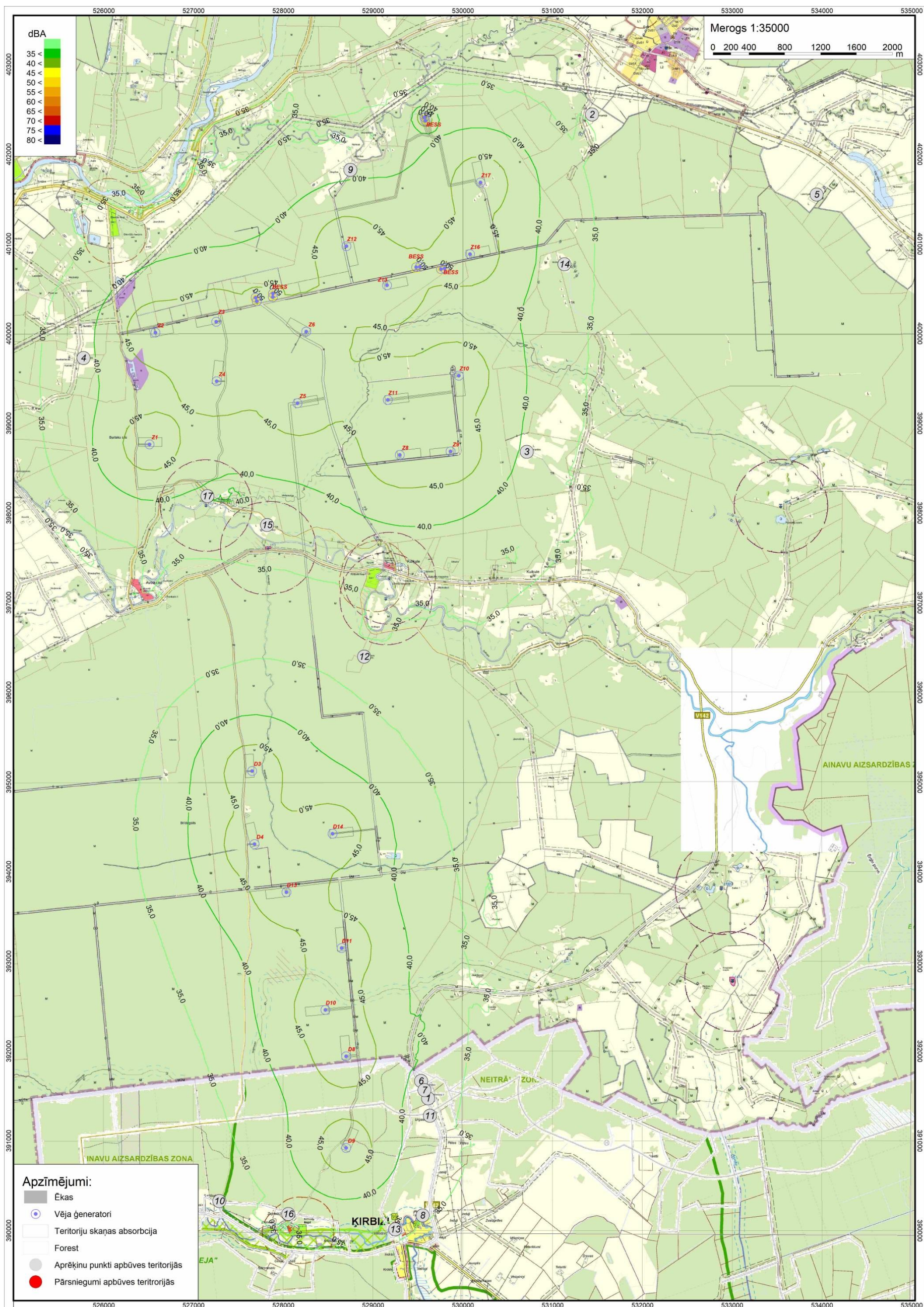


Figure 7.2.1. Long-term indicator for noise from WPPs Day, Evening, Night: Alternative B with 20 WPP

Table 7.2.3. Long-term existing (road) noise at night_{Night} in farmstead areas

Designation of calculation points on the map	Designation of calculation points for built-up areas, characteristic of the area	Height of calculation point above site, m	Long-term ambient noise level, L day dBA	Long-term ambient noise indicator level, L evening dBA	Long-term ambient noise indicator level, L night dBA	Limit value for the long-term environmental noise indicator LR MK Nr.016, L day	Difference of the level of the environmental noise indicator L Day compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L evening	Difference of the evening level of the environmental noise indicator L with respect to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L night	Difference of nighttime ambient noise level L compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Calculated value of the ambient noise indicator _{LDVN} dBA
1.	Akmentīni, Vilķenes pag.	4	51	49	43	65	-14	60	-11	55	-12	52
2.	Jaunsprīģi, Salacgrīva municipality	4	28	26	20	65	-37	60	-34	55	-35	29
3.	Kardes, Salacgrīva par.	4	9	6	1	65	-56	60	-54	55	-54	10
4.	Krusteīči, Salacgrīva par.	4	13	10	5	65	-52	60	-50	55	-50	14
5.	Lakstīgalas, Salacgrīva pag.	4	34	31	26	65	-31	60	-29	55	-29	35
6.	Lauri, Vilķenes pag.	4	48	45	40	65	-17	60	-15	55	-15	49
7.	Pietes, Vilķenes pag.	4	50	47	42	65	-15	60	-13	55	-13	51
8.	Plūdumi, Vilķenes pag.	4	35	32	27	65	-30	60	-28	55	-28	36
9.	Silupītes, Salacgrīva par.	4	18	15	10	65	-47	60	-45	55	-45	19
10.	Smilškalni, Vilķenes pag.	4	29	27	21	65	-36	60	-33	55	-34	30

Designation of calculation points on the map	Designation of calculation points for built-up areas, characteristic of the area	Height of calculation point above site, m	Long-term ambient noise level, L day dBA	Long-term ambient noise indicator level, L evening dBA	Long-term ambient noise indicator level, L night dBA	Limit value for the long-term environmental noise indicator LR MK Nr.016, L day	Difference of the level of the environmental noise indicator L Day compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L evening	Difference of the evening level of the environmental noise indicator L with respect to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L night	Difference of nighttime ambient noise level L compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Calculated value of the ambient noise indicator _{LDVN} dBA
11.	Urgaskalni, Vilkenes pag.	4	40	38	32	65	-25	60	-22	55	-23	41
12.	Vālodzes, Vilkenes pag.	4	23	21	16	65	-42	60	-39	55	-39	25
13.	Vectošēni, Salacgrīva par.	4	5	2	-3	65	-60	60	-58	55	-58	6
14.	Vējiņi, Salacgrīva par.	4	22	19	15	65	-43	60	-41	55	-40	24
15.	Zaļmeži 2, Vilkenes pag.	5	23	20	15	65	-42	60	-40	55	-40	24
16.	Zvaigznes Salacgrīva municipality	6	13	10	5	65	-53	60	-50	55	-50	14

Table 7.2.4. Long-term WPP noise at night in the L_{night} homestead areas: Alternative A with 12 WPP.

Designation of calculation points on the map	Designation of calculation points for built-up areas, characteristic of the area	Height of calculation point above site, m	Long-term ambient noise level, L day dBA	Long-term ambient noise indicator level, L evening dBA	Long-term ambient noise indicator level, L night dBA	Limit value for the long-term environmental noise indicator LR MK Nr.016, L day	Difference of the level of the environmental noise indicator L day compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L evening	Difference of the evening level of the environmental noise indicator L with respect to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L night	Difference of nighttime ambient noise level L compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Calculated value of the ambient noise indicator L_{DVN} dBA
1.	Akmentīni, Vilķenes pag.	4	0	0	0	55	-55	50	-50	45	-45	6
2.	Jaunsprīgi, Salacgrīva municipality	4	34	34	34	55	-21	50	-16	45	-11	41
3.	Kardes, Salacgrīva par.	4	38	38	38	55	-17	50	-12	45	-7	44
4.	Krusteīči, Salacgrīva par.	4	39	39	39	55	-16	50	-11	45	-6	45
5.	Lakstīgalas, Salacgrīva pag.	4	25	25	25	55	-30	50	-25	45	-20	32
6.	Lauri, Vilķenes pag.	4	0	0	0	55	-55	50	-50	45	-45	6
7.	Pietes, Vilķenes pag.	4	0	0	0	55	-55	50	-50	45	-45	6
8.	Plūdumi, Vilķenes pag.	4	0	0	0	55	-55	50	-50	45	-45	6
9.	Silupītes, Salacgrīva par.	4	39	39	39	55	-16	50	-11	45	-6	45
10.	Smilškalni, Vilķenes pag.	4	0	0	0	55	-55	50	-50	45	-45	6

Designation of calculation points on the map	Designation of calculation points for built-up areas, characteristic of the area	Height of calculation point above site, m	Long-term ambient noise level, L day dBA	Long-term ambient noise indicator level, L evening dBA	Long-term ambient noise indicator level, L night dBA	Limit value for the long-term environmental noise indicator LR MK Nr.016, L day	Difference of the level of the environmental noise indicator L day compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L evening	Difference of the evening level of the environmental noise indicator L with respect to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L night	Difference of nighttime ambient noise level L compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Calculated value of the ambient noise indicator _{LDVN} dBA
11.	Urgaskalni, Vilķenes pag.	4	0	0	0	55	-55	50	-50	45	-45	6
12.	Vālodzes, Vilķenes pag.	4	0	0	0	55	-55	50	-50	45	-45	6
13.	Vectošēni, Salacgrīva par.	4	35	35	35	55	-20	50	-15	45	-10	42
14.	Vējiņi, Salacgrīva par.	4	38	38	38	55	-17	50	-12	45	-7	44
15.	Zaļmeži 2, Vilķenes pag.	5	0	0	0	55	-55	50	-50	45	-45	6

Table 7.2.5. Long-term indicator of WPP noise at night in the_{Lnight} homestead areas: Alternative B with 20 WPP

Designation of calculation points on the map	Designation of calculation points for built-up areas, characteristic of the area	Height of calculation point above site, m	Long-term ambient noise level, L day dBA	Long-term ambient noise indicator level, L evening dBA	Long-term ambient noise indicator level, L night dBA	Limit value for the long-term environmental noise indicator LR MK Nr.016, L day	Difference of the level of the environmental noise indicator L day compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L evening	Difference of the evening level of the environmental noise indicator L with respect to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L night	Difference of nighttime ambient noise level L compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Calculated value of the ambient noise indicator _{LDVN} dBA
1.	Akmentīni, Vilķenes pag.	4	39	39	39	55	-16	50	-11	45	-6	46
2.	Jaunsprīģi, Salacgrīva municipality	4	34	34	34	55	-21	50	-16	45	-11	41
3.	Kardes, Salacgrīva par.	4	38	38	38	55	-17	50	-12	45	-7	45
4.	Krusteīči, Salacgrīva par.	4	39	39	39	55	-16	50	-11	45	-6	45
5.	Lakstīgalas, Salacgrīva pag.	4	25	25	25	55	-30	50	-25	45	-20	32
6.	Lauri, Vilķenes pag.	4	40	40	40	55	-15	50	-10	45	-5	46
7.	Pietes, Vilķenes pag.	4	40	40	40	55	-15	50	-10	45	-5	46
8.	Plūdumi, Vilķenes pag.	4	34	34	34	55	-21	50	-16	45	-11	41
9.	Silupītes, Salacgrīva par.	4	39	39	39	55	-16	50	-11	45	-6	45
10.	Smilškalni, Vilķenes pag.	4	34	34	34	55	-21	50	-16	45	-11	40

Designation of calculation points on the map	Designation of calculation points for built-up areas, characteristic of the area	Height of calculation point above site, m	Long-term ambient noise level, L day dBA	Long-term ambient noise indicator level, L evening dBA	Long-term ambient noise indicator level, L night dBA	Limit value for the long-term environmental noise indicator LR MK Nr.016, L day	Difference of the level of the environmental noise indicator L day compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L evening	Difference of the evening level of the environmental noise indicator L with respect to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Limit value for the long-term environmental noise indicator LR MK Nr.016, L night	Difference of nighttime ambient noise level L compared to the normative limit values of the Cabinet of Ministers of the Republic of Latvia, dB	Calculated value of the ambient noise indicator _{LDVN} dBA
11.	Urgaskalni, Vilķenes pag.	4	39	39	39	55	-16	50	-11	45	-6	45
12.	Vālodzes, Vilķenes pag.	4	35	35	35	55	-20	50	-15	45	-10	41
13.	Vectošēni, Salacgrīva par.	4	35	35	35	55	-20	50	-15	45	-10	41
14.	Vējiņi, Salacgrīva par.	4	38	38	38	55	-17	50	-12	45	-7	44
15.	Zaļmeži 2, Vilķenes pag.	5	37	37	37	55	-18	50	-13	45	-8	43

7.2.2. Assessment and significance of low-frequency noise

There are no laws and regulations in Latvia that set limit values for low-frequency noise. For the assessment of low-frequency noise in this EIA, the Danish limit values and the procedure for setting them for WPP development projects have been used as a basis. The cumulative low-frequency (10-160 Hz) noise level from WPP in residential buildings must not exceed 20 dB at wind speeds of 6 m/s and 8 m/s. The predicted low-frequency noise of the WPPs has been calculated for all 37 WPPs initially assessed at the same time, fully covering the two alternatives assessed in more detail, using the WindPro software with up-to-date data from WPP manufacturers on the latest models for which low-frequency noise measurements have been made¹⁸⁸: see Annex 7. The results obtained do not exceed the Danish limit values (see Figure 7.2.2). However, these results would have no real use even if the Danish (not Latvian) thresholds were exceeded.

As discussed in the previous section, hearing sensitivity in the infrasound range (below 20 Hz) is more than 60 dB lower than in the basic hearing range (160-14000 Hz). And in accordance with LVS ISO 1996-2:2018 "Acoustics. Ambient noise characterisation, measurement and assessment. 2. part: In the case of the "Determination of sound pressure level", in relation 10.4, if the difference between two noise sources is greater than 10 dB, the noise contributing to the total noise is the greater and the lesser contribution is negligible or zero, so in this case, when the difference between the ear perception level in the infrasound range and the basic hearing range is ~60 dB instead of 10 dB, there is no possibility to perceive this part of the noise (infrasound). However, the WPP noise spectrum modelled in the previous section also includes most of the infrasound, 6.3-20 Hz, and therefore even more of the low-frequency sound: 6.3-160 Hz (only the very bottom is missing: 0-6.3 Hz), except that it is not assessed separately, but only as a minor component of the overall sound emission.

It is believed that WPP produce strong low-frequency sounds in the range inaudible to humans (infrasound), which travel long distances and do not harm health. However, *"EU and global studies show that noise from wind farms generally causes disturbance to people living near them, but there is no scientific evidence of harmful effects on human health"*¹⁸⁹. Other sources (Guidelines for the Environmental Impact Assessment of Wind Power Plants and Recommendations on Requirements for the Construction of Wind Power Plants) also confirm this: *"Several studies have shown that even lower sound pressure levels from wind farms disturb people more than higher sound pressure levels from road traffic. The pulsed nature of the sound produced by wind turbines has been cited as the main reason for this exacerbated noise perception"*.¹⁹⁰

¹⁸⁸ WindPRO 3.6.366 by EMD International A/S, SIA "Environment" licence (client) No 8797.

¹⁸⁹ <https://pubs.aip.org/asa/jasa/article-abstract/116/6/3460/545245/Perception-and-annoyance-due-to-wind-turbine-noise?redirectedFrom=fulltext>

¹⁹⁰ <https://www.vpvb.gov.lv/lv/media/827/download>

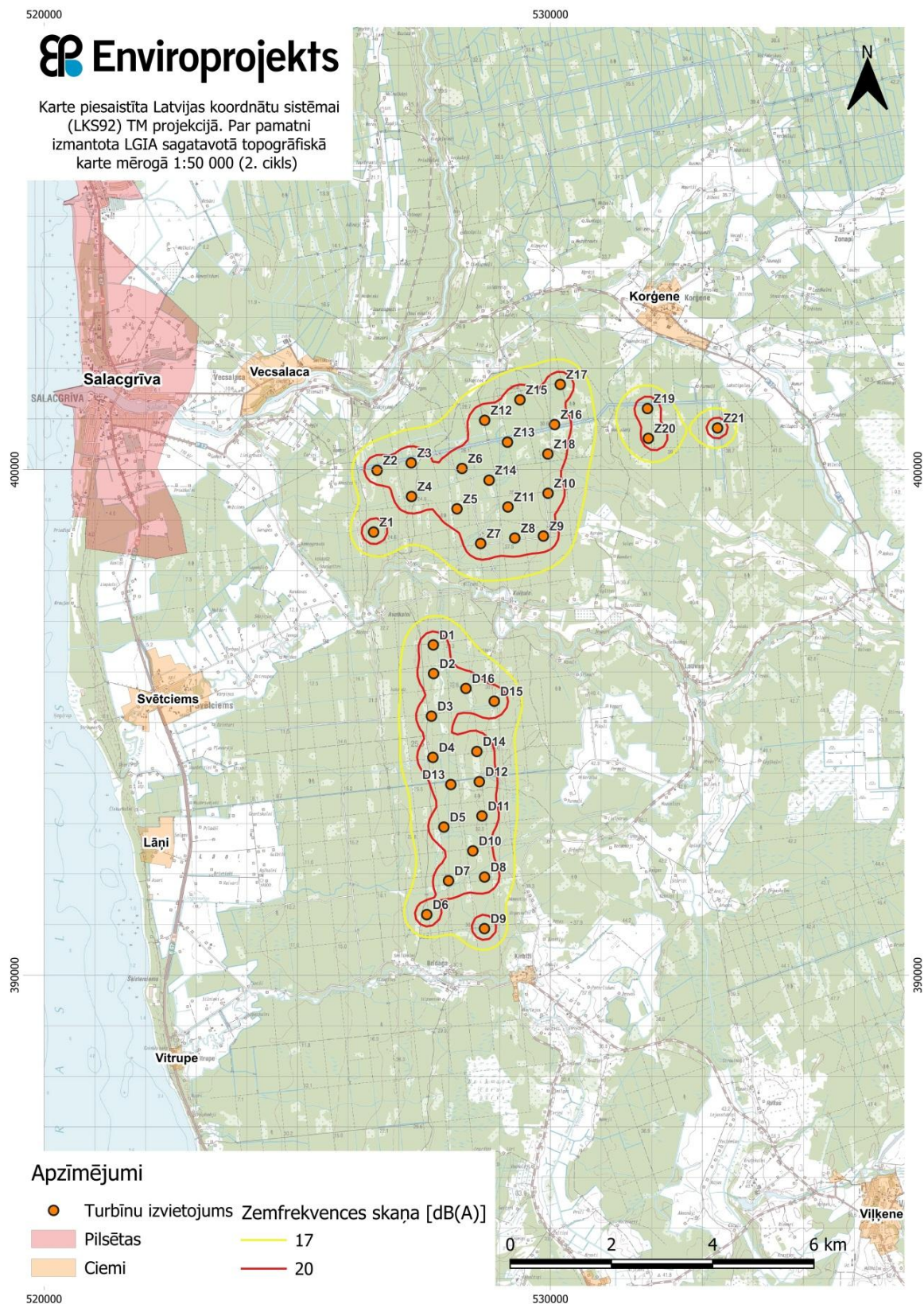


Figure 7.2.2. Long-term low-frequency noise from WPPs at night at wind speeds of 8 m/s according to the Danish methodology: all 37 WPPs initially assessed

In the "Guidelines for Environmental Impact Assessment and Recommendations on Requirements for the Construction of Wind Power Plants" it is stated that "sound pressure levels in the frequency range below 10 Hz can exceed 60 dB(A) even at a distance of 750 m from a wind power plant", quoting G.P. Van Den

Berg (2004)¹⁹¹, however, this study does not find any direct effects on people (neither health nor comfort) from this inaudible sound, but deals with a completely different issue: infrared sound, while inaudible itself, can cause vibration of building elements (such as open windows), transforming this sound into an already higher frequency audible sound, whose pressure level is negligible, although it may be slightly audible.

The literature provides information on health symptoms attributed by some people to WPPs, particularly audible noise, low frequency noise, infrasound and electromagnetic fields, but several studies link this to the *nocebo* effect, which can lead to expectations of undesirable effects or symptoms being fulfilled, as well as misattribution of existing or new symptoms to a new technology.¹⁹²

A study¹⁹³ by Finnish scientists on the potential health effects of WPP found that the infrasound they produce does not affect human health and does not cause any symptoms. The project consisted of three sub-projects: a long-term measurement campaign, surveys and listening tests. The study focused on locations where local residents reported symptoms that they themselves associated with infrared radiation from nearby WPPs. In the infrasound measurement campaign, the researchers aimed to investigate the levels and variations of infrasound inside dwellings adjacent to wind farms. On the other hand, according to the survey results, symptoms associated with WPP-emitted infrared radiation were common: ~15% of respondents living near a WPP.

Measurements in the two regions continued for 308 days. The continuous infrasound pressure levels in the residential homes were found to be 67-75 dB(A). The worst-case scenarios were then selected and used in listening tests, which divided participants into two groups based on their reports of symptoms caused by WPP infrasound: people who suffered from them and people who did not. None of the participants were able to distinguish the frequencies of the infrasound in the WPP noise, nor did the presence of infrasound make any difference to how distracting they found the WPP noise. The participants' autonomic nervous system also did not react to the infrared sound. No evidence was found on the health effects of WPP-induced infrasound.

Large national epidemiological studies on the public health effects of low-frequency noise from WPP have been carried out in Denmark, analysing the effects of WPP noise on cardiovascular disease, pregnancy and diabetes. The results of the studies have been published in 2018 at ^{194, 195, 196, 197}. These studies, which analysed public health aspects in the vicinity of all Danish WPPs (up to 40 WPP heights) where ~615 000 people lived during the reporting period, were carried out in a total area of ~650 000. The original hypotheses that noise from WPPs, including low frequencies, would have a negative impact on public health have not been confirmed. The authors note that some observations suggest that potentially higher relative risk factors could be observed in areas where the ambient noise level from the WPP is above 42 dB(A) and the indoor low-frequency noise level is above 15 dB(A).

¹⁹¹ <https://eolmernormandie.debatpublic.fr/images/documents/bibliotheque-debat/22.do-wind-turbines-produce-significant-low-frequency-sound-levels.pdf>

¹⁹² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6121031/>

¹⁹³ https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/162329/VNTEAS_2020_34.pdf?sequence=1&isAllowed=y

¹⁹⁴ A. H. Poulsen et al., Long-term exposure to wind turbine noise and redemption of antihypertensive medication: A nationwide cohort study. *Environment International* 121 (Pt.1), September 2018

¹⁹⁵ A. H. Poulsen et al., Pregnancy exposure to wind turbine noise and adverse birth outcomes : A nationwide cohort study, *Environment International* 167, September 2018

¹⁹⁶ A. H. Poulsen et al., Long-term exposure to wind turbine noise at night and risk for diabetes: A nationwide cohort study, *Environmental Research* 165, April 2018

¹⁹⁷ A. H. Poulsen et al., Short-term nighttime wind turbine noise and cardiovascular events: A nationwide case crossover study from Denmark, *Environment international* 114, March 2018

The low-frequency outdoor noise modelled in this EIA does not reach even the lowest indoor level in any of the nearby developments mentioned in all these studies: 15 dB(A).

7.2.3. Assessment and significance of changes in vibration levels

During operation, the imbalance and friction of the rotating parts cause vibrations that are undesirable not only from an environmental point of view, but above all for the operation of the WPP itself, so they are minimised in the design of the WPP. The main sources of vibration in a WPP are the generator, gearbox and bearing systems. The vibration of these rotating parts can also cause the nacelle and tower to vibrate. At high wind speeds, the level of vibration can be increased by imbalances in the WPP parts due to wind pressure and turbulent flows.

No significant effects related to vibrations from WPPs have been observed in studies to date. Studies in Canada^{198 199} indicate that vibration levels are no higher than 0.01m/s² at a distance of about 300 m from the WPP. Vibrations from WPPs have not been studied in Latvia, and relatively few studies have been carried out in other countries. Most of these studies analyse solutions to mitigate vibration from the mechanical parts of the WPP to prevent damage to the WPP due to vibration, and only a few studies analyse the impact of vibration on areas close to the WPP. The nearest country where vibration studies have been carried out is Germany.

2009. In 2009, the first guidelines in the world²⁰⁰ were approved in Germany, setting vibration limit values for the mechanical parts of WPPs. In 2010, these guidelines were updated to extend the thresholds to WPPs with a rated capacity of more than 3 MW. These guidelines and the limit values they set are taken into account by all major WPP manufacturers when developing new WPP models and by users when operating WPPs. The permissible limits for vibration velocity(*velocity*) and acceleration(*acceleration*) set by VDI 3834 are not met.

Short-term effects may arise from vibrations caused by construction machinery during construction.

WPPs do not directly generate mechanical vibrations (unlike, for example, the operation of a pneumatic hammer or road traffic on rough roads, which directly generate vibrations). However, slight vibrations may occur due to imbalance and friction of the rotating parts. The main sources of potential vibration in a WPP are the generator, gearbox and bearing systems.

Vibration velocities (mm/s) and accelerations (m/s²) at different frequencies are determined for the WPP components that generate the vibrations: bearing system, gearbox, alternator and nacelle.

A low-frequency noise and vibration study was carried out in Germany in 2013-2015²⁰¹, which, similar to Canadian studies, found that vibration levels were slightly higher than 0.01m/s² at 285 m from the WPP. The vibration level at the base of the WPP was relatively high at 1m/s², but the vibration level decreased rapidly as the WPP was moved away.

There are no laws and regulations in Latvia that regulate the level of vibration in the environment. Until 2010, Cabinet of Ministers Regulation No 341 of 25 June 2003 on permissible vibration levels in residential and public buildings (hereinafter - Cabinet of Ministers Regulation No 341) was in force. These regulations set lower vibration limits for operating theatres and wards in medical and rehabilitation facilities (night

¹⁹⁸ J. G. Hurtado et al., Field monitoring and analysis of an onshore wind turbine shallow foundation system, Geo Ottawa 2017

¹⁹⁹ W.N. Edwards, Analysis of Measured Wind Turbine Seismic Noise Generated from the Summerside Wind Farm, Prince Edward Island; Geological Survey of Canada, 2015

²⁰⁰ VDI 3834 "Messung und Beurteilung der mechanischen Schwingungen von Windenergieanlagen und deren Komponenten - Onshore Windenergieanlagen mit Getrieben, March 2009

²⁰¹ Ministerium für Umwelt, Klima und Energiewirtschaft Baden-Württemberg, 2016. Low-frequency noise incl. infrasound from wind turbines and other sources. Report on results of the measurement project 2013-2015

period), where the weighted vibration acceleration could not exceed 0.028m/s². In living areas, the weighted vibration acceleration must not exceed 0.04m/s² at night and 0.07 m/s² during the day. Comparing the permissible limit values of Cabinet Regulation No 341 with the vibration values determined in Canadian and German studies, the vibrations from WPPs already exceed the limit values set until 2010 by about 300 m from the WPP, even in operating theatres of medical institutions.

As the vibration level of the technical components of the WPP (bearings, gearbox, etc.) does not depend on the capacity of the WPP and the major WPP manufacturers follow the VDI 3834 guidelines, there is no reason to believe that the implementation of the Proposed Action by Ltd Latvijas vēja parki. will result in a higher vibration level than that specified in the former Cabinet Regulation No 341 in force in Latvia or in the above studies where the vibration level was obtained by measurements. Therefore, the proposed operation, which does not foresee any WPP within 800 m of any human dwelling, cannot by a large margin cause vibration that would disturb people. Therefore, the impact of vibration on the population is assessed as negligible.

7.3. Effects of the flicker effect

One of the impacts that is always considered to be important in assessing the impact of WPPs on social welfare is the flicker effect of WPPs. The flickering effect (also known as "disco effect" or "shadow flickering") is caused by the movement of the rotor wings as they periodically block out the sun and create moving shadows on the ground, on the surface of objects and on the person, who may experience subjective discomfort from this rhythmic alternation of sun and shadow. However, the only objective adverse effect on human health found in the literature is that for epileptics, lighting changes of 3-60 Hz can trigger epileptic seizures. Modern high-power wind rotors, however, produce much slower flicker: typically, in the range of 0.2-1 Hz.

There are no laws and regulations in Latvia that set out how the flicker effect should be assessed and limited. Similarly, in other EU countries, where flicker exposure limits are set in guidelines rather than in legislation, the reason is that flicker is recognised and defined as a nuisance, but there is no scientific evidence of its effects on public health.

In the environmental impact assessment of WPP in other countries and also in the latest Latvian guidelines²⁰², the following flicker impact target values (preferred, as they are not mandatory threshold values) have been set:

- 30 flicker hours per year if calculated using the worst-case scenario method;
- 10 flicker hours/year if calculated under a realistic scenario (Germany, Belgium and Sweden recommend a limit of 8 h/year);
- 30 minutes per day for both evaluation scenarios (clearly an unreasonable figure, as in the real scenario modelling this figure decreases by about the same amount as the number of hours per year, compared to the worst-case scenario).

These targets are very strict: 10 hours per year means ~1 min. 40 seconds per day. Such a disturbance is difficult for the exposed person to notice even if a sharply contoured shadow of a nearby WPP flickers over his house for ~1.5 minutes a day (and he stays in the room or outdoor space where the shadow falls every day during that time): it is incomparably smaller than, for example, a disturbance of air pollution or noise levels (factors with proven health risks) that is recognised by law as acceptable. However, if the flickering shadow is only present for a minor part of the days of the year, e.g. 1 month, and the duration of the

²⁰² <https://www.vpvb.gov.lv/lv/media/827/download>

shadow is on average 20 minutes during that month, approaching half an hour for part of the month, it may already be (if the WPP is close and the shadow is sharp) a significant disturbance during this limited period of the year, the undesirability of which is understandable.

However, no objective harm has been proven from the flickering effect, only that the shadow can be subjectively annoying and make reading and other concentration-related activities more difficult. Even epilepsy patients are no longer harmed by the slow flickering of modern large WPP. This is apparently why no country has statutory limits for the flicker effect, because there is no scientific basis for them (unlike, for example, air pollution or noise, which have objective grounds). At the same time, there are guideline targets that are being pursued as a precautionary measure without a firm scientific or legal basis. Moreover, this minute and a half tends to be applied to a distance of ten WPP rotor diameters (see analysis below), where the shadow is actually no longer visible at all. These recommendations, unchanged for decades and untouched by the development of WPPs, must have been made in the early days of WPP impact assessment, when there was no methodology for realistic scenarios, and the shadows of small, rapidly rotating WPPs were assessed only by the worst-case scenario method and recommended not to exceed 30 hours per year (5 minutes per day), virtually always citing the risk of seizures in epileptics as the only justification. (For comparison: the law's objectively determined noise standards in Latvia have been changed in 2004, 2014 and 2023, so 3 times in the history of these WPP's flickering shadow law's vague subjective recommendations, even though noise as an environmental factor whose harm has been proven has existed unchanged for millions of years, while the nature and rotor diameter of WPP shadows have changed significantly over decades).

For a person to be exposed to such a harmless but potentially unpleasant shadow flicker, the following factors must coincide:

- 1) bright sun casting contrasting shadows,
- 2) the distance to the WPP is small enough for the shadow to reach a person and still have a perceptible contrast,
- 3) The rotor of a WPP is angled so that the shadows it produces oscillate: if the rotor plane is perpendicular to the direction of human vision, the flickering effect is visible over the entire area of rotor rotation, whereas if the rotor plane is parallel to the direction of human vision, the flickering shadow is virtually absent, except at the very tips of the wings, whose narrowness means that this shadow can only be perceived at very short distances,
- 4) the rotor turns (but part of the year it doesn't: in no wind and too strong winds).

The flicker effect may only be potentially significant in places where a person is obliged to stay and cannot avoid it, i.e. in a place of residence, workplace or other place of permanent residence: the flicker effect is irrelevant if a person is occasionally exposed to the rotor shadow area and briefly disturbed by it.

So, for a person to experience the inconvenience of the flicker effect at their place of residence or work, that place must be close enough to the WPP and the flickering shadow must hit that place for enough of the year.

In order to assess this situation, it is first necessary to define the shadow itself, as there is no specificity and no consensus on the distance to which the shadow of a WPP spot can be considered contrasting enough to fit the meaning of an uncomfortable flickering shadow. Different sources define this distance very differently.

In Britain, for the second decade, there has been a conservative trend to recommend that flickering shadows be assessed as a nuisance up to a distance of 10 rotor diameters^{203 204 205 206}. It is one of those recommendations without legal and, in fact, without scientific basis, which is obvious from the lack of a direct correlation between rotor diameter and shadow intensity at a distance from the rotor. These recommendations were made 20 years ago, when WPPs were much smaller and the 10 rotor diameters were consequently a much smaller distance than, for example, the WPPs evaluated in this EIA, which are 2 km apart. It is understood that a larger rotor diameter does not in any way increase the contrast of the shadow at greater distances from it (only indirectly may there be a correlation, since a larger rotor diameter is usually associated with a larger wingspan).

Other international guidelines take a different approach: to be based on a fixed distance. *The Danish Wind Industry Association (2010)* recommends that at distances of 500-1000 m from a WPP, the rotor is no longer perceived simply as an object with the sun behind it, so there is no point in assessing shadow flicker at longer distances; *The South Australian Planning Bulletin (2002)* notes that flickering shadow is not an object of assessment at distances beyond 500 m - but WPPs were much smaller at that time. It should be noted that these recommendations are well in line with the minimum distance of a WPP from an individual residential building as set out in Cabinet Regulation No 240 of 30 April 2013 "General Regulations on Spatial Planning, Use and Development" (16.10.2020 version): "163.1. for wind power plants with a capacity of between 20 kW and 2 MW, the distance from the nearest planned boundary of the wind power plant and wind park to residential and public buildings shall be at least 500 m; 163.2. for wind power plants with a capacity greater than 2 MW, the distance from the nearest planned boundary of the wind power plant and wind farm to residential and public buildings shall be at least 800 m;" i.e. 500 m for small WPPs (as they were in 2002), 800 m for larger ones (as they are from ~2010).

It is noteworthy that there was no contradiction between these different historical recommendations: their dating indicates that the rotor diameters of the WPPs common at the time of their creation were ~50 m, 80-100 m were still prospective models that did not exist in nature or were rare exceptions, and ten rotor diameters were broadly in line with the proposed fixed distances.

In New Zealand, an assessment of specific WPPs with a maximum wingspan of 4.2 m by *Energy3 Services Ltd, New Zealand (Kaimai Wind Farm Shadow Flicker Analysis, 2018)*²⁰⁷ finds: "International guidelines state that a practically meaningful distance to judge a flickering shadow is up to the greatest widths of the 265 wings, or about 1.1 km". This reference is to much more up-to-date guidelines,²⁰⁸ obviously much more scientific, since the intensity of the shadow is independent of the diameter of the rotor but depends on the size of the object casting the shadow, and of course the shadow cast by a wider wing spread perceptibly over a greater distance than that cast by a narrower wing. The coefficient "265" describes the distance over which a longitudinal obstacle of constant width on its way over the solar disk (angular diameter 0.533° on average) obscures half the disk area at maximum phase and is considered to be the threshold beyond which the shadow is practically no longer perceptible/noticeable due to light scattering (wrapping around the obstacle) in the atmosphere. By analogy: a partial solar eclipse, in which the Moon

²⁰³<https://cumbria.gov.uk/elibrary/Content/Internet/538/755/1929/17716/17720/17723/42130145839.PDF>

²⁰⁴https://www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/Best_Practice_Guidance_to_PPS_18_-_Renewable_Energy_0.pdf

²⁰⁵<https://www.gov.scot/collections/planning-advice-notes-pans/>

²⁰⁶<https://www.gov.ie/en/collection/85b83-planning-guidelines-standards/>

²⁰⁷https://www.hauraki-dc.govt.nz/assets/services_documents/WindFarm/B-Technical-reports/B16-Shadow-Flicker.pdf

²⁰⁸<https://assets.cleanenergycouncil.org.au/documents/advocacy-initiatives/community-engagement/wind-best-practice-implementation-guidelines.pdf>

covers no more than half of the Sun's disk, is virtually imperceptible. The validity of this conclusion is also visually illustrated by an independent experiment carried out in Latvia already in 2010 (see below).

There is just one important nuance to note: the wing width, which varies continuously throughout its length, is close to the maximum (although on average less than it) until about one third of the wing length from the rotor axis, after which it narrows rapidly. For example, the maximum width of the wing of the WPP under assessment in this EIA is ~5.5 m, and the first third of its length can be considered to be about this wide (rounded up). After that, the wing width decreases rapidly and reaches only ~1.3 m at the 10% wing tip. Consequently, the factor of 265 recommended in the referenced Australian guidelines (2018) as the distance to be judged, by which the maximum width of the wing should be multiplied, is a maximum precautionary factor, as shadows cast by the majority of the wing length with much smaller widths are consequently judged to be significant at the same distance. In addition, all these widths are only valid in situations where the plane of the wing is exactly perpendicular to the observer's gaze and the wing casts a shadow from its full width: in reality, such situations are rare, the wing is mostly at an angle to the observer's gaze and is therefore narrower as a shadow-casting object. The wing projects on average a statistical 45° angle relative to each individual location, or $\sqrt{2}$ times narrower, so that the widest part of a 5.5 m wide wing projects on average 3.9 m wide, with a corresponding assessment distance of $3.5 \times 265 = 1033$ m.

However, the unscientific nature of all the guidelines listed above (including the most recent one) in relation to flickering shadow duration modelling programmes is further illustrated by the following observation. It is clear that at a distance of 10 rotor diameters (some guidelines recommend even further) or at a distance of 265 maximum wing widths, the shadow intensity will be much weaker and therefore less intrusive than at a much shorter distance near the WPP itself. However, the guidelines only specify specific hours to a specific distance: from zero to 10 rotor diameters (or 265 wingspan) distance - 100%, from 10.01 rotor diameters (or 265.1 wingspan) distance - 0%. Of course, guidelines that claim to be scientific should establish a relationship between shadow intensity and duration: the closer to the WPP, the more contrasty the shadows and the fewer hours allowed; the further from the WPP, the weaker the shadows and the more hours allowed, up to a threshold after which there is no point in counting (but even before that, the shadow has become almost imperceptible and the number of hours allowed must be very high). Analogy - noise modelling: the long-term radiated noise level is calculated from the duration of noise exposure in relation to its intensity (determined by the distance from the noise source and the intensity of the source), while for a flickering shadow only the duration is calculated, ignoring the intensity of the shadow determined by the width of the object casting the shadow (which is only considered in the most up-to-date Australian guidelines) and the much different distance from the shadow source (which is not considered in any guidelines). For example, if the maximum judging distance is determined to be the distance at which the shadow casting object covers half the solar disk at maximum phase, or 265 times the width of the object, the next logical limiting point would be, is the last distance at which the shadow would momentarily become 100% sharply contoured, at least in vacuum (light scattering in the atmosphere makes it illuminated anyway), which is 107.5 times the width of the object, which in this case would be only 591.25 m.

In the following we present the conclusions of one of the EIA report authors' (V. Felsbergs) observations from a field study carried out in Latvia. The study sought to answer the question: what is a "shadow", the distance of which is debated in international sources, without describing what it is, i.e. how intense is it from a distant object compared to the shadow of a close object.

A "shadow" means that less light from a light source falls on a location due to an obstruction than on surrounding locations that are unobstructed from the light source, and there is a clear boundary between the shadow and the non-shadow, i.e. the shadow has a definable geometric shape or at least an obvious (literally, since a shadow only makes sense if you can see it with your eyes) drop in light intensity compared

to the non-shadow. From a scientific point of view, there should be a quantitative description of the difference that distinguishes a shadow from the adjacent non-shadow. 2018. in 2010, it is implicit in the current Australian guidelines - the shadow starts from covering half of the sun's disk area - but in Latvia it was sought visually on an experimental basis.

The shadow is characterised by the Latvian Radio and Television Tower in Zaķusala, which casts a shadow on Lucavsala in the morning hours. The experiment was carried out on 23 May 2010 at ~8am on Lucavsala Street ~630 m from the axis of the TV tower (Figure 7.3.1)

Figure 7.3.2 shows which part of the TV tower antenna casts the shadow used for the experiment. The cylindrical antenna has a total height of 146 m²⁰⁹, the sun shading point is 310 m high, and the antenna diameter at the sun shading point is approximately equal to the average wing width of the WPPs assessed in this EIA ($\frac{1}{3}$ - $\frac{1}{2}$ of the maximum width). According to the Pythagorean theorem, the distance of a shadow from the object casting it is ~700 m. In addition, the antenna of the TV tower casts its shadow from one and a half times the height of the shadow of the averaged WPP, which makes the shadow more sharply contoured than in more oblique light. The shadow of this TV tower antenna is shown in Figure 7.3.3. Knowing in advance what to look for, the image shows a barely perceptible blurred strip of low-intensity light across the road, in the middle of which the cyclist stands and casts her own sharply contoured shadow onto this shadow, which is the virtually unshadowed surface of the road and grass.

The distance to which the effect of the flickering shadow must be judged, calculated from the maximum wing width of 5.5 m, is $5 \times 265 = \sim 1460$ m, and the shadow that could reach it is already very faint, close to invisible: even more invisible than the shadow of the nearest TV tower, more than twice as visible in Figure 7.3.4.



Figure 7.3.1. Diagram of the situation with the Riga TV tower in Zaķusala and Lucavsala Street: the shadow of the TV tower falls over Lucavsala Street on 23 May 2010 at 8 o'clock (this situation is illustrated in nature in the next two pictures).

²⁰⁹<https://www.lvrtc.lv/>

In Latvia's current guidelines "Guidelines for the Environmental Impact Assessment of Wind Power Plants and Recommendations on Requirements for the Construction of Wind Power Plants" ²¹⁰ states: "To minimise the human impact of flicker, the distance from the wind turbine to the dwelling should not be less than 500 m or 5 times the maximum height of the wind turbine."



Figure 7.3.2. The solar disc behind the TV tower antenna, which casts the shadow shown in the next image (the disc is much smaller than the blurred patch of light in the image).



Figure 7.3.3. Shadow on Lucavsala Street of the TV tower antenna in the previous picture.

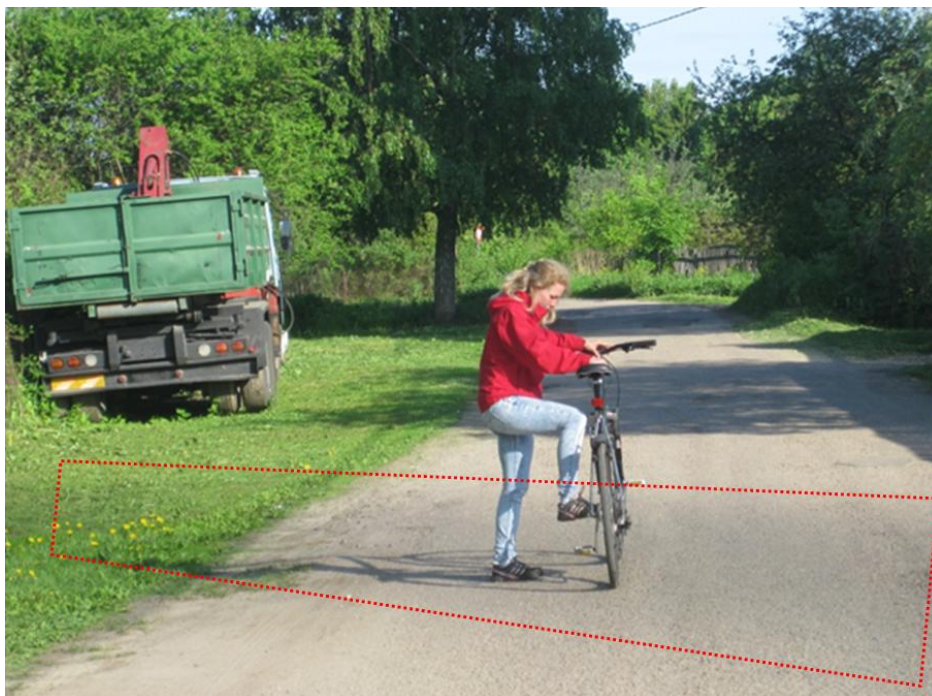


Figure 7.3.4. The shadow on Lucavsala Street is outlined in red in the previous picture.

²¹⁰ <https://www.vvd.gov.lv/lv/media/9969/download?attachment>

Obviously, the 500 m minimum applies to WPPs with a maximum height of less than 100 m. On the other hand, for larger WPPs, such as the ones assessed in this EIA, the distance to be assessed "*5 times the maximum height of the WPP*" applies. In this case, it is $300 \text{ m} \times 5 = 1500 \text{ m}$. This corresponds perfectly to the 1460 m mentioned above as a result of the previous considerations.

To further illustrate what the shadow of a WPP at 500 m (but the smallest distance assessed in this EIA is 824 m, see below) means, Annex 8 is attached: a video showing the shadow of the WPP of the Targale wind park on the road and the forest wall at 500 m. As can be seen, the shadow is similarly faint and blurred as in Figure 7.4: when the video is paused, it is just as imperceptible; in motion, of course, the shadow is more eye-catching. As can be easily understood, at a distance of twice 1 km, such a shadow will be invisible even in motion, while at a distance of three times 1.46 km there is no doubt that it will disappear altogether: this assessment distance is certainly consistent with the principle of maximum precaution.

In total, there are 162 residential houses within 1460 m of at least one WPP, of which 32 are multi-apartment houses and 130 are rural farmsteads. The closest (451 m from WPP D4) is the "Hunting Lodge", which is not subject to the requirement to be at least 800 m from the WPP, as it is not a dwelling house (building type: "12120101 - Recreational buildings", principal use: "1212 - Other temporary accommodation"), i.e. the effects of WPP, if any (including the flickering shadow) in this house do not have to be endured by people permanently as in a permanent residence, but only temporarily when using the Hunting Lodge for specific activities, and also only if these effects are present at the time (e.g. the flickering shadow hits the house only temporarily, periodically, and in most cases will not be present at all during the temporary stay). Of the dwellings subject to flickering shadow duration targets, Tamisāri is the closest: 824 m from WPP No Z2. Accordingly, a simple weighting system has been developed to assess the intensity of the Shadow. The intensity of the shadow cast by Z2 on the nearest house "Tamisāri" is given a factor of "1" or 100 %, i.e. all hours from this WPP to this house are counted as 100 % shadow duration. The intensity of the shadow at the limit of its complete disappearance at a distance of 1460 m has been assigned a factor of "0". Accordingly, all other shadow durations from a given WPP to a given house are given decreasing coefficients in an inverse linear relationship with increasing distance: for example, if the distance between the WPP and the house is 1142 m (halfway between 824 m and 1460 m), the coefficient is 0.5 or 50 % and 1 hour of shadow from the modelling is calculated as half an hour in the interpretation of the results in Annex 8.

This method uses the following relative assumption, based on the principle of maximum precaution, which makes the result significantly worse (longer shadow durations) than would be scientifically justified: the sharpest shadow in a given situation with a given minimum distance to the house of 824 m is considered as 100 %; if the distance to the nearest house were different (smaller), the 100 % would be different and the percentages would accordingly be smaller for all houses. In fact, the blurriness of a shadow at this distance is vividly illustrated by the experiment already mentioned: it can in no way be considered 100% shadow. A more correct definition of a 100 % shadow would be at least that falling from the widest point of the wing at the minimum possible height, so $\sim 200 \text{ m}$ (rotor axis height) minus ~ 33 (one third of the wing length) = $\sim 167 \text{ m}$, at the smallest possible distance from the WPP, which in Latvia is $\sim 92 \text{ m}$ (south of the summer solstice), and consequently at a distance of 451 m its intensity would not be 100 % but only 74 %, which is significantly less and certainly more scientifically representative of the true effect of the shadow as a function of distance.

Assumptions so unfavourable to the deterioration of the situation for computational convenience are justified further on the results obtained with them are also so "innocuous" for the operation of the WPP fleet that a higher complexity would not be a useful result.

There are two ways to get the duration of the shadow: the worst-case scenario and the real scenario. The worst-case scenario method (preferably no more than 30 hours per year) assumes that the sun shines continuously during daylight hours and is always perpendicular to the rotor, which rotates continuously.

However, in a realistic scenario (preferably no more than 10 hours per year), all the factors that affect shadow duration at any given point are taken into account:

- 1) hours of sunshine,
- 2) wind direction (which determines the orientation of the entire rotor),
- 3) wind speed (which determines how much of the year the rotor will not turn),
- 4) the overall relationship between wind direction and speed (which determines the orientation of the wing planes themselves),
- 5) natural obstacles (buildings, trees, etc.)

Shadow durations on all houses within a radius of 1460 m around each WPP have been modelled with WindPro (results of the modelling in Annex 8) and the analysis of the results is summarised in detail in Annex 8.

The flicker impact calculations are for the potential WPPs to be constructed, corresponding to the WPP park Limbaži location alternative A with 14 WPPs and location alternative B with 22 WPPs. For these alternatives for the location of the WPP park, an assessment of physical impacts (flicker, landscape impact assessment) was carried out for the public consultation version of the EIA report. It is envisaged that during the public consultation of the EIA report, the WPPs that are currently recommended for construction may be refined, taking into account the proposals submitted by the public and other institutions and the results of the public consultation. In the updated version of the EIA report that will be submitted to the SEB for its opinion, the assessment of the impact of flicker will be updated according to the number of WPPs recommended, but it can already be said that the updated results will have a lower potential impact.

This chapter summarises the main findings, conclusions and recommendations of the flicker modelling. The modelling on which the calculations are based is based on a scenario that is closer to the worst case than the real one: of all the factors that reduce shadow duration in the real scenario, only the proportion of sunny weather (Table 7.3.1) and the windless period (see Annex 8) are taken into account.

The direction of the wind, which determines the orientation of the rotor, is not taken into account, but it is calculated that the rotor casts the shadow in a full circle perpendicular to the direction of the shadow fall, as if its orientation follows the path of the sun in the sky all the time, in order to shade a house for as long as possible, which is completely impossible, especially in relation to several houses at the same time. The variable orientation of the wing planes oblique to the wind, as determined by the correlation between wind direction and speed, is not taken into account, but it is assumed that they are always oriented perpendicular to the direction of view at their maximum width, which is impossible in principle in relation to the orientation of the whole rotor, also perpendicular to the direction of view, because the wing planes can never be parallel to the plane of the rotating rotor, they are always at an angle to it. No account is taken of natural obstructions, which in particular block the sun much of the time when it is low on the horizon, as is the case when shadows reach buildings only in low slanting sunlight (which in the morning/evening and/or winter months is exactly the case).

Table 7.3.1. Average number of hours of sunshine per day by month at the Skulte observation station over the whole observation period: 1988.-2004. (Data from the LVGMC, www.lvghmc.gov.lv)

Month	Average number of hours of sunshine per day
January	0,96
February	2,07
March	4,32
April	6,59

Month	Average number of hours of sunshine per day
May	9,64
June	9,55
July	9,82
August	8,35
September	5,52
October	3,17
November	1,24
December	0,85

Of all these factors, only one can be quantified without complex calculations: assuming that the rotor plane is, on average, facing the observer at an angle of 45°, the area and therefore the shadow duration are reduced by a factor of $\sqrt{2}$ or 1.414. All others are not analysed further in order not to complicate the already complex calculations (and even more: not to complicate the verification of the calculations by the competent authorities).

Effects of the Flashing Shadow

In total, the shadow duration target of 10 hours per year is exceeded (11-33 h) in 12 dwellings: see Annex 8 of the worksheet "Shadows with distance attenuation" (shaded red) and the summary in Table 7.3.2, which also shows the main shadow casting WPP on each dwelling causing the exceedance and the times of the year and day when the specific WPP should be stopped during sunny periods to prevent these exceedances.

Table 7.3.3 shows the same information for WPP: which limiting WPP (four in total) cast shadows on which houses and the times of the year and day when a particular WPP should be stopped during sunny periods to prevent these exceedances.

Only one map is included to illustrate the distribution of the flickering shadow graphically (to avoid cluttering the EIA report with large images that are difficult to see): Alternative B, which has the highest overall shadow durations (see Figure 7.3.5): The differences of alternative B' from it are not very clear on the map, while alternatives A and A' can be read as part of it on the same map. See Annex 8 for individual maps of each alternative respectively.

Table 7.3.2. Flicker shadow effects on houses near the area of the Proposed Action

Code*	House	Alternatively, limiting WPP No., period of most intense shadow:					
		A	A'	B	B'	No.	Shade over 20 minutes per day (shorter shadows are more extensive)
B	Akmentiņi 1			25:10	24:05	D8	20.V-23.VII,20:15-21:00
R	Jaunkastaņas	28:29	28:29	28:29	28:29	Z2	1.-26.V, 19.VII-16.VIII,6:45-7:25
S	Jauntošēni	22:30	22:30	22:30	22:30	Z16	18.IV-8.V, 6-29.VII,18:55-19:40
V	Kardes	20:52	21:56	20:52	21:56	Z9	8.-24.IV,15.VIII-3.IX,18:40-19:30
W	Krusteiči	41:33	41:33	41:33	41:33	Z2	1.V-11.VIII,6:35-7:20
AB	Lauri			40:13	40:54	D8	3.V-8.VIII,19:45-20:25
AE**	Medību māja			16:22	16:22	D14	-
AK	Pietes			33:42	33:16	D8	9.V-1.VIII,20:00-20:35
AL	Plesīņi	17:40	18:00	17:40	18:00	Z9	23.III-5.IV,10.-25.IX,17:40-18:25
AU	Tamīšāri	25:45	25:45	25:45	25:45	Z2	7.-27.IV,13.VIII-3.IX, 7:40-8:20
AW	Urgaskalni			13:51	12:52	D8***	24.V-20.VII, 20:50-21:20***
BA	Veckastaņi	31:34	31:34	31:34	31:34	Z2	8.V-3.VIII, 6:20-7:00
BD	Vectošēni	11:09	11:09	11:09	11:09	Z16	14.-27.VII, 19:05-19:40
	Total	214:18	214:05	312:23	313:05		
	Total overruns	124:18	124:05	192:23	193:05		

* The code assigned by the *WindPro* software to find all the shadow parameters for this house in Annex 8.

** Not a dwelling house: shadow duration given for information but not counted towards total and WPP not to be stopped.

*** For Urgaskalni, the dominant shadow is D9 (7.5h), but to stay within the target, it is sufficient to stop D8 for 2/3 of the entire (5.5h) period, where its shadow duration does not exceed 15.5 minutes per day.

Table 7.3.3. WPP operating restrictions to reduce the flicker shadow

VES	Shaded houses (numbers according to previous table), shutdown periods in sunny weather by alternative:													Stop A and A' in alternative	Stop B and B' in alternative
	B	R	S	V	W	AB	AE	AK	AL	AU	AW	BA	BD		
D8	+					+	+								20.V-23.VII,20:15-21:00; 9.V-1.VIII,20:00-20:35; 24.V-20.VII, 20:50-21:20
Z2		+			+				+	+				1.V-11.VIII,6:35-7:20; 7-27.IV,13.VIII-3.IX, 7:40-8.20	1.V-11.VIII,6:35-7:20; 7-27.IV,13.VIII-3.IX, 7:40-8.20
Z9				+				+						8.-24.IV,15.VIII-3.IX, 7:40-8:20,18:40-19:30	8.-24.IV,15.VIII-3.IX, 7:40-8:20,18:40-19:30
Z16			+										+	8.-24.IV,6.-29.VII,19:05-19:40	8.-24.IV,6.-29.VII,19:05-19:40

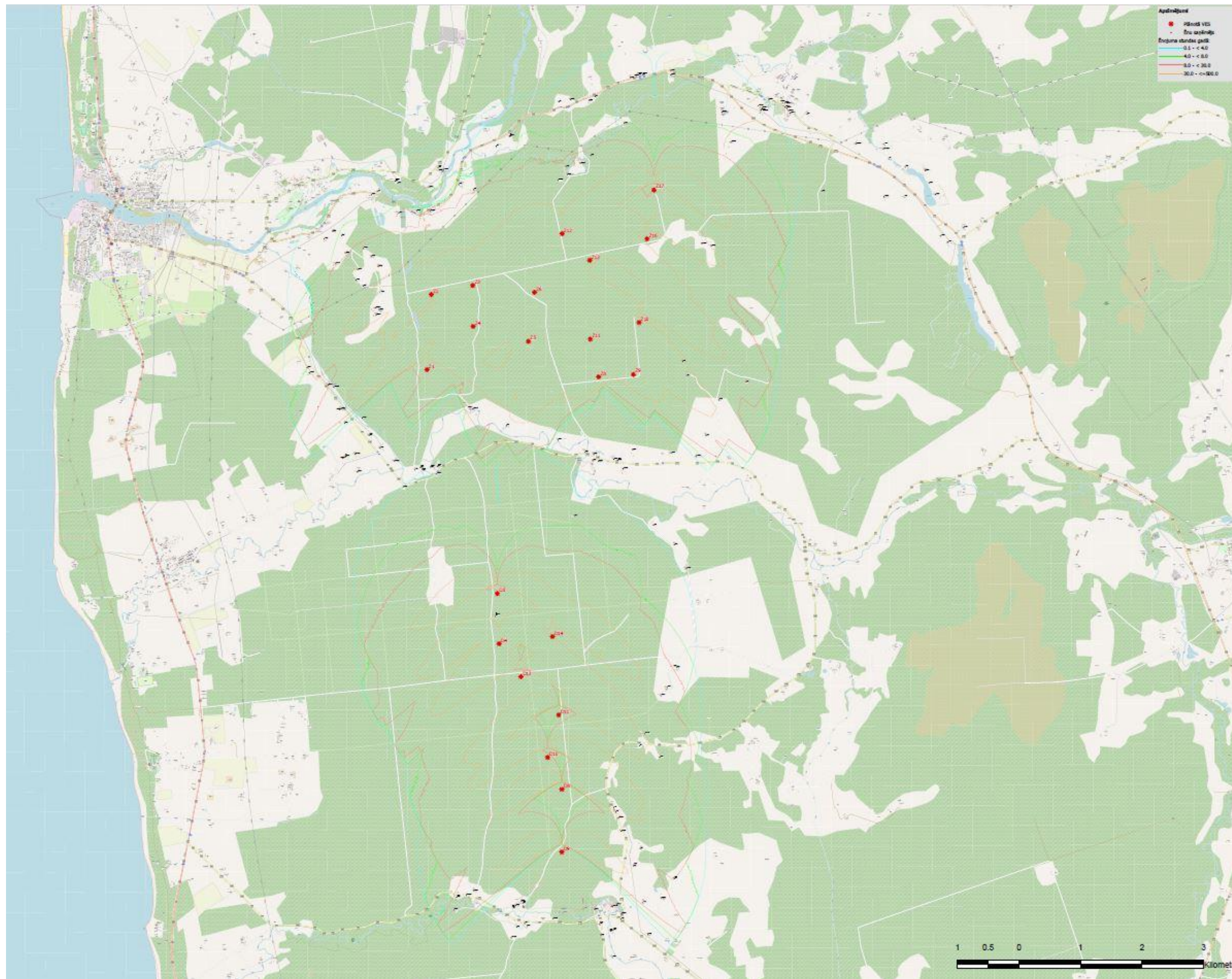


Figure 7.3.5. Map of the Flickering Shadow distribution: Alternative B

It should be stressed here that paragraphs 7.3.2 and 7.3.3. the annual and daily periods of WPP shutdowns in Table 3.7.3 and Table 3.7.3 do not represent the duration during which the WPPs concerned must be shut down all the time: the number of hours is much higher in these periods, but this is only an indication of which period will have to be included for those times when the WPP in question must be shut down if it is sunny and windy (the rotor is turning) and the annual shadow target is at risk (the daily target of 30 minutes is not at risk in any case). The total shadow duration exceedances (see Tables 7.3.2 and 7.3.3) are only 124.3 hours in Alternative A and 192.4 hours in Alternative B, which would correspond respectively to a 1.4 % annual shutdown of WPP 1 in Alternative A, or a 0.1 % annual shutdown of the entire WPP fleet, and a 2.2 % annual shutdown of WPP 1 in Alternative B, or a similar 0.1 % annual shutdown of the entire WPP fleet. However, the WPPs will have to be shut down for about three times less time overall, because (see Table 7.3.2) shutting down Z2 reduces the shadow duration for 4 houses at a time, D8 for 3, Z9 and Z16 for 2 each, so the required WPP shutdown will reduce the annual lifetime of the WPP fleet by a negligible amount.

The need for technical means for the four WPPs to ensure this shutdown is also relatively insignificant compared to the cost of the entire WPP fleet.

For this purpose, four WPPs must be equipped with a shadow *impact* module. It is mounted on top of the nacelle, which is a free zone from any other shadows (Figure 7.3.6), and has a light sensor that continuously measures the intensity of the sun's rays at intervals of about one second, and a shadowing modulator that determines whether, for a given position of the sun in the sky and wing rotation plane, shading is likely to occur at any of a number of predefined points on the ground. If shading can occur at one of the defined points and the sun's brightness is sufficient to create shade (i.e. the weather is clear: not cloudy or hazy), the WPP automatically stops. It automatically starts again when the sun has moved (or clouded over) and no longer casts a shadow at a given point. One such shadow control module is capable of monitoring up to 300 pre-defined capture points. The management system also generates a "shadow report" (the "shadow report"). *shadow report*), which stores all data and measurement parameters for each trip in the system memory. The duration of the flickering shadow from a given WPP is thus adjusted according to the specific conditions each year/month/day/hour/minute, which will of course be variable.



Figure 7.3.6. A light sensor is installed above the WPP nacelle to prevent shadow flicker (source: Environmental Impact Assessment of the Construction of Wind Power Plants in Tārgale Parish, Ventspils Municipality, Ltd Vides eksperti, 2022)

7.4. Impact on air quality

During the construction of the WPP, construction equipment and vehicles will cause insignificant, local, temporary and episodic air pollution, which will be localised in the construction zone, which is not located in the immediate vicinity of a residential area.

The air quality impacts of the construction process have been assessed on the basis of the guidelines below and information available on the public web:

- *Guidance on the assessment of dust from demolition and construction. January 2024 (Version 2.2) - IAQM Guidelines*²¹¹;
- *Discover The Vital Role of Air Quality in Construction Sites Worldwide. From Understanding Pollution Sources to Implementing*²¹²;
- *Local Government Air Quality Toolkit. Air quality guidance note. Construction sites*²¹³ ;
- *Sustainability & Environment Appraisal. LA 105 Air Quality. Design Manual for Roads and Bridges - (hereinafter - DMRB). Published June 2024*²¹⁴.

The guidance applies to the assessment of air pollution from demolition and construction. At the construction sites, the works can be divided into four phases, which reflect:

- dismantling;
- earthworks;
- construction;
- spreading mud and dust on roads

The three groups of potential impacts that may be affected by the construction process are:

- 1) disturbance from dust pollution (property impact)
- 2) damage to the ecosystem
- 3) impact on human health.

When assessing the impact of dust on the area of the Proposed Activity, the presence of *receivers* in the vicinity of the Proposed Activity is an important consideration. The IAQM distinguishes between three levels of *receivers*: high, medium and low sensitivity. Examples of high-sensitivity receivers include residential buildings, heritage sites where dust has a direct impact on property values. Users expect high quality amenities. Examples of medium sensitivity receivers are parks and workplaces, where users expect a reasonable level of comfort, but lower than in their own homes. Indicative examples for low-sensitivity receivers are agricultural land, footpaths, car parks and roads.

When assessing the impact of dust, including PM_{10} and $PM_{2.5}$, on human health, there are three levels of sensitivity - high, medium and low - similar to the impact on property. High-sensitivity receivers are places where people stay for long periods of 8 hours or more, such as residential areas, hospitals, schools, care homes. Medium sensitivity receivers are places where people stay for up to 8 hours. These are usually workplaces. Indicative examples for low-sensitivity receivers are places where people are occasionally present - walking trails, playgrounds, parks.

²¹¹ <https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-Dust-Guidance-Jan-2024.pdf>

²¹² <https://neuroject.com/air-quality-in-construction/>

²¹³ <https://www.environment.nsw.gov.au/resources/air/mod3p3construc07268.pdf>

²¹⁴ <https://www.standardsforhighways.co.uk/search/af7f4cda-08f7-4f16-a89f-e30da703f3f4>

There are also three levels of receptors for assessing damage to ecosystems: high, medium and low. High sensitivity receptors are habitats or species of international or national importance that are of special conservation concern, where dust deposition directly affects these plant habitats. These plants may be listed in the Red Data Book, such as vascular plants or lichens in the immediate vicinity of the construction site. Medium-sensitivity receptors are ecosystems where the effects of dust have not been clearly studied. Nature parks are an indicative example of low-sensitivity receivers.

Additional factors to be taken into account in determining the sensitivity of a site are the existing or background level of contamination, the season in which the works will be carried out, the local topography (topography), the duration of the potential impact.

During construction, the following have been identified as air pollutants:

- Dust. This pollutant is caused by construction activities such as excavation, drilling and the movement of machinery. These activities can produce dust particles of different sizes, from coarse to fine.
- Diesel exhaust gases from heavy machinery and equipment powered by diesel engines. The main pollutants emitted by diesel-powered machinery are nitrogen oxides, PM particulates, including PM₁₀ and PM_{2.5}.

The criteria according to the receptor used to assess the impact of the construction process on air quality are given in Table 7.4.1.

Table 7.4.1. Evaluation criteria

Sensitive receiver/receptor	Criterion
Human environment receivers/receptors (places where people spend time, and dust can affect real estate)	250 m from the boundary of the construction site
	50 m from a road used by vehicles involved in the construction process up to 250 m from an entrance to the construction site
Ecological receptors (habitats of protected plants or species, protected habitats)	50 m from the boundary of the construction site
	50 m from a road used by vehicles involved in the construction process up to 250 m from an entrance to the construction site

The assessment of the sensitivity of a site is based on information on the distance to sensitive *receptors*, their number and the background concentrations of pollutants present. Both the harm caused by the dust itself (deposition, impact on real estate) and the impact of PM₁₀ fine particles on the health of the population as well as the impact on the ecosystem are assessed. The criteria are summarised in Tables 7.4.2 below. - 7.4.4. The limit values for PM₁₀ used in the IAQM guidelines are consistent with the limit values of 40 µg/m³ of the Cabinet of Ministers Regulation No 1290 of 3 November 2009 "Regulations on Air Quality". The concentration ranges used for the sensitivity assessment are 80 %, 70 % and 60 % of the threshold value, respectively.

Table 7.4.2. Site sensitivity criteria for dust effects on people and property depending on the number of receivers/receptors and the distance to the construction site according to Table 2 of the IAQM Guidelines²¹⁵.

Receiver/ sensitivity	Number of receivers	Distance from the emission source (construction site), m			
		<20	<50	<100	<250
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low

²¹⁵ <https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-Dust-Guidance-Jan-2024.pdf>

Receiver/ sensitivity	Number of receivers	Distance from the emission source (construction site), m			
		<20	<50	<100	<250
Low	>1	Low	Low	Low	Low

Table 7.4.3. Site sensitivity criteria for dust effects on human health depending on the number of receivers/receptors and the distance to the construction site according to Table 3 of the IAQM Guidelines²¹⁶

Receiver/ sensitivity	Annual mean _{PM10} concentrations	Number of receivers	Distance from the emission source (construction site), m			
			<20	<50	<100	<250
High	>32 µg/m ³	>100	High	High	High	Medium
		10-100	High	High	Medium	Low
		1-10	High	Medium	Low	Low
	28-32µg/m ³	>100	High	High	Medium	Low
		10-100	High	Medium	Low	Low
		1-10	High	Medium	Low	Low
	24-28µg/m ³	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<24µg/m ³	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	>32µg/m ³	>10	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	28-32µg/m ³	>10	Medium	Low	Low	Low
		1-10	Low	Low	Low	Low
	24-28µg/m ³	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
	<24µg/m ³	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low

Table 7.4.4. Sensitivity criteria for impacts on ecosystems according to Table 4 of the IAQM Guidelines²¹⁷

Sensitivity of the receiver	Distance from the emission source (construction site), m	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Having assessed the available information on the existing background levels of pollutants, the size of the development, the area of the development, the condition of the access roads (tarmac or gravel) and the location of the nearest receivers/receptors (Table 7.4.5 summarises the construction dust per construction site), Table 7.4.6 summarises the potential impacts from the construction of the WPP.

Table 7.4.5. Assessment of the impact of dust from construction activities per construction site

Activities	Significance of the issue volume	Criterion	Background
Earthworks	Low	Low: built-up area <18000 m ²	The construction area of the WPP per construction site is planned at 2600 m ²

²¹⁶ <https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-Dust-Guidance-Jan-2024.pdf>

²¹⁷ <https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-Dust-Guidance-Jan-2024.pdf>

Activities	Significance of the issue volume	Criterion	Background
		Medium: Building area 18000-110000 m ² High: built-up area > 110 000 m ²	
Construction	Low	Low: building volume <12000m ³ Medium: building volume 12000-75000m ³ High: building volume >75000m ³	~1100m ³ of reinforced concrete will be used in the construction of one foundation foot of the WPP
Mud and dust on roads	High	Zems: Length of roads without hard surface < 50 m Medium: Length of roads without hard surface 50-100 m High: Length of unpaved roads > 100 m	Unpaved roads are more than 100 m long.

Table 7.4.6. Sensitivity assessment of surrounding areas

Potential impact	Sensitivity of surrounding areas					
	Earthworks	Background	Construction	Background	Kneeling material	Background
Dust pollution	Low	The nearest receivers/receptors are at least 800 m from the construction site	Low	The nearest receivers/receptors are at least 800 m from the construction site	Medium	Only a few receivers/receptors (farmsteads) are located in the immediate vicinity of dirt roads
Impact on human health	Low	The nearest receivers/receptors are at least 800 m from the construction site; the annual mean background concentration of dust shall not exceed 13,90µg/m ³	Low	The nearest receivers/receptors are at least 800 m from the construction site; the annual mean background concentration of dust shall not exceed 13,90µg/m ³	Low	The annual mean background concentration of dust shall not exceed 13,90µg/m ³
Damage to the ecosystem	Low	The nearest ecological receptors (protected plant or species habitat, protected biotopes) are more than 50 m from the construction site boundary	Low	The nearest ecological receptors (protected plant or species habitat, protected biotopes) are more than 50 m from the construction site boundary	Low	The nearest ecological receptors (protected plant sites or species habitats, protected habitats) are located more than 50 m from construction vehicle traffic routes

The overall level of risk of impacts is low according to the IAQM guidelines used²¹⁸. The construction process of the WPP, including the movement of vehicles involved in the construction process, will have a

²¹⁸ <https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-Dust-Guidance-Jan-2024.pdf>

negligible impact on the health, property and ecosystem of the population. Localised dust abatement measures (e.g. road dusting for nearby farmsteads) should be considered during construction.

Criteria for assessing the impact of road traffic are defined in the DMRB guidelines²¹⁹. Paragraph 2.6 of the guidance states that the *impact on air quality from the movement of vehicles involved in construction activities on roads should be assessed if the duration of construction activities exceeds 2 years*. The total time needed to build the WPP park is expected to be no more than 2 years. The same criterion is set out in point 2.1 of the Guidelines: *if the annual average daily traffic volume is less than 1 000 vehicle units or if the truck traffic volume does not exceed 200 vehicle units per day, the impact on air quality is assessed as negligible*. Based on the information provided in Section 4.3.1, none of the criteria for an air quality assessment for vehicles involved in the construction of the WPP are met. Note that Table 4.3.1 provides information on the number of transport units for each phase of the project. All these steps do not add up at the same time.

Overall, the air pollution from the construction process is assessed as insignificant, with negligible environmental damage and a more significant consequential benefit from the constructed renewable energy facility, which will not cause air pollution in future operation.

7.5. Protection zones and their impact

In accordance with the Law on Protective Zones, four protective zones have been established in the spatial plan of Limbaži municipality:

- 1) environmental and natural resource protection zones
- 2) operational protection zones
- 3) sanitary protection zones
- 4) safety buffer zones.

Environmental and natural resource protection zones are established around objects and territories that are important for the protection and rational use of the environment and natural resources. Their main purpose is to reduce or eliminate the negative anthropogenic effects on the objects protected by the buffer zones.

- Surface water protection zones are established for water bodies, watercourses and artificial water bodies to reduce the negative impact of pollution on aquatic ecosystems, prevent the development of erosion processes, restrict economic activities in flooded areas, and preserve the characteristic landscape of the area.
- The buffer zones around the marshes are established to preserve biodiversity and stabilise the moisture regime in the forest-marsh interface (transition) zone (not in the area of the Proposed Action).
- Protection zones around cultural monuments are established to ensure the protection and preservation of cultural monuments, as well as to reduce various types of negative impacts on immovable cultural monuments (not in the territory of the Proposed Action).
- Protection zones around water abstraction points are established to ensure the preservation and replenishment of water resources and to minimise the negative impact of pollution on the quality of abstracted water resources throughout the lifetime of the water source (not within the area of the Proposed Action).

Operational protection zones are established along transport lines, along electronic communications networks and other communication lines, and around facilities that support the operation of various public

²¹⁹ <https://www.standardsforhighways.co.uk/search/af7f4cda-08f7-4f16-a89f-e30da703f3f4>

services. The main purpose of operational protection zones is to ensure the efficient and safe operation and development of these communications and facilities.

- Protection zones along streets, roads and railways are established to reduce the negative impact of streets, roads and railways on the environment, to ensure the operation and safety of transport arteries, and to create a construction-free zone necessary for the reconstruction of streets and roads.
- Protection zones along telecommunication lines and their facilities of all types and affiliations are established to ensure their maximum protection from unwanted influence of man, nature or other factors, which may result in disruption of normal operation of telecommunication lines, damage to the national economy and the state (not within the territory of the Proposed Activity).
- Protection zones along electrical networks, their equipment and structures of all types and of all kinds shall be established to ensure the operation and safety of electrical networks, their equipment and structures.
- Operational protection zones along heat networks, their equipment and structures are established to ensure the operation and safety of heat networks, their equipment and structures (not within the territory of the Proposed Operation).
- Protection zones around drainage structures and devices are established to ensure the operation and safety of drainage structures and devices.
- Protection zones along water and sewerage networks are established to ensure the operation and safety of water and sewerage networks (not within the area of the Proposed Action).
- Protection zones around geodetic network points shall be established around points of the national geodetic network and local geodetic network for which a permanent geodetic point centre has been established in the locality to ensure access to and geodetic work on the geodetic network points, long-term preservation, stability and structural integrity of the geodetic network points (not within the area of the Proposed Operation).
- Operational protection zones around gas pipelines, gas supply facilities and structures, gas warehouses and storage facilities are established to ensure operation of gas pipelines, gas supply facilities and structures, gas warehouses and storage facilities (not within the territory of the Proposed Activity).

Sanitary buffer zones are established around facilities that have higher sanitary requirements. Their main task is to ensure sanitary requirements (not in the area of the Proposed Action).

The main purpose of the safety buffer zones is to ensure the safety of the environment and people during the operation of the facilities and in case of possible accidents, as well as the safety of the facilities themselves and the facilities in their vicinity (not in the area of the Proposed Operation).

Protection zones for watercourses, existing drainage and drainage facilities

In accordance with the TIAN of Salacgrīva town with rural territory of Salacgrīva municipality and TIAN of Limbaži municipality. The following surface water protection zones have been established in the vicinity of the proposed activity area:

- Salaca protection zone - 100 m wide strip on each bank in rural areas, 10 m wide strip on each bank in Salacgrīva, 100 m wide strip on each bank in Vecsalaca;
- Vitrupe protection zone - 100 m wide strip on each bank;
- Svētdciems - 10 m wide on each bank,
- Korgē protection zone - 50 m wide strip on each bank;
- Vedamurga buffer zone - a 50 m wide strip on each bank;
- Ungenurga Protection Zone - a 50 m wide strip on each bank.

For other watercourses and water bodies in the territory of Salacgrīva town and countryside - 10 m wide strip on each bank.

The construction of associated infrastructure (access roads, assembly yards, cable routes) could affect the buffer zones around the Korge, Vedamurga and around crossings of small watercourses where infrastructure is to be constructed.

According to Article 37(5)(b) of the Law on Protected Zones, the construction of energy management and distribution structures, as well as the construction of transport networks, is allowed in the protected zone of surface water bodies.

The WPP Park study area is adjacent to areas used for agricultural purposes, which have a dense network of shared watercourses and drains²²⁰, providing groundwater recharge and allowing agricultural activities in these areas. The LVM subdivisions also have a drainage system, which ensures an optimal groundwater regime and thus optimal growing conditions for the forest stand (Figure 6.2.2).

According to the explanatory memorandum to the spatial plan of Limbaži municipality, since most of the drainage systems were built several years ago, they are increasingly deteriorating and are currently no longer functioning as designed.

The width of the protection zones around drainage structures and devices has been determined in accordance with the Law on Protection Zones and the requirements of the Methodology for Determining Protection Zones around Drainage Structures and Devices, which will have to be taken into account when carrying out construction works in the WPP area.

Protection zones around roads

Protection zones along roads are established to reduce the negative environmental impact of roads, to ensure the operation and safety of transport arteries, and to create a development-free zone for the reconstruction of streets and roads.

The Guidelines for the Preliminary Environmental Impact Assessment of Wind Power Plants in Latvia state that the minimum recommended distance from a WPP to the State (main roads (A), regional roads (P), local roads (V)) and public railway lines is 300 m, unless technical solutions are implemented to mitigate environmental risks.

However, this EIA report takes into account Article 13 of the Protected Zones Act, which states that in rural areas, the width of the protected zones along roads from the road axis to each side is:

- (a) 100 metres for national trunk roads (A),
- (b) 60 metres for national regional roads (P),
- (c) 30 metres for national and local roads (V).

In addition to the general restrictions in the protection zones:

- new residential construction is prohibited;
- building new public, business or industrial facilities without the consent of the road owner;
- actions that reduce the visibility of the road or increase its obstruction are prohibited;
- no clear-cutting is allowed along roads of technical categories I-III in a 50 m wide strip;
- no clear-cutting is allowed along technical category IV roads in a 30 m wide strip;
- any construction or assembly work is prohibited without the approval of the national road authority;
- is prohibited in the road protection zone without the agreement of the road owner:
 - a. construction work;

²²⁰ <https://www.melioracija.lv>

- b. mechanised excavation and filling;
- planting trees and shrubs, felling trees

7.6. Impacts on natural values and mitigation measures

7.6.1. Habitats and vascular plant species - impacts and mitigation measures

This chapter provides a description of the proposed WPP, platform sites, access roads, cable sites and adjacent terrain, as well as the potential impacts of the activities on the identified natural values and measures to address the identified negative impacts.

The assessment of the impact of the proposed action on habitats and plant species is based on two expert opinions: **06.02.2024 expert opinion on the impact of the construction of the planned WPP Limbaži and its associated infrastructure project on the status of the identified species and habitats in the municipalities of Salacgrīva and Viļķene of Limbaži municipality** and **07.11.2024 expert opinion on the impact of the planned activity - construction of the wind park infrastructure in Limbaži municipality on forest, heath and bog habitats, vascular plants and mosses**, both opinions are attached as Annex 6.

Factors identified as threatening nature values in relation to protected plant species sites, protected freshwater, grassland, marsh and forest and swamp habitats include direct destruction of protected habitats as a result of construction of the WPP and associated infrastructure, fragmentation of habitat areas by power plant assembly/operation areas and access roads, and potential drainage impacts that may result from ditching around assembly areas and access roads where necessary for drainage.

The proposed action includes the construction of assembly/operation areas and access roads for the WPPs and for their construction and operation, or the reconstruction of existing road turns and connections, as well as the creation of ditches around assembly areas and along access roads where necessary for drainage of the areas. Assembly/construction area: not more than 100 x 260 m. The Proposed Action also includes the construction of electricity transmission cables along roads (the possible construction on both sides of the roads has been assessed in order to select the optimal option).

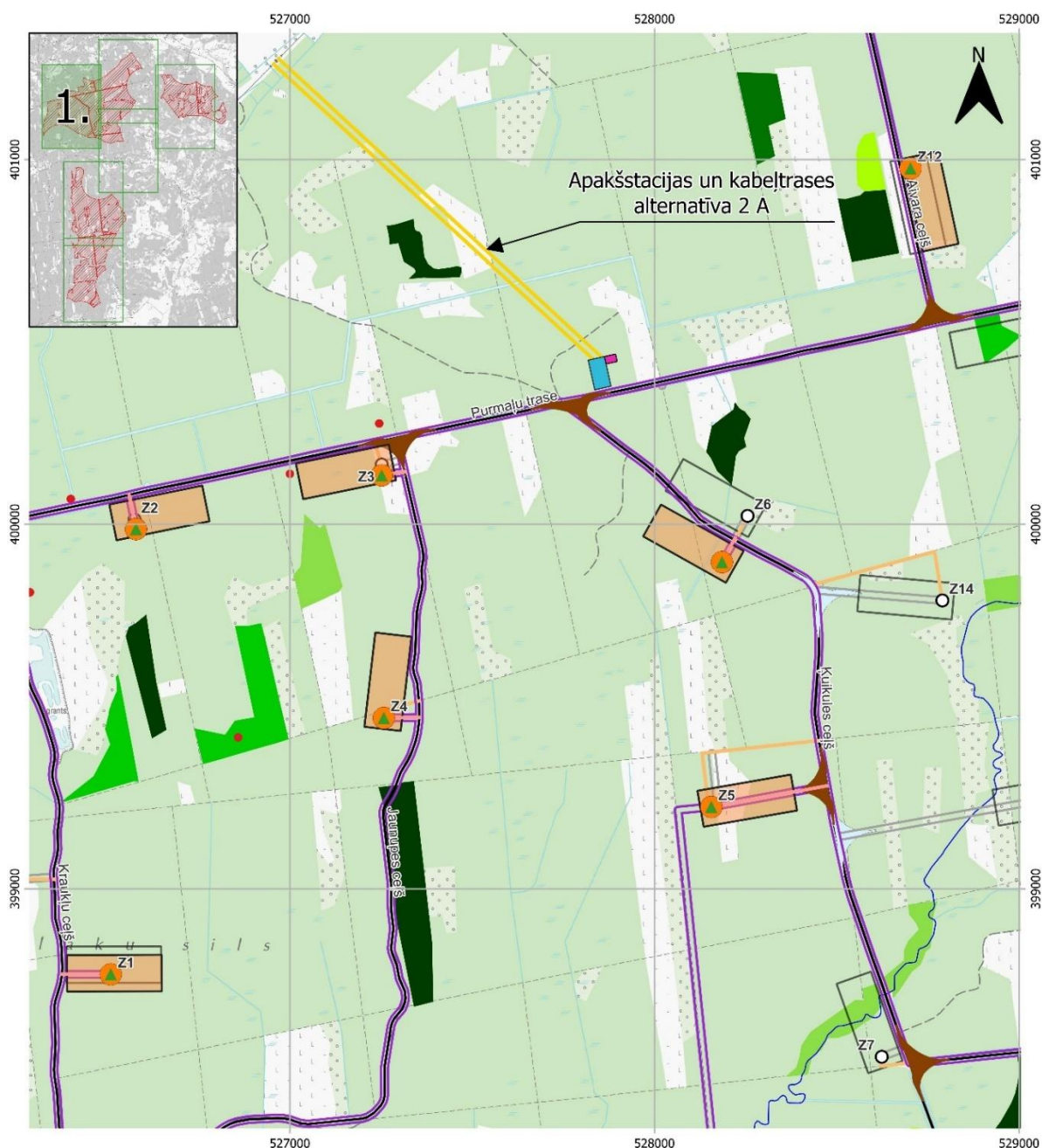
In assessing the potential impacts on the identified natural values, the area of the proposed infrastructure (building sites, roads and their junctions, power transmission cable routes, potential substation and energy storage system sites) and the area around them where machinery movements could take place depending on the technical solution have been assessed as potential areas of direct impact: 5 m around medium-voltage cable routes along roads (the width of the cable route itself is 6 m in the cartographic material), storage yards and substation yards. In the area of direct impact associated with the cable routes, excavation works are planned which will temporarily destroy understorey vegetation.

The habitat impact surveys take into account information on rare and protected species localities and specially protected habitats available in the Nature Data Management System (NDMS) "Ozols". Protected habitats already identified were surveyed to complete the information on the occurrence of rare and protected species, recorded with GPS equipment, and protected species found in other surveyed areas were also recorded. For protected habitats not included in the DDPS "Ozols" an inventory questionnaire has been completed and habitat polygons have been marked on the map (see 06.02.2024. and 07.11.2024.) in accordance with the methodology for inventory of protected habitats of EU importance approved by the MoEPRD.

On **06.02.2024 an expert opinion** was prepared on the impact on forest and swamp habitats for 37 WPP installation sites, while on **07.11.2024 an additional expert opinion was prepared** for 14 WPP installation sites only in the northern part of the WPP park Limbaži, which corresponds to alternative A, assessing the impact of the Proposed Action both on forest and swamp habitats and on vascular plant, moss and lichen

species. 07.the 11.2024 Opinion also assesses two substation and BESS Park alternatives (1A and 2A) and three possible connection options: cable route (1A A and 1A R) or overhead line (2A).

Consultations with the NCA as part of the assessment process (23.08.2024. 4.9/5192/2024-N), it was concluded that special attention should be paid to the study of specially protected species of mosses and lichens. The **assessment of** additional vascular plant, moss and lichen species **and the development of a solution** for the connection to the AST, as well as the **additional impact study on freshwater** for the power line crossing over the Svētupe River, **were not** carried out **at this stage** for the potential locations of **the southern part of the WPP park**, as after the initial assessment **on 06.02. 2024. it** was concluded that the implementation of Alternative A would be more promising and feasible at this stage of the project development, and therefore an additional detailed species and habitat survey and assessment of moss and lichen species was carried out, taking into account the previous consultations with the NCA.



Apzīmējumi

- | | |
|--|------------------------|
| ▲ A alternatīva, 12 VES | ■ Kabeltrase |
| ● B alternatīva, 20 VES (iekļautas arī A alternatīvas VES) | ■ Sākotnējā kabeltrase |
| ○ Sākotnējais VES izvietojums | ■ Pagriezienu rādīsi |
| — VES pievedceļi | ● Sugu atradnes |
| — Sākotnējie VES pievedceļi | |
| — Pieslēguma trase | |
| ■ BESS novietojuma alternatīva | |
| ■ Apakšstacijas novietojuma alternatīva | |
| ■ VES montāžas laukumi | |
| ■ Sākotnējie VES montāžas laukumi | |
-
- | ES nozīmes biotopi | |
|-----------------------------------|--|
| ■ Upju straujtecis (3260) | |
| ■ Boreālie meži (9010*) | |
| ■ Staignāji (9080*) | |
| ■ Nogāžu un gravu meži (9180*) | |
| ■ Purvaini meži (91D0*) | |
| ■ Pārmitri platlapju meži (91E0*) | |

0 250 500 750 m

Enviroprojekts

Karte piesaistīta Latvijas koordinātu sistēmai (LKS92) TM projekcijā. Par pamatni izmantota LGIA sagatavotā topogrāfiskā karte mērogā 1:10 000 (3.- 4. cikls)

Figure 7.6.1. Habitats and species of EU importance in the area of the Proposed Action, page 1 of 6

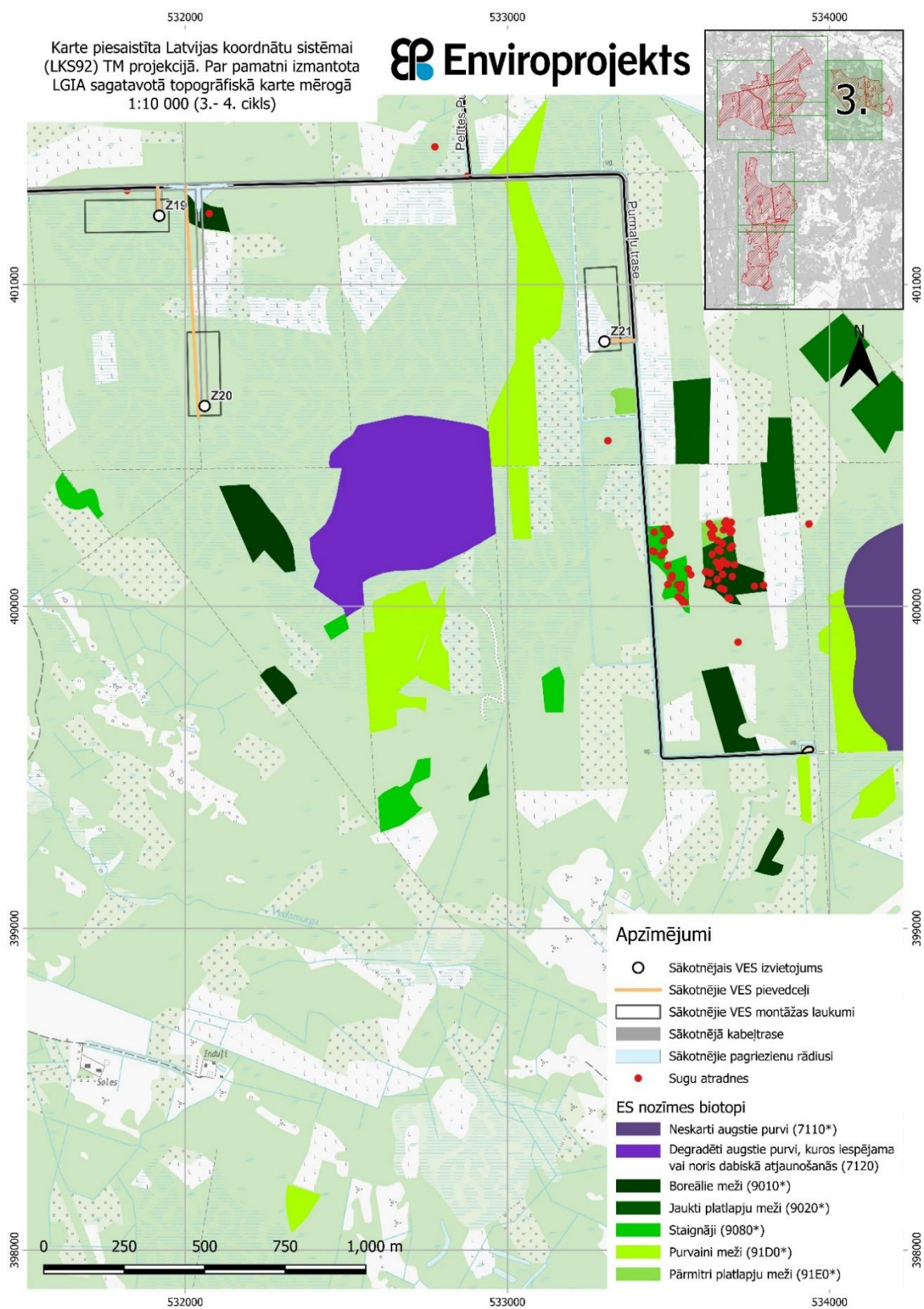


Figure 7.6.3. Habitats and species of EU importance in the area of the Proposed Action, page 3 of

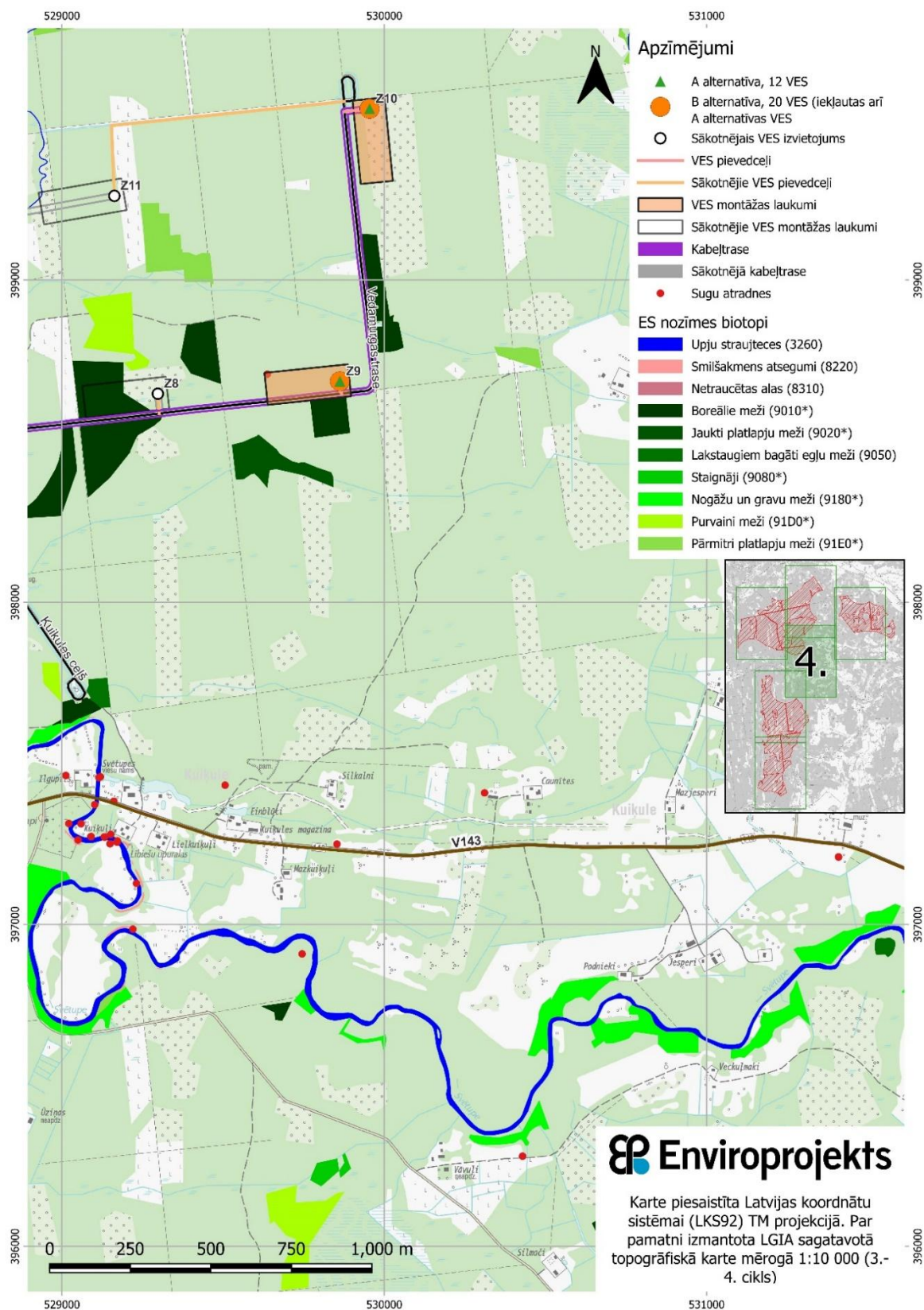


Figure 7.6.4. Habitats and species of EU importance in the area of the Proposed Action, page 4 of 6

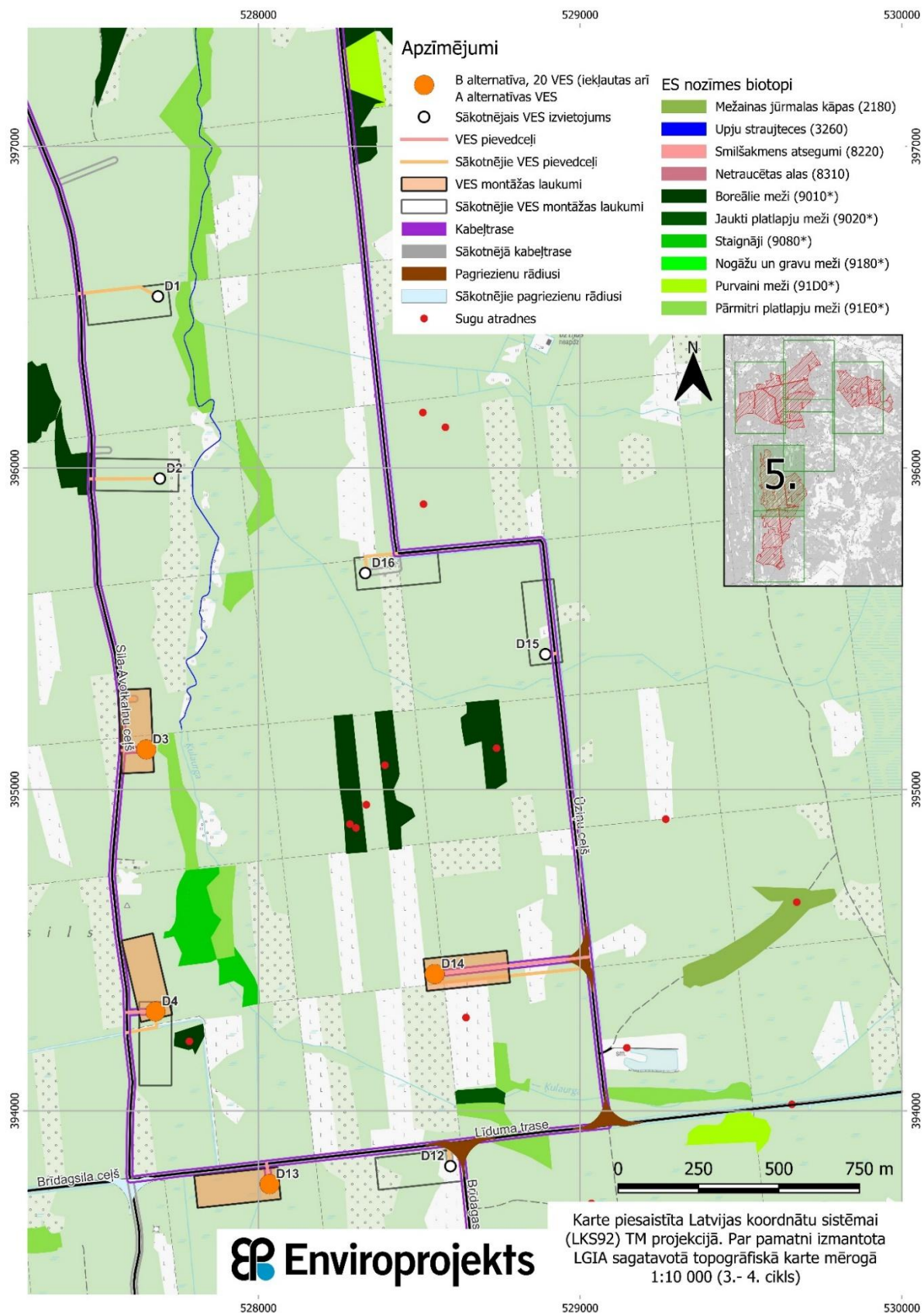


Figure 7.6.5. Habitats and species of EU importance in the area of the Proposed Action, page 5 of 6

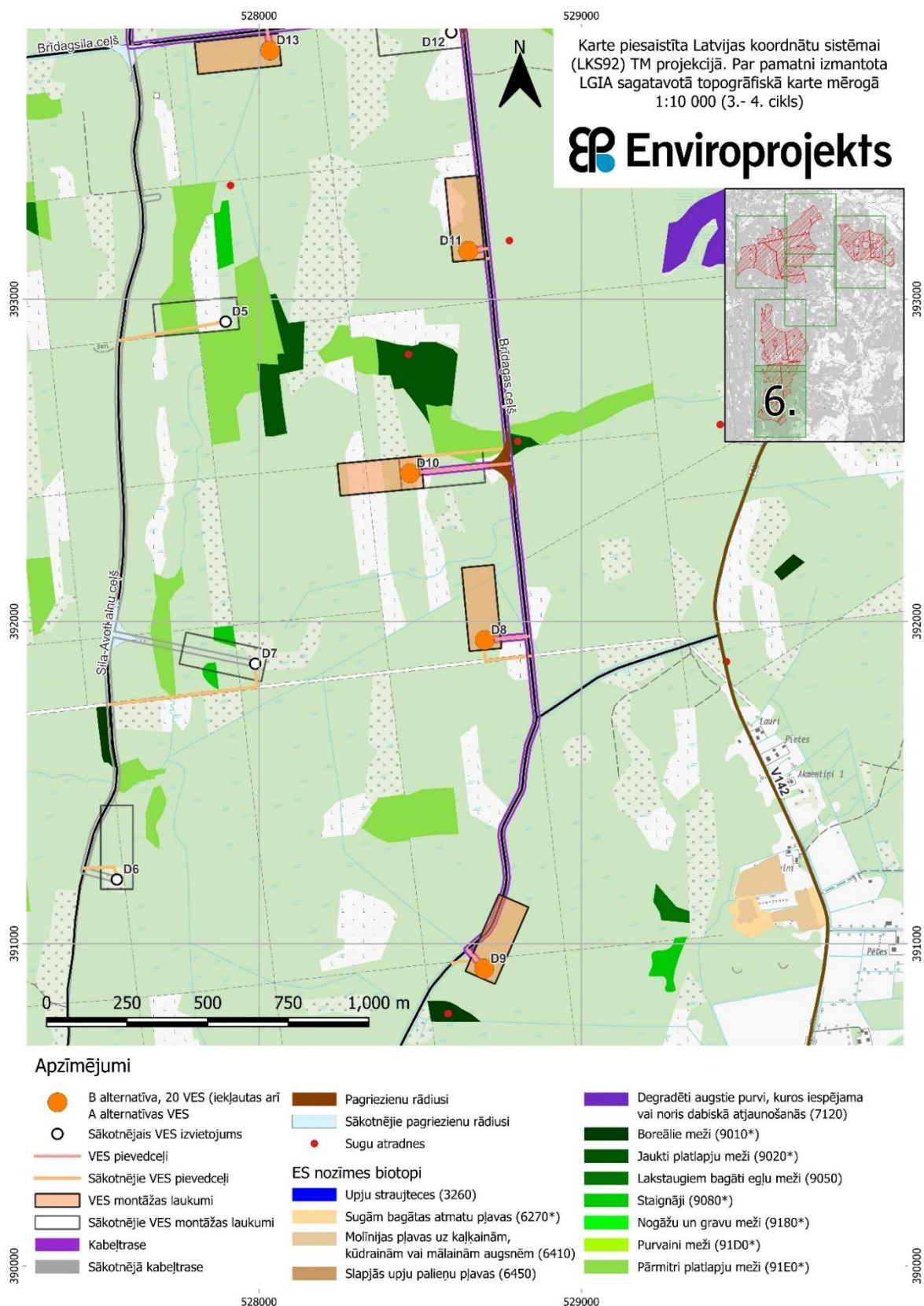


Figure 7.6.6. Habitats and species of EU importance in the area of the Proposed Action, page 6 of 6

Summary of the impacts on habitats and species of the recommended alternatives (1A and 2A) for the northern part of the WPP wind farm and the substation and battery farm and the three possible connection options - cable route (1A A and 1A R) or overhead line (2A) - based on **07. 11. 2024 expert opinion on the**

impact of the planned activity - construction of the wind farm infrastructure in Limbaži municipality - on forest and heathland and bog habitats, vascular plants and mosses (attached as Annex 6) is presented in Table 7.6.1.

Table 7.6.1. Summary of impacts on habitats and species of the recommended alternatives and pathways for the northern part of the WPP park, substation and battery farm

WPP/ substation/ path	Identified natural values	Impacts on natural values, mitigation measures, residual impacts
Z1	Flat terrain, mainly under dry growing conditions. Access from the existing LVM road, the technological site is directly adjacent to it with its narrowest edge. The planned WPP is located in Block 434, at the intersection of a birch coppice, a middle-aged pine coppice and a clearing; the planned process area is located in forest patches that are coppice or middle-aged pine and spruce coppice, some of which is also a clearing.	Impacts on low quality habitat are expected - the site is in close proximity to a very young, minimum suitable habitat, Staghorn Woodland 9080*, no SPA species are present. On the edge of the technological site there is a site of annual swift (~2 ^{m2}) which will be destroyed during construction. The construction of the technological site should preferably be designed to minimise the impact of dewatering, with a maximum potential impact area of 0.7 ha, at least part of which is expected to remain as the habitat is immediately adjacent to the site. The construction of the site will result in the destruction of an annual site of ~2 ^{m2} of swift.
Z2	Flat terrain, dry growing conditions, ditch along the road. Access from the existing LVM road, the technological site is directly adjacent to it with its longest edge. The planned WPP is located in Block 404 in a middle-aged pine stand, the planned process area is located in a birch and spruce mixed deer stand and a middle-aged spruce-birch mixed stand.	No protected forest or swamp habitats and no specially protected plant species were found in the area. To the north of the Purmali track is habitat 91E0* Alluvial forests (also habitat of chestnut-brown Dartford warbler), which is already affected by dewatering, impact from the construction of the WPP is low. No dredging of road ditches along the Purmali track is allowed , as no negative impacts on protected habitats and species are expected.
Z3	Located at the junction of two LVM tracks, flat terrain, drained soils, as there are drainage ditches along both roads. The WPP is located in a coppice in block 406. The location of the technological site is planned in dry conditions, in damsack and hemlock forest types, mainly middle-aged, also mature conifer-birch stands.	No protected forest or swamp habitats and no specially protected plant species were found on the site. Theoretical potential impact on habitat 91E0* Alluvial forest (located 50 m south of the edge of the planned process area, also habitat of chestnut-brown arthonia). The construction of the technological site must be carried out in the planned location, on an elevation; no solutions are allowed that would cause dewatering impacts on the 91E0* biotope - the theoretical potential impact area is 1 ha, but the site is located on an elevation relative to the biotope.
Z4	Located close to an existing LVM road, the WPP site is 80 m from an existing LVM road. A road through the clearing is proposed for access (Leg 21). The site is dry with flat terrain. The WPP is planned to be located in a young stand (406 sq.20.nog.), in a clearing of technological sites, as well as in middle-aged dry pine stands, part of which is also a mature stand.	No protected forest or swamp habitats and no specially protected plant species were found in the area. Habitat 91E0* Alluvial forests (which is also a habitat for chestnut-brown artonia) is located in the periphery of the area of potential effect, but the impact is low, as the site is planned to be located on an elevated site.
Z5	The WPP site is 310 m from the existing	The surrounding area to the south and west is

WPP/ substation/ path	Identified natural values	Impacts on natural values, mitigation measures, residual impacts
	<p>Kuikule road alignment. The WPP site is located in a 438 sq.2.nog. coppice of a dry forest type, while the technology site as well as the location of the cable route is located in a coppice of spruce and spruce-fir coppice of wet heather and wet mint types, also in a middle-aged pine coppice.</p>	<p>woodland - habitat of the chestnut-brown Dartford warbler. Negative impacts on habitat microclimate (1.1 ha) and hydrological regime (up to 2.6 ha) are expected. To the east of the existing road connection is habitat 91E0 Alluvial forests and habitats for several SPA species, but the impact from the construction of the connection is unlikely to be significant if mitigation measures are taken.</p> <p>The road ditch on the east side of the existing road shall not be deepened to form a connection. It is preferable to design the site without side ditches on the western and southern sides to minimise the impact of dewatering on the habitat of the chestnut-brown Dartford warbler, but it is expected that the impact on the hydrological regime may remain in at least part of the site due to the direct adjacency of the site to the habitat. Estimated residual impact on chestnut-brown arthropod habitats: approximately 1.1 ha impact on microclimate and 1.3 ha impact on hydrological regime (half of maximum potential).</p>
Z6	<p>It is recommended that the location of the planned WPP and the site be relocated to the opposite side of the road, Block 408, on flat terrain, in dry soil conditions, close to the existing Kuikule track. The planned WPP site and site are located in dry pine, spruce-birch middle-aged and mature stands.</p>	<p>No protected forest or wetland habitats and no specially protected species have been identified in the area of the proposed action and the area of influence.</p> <p>In its original location, the site was adjacent to wet woodlands and the habitats and species they contain. The site would have a negative impact on the microclimate of habitat 9010* Old or natural boreal forests and also of chestnut-brown Dartford and dark-brown Helleborine in an area of 0.3 ha. Negative impacts on the hydrological regime could affect habitat 9010* up to 2.2 ha and would also affect the habitat of species such as chestnut-brown Dartford warbler 1 ha, naked round-leaved warbler 1.6 ha and dark-brown spadefoot 0.6 ha. The construction of the site would destroy 4 square metres of caterpillar moth.</p> <p><u>The recommendation to relocate the planned WPP has been taken into account.</u></p>
Z9	<p>Located in close proximity to the road alignment, in gently undulating terrain. Soil conditions are both dry and alternately wet, with a drainage ditch along the road. The WPP is located at 441 sq.37.nog. in a clearing, under dry conditions. The planned site is located parallel to the road in part of plots 32,34,35, which are generally medium-aged spruce-birch and mature stands.</p>	<p>No protected forest or swamp habitats and no specially protected plant species were found in the area. The southern side of the Vedamurga track, near which the site is planned, contains habitats 9010* Old or natural boreal forest and 9080* Coniferous Forest (including cattail marten habitat), but impacts on these habitats are unlikely if mitigation measures are followed.</p> <p>Dredging of the Vedamurga track ditches is not allowed and the site should be designed in such a way as not to affect the hydrological regime of the habitats on the south side of the existing road.</p>
Z10	<p>The proposed WPP is located approximately 75 km from the existing</p>	<p>In the vicinity, approximately 80 m to the east of the site, the wetland forest habitat 9080* Coppice</p>

WPP/ substation/ path	Identified natural values	Impacts on natural values, mitigation measures, residual impacts
	road alignment, in dry soil conditions, on flat terrain, on 442 sq.2 km of birch woodland. The planned process area is located parallel to the road route, in the clearing of section 1 and part of section 2. Forests in the surrounding area also grow in dry or parched conditions	woodland has been identified with potential construction impacts (up to 0.9 ha), as has the habitat of the protected species chestnut-brown arthonia and hollow-leaved lechenia (0.8 and 0.9 ha, respectively). Potential impacts on natural values should be avoided by not designing side ditches on the habitat side.
Z12	The proposed WPP site is located next to an existing forest track, in dry conditions, on undulating terrain. The WPP site is 398 sq.m. on the 6th of Nov. in a middle-aged pine-spruce stand, as is most of the process area, part of which is also on the 11th of Nov. in a spruce stand	In the vicinity, across the road 50 m to the west, there are protected forest habitats 9010* Old or natural boreal forest and 91D0* Swamp forest, as well as species of special conservation concern - bald eagle-foot, Heller's keel, habitat of the green box, hollow-leaved lechenia, chestnut-brown, vine-coloured and cat's-foot arthonia, which could be adversely affected by additional dredging on the west side of Aivars Road. As the road has already been reconstructed and the site is planned to be constructed on the eastern side of the road, it is expected that there will be no adverse effects on these natural values provided that the condition not to dredge the road during design is respected.
Z13	The proposed action site is located in dry, moist and dehumidified soil conditions, in middle-aged spruce-fir stands and in mature stands. The WPP site is planned on a quarter-mile, close to an existing forest track. Technological site parallel to the road route.	The site of the proposed activity is a forest patch which is a habitat of the chestnut-brown Dartford warbler, the expected impact on the habitat is 0.3 ha habitat destruction, 0.2 ha negative impact on the microclimate and hydrological regime. Habitat 91D0* Swamp woodland and chestnut-brown Dartford warbler habitat is located approximately 100 m to the south of the site; given the site's location on a slight elevation, no adverse effects are expected if the design conditions are met. As the habitat of the chestnut-brown Dartford warbler in the immediate area of influence is of low quality and does not qualify as a protected habitat of EU importance, it is acceptable not to relocate the proposed site. Ensure that no side ditches are created on the southern side and that the hydrological regime of habitat 91D0* is not affected.
Z16	The site is located on undulating terrain, in waterlogged soil conditions, in close proximity to the LVM road route. The planned WPP site is located in a spruce-fir stand, the process area in a birch stand, a middle-aged spruce-fir stand and a deer stand	The proposed WPP site was located approximately 35 m from habitat 9080* Coppice woodland, which is also a habitat for Chestnut-brown Dartford Warbler, in the originally assessed location. Construction of the site would have a negative impact on the habitat and the 0.1 ha habitat of the species and could have a dewatering effect on this habitat polygon (0.2 ha) and further west on habitat 9080*, the habitat of chestnut-brown Dartford warbler and smooth-cockaded jungermannia. During the development of the opinion, it was recommended that the WPP and the site should be shifted to the east (this

WPP/ substation/ path	Identified natural values	Impacts on natural values, mitigation measures, residual impacts
		<p><u>recommendation has been taken on board</u>) to avoid potentially negative impacts on wetland habitats and species assemblages and to avoid potential dewatering impacts on the habitat and habitat of the chestnut-brown Dartford warbler during design. No impacts on natural values are expected.</p>
217	<p>The site is located on undulating terrain, in wet and waterlogged soil conditions. The planned location of the WPP is in a pine coppice (401 sq.4 nog.), the technological site is planned partly in a forest animal feeding field and clearing, in a pine coppice and partly in an adult pine coppice. Access to the site is via the existing Purmali Road track.</p>	<p>Two options for the WPP process site have been considered - a north-south oriented and a north-east-south-west oriented site. The first option would place the edge of the site close to habitat 9010* Coppice woodland, which is also the habitat of Chestnut-brown Dartford Warbler and Bare-leaved Fritillary, potentially affecting 0.7 ha. The dewatering would also affect the surrounding wet woodland complex. It is therefore recommended that the site be reconfigured <u>(this recommendation has been taken on board)</u> to be located on an elevated site crossed by an existing road. In this configuration, dewatering impacts on habitat 9080* (0.2 ha) and Chestnut-brown Dartford Warbler habitat (0.7 ha) are theoretically possible, but these areas are located in an area already affected by road and ditch construction, as well as at a lower elevation relative to the site. To avoid impacts, ensure that no ditches are created on the southern side of the site with a bottom mark lower than the top mark of the habitat and the species' habitat.</p> <p>There are some trees of large landscape dimensions - oak, linden (401 sq.m.-5 sq.m.), which will be destroyed as a result of construction.</p>
Connection to substation 1A R	<p>The planned location of the cable route and the road is in a complex of pine, spruce and mixed spruce-fir stands of middle age, sometimes mature, with moist forest growth conditions. The route follows forest quarter-track, natural carriageways or crosses forest slopes.</p>	<p>The planned route contains small patches of spotted (6 individuals) and Fuchs' cuckoos (5 individuals), creeping buttercup (1 individual), nightshade (1 individual), naked round-leaved (3 inhabited fallow). The connection would destroy these deposits. Habitat 9080* Coniferous forests and habitats of various species associated with forest habitats and elevated moisture conditions are located in the immediate vicinity of the action site, which would be partially destroyed and have a negative impact on the microclimate and moisture conditions of the remaining habitats. Given that the road would be constructed through a hitherto undisturbed forest and the length of the connection is too long to allow construction without thinning the road alignment, it is expected that the affected areas would be close to the estimated areas. Areas of habitats and species negatively affected: 9080* (direct impact 0.16 ha, impact on microclimate and hydrological regime 0.3 ha), chestnut-brown and cattail arthonia (direct impact 0.4 ha, impact on microclimate and</p>

WPP/ substation/ path	Identified natural values	Impacts on natural values, mitigation measures, residual impacts
		<p>dehumidification 0.8 ha), green boxwood (direct impact 0,1 ha, microclimatic impact 0,5 ha), hollow-leaved lachen (direct impact 0,4 ha, microclimatic impact 0,9 ha, dehumidification impact 1,5 ha), naked round-leaved (0,2, 1,2 and 1,6 ha respectively), shoveler (0,2 , 0,3 and 0,3 ha respectively).</p> <p>Overall, this connection option has the most adverse impact on natural values, as it would degrade forest areas that have been undisturbed by deforestation.</p>
Connection to substation 1A A	<p>The location of the planned cable and road runs mostly, except in the northernmost part, through existing forest blocks. The forest stands found here grow under moist conditions, mainly birch coppice, but also pine and pine-larch mature stands, but there is also the influence of dehumidification.</p>	<p>In the northern part of the site, the forest habitat 9080* Coniferous forests is located in the immediate vicinity. The proposed road alignment crosses habitats of various protected species, which would be adversely affected by habitat destruction, microclimate and hydrological conditions. Expected impacts and their areas: 9080* Coniferous forests (negative impact on microclimate 0.1 ha, dehumidification impact 0.7 ha), chestnut-brown arthonia (direct impact 0.1 ha, impact on microclimate 0.1 ha, dehumidification impact 0.7 ha), cat's foot arthonia (dehumidification impact 0.8 ha), three-spotted bacania (direct impact 0.1, microclimate impact 0.3), hollow-leaved lachen (direct impact 1.5 ha, microclimate impact 2.7 ha), naked round-leaved (dehumidification impact 0.3 ha)</p> <p>Although this option has a greater direct impact on habitat areas than Option 1A R, the areas crossed by the connection are already affected by dewatering and engineering measures to reduce dewatering (shallow side ditches, limiting runoff from habitats) would reduce the areas affected slightly but would still have a negative impact on the microclimate. If possible, this connection option should also be discarded and option 2A should be chosen.</p>
Sub-satellite and cable route alternative 2 A	<p>The planned alternative substation/cable line connection site is located in a dry pine stand of mature age (site 396 sq.-13, see photo below). The planned cable route then passes through middle-aged and mature pine, spruce-fir wet forest stands in undulating terrain, crossing deep ditches in places.</p>	<p>No protected forest habitats or species habitats were identified in the direct-action area and in the potential area of impact on forest microclimates.</p>
Purmali track	<p>See Figure 7.6.1. Existing full-width forest road with side ditches, crosses a small rise in the west, then follows the plain.</p>	<p>The potential zone of influence of dewatering includes habitats 9010* <i>Old or natural boreal forests</i>, 9080* <i>Coniferous forests</i> and 91E0* <i>Alluvial forests</i>, as well as habitats of species associated with wet forest habitats (cattail and chestnut-brown arthonia, smooth-crowned jungermannia, naked roundleaf and dark-brown</p>

WPP/ substation/ path	Identified natural values	Impacts on natural values, mitigation measures, residual impacts
		and black-streaked hard-vetch). In order to avoid negative impacts, no deepening of side ditches below the existing mark is allowed in case of road realignment. Extensions to the cable route and road alignment, if necessary, should be directed along the northern side of the road, as the southern side contains some of the habitats of these species; the northern side does not contain any habitats of these species, so negative effects of the road and cable route can be ruled out in this section.
Purmali track branch	See Figure 7.6.2. Existing full-width forest road with side ditches, running on flat terrain, with a slight rise in the northern part near the turnaround area.	Along the roadside before site Z17 is the habitat of Chestnut-brown Dartford Warbler and habitat 9080* <i>Coppice woodland</i> . No dredging of roadside ditches . It is preferable to locate the cable routes on the western side of the road, where there are larger forest patches, in order not to increase the impact of fragmentation on the habitat 9080* on the eastern side.
Aivars' Road	See Figure 7.6.1. A small section of the road is in the process of reconstruction, most likely with deepened side ditches and a widened alignment.	To the west of the road, habitat 9010* <i>Old or natural boreal forest</i> and 91D0* <i>Swamp forest</i> are likely to be adversely affected by dehumidification over 2 and 0.9 ha, respectively. The habitats are also habitats for protected species (cattail, chestnut-brown and wine-coloured arthonia, green box elder, Heller's knapweed, hollow-leaved lachen, naked round-leaved). No dredging of road side ditches is allowed if the road needs to be reconstructed, the east side of the road should be chosen for cable routes to avoid negative impacts on the microclimate of habitats and species habitats.
Kraukļu ceļš	See Figure 7.6.1. Full-width forest road with side ditches, quarry in the northern part to the east of the road. The road is elevated for long stretches.	To the south of the quarry, on the roadside, is forest habitat 9080* <i>Coppice woodland</i> and a 0.5 ha habitat of protected species (chestnut-brown and vine-coloured arthonia, green boxwood). The site is adversely affected by dewatering from a quarry and an existing ditch. No roadside ditches shall be dredged for approximately 150 m along the biotope.
Jaunupe road	See Figure 7.6.1. A full-width forest road with side ditches, forming a connection between the Raven Road and the Purmali track. The southern part of the road is surrounded by coppice and crosses a small ditch. In the eastern and northern parts, the road passes through a complex of both dry swamp forests and dry pine woodlands.	The southern part of the road is bordered on its northern side by habitats 9010* <i>Old or natural boreal forest</i> and 91E0* <i>Alluvial forest</i> , which is also a habitat for chestnut-brown arthonia and birch stag beetle. To the south of site Z4 the road crosses habitat 9010*, which is a dry stand of old pine. The impact of the densification could potentially affect habitats 9010* and 91E0* and species habitats in the southern part of the road, while the crossing of habitat 9010* at site Z4 for the cable route will destroy part of habitat 9010*. To reduce the impacts, it is not allowed to deepen the road side ditches and widen the road to the north where it passes through biotopes 9010* and

WPP/ substation/ path	Identified natural values	Impacts on natural values, mitigation measures, residual impacts
		91E0* (polygons 24AP116_108, 109) , while at site Z4 the western side of the road should be selected for the cable route , where part of the biotope is already negatively impacted by the road and quarter-track, keeping the majority of the biotope polygon intact. Residual impact - destruction of 0.1 ha of habitat 9010*.
Kikule road	See Figure 7.6.1. Full-width forest road with side ditches, crossing wet and dehumidified forest stands. It crosses Vedomurga in the middle.	Along Vedomurg, both on the west and east side of the road, there is a habitat 91E0* <i>Alluvial forests</i> . During the road reconstruction, trees along the roadside have already been partially felled. No additional dewatering of the 91E0* habitat is allowed, and the cable route should be located on only one side of the road (preferably on the east side , where the habitat area along the road is smaller). Residual impact - 0.03 ha habitat destruction).
Vedomurga route	See Figure 7.6.4. Full-width forest road with side ditches. In the western part it crosses a complex of swamp forests drained by the road's side ditches, in the eastern part around the road stands of dehumidified and wet growing conditions.	At site Z8, on both sides of the road is habitat 91D0* <i>Swamp forests</i> , on the northern side it is also the habitat of the naked round-leaved fritillary. At the road turning north, habitats 9010* <i>Old or natural boreal forest</i> and 9080* <i>Coppice woodland</i> (also habitat of Chestnut-brown Dartford Warbler). In the eastern part of the road, it passes through habitat 9010* <i>Old or natural boreal forests</i> , which is also a habitat of the Vine-coloured Dartonia. The potential area of habitat destroyed by the cable routes could be up to 0.8 ha, but almost everywhere it is possible to locate the cable route on the opposite side of the road to the habitat - from the Kikule road to the southern side of the Z8 road, then on the northern and western sides of the road. Residual impact - destruction of 0.12 ha of habitat 91D0* (polygons 24AP116_112, 113). No deepening of roadside ditches below the existing mark or widening of the road where it adjoins a protected habitat.

The summary of the nature values, conclusions and conditions for the implementation of the Proposed Action provided by the habitat expert in the expert opinion of 06.02.2024, as well as the additional assessment of the hydrological expert on the potential impact of the Proposed Action on changes in the hydrological regime and the clarification of the location of the WPP in the southern part of the wind farm are summarised in Table 7.6.2. **For potential WPP sites, additional assessment of vascular plant, moss and lichen species and development of a solution for the AST connection, as well as additional freshwater impact studies for the power line crossing over the Svėtupe River, are mandatory measures.**

Table 7.6.2. Summary of impacts on habitats and species in the southern part of the WPP wind farm

WPP substation	Identified natural values	Conclusions and conditions for taking action
D3	no protected forest or swamp habitats and no specially protected plant species were found in the	The proposed development may have a significant adverse effect on habitat 91E0*, which is located within the zone of influence.

WPP substation	Identified natural values	Conclusions and conditions for taking action
	area. In the immediate vicinity of the habitat <i>Alluvial forests 91E0*</i>	Conclusions of the hydrological expert on the potential impact on habitat 91E0*: due to the slope of the land surface of the site, surface water runoff occurs in the A direction towards the Kulaurgs stream. Surface water harvesting by the side ditch will only take place in the immediate vicinity of the side ditch and is unlikely to significantly affect the hydrological and moisture regime of the habitats. The impact of groundwater seepage from a drainage ditch or drain on adjacent properties and on the hydrology of wetlands depends very much on the "lateral effect" of the ditch - the distance in metres from the ditch that the seepage impacts occur, rather than on the width of the strip of land adjacent to the ditch whose hydrology has been altered. Given that the side roads of the planned access road will be oriented parallel to the access road, no impact on the habitat is expected. It is recommended to use the existing forest road as access.
D4	no protected forest or swamp habitats and no specially protected plant species were found in the area. Habitat <i>Old-growth or natural boreal forest 9010*</i>	The proposed development may have significant negative impacts on the dry and wet forest habitats in the area of influence. D4 The WPP maintenance area crosses the shared watercourse MK 53811:K:1. Therefore, in order to maintain the hydrological regime, the construction of the maintenance yard requires the installation of a culvert approx. 105m in length, which will make future maintenance significantly more difficult and may affect the hydrological regime of the surrounding area. Therefore, it is recommended to change the location of the maintenance area. The location of the WPP D4 maintenance site has been refined in the light of the hydrological and habitat expert's assessment.
D8	No protected forest or swamp habitats and no specially protected plant species were found in the area.	The construction of the WPP and the process yard is not expected to result in impacts on nearby protected nature areas and plant species sites that are sufficiently distant from the site of operation
D9	No protected forest or swamp habitats and no specially protected plant species were found in the area.	The construction of the WPP and the process yard is not expected to result in impacts on nearby protected nature areas and plant species sites that are sufficiently distant from the site of operation
D10	The area where the technological	The construction of a WPP and a process yard

WPP substation	Identified natural values	Conclusions and conditions for taking action
	site is originally planned contains a specially protected forest habitat <i>Alluvial forests 91E0</i> and in the immediate vicinity there is a site of a specially protected plant species - perennial moonwort <i>Lunaria rediviva</i>	is not allowed on the planned site, as the area contains specially protected biotopes and in the immediate vicinity there are deposits of specially protected plant species. The area is dominated by waterlogged woodland and without drainage, construction will not be possible and there will be significant impacts on existing natural values. It is recommended to relocate the WPP to the west, where no impacts on protected habitats are expected from the drainage of the side ditches. Repositioning of D10.
D11	No protected forest or swamp habitats and no specially protected plant species were found in the area.	The construction of the WPP and the process yard is not expected to result in impacts on nearby protected nature areas and plant species sites that are sufficiently distant from the site of operation
D13	No protected forest or swamp habitats and no specially protected plant species were found in the area.	The construction of the WPP and the process yard is not expected to result in impacts on nearby protected nature areas and plant species sites that are sufficiently distant from the site of operation
D14	No protected forest or swamp habitats and no specially protected plant species were found in the area.	The construction of the WPP and the process yard is not expected to result in impacts on nearby protected nature areas and plant species sites that are sufficiently distant from the site of operation

Conclusions and summary of impacts on habitats and SPA species

The construction of the WPP Park Alternative B, which includes the WPP in the southern part of the WPP Park, is not recommended at this stage, as it has not been subject to an assessment of vascular plant, moss and lichen species and the development of a solution for the AST connection, as well as an additional impact study on freshwater for the power line crossing over the Svētupe River. The information to assess the residual effects of the Proposed Action is incomplete.

The residual impacts on protected natural values resulting from the construction of WPP Park Alternative A after the application of mitigation measures are summarised in Table 7.6.3. One of the largest areas of habitats and species habitats affected is related to the construction of the 1A A and 1A R connection, forming the road to the substation. Even with the lower impacts of Alternative 1A, there will be moderate adverse impacts at the local scale and insignificant adverse impacts at the regional scale, creating a new linear opening in the forest mass and associated impacts on the microclimate and hydrological regime of habitats and species habitats. In the case of the implementation of the connection alternative 2A, the **proposed operation would have an overall insignificant adverse effect at the local and regional level**: some species individuals and small areas of species habitats and protected habitats would be destroyed, but this **would not have an adverse effect on species populations and the conservation status of habitats**.

Additional recommended measures to protect other natural assets during construction.

- Large-sized (>25 cm) fallen trees in the paths of roads and building sites should be moved to the nearest stand.
- If ecological trees are felled in clearings during construction, they should be moved to the nearest stand as far as possible.
- The use of imported black earth should be avoided to prevent the introduction of seeds of invasive species.

Table 7.6.3. *Estimated residual impacts of Alternative A after implementation of all mitigation measures (area ha, if no other unit is specified)*

	Direct impact							Impact on the microclimate					Effects of Suspension			
	Z1	Z13	1AR	1AA	Jaunupe road	Kuikule track	Vedamurga route	Z1	Z5	Z13	1AR	1AA	Z1	Z13	1AR	1AA
9010*					0.1											
9080*			0.2					0.1			0.3	0.1	0.35		0.3	0.7
91D0*							0.12									
91E0*						0.03										
Chestnut-brown Arthonia		0.3		0.1					1.1	0.2	0.8	0.1	1.3	0.2	0.8	0.7
Catnip Artonia											0.8				0.8	0.8
Spotted Cuckoo Thrush			6 i													
Fuchs' Cuckoo Thrush			5 i													
Step of the Year	2 kvm															
Cowslip			1 i													
Nightshade			1 i													

	Direct impact							Impact on the microclimate					Effects of Suspension			
	Z1	Z13	1AR	1AA	Jaunupe road	Kuikule track	Vedamurga route	Z1	Z5	Z13	1AR	1AA	Z1	Z13	1AR	1AA
Naked roundleaf			0.6								1.2				1.6	0.3
Green boxwood			0.1								0.5					
The cavern of the lager			0.4	1.5							0.9	2.7			1.5	
Shovel			0.2								0.3				0.3	
Three-day bacania				0.1								0.3				

7.6.2. Effects on birds

The assessment of impacts on bird species, in the case of bird populations, is purely a prediction of impacts - factors that make an objective assessment difficult must be taken into account:

- birds are characterised by high mobility (flight), which, despite their territoriality and occupied breeding sites, does not preclude occasional arrivals in other areas that may be several kilometres or tens of kilometres from their breeding sites, as well as non-breeding individuals and juveniles that may wander and are not tied to a specific area;
- within a given area, species composition, density and distribution of breeding sites can vary from year to year, due to local extinction and recolonisation processes, migration conditions or available food resources and other factors;
- the likelihood of detecting individuals varies within species;
- including climate impacts.

The literature indicates that quite often the environmental impacts assessed in EIAs, especially for birds in terms of collisions, are very different from the situation on the ground after the establishment of the park and the predicted collision risks are assessed to be significantly higher than originally estimated.²²¹

In the specific area of the park, the main impacts are collisions, habitat destruction, habitat use restriction (noise and flicker), barrier effect.

Clashes

In the literature, the most prominent impact of the construction of WPP parks is the death of birds as a result of collisions. It is also pointed out that there are no places where birds are not likely to have traumatic or fatal collisions with WPP structures - rotors or towers - and no bird species (at least within Europe) that are not likely to have such collisions.²²²

Collision mortality is mostly estimated as the number of birds killed per year per WPP, while it has been pointed out that these values fluctuate depending on both the location and the size of the WPP, ranging from 0 birds per year to 60. The statement is expressed as an average score: 0-5 birds.²²³

Most literature identifies the most vulnerable species to collisions as soaring birds: diurnal birds of prey, especially sea eagles and storks, as well as migratory birds, are considered to be significant victims of collisions.²²⁴ The second group of species assessed as being at risk of collisions are passerines, more specifically, huns: this group is more likely to be involved in collisions with fixed infrastructure objects, including the mast of a WPP.²²⁵ There are studies that have experimentally shown a reduction in the number of collisions between passerines (*Lagopus lagopus*) by painting the base of towers (up to 10 metres high) black²²⁷. However, according to the "Guidelines for the Preliminary Environmental Impact Assessment of Wind Power Plants"²²⁸ - relatively recent studies have shown that most bird species collide with WPPs without distinguishing a moving wing or WPP pole against the background of the surrounding environment, while increasing contrast can significantly reduce the risk of collisions: colouring that blends

²²¹ <https://doi.org/10.1111/j.1365-2664.2011.02054.x>

²²² Rydell, J., Ottvall, R., Pettersson, S., Green, M. 2017. *The effects of wind power on birds and bats*. Swedish Environmental Protection Agency, Sweden.

²²³ Ibid,

²²⁴ Ibid,

²²⁵ <https://doi.org/10.1002/ece3.6307>

²²⁶ González, M. A. 2018. Female Cantabrian capercaillie dead by collision with wind turbine. Grouse News, 55

²²⁷ <https://doi.org/10.1002/ece3.6307>

²²⁸ <https://www.vvd.gov.lv/lv/media/9969/download?attachment>

into the landscape increases the risk of bird mortality. Given that the land use of the units included in the study area of the Proposed Action is forest, the black colouring of the lower part of the WPP would blend into the landscape and create a potential risk of bird strikes.

Some of the protected species found in the study area mainly stay at or slightly above tree height, at least during the breeding season: mainly woodpeckers, but also shrikes, and to a lesser extent pigeons and European nightjar. This could quite plausibly be seen as one of the main reasons for their relatively low collision rates with WPP rotors, while at the same time it should be noted that within the EU most WPP parks are established in different habitats rather than in a larger forested area. Technical parameters of WPPs, on the other hand, are much less covered in the studies, including information on the height of WPPs, their rotor diameter, the size of the fleet and the density of their deployment. **Primary** impacts should be addressed in areas of particular importance (large local populations, nesting sites or close to them), **avoiding the construction of specific WPPs. Secondary: through the use of mitigation technologies that help avoid collisions.**

Habitat destruction

The construction of infrastructure facilities - access roads, cable lines and installation sites - increases fragmentation in the WPP Park area, which may have complex impacts on both nesting species and their habitat quality, both by directly destroying or transforming habitats overlapped by the planned facilities and by altering the quality of the surrounding habitats. The presence of anthropogenic disturbance in the area could potentially increase during the technical work on the WPP. Given the location of the WPP Park site, an increase in the presence of visitors unrelated to the maintenance of the WPP Park cannot be excluded. The area was assessed during the survey as a relatively popular recreational and wildlife site, with a relatively well-developed hunting infrastructure.

In general, forest-nesting bird species are characterised by higher occupancy of breeding sites in areas with lower levels of fragmentation.^{229 230 231 232} The literature recognises that the impacts of fragmentation are significant but difficult to assess: its direct effects on breeding bird populations may only become apparent over several years.²³³

It is known that there has been a decline in the intensity of habitat used by Western capercaillie around roads, but anthropogenic disturbance must also be taken into account.^{234 235 236 237} For Hazel grouse, on the other hand, the area of the stand retained and the connectivity of individual plots or groups of plots

²²⁹ Baroni, D. 2022. *CAVITY-USE AND SPATIAL ECOLOGY OF THE EURASIAN PYGMY OWL IN THE MANAGED BOREAL FORESTS*. University of Turku.

²³⁰ <https://doi.org/10.1007/s10980-023-01667-1>

²³¹ Priedniece, I., & Priednieks, J. 2013. *The impact of habitat fragmentation on forest animal populations*.

²³² Wegge, P., Rølstad, J., & Gjerde, I. 1992. *Effects of Boreal Forest Fragmentation on Capercaillie Grouse*. Empirical Evidence and Management Implications. In *Wildlife 2001: Populations* (pp. 738 749). Springer Netherlands.

²³³ Uezu, A., & Metzger, J. P. 2016. *Time Lag in Responses of Birds to Atlantic Forest Fragmentation*. Restoration Opportunity and Urgency. PLOS ONE, 11(1), e0147909.

²³⁴ Summers, R. W., McFarlane, J., & Pearce Higgins, J. W. (2007). *Measuring Avoidance by Capercaillies Tetrao Urogallus of Woodland Close to Tracks*. *Wildlife Biology*. 13(1), 19 27.

²³⁵ Gonzalez, M., & Ena, V. 2011. *Cantabrian Capercaillie signs disappeared after a wind farm construction*. *Chioglossa*, 65-74.

²³⁶ <https://www.cambridge.org/core/journals/bird-conservation-international/article/severe-decline-in-cantabrian-capercaillie-tetrao-urogallus-cantabricus-habitat-use-after-construction-of-a-wind-farm/C6ABBFF601E3A60E86DC53D34CBC01A1>

²³⁷ Taubmann, J., Kämmerle, J. L., Andr\'en, H., Braunisch, V., Storch, I., Fiedler, W., Suchant, R., & Coppes, J. 2021b. *Wind energy facilities affect resource selection of capercaillie Tetrao urogallus*. *Wildlife Biology*.

are more important factors than their quality.^{238 239 240} For woodpecker species, habitat quality is a more important factor: edge effects and removal of dead wood from the stand, especially in the form of clear-cut management, have a negative impact on the species.^{241 242}

It is recommended to avoid designing new facilities in stands with low levels of existing fragmentation and, in particular, in areas with higher concentrations of biologically valuable stands.

Before construction works, planned infrastructure facilities shall be re-surveyed within a buffer zone of at least 50 m around them, and within a 500 m buffer zone around the WPP, looking at biologically valuable forest stands, assessing possible fragmentation. Based on the natural situation observed during the surveys, a relatively small increase in the existing level of fragmentation is expected, but it should be noted that the main source of fragmentation in the study area is forestry activities.

Overall, the infrastructure layout is assessed as having relatively low new impacts: most infrastructure is planned along existing forest roads.

It is recommended to plan the new sections on existing carriageways or stiles or avoiding mature woodland as much as possible. To the extent possible, impacts on watercourses in the study area should be minimised.

To mitigate the impact of direct disturbance, deforestation and construction works should be organised outside the breeding season. **Construction work within 1000 metres of Western capercaillie rookery is strictly forbidden during the rutting period from 1 April to 15 May.** Where possible, this condition should be considered up to a distance of 1500 metres from the roost. The **restriction applies to WPPs D8, D9, D10, D11, D12, D13, D14, D15, D16 and associated infrastructure.**

Barrier effect

The barrier effect of WPP parks is often mentioned in the literature as one of the important impacts of WPP parks.^{243 244 245}

Migratory birds with a WPP as an obstacle in their flight path will often choose to avoid it by flying over or around it, consuming more energy than they normally would in the absence of the WPP. The barrier effect is stronger in species that tend to avoid parks, mainly geese, swans and cranes; similar behaviour is also observed in nocturnally migrating passerines.^{246 247} More research has been carried out on the barrier

²³⁸ Strazds, M. and Ķerus, V. 2017. *Conservation plan for the woodlark (Bonasa bonasia) 2017-2026*. Latvian Ornithological Society, Riga.

²³⁹ Kajtoch, Ł., Żmihorski, M., & Bonczar, Z. 2012. *Hazel Grouse occurrence in fragmented forests: habitat quantity and configuration is more important than quality*. European Journal of Forest Research. 131(6), 1783-1795.

²⁴⁰ Borchtchevski, V. G., Hjeljord, O., Wegge, P., & Sivkov, A. V. 2003. *Does fragmentation by logging reduce grouse reproductive success in boreal forests*. Wildlife Biology, 9(4), 275-282.

²⁴¹ Czeszczewik, D., & Walankiewicz, W. 2006. *Logging affects the white backed woodpecker Dendrocopos leucotos distribution in the Białowieża Forest*. Annales Zoologici Fennici, 43(2), 221-227.

²⁴² Imbeau, L., & Desrochers, A. 2002. *Area sensitivity and edge avoidance: the case of the Three-toed Woodpecker (Picoides tridactylus) in a managed forest*. Forest Ecology and Management, 164(1-3), 249-256.

²⁴³ Rydell, J., Ottvall, R., Pettersson, S., Green, M. 2017. *The effects of wind power on birds and bats*. Swedish Environmental Protection Agency, Sweden.

²⁴⁴ Morkūnė R., Marčiukaitis, M., Jurkin, V., Gecevičius, G., Morkūnas, J., Raudonikis, L., et al. 2020. *Wind energy development and wildlife conservation in Lithuania: A mapping tool for conflict assessment*.

²⁴⁵ DREWITT, A. & LANGSTON, R. 2006. *Assessing the impacts of wind farms on birds*. Ibis, 148(s1), 29-42.

²⁴⁶ Rydell, J., Ottvall, R., Pettersson, S., Green, M. 2017. *The effects of wind power on birds and bats*. Swedish Environmental Protection Agency, Sweden.

²⁴⁷ Pearse, Aaron & Metzger, Kristine & Brandt, David & Shaffer, Jill & Bidwell, Mark & Harrell, Wade. 2021. *Migrating Whooping Cranes avoid wind-energy infrastructure when selecting stopover habitat*. Ecological Applications. 31. 10.1002/eap.2324.

effect on birds in Offshore Wind Farms, where some species show strong avoidance behaviour when circling the farms, e.g. less than 1% of migrating geese were found to be within the collision risk zone during flight.²⁴⁸ The literature is mixed on the impact of the barrier effect on diurnal birds of prey, with both avoidance of WPP parks and, on the contrary, a marked lack of such behaviour. It is important to note that a significant proportion of the WPP park sites reviewed in the literature are geographically and in terms of park configuration significantly different from the area under assessment, including some sites that are objectively positioned not only in areas of risk to birds, but even in strong migration routes.²⁴⁹

Observations during the breeding seasons in the WPP Park have not revealed any significant flyways or distinct migration routes. However, the site is relatively close to the coast, which acts as a natural boundary for migratory species: migratory birds tend to concentrate their flights along obstacles or changes in terrain in the direction of migration.²⁵⁰ In addition, it should be noted that, apart from the migration of small passerines, birds equipped with GPS transmitters have crossed the territory of Latvia on very diverse trajectories during migration and there are essentially no regions that are not crossed by migrating individuals.

Looking at the overall location of the WPPs, it can be characterised as a relatively narrow but long group of N-S aligned (especially if the recommendation to abandon the NE part of the three WPPs is accepted), overlapping at least relatively with the general migration direction from N-NW to SW or vice versa, depending on the direction of migration. The park is also divided into two parts by a watercourse, and there is a strip of at least 2 km between the WPP groups, which could potentially be used as a flight corridor. In view of the above, the **impact of the barrier effect** is expected **to be low** and the migratory flight paths that pass through the study area episodically are not expected to cause disproportionate energy losses to migratory bird species.

Noise pollution

Priority protected areas for a number of special-status owl species have been modelled within the planned wind park.²⁵¹

For the priority protected areas identified in the Owl Conservation Plan, it is recommended to limit additional noise pollution from WPPs by choosing the quietest possible WPP model.

Taking into account that scientific studies^{252 253 254 255} on the impact of noise from WPP on *Strix uralensis* are controversial and many countries (Finland, Poland, etc.) do not have restrictions on noise impact, and that the approved Owl Conservation Plan specifies that "noise pollution levels anywhere within the micro-reserve (including at the boundary) in the frequency range 0.1 to 20 kHz should be below 35 dB", pre-construction monitoring of this species is required.

²⁴⁸ Newton, I. 2023. *The migration ecology of birds*. Elsevier.

²⁴⁹ Martín, B., Perez - Bacalu, C., Onrubia, A., De Lucas, M., & Ferrer, M. 2018. *Impact of wind farms on soaring bird populations at a migratory bottleneck*. European Journal of Wildlife Research, 64(3).

²⁵⁰ Newton, I. 2023. *The migration ecology of birds*. Elsevier.

²⁵¹ Avotiņš jun. A. 2019. *Conservation plan for the Barn Owl *Glaucidium passerinum*, the Short-eared Owl *Aegolius funereus*, the Barn Owl *Strix aluco*, the Barn Owl *Strix uralensis*, the Long-eared Owl *Asio otus* and the Barn Owl *Bubo bubo**. Latvian Ornithological Society, Riga.

²⁵² <https://academic.oup.com/bioscience/article/61/3/203/238162>

²⁵³ Rheindt, F.E. 2003 - *The impact of roads on birds: Does song frequency play a role in determining susceptibility to noise pollution?* Journal of Applied Ecology, 40(5), 744-753.

²⁵⁴ <https://www.sciencedirect.com/science/article/abs/pii/S0006320716304621?via=ihub>

²⁵⁵ Foote, A. D., et al. 2004. *Noise pollution and marine mammal populations: Conservation biology implications for large cetaceans*. Conservation Biology, 18(2), 373-375.

The published study *Anthropogenic Noise Effects on the Hunting Ability of Owls*²⁵⁶ provides information on the ability of owls to identify prey in the presence of increased noise pollution (Figure 7.6.7).

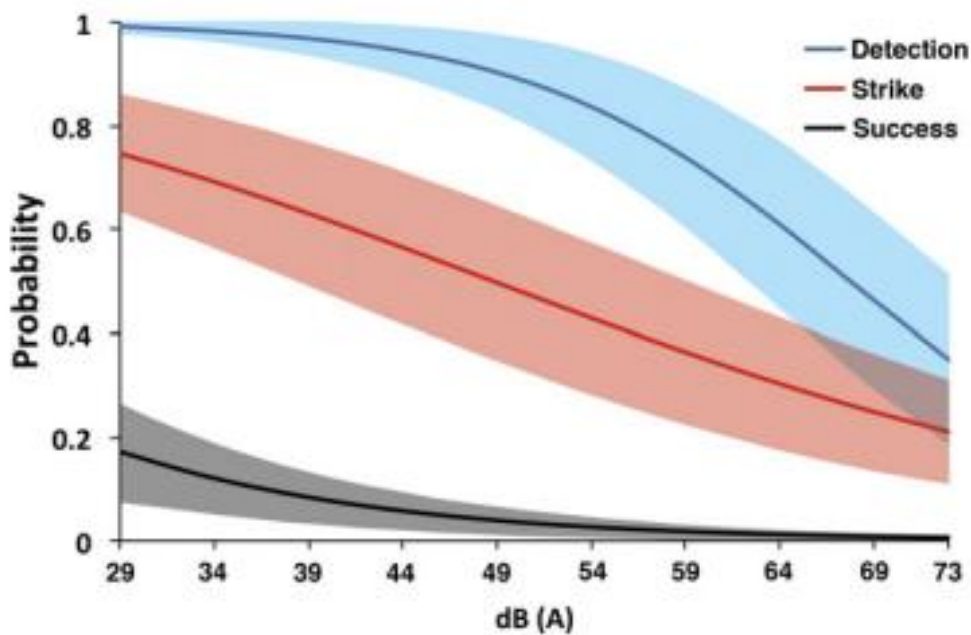


Figure 7.6.7. The graph shows the owl's ability to detect, attack and successfully capture a mouse at different noise levels (dB(A)). The graph shows three different factors influencing owl hunting: detection (blue curve), attack (red curve) and successful capture (grey curve).

35-40 dB range:

- Detection (blue curve): at noise levels between 35 and 40 dB, the owl's ability to detect prey is quite high, around 0.7 to 0.8. This suggests that this level of noise, which is similar to natural forest noises such as wind, does not significantly interfere with the owl's ability to hear its prey.
- Attack (red curve): The owl's ability to launch an attack at a noise level of 35-40 dB is slightly lower, around 0.5 to 0.7. This means that, although prey is identified, launching an attack in noise is somewhat more difficult.
- Success (grey curve): The probability of successfully capturing prey at this noise level is approximately 0.3 to 0.4, suggesting that a noise level of 35-40 dB has a moderate effect on the overall hunting efficiency of the owl.

Thus, the results of this study show that when noise levels reach 35-40 dB, which is typical for natural forest noises such as wind, the owl's ability to detect prey and launch an attack is still high, although overall hunting success is slightly reduced due to noise. This level of noise therefore creates some obstacles but does not significantly prevent owls from hunting effectively.

Taking into account the Latvian Owl Conservation Plan²⁵⁷, where the noise threshold is set at 35 dB, and based on various studies on natural noise in forest environments, where 30-40 dB is considered typical background noise, it can be concluded that a level of 40 dB, which corresponds to natural conditions, is unlikely to be harmful to owls. It can therefore be assumed that noise levels up to 40 dB will not have a

²⁵⁶ <https://www.sciencedirect.com/science/article/abs/pii/S0006320716301343?via=ihub>

²⁵⁷ Avotiņš jun. A. 2019. *Conservation plan for the Barn Owl *Glaucidium passerinum*, the Short-eared Owl *Aegolius funereus*, the Barn Owl *Strix aluco*, the Barn Owl *Strix uralensis*, the Long-eared Owl *Asio otus* and the Barn Owl *Bubo bubo**. Latvian Ornithological Society, Riga.

significant impact on the owls' lifestyle and hunting efficiency. If it is possible to operate WPP in this range at night, this does not affect the ability of owls to hunt.

There are other studies^{258 259} that show that owls are highly adaptable predators that have survived and hunted even in noisy environments. Although noise levels above 40-50 dB can affect their hunting efficiency, natural background noises such as wind, rain and tree whistling usually do not exceed this threshold, so owls have learned to cope with short-term noises that can cause difficulties in hunting.

Cumulative impact assessment in the context of other WPP parks

In the assessment of the EIA report preparers, there is currently no information available to carry out a full assessment of cumulative impacts in the context of impacts on bird populations, as it is not possible to state unequivocally that such impacts will occur or that all construction plans will be implemented in full.

Objective assessment of cumulative impacts is not feasible: experts do not have access to a system for exchanging information on other planned WPP parks in the vicinity (see Figure 3.2.4). There is also no common approach or methodology for assessing these impacts.

There is information that the installation of one WPP is planned in the northern part of the WPP Park. Potentially minor impacts are expected from this proposal, which may increase the barrier effect, as if the WPP is installed in the vicinity of the WPP assessed in this Opinion (at a distance of less than 1 km) - this WPP would be perceived as a single barrier to migratory birds.

Risk assessment of the impact of the proposed action on bird species

By summarising the information on the observations made during the EIA and analysing them in the context of the information recorded by DDPS "OZOLS", nest inventory data and, in some cases, observations recorded on dabasdati.lv, a risk assessment of the impact on bird species has been prepared for the recommended WPP.

The 500 x 500 m grid cell map used in the Species Conservation Plans for owls and woodpeckers was used to characterise the impacts. Given that birds are mobile creatures and their breeding sites vary from year to year, this allows for a more efficient and transparent characterisation of the WPP Park study area. The expert who carried out the risk assessment points out that the cell boundaries are not absolute: the local situation must be taken into account, while the assessment provides a summary picture of the most important sites for birds in the area of the proposed activity, see Figure 7.6.8.

The criteria used for the assessment are described in the bird expert opinion (see Annex 6).

²⁵⁸Rheindt, F.E. 2003 - *The impact of roads on birds: Does song frequency play a role in determining susceptibility to noise pollution?* Journal of Applied Ecology, 40(5), 744-753. (This study looks at background noise levels in forests and how different environmental noises, including wind, can affect the audibility and behaviour of birds. It mentions that winds of 3-5 m/s can produce noise levels of 30-50 dB, which can interfere with communication.)

²⁵⁹<https://www.sciencedirect.com/science/article/abs/pii/S0006320716304621?via=ihub>

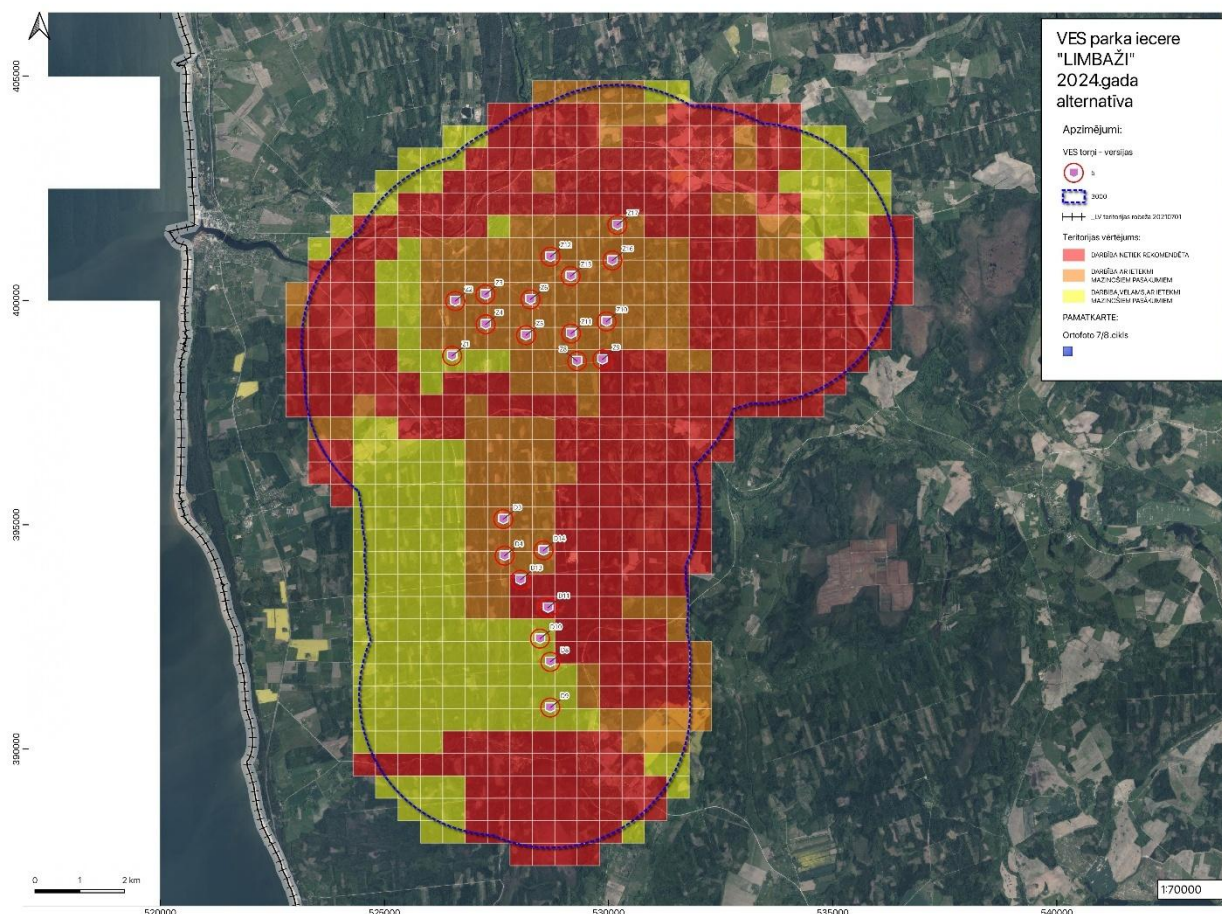


Figure 7.6.8. Risk assessment of impacts on bird species for the recommended WPP

ŠŪNAS VĒRTĒJUMS

- 1- DARBĪBA NETIEK REKOMENDĒTA (SARKANS)
- 2- DARBĪBA AR IETEKMI MAZINOŠIEM PASĀKUMIEM (ORANŽS)
- 3- DARBĪBA, VĒLAMS, AR IETEKMI MAZINOŠIEM PASĀKUMIEM (DZELTENS)
- 4- DARBĪBA BEZ IETEKMI MAZINOŠIEM PASĀKUMIEM (ZAĻŠ)
- NA - ŠŪNA NAV VĒRTĒTA

Alternative A of the proposed action (which is also part of Alternative B) has been eliminated as a low collision risk option provided that all WPPs are equipped with technological solutions that reduce the risk of accidental collisions (WPP containment chamber systems). WPP Z9 can also be retained despite being located on the periphery of the 'red' cell (see Figure 7.6.8) and would be considered a borderline case as a result of the geometry chosen.

The southern part of Alternative B is assessed as a relatively low risk area for collisions with soaring birds.

In the southern part of Alternative B, risks are posed to the Western capercaillie rookeries and potential rookeries on the periphery of the Proposed Action. If the known breeding ground (information provided by LVM, 2023 field data) is located at a relatively safe distance based on the literature, the potential breeding ground in the area south of the LVM Kulaurga quarry is located within the minimum recommended distance: 1 km. As a matter of maximum precaution, WPP D11 and D13 can only be installed after additional site investigation as part of the pre-construction monitoring, as the EIA studies and surveys have not identified the exact location of the roost but have identified indications that this is the case. The restriction of the operation of WPP D11 and D13 during the rutting period (suspension of WPP operation from 1 April to 15 May in the mornings between one hour before and four hours after local sunrise and in the evenings between one hour before and one hour after local sunset) should be adapted, but should be

specified according to the results of additional surveys to be carried out during the pre-construction period.

Negative impacts on the breeding population of Ural owls are **potentially** expected throughout the Park (both under Alternative A and B). The application of owl protection measures (noise restrictions) should be assessed according to the results of the pre-construction monitoring: choose the quietest possible WPP design and solution.

7.6.3. Measures to mitigate impacts on bird species

During the construction of a WPP

It is recommended to abandon the construction of WPP Z19, Z20 and Z21 in the NE part of the WPP Park. This is based on the presence of nesting Eurasian goshawk at distances of less than 1000 m between these WPP, as well as the presence of a known Western capercaillie rookery and another potential rookery towards the D and SE of the WPP group, also at distances of less than 1 km. This recommendation has been taken into account.

WPP Z1 and Z2: Despite being located in habitats of relatively low value for protected birds, these WPP include a water body that has the potential to attract protected species such as Western marsh harrier, osprey and black stork. If WPPs are built, mitigation measures are mandatory: WPP containment chamber systems, operating restrictions in line with pre-construction monitoring results, avoid risks of collisions with soaring birds. The condition for Z1 and Z2 has been taken into account (see Annex 12).

WPP D11, D12, D13, D14. These WPP are located along an already established road with a relatively high level of use and an active quarry, which are considered to be pre-existing negative factors for the Western capercaillie rookery adjacent to these WPP. If WPP are restricted by shutting down during the breeding season, the potential impact is relatively small. Ideally, if the proposed development does not allow the construction of these WPPs, this is a more optimal solution, but it does not mitigate the adverse impacts of the existing forest roads and gravel pit. The condition for D11, D13, D14 has been taken into account (see Annex 12). Construction of D12 is not recommended.

During construction and operation

Mitigation measures to be taken during implementation of the proposed action will focus on avoiding collisions with sensitive species groups.

Planetary birds: birds of prey of the day and black storks

To significantly reduce the risk of collisions with diurnal birds of prey that have occupied breeding sites on the periphery of the Proposed Action site (mainly lesser spotted eagles) and may consequently pass through the WPP Park area or stay at low intensity in the vicinity of the peripheral WPP, **It is recommended to equip the WPP park with "smart camera systems" that** can reduce or stop the rotation of WPP (SOD or Shutdown on Demand type solution using cameras and bird identification software), groups of WPP or the whole park, if necessary (depending on the specifics of the solution). Based on the information available in the literature, this solution avoids a significant number of potential collisions, although different assessments are available in different literature.²⁶⁰ A 65% reduction in collision risk for all diurnal raptor species using solutions that stop WPP operation is reliably estimated.²⁶¹ There are also solutions where these systems are equipped with specific deterrent solutions (audible or visual), which also reduce

²⁶⁰ Rydell, J., Ottvall, R., Pettersson, S., Green, M. 2017. *The effects of wind power on birds and bats*. Swedish Environmental Protection Agency, Sweden.

²⁶¹ Garcia-Rosa, P. B., & Tande, J. O. G. 2023. *Mitigation measures for preventing collision of birds with wind turbines*. Journal of Physics: Conference Series, 2626(1), 012072.

the risk of collisions in situations where the bird has already flown into the collision risk zone of the WPP rotor. These systems are constantly evolving and improving, and their efficiency is increasing.

In terms of the potential presence of soaring birds and therefore the risk of collisions, the affected WPP are located within the area of the identified breeding sites, however, due to the temporal variability of the breeding sites, it is recommended that all WPP are fitted with stop camera systems. If the solution for the WPP suspension camera system, which is being refined during pre-construction monitoring, does not ensure identification of raptors, a **solution for raptor protection** is recommended for **all WPPs**: Stop the WPP up to one hour before and after both local sunrise and sunset for the protection of soaring birds from 1 April to 1 October. The condition is partially taken into account as there are already camera solutions that are effective at dusk and the camera solution can be fine-tuned during pre-construction monitoring and there is no need for WPP shutdown, such as the dtbird solution²⁶² (see Annex 12).

Grouse: Western capercaillie

One of the mitigation measures to reduce the risk of collisions between Western capercaillie and rotor wings, as well as potentially reducing the risk of collisions between other species nesting in the forest, is the height condition of the lowest point of the WPP rotor wing: the lowest point must be at least the height of two mature trees of the surrounding forest. This condition is already considered to be fulfilled in the initial planning, since if the maximum height of the WPP is 300 m and the rotor diameter is 200 m, the lowest point of the rotor is at a height of about 100 m.

Taking into account the potentially high risk of the overall impact of the operation of the constructed WPP on the success of the Western capercaillie rut, the WPP located approximately 1 km away from the rookeries (**D8, D10, D11, D12, D13, D14, D15, D16**) **should be suspended during the rutting period**: it is recommended to suspend the operation of the **WPP** during the rutting period from 1. the following should be recommended for the period from 1 April to 15 May: in the mornings from one hour before local sunrise to four hours after local sunrise, and in the evenings from one hour before to one hour after local sunset. The condition for D8, D10, D11, D12, D13, D14 has been **partially** taken into account (see Annex 12) as the ornithologist has based the WPP restrictions on assumptions, so the need for them can be clarified during pre-construction monitoring and the suspension time can be reduced accordingly. D12, D15, D16 are not recommended at all, **and it should be noted that the southern part of the WPP is not recommended at all at present**.

Birds' active at night: owls

Protected owl species occur throughout the proposed WPP park, or their priority cells are located within 500 metres of the proposed WPP sites. The bird expert points out that the operation of the WPP should be limited throughout the year (owls are roosters) so that noise pollution levels are not exceeded.

In the absence of studies on the impact of sound from wind farms on birds, caution should be exercised, and further pre- and post-construction monitoring of birds should be carried out to assess the noise and disturbance impacts of WPPs. This includes studying bird behaviour and, if necessary, adjusting the operation of the WPP in line with the observed data if negative impacts from the WPP are detected.

To reduce the potential impact of noise pollution on the owl species present and potentially nesting, it is recommended to choose technical solutions with the quietest possible operation of the WPP system. Condition taken into account (see Annex 12).

Migratory birds

²⁶² <https://www.dtbird.com/>

In order to significantly reduce the risk of collisions with large migratory birds (mainly *Anser sp.* and *Branta sp.* geese as well as swans), which may pass through the territory of the WPP park or stay at low intensity in the vicinity of the edge WPP during the migration period, it is recommended to equip the WPP park with camera system(s), which can, if necessary (depending on the specifics of the particular solution), slow down or stop the rotation of one or more WPP turbines or the turbines of the entire park. The literature also mentions the positive effect of radar applications in reducing collisions of migratory birds in wind farms, which have been installed even in strong migration routes.²⁶³

Although the proposed WPP park is not considered to be located in a strong migratory flyway or bird concentration area based on survey information, it is likely to have a temporarily high presence of migratory birds.

To reduce potential collisions during migration periods, it is recommended to apply solutions based on camera technology to all WPP in the park area, which limit the operation of WPP. This solution has the potential to reduce bird strikes with WPP during daylight hours, in difficult visibility conditions and at night.

Alternatively, the WPP park rotors can be stopped during periods of difficult visibility and dark periods of the day during migration, which is combined with the camera systems mentioned above, but these are then additionally applicable for the detection of migrating birds (either for indicating bird size or for training the system, depending on the solution chosen).

Recommended solution for migratory bird conservation for all WPP: The WPP is to be suspended for up to one hour before and after both local sunrise and sunset for the protection of migratory birds in flocks (15 February to 15 May and 1 September to 15 November), if this cannot be remedied by a camera solution to be specified during pre-construction monitoring. Condition taken into account (see Annex 12).

None of the recommended solutions exclude collisions of passerines, which in exceptional cases with different infrastructure or buildings can reach extremely high levels in terms of mortality, but should be considered as exceptional cases.^{264,265} At the same time, however, it should be noted that even existing estimates, based mainly on counts of dead birds under WPP, reliably find only a small number of dead birds.²⁶⁶ The numbers of passerine mortalities recorded so far range from 100 to a few hundred.²⁶⁷ At the same time, the impact of these collisions on passerine populations is considered to be negligible, given their rapid recovery during the breeding season (one or more breeders, many young, high population densities to a greater or lesser extent).

7.6.4. Effects on bats

The recorded bat activity in the area of the Proposed Action is significantly higher than in other similar areas surveyed using identical methodologies, due to the fact that in other areas forests covered a relatively small part of the surveyed area but are considered to be one of the most suitable habitats for bats. Potential spontaneous concentrations of bats foraging at different locations in the forests may increase the risk of otherwise low collisions with the planned rotors. This is particularly important during migration, when overall bat activity and species numbers increase.

²⁶³ Cohen, E. B., Buler, J. J., Horton, K. G., Loss, S. R., Cabrera-Cruz, S. A., Smolinsky, J. A., & Marra, P. P. 2022. *Using weather radar to help minimize wind energy impacts on nocturnally migrating birds*. Conservation Letters, 15(4).

²⁶⁴ Newton, I. 2023. *The migration ecology of birds*. Elsevier.

²⁶⁵ Rydell, J., Ottvall, R., Pettersson, S., Green, M. 2017. *The effects of wind power on birds and bats*. Swedish Environmental Protection Agency, Sweden.

²⁶⁶ Nilsson, A. L. K., Molværsmyr, S., Breistøl, A., & Systad, G. H. R. 2023. *Estimating mortality of small passerine birds colliding with wind turbines*. Sci Rep, 13(1), 21365.

²⁶⁷ <https://lfu.brandenburg.de/sixcms/media.php/9/Voegel-Uebersicht-Europa.xlsx>

The highest risk of bat mortality in the planned area of the WPP Park is in July-September, i.e. during bat dispersal and migration. In May-June, the increased risk is mainly associated with one species: the northern bat. Bat activity in May is generally low, with the exception of one station that may have a colony of northern bats nearby.

Based on bat activity, it is not possible to distinguish night hours when bat mortality risks would be lower, except for morning hours in autumn (September and October) when activity/migration is close to zero. The greatest risk of bat mortality at WPP is in the 2nd-8th hour after sunset.

A potential bat-attracting habitat in the area of WPP Limbaži is the Ķulaurga quarry (see location in Chapter 6.12). A number of research publications²⁶⁸ suggest that bat activity in the area of wind parks may increase significantly after the construction of the WPP and that bats may appear in large numbers in places where they were not found during the feasibility study, including in theoretically unsuitable or poorly suited landscapes in terms of habitat. Bats are strongly attracted to WPP, although the reasons for this have not yet been clearly established.²⁶⁹ Thus, it is imperative to carry out at least two years of monitoring after the WPP is built and the wind farm is operational.

The northern part of the proposed development (Z1 - Z21 WPP) is generally considered to be 'safer' in terms of the risk of collisions with bats, provided that the WPP are not sited near the quarry to the west of this part of the site, which is currently the case. In the southern part (D1-D16 WPP), forests generally have higher bat activity and a higher proportion of suitable foraging and roosting habitats for bats, **the southern part of the WPP is not currently recommended.**

7.6.5. Measures to mitigate impacts on bats

The development of a wind park is permitted subject to the following restrictions and conditions on the operation of the WPP:

1. WPPs are not installed in the vicinity of the Stienūži IV and Stienūži V quarries. Minimum distance from water: 200 m from the projection of the WPP wing, but more if possible.

- Currently, the nearest planned WPP Z2 is at least 400 m away, so this condition is met.

2. Monitoring of bats is ensured in the first and second year after the start of operation of the WPP. The monitoring methodology is developed and standardised by a bat species expert certified by the NCA according to the site specifics and the 2022 Guidelines for assessing the impact of wind power plants on bats in Latvia.

- Bat monitoring in the first and second year after the start of operation of the WPP is included as a mandatory measure to be implemented after the start of operation of the WPP (see Chapter 12).

3. At the northern WPP (Z1-Z21), automatic shutdown or non-start of the WPP shall be ensured from 1 July to 30 September for at least the first eight hours after sunset or until sunrise in summer when the length of night is less than 7 hours if:

1. the wind speed at the height of the WPP tower (nacelle) does not exceed 6 m/s,
- 2) rainfall does not exceed 1 mm/h,
- 3) the air temperature is above +60C.

²⁶⁸ Solick D., Pham D., Nasman K. & Bay K. 2020. *Bat activity rates do not predict bat fatality rates at wind energy facilities*. Acta Chiropterologica, 22(1): 135-146.

²⁶⁹ <https://tethys.pnnl.gov/sites/default/files/publications/EUROBATS-2015.pdf>

In north-eastern Latvia, especially in September, the nights are getting colder, but bat activity continues. In this study, bat activity in September was also observed at night, when air temperatures were only +6...+8°C.

4. At the southern part of the WPP (D1-D16), automatic shutdown or non-start of the WPP shall be ensured from 1 May to 30 September for at least the first eight hours after sunset or until sunrise in summer when the length of night is less than 7 hours if:

1. the wind speed at the height of the WPP tower (nacelle) does not exceed 7 m/s,
- 2) rainfall does not exceed 1 mm/h,
- 3) the air temperature is above +6°C.

Depending on the results of the monitoring, which would or would not confirm increased bat activity and/or mortality at the constructed WPPs, the **WPP operating restrictions could be reviewed** after the first and second years of post-construction monitoring - **removed altogether, relaxed or strengthened**, in particular: the period during which WPP operating restrictions are required could be extended or reduced, or the wind speed threshold at which WPP operation is allowed could be changed.

According to the consultant, other solutions to mitigate the impact on bats can be used during the design of the WPP, in consultation with a certified bat expert, such as smart monitoring systems equipped with ultrasonic sensors and artificial intelligence technologies that detect the presence of bats in real time and stop turbine operation. Smart technologies are also used elsewhere in Europe and provide both effective bat protection and increased power generation, e.g. Fleximaus²⁷⁰.

WPP D12 is not recommended as it is to be installed at a site where extremely high bat activity was observed, indicating a very likely proximity to a colony. It would be preferable not to install this WPP at all, and it would also be preferable not to install WPP D11, where high bat activity has also been observed. If WPP D11 were to be installed, **post-installation monitoring would be mandatory**.

7.6.6. Effects on mammals

The construction of the WPP parks (both "Limbaži" and "Valmiera-Valka") will not significantly change the status of specially protected species at national level. Local and wider indirect and cumulative impacts on wild mammals (up to 10 km away from the study area of the Proposed Action) are expected, the consequences and spatial limits of which are currently unknown and unpredictable.

The available information suggests that, in the temporal and spatial dimensions, the most widespread and, from a human perspective, the most difficult to manage impacts will be those associated with wild large mammals. Large mammals have relatively high intelligence and good mobility. Their response and speed of adaptation to a new disturbance is completely unpredictable, as are the resulting impacts on areas outside wind farms and the myriad other species they affect. Their future behaviour will be determined by the new element in their environment, and they will actively seek out places and times to make up for lost resources or exploit the new resources that will be created by the construction of the WPP. It should also be borne in mind that today's society has already developed a high level of conflicts of interests, opinions and values in relation to large mammals. This includes conflict areas such as ungulate damage to forestry and agriculture, predator attacks on domestic animals, otter and mink damage in aquaculture, animal-caused traffic accidents, synanthropisation in cities and human settlements, human fear and safety, epizootics, hunting, food safety and health, so-called animal rights issues, etc. Many of these aspects are also poorly regulated and lack a well-established legal platform for conflict resolution.

²⁷⁰ <https://www.fleximaus.de/?lang=ne>

7.6.7. Measures to mitigate impacts on mammals

The installation and operation of the WPP is likely to have an impact on wild species in the vicinity, including specially protected species, but it is currently not possible to assess the scale and significance of the impact in terms of maintaining a favourable conservation status for these species, and in the case of economically exploited species, in terms of changes in the overall value of the population and the impact on the economy. Species interactions in the ecosystem also need to be taken into account, as WPP may indirectly affect one species and affect others. Moreover, in this context, it is not about the direct destruction of species or habitats, but about the impact on the behaviour of highly organised living organisms - mammals - which determine other biological parameters at the level of individuals and populations, and which are very limited to manage and manipulate in the wild.

As the construction and operation of wind farms may have impacts on wild non-flying mammal communities, the consequences and territorial limits of which are unknown and unpredictable, the expert recommends the following measures:

- Leave the intensity and seasonal cycle of other existing economic activities unchanged in the area of the WPP parks and their immediate surroundings. The above applies to logging (if not directly related to the installation of WPP), reforestation, all types of stand management, restoration of drainage systems, hunting pressure, game feeding, nature tourism pressure and agriculture in farmland adjacent to forests. Of course, this does not apply to fighting forest fires, windstorms and forest pests. Action is needed to avoid cumulative disturbance effects and to separate the potential impacts of WPPs from the background of other economic activities.
- Given that there are no assessments of the impact of WPP on non-flying mammals in Latvia based on wildlife studies or monitoring data, the expert does not propose mandatory monitoring requirements for the wind farm in question. The expert recommends that the controlling national authorities should require the developers of the North Latvian and Estonian border wind farms (Figure 3.2.4) to jointly initiate specialised monitoring of wild mammals in cooperation with the controlling national authorities and scientific institutions. This need is underlined by all the authors of the scientific publications used in the opinion. Monitoring is carried out in accordance with a monitoring programme developed and agreed with a certified expert.
- In case of negative impacts, mitigation measures to protect mammals.

In addition to the measures listed above, it is desirable to preserve the beaver forests, which serve as an important refuge and feeding ground for all mammal species, when constructing the wind farm.

7.7. Landscape and heritage impact assessment

7.7.1. Impact on the landscape

The landscape impact assessment takes into account the Guidelines for Initial Environmental Impact Assessment of Wind Power Plants²⁷¹, the Guidelines for Local Landscape Planning approved by the Ministry of Environmental Protection²⁷², as well as the landscape impact assessment methodology of the Lithuanian

²⁷¹ <https://www.vvd.gov.lv/lv/media/9969/download?attachment>

²⁷² https://www.varam.gov.lv/sites/varam/files/content/files/vadlinijas_viet_limenim_2019.pdf

and Latvian researchers Abroms, Kamičītīte and Ziemeļniece wind parks.²⁷³ In addition, consultations have been carried out with the municipality of Limbaži on the implementation of the Proposed Action in Limbaži.

Part of the landscape study area is located in the nationally important scenic area²⁷⁴ (NNAV) "Piejūra un Lībiešu krasts". Within the Landscape Study Area, it is a narrow strip between the shoreline of the Gulf of Riga and the main national road A1. The nearest location to the area of the Proposed Action is in the south of Salacgrīva (at Vidzemes Street 70) - 4.6 km. The most important part of the site, the coastal zone, would not be affected, except in the vicinity of Meleki, where the WPPs would be visible at a distance of 7.2 km and would be considered as background elements.

Visual impacts are expected in the landscape of the open fields (between the coastal forest and the A1 motorway) in the section from Šķīsterciema to Krūmiņu Street in Salacgrīva (see Figures 7.7.1, 7.7.2) under Alternatives B and B'. The most scenically valuable places here are the area between Lāņu Manor Avenue and the forest to the N of Svētdciems, where the open areas are enriched by individual oaks (indirect effects can be seen in Figure 7.7.3, which is outside the NNAV). WPP could be described here as **prominent accents in the landscape**.



Figure 7.7.1. Modelled view from A1 motorway in Salacgrīva near Bišu street, direction A, scenario 'A'. WPP highlighted in red for better visibility. Photo: Google Street View.

²⁷³ Abromas, J. & Kamičaitytė, J. & Ziemeļniece, A. 2014. *Visual impact assessment of wind turbines and their farms on landscape of Kretinga region (Lithuania) and Grobina townscape (Latvia)*. Journal of Environmental Engineering and Landscape Management.

²⁷⁴ Lakovskis, P. 2023. Latvian Landscape Atlas. *Landscape maps. National landscapes*. Institute of Agri-Resources and Economics.



Figure 7.7.2. Modelled view from the A1 motorway in Salacgrīva at Krūmiņu street, SE direction, in the distance the WPPs of the B' scenario are visible in the D part of the site, in the A and A' layouts the WPPs are not visible in this direction. WPP highlighted in red for better visibility. Photo: Google Street View.



Figure 7.7.3. View near the junction of A1 motorway and Rīgas street in Svētciems towards A, clearly visible in part D of the WPP area under scenarios B and B'. Photo: D. Immurs.

The most significant landscapes or landscape elements in the area of the Proposed Action and/or the landscape study area are:

- river landscapes (Salaca, Svētupe, Vitrupe, Jaunupe), including:
 - Lībiešu Upuralas and the surroundings of Kuiķule,
 - Sarkanās klintis;
 - lamprey pots in the Salaca;
- coastal landscape;
- landscapes of small rivers (Vedamurga, Kulaurga, Ārupīte, etc.)
- Lake Primma and Lake Kliķu;
- Niedrāju-Pilka purvs;
- Randu meadows.

Limbaži municipality assessed and provided an opinion on the possibility that the EIA study could result in the designation of WPP Z11, Z8 and Z9 as permissible with a maximum height of 275 m and no designation of WPP Z7. Limbaži Municipality, taking into account the recommendations on the heights of the WPPs in the letter of Vidzeme Livic Centre of 25.04.2024, agreed that despite the fact that the WPPs are planned in the two-kilometre protection zone around the Lībiešu Upuralas, WPPs Z11, Z8, Z9 with a height not exceeding 250 m should be allowed and WPP Z7 should not be constructed. These letters from the municipality of Limbaži and the Vidzeme Livic Centre are attached as Annex 2.

7.table 7.1. High-value viewpoints of Salacgrīva municipality in the study area

Viewing site	Distance, km	Nearest WPP	Visibility (for 300 m high WPP)	Notes
A stretch of the Salaca river with floodplain meadows	1,33	Z2	Partially visible and in places, but not towards Salaca	No specific location, chosen near the Jaunjēcēniem
Lībiešu Upuralas	1,27	Z7	Visible	WPP not recommended
	1,34	Z8	Visible	Limbaži Municipality's condition for WPP height limits - 250 m - will be taken into account
	1,58	Z9	Visible	Limbaži Municipality's condition for WPP height limits - 250 m - will be taken into account
	1,93	Z11	Visible	Limbaži Municipality's condition for WPP height limits - 250 m - will be taken into account
	1,55	D1	Visible	WPP not recommended
	1.81	D2	Visible	WPP not recommended
	1,63	D15	Visible	WPP not recommended
	1,58	D16	Visible	WPP not recommended
Annasmuiža Bridge	2,88	Z2	Visible	Established viewpoint (distance from)
2. lamprey tacs	3,52	Z2	Visible	Mentioned as a single common object
1. lamprey tacs	4,44	Z2	Visible	
Salacgrīva promenade	5,06	Z2	Unpleasant, except in certain open areas of the promenade	
Salaca pilskalns	5,11	Z2	Visible	From the mound edge area (closer to Salaca)
Vitrupe beach	6	D6	Unhappy, except in some places and in the water	No effect on the sea view
Zvejnieku Park	6,29	Z2	In selected open areas of the park	
Svētupes ieteka	6,32	D4	None	
Kuiviži observation tower	7,72	Z2	Will be seen far away	
Kuiviži pier	8,1	Z2	None	

Viewing site	Distance, km	Nearest WPP	Visibility (for 300 m high WPP)	Notes
Sarkanās klintis	9,83	Z17	None	

According to the visibility model (7.7.4. -figure 7.7.7) A 300 m high WPP, if all 37 assessed were built, would be visible in 26.3 % of the total landscape study area, or 143.6 km² out of 544.9 km². It should be noted that they would be less visible under Alternatives A/A' or B/B', particularly in remote locations from the area of the Proposed Development, and only to a limited extent.



Figure 7.7.4. Modelled visibility zones in scenario A. Basic: Ltd Jāņa sēta



Figure 7.7.5. Modelled visibility zones in scenario A'. Basic: Ltd Jāņa sēta

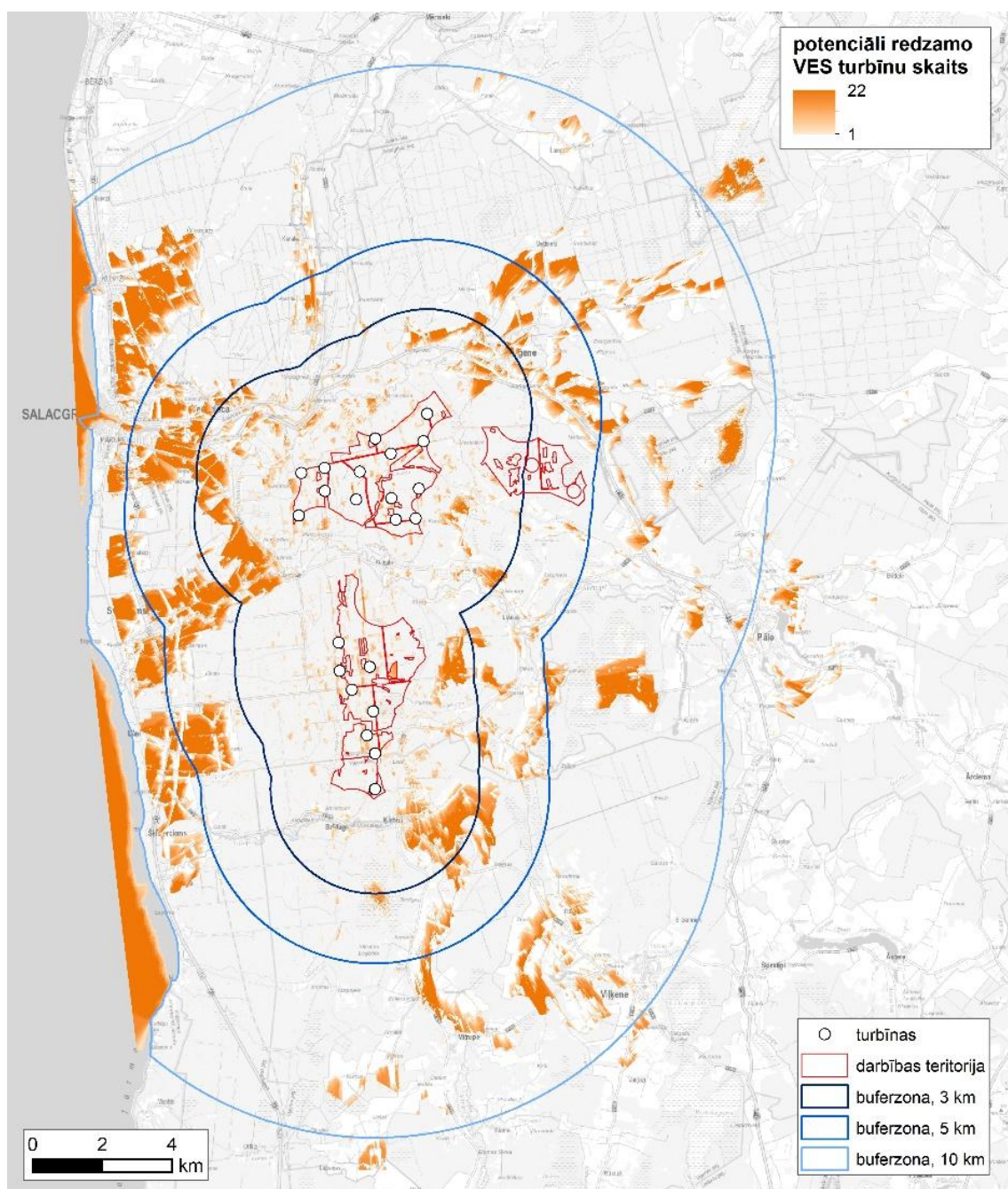


Figure 7.7.6. Modelled visibility zones in scenario B. Basic: Ltd Jāņa sēta

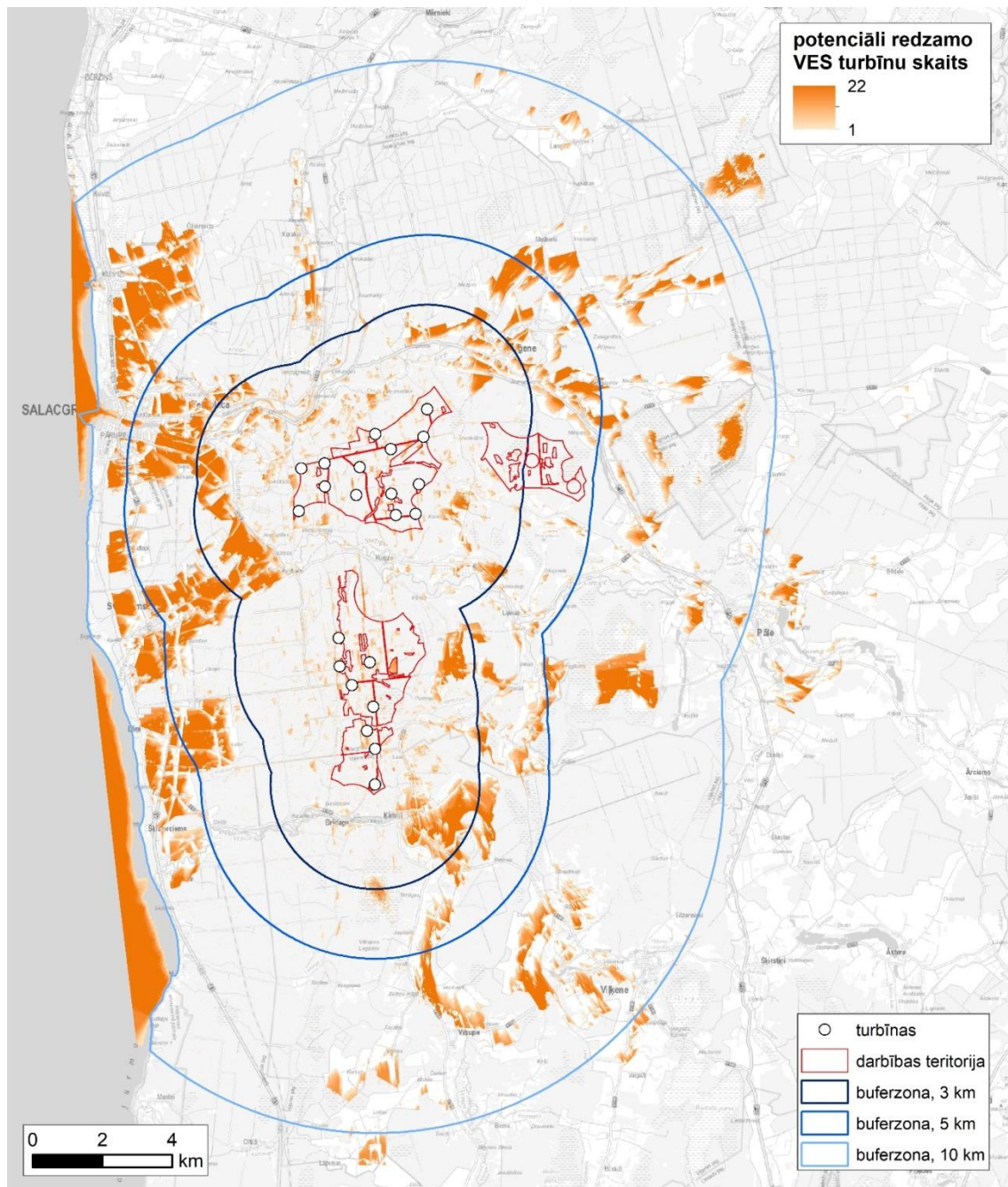


Figure 7.7.7. *Modelled visibility zones in scenario B'. Basic: Ltd Jāņa sēta*

However, in the consultant's opinion, based on the Landscape Policy Implementation Plan 2024-2027 (LIP 2024-2027), adopted in 2024, which states that in line with the objectives of the European Green Deal and Latvia's energy independence, landscape assessment at regional and local scales should take into account that energy independence and security are just as important and important as tourism and environmental protection. The Latvian cultural canon on seascapes also stresses that "climate change is predicted to lead to sea level rise and increased storms, which could potentially have a major impact on coastal landscapes. The development of wind farms, both offshore and onshore, as part of climate policy will also change the seascape. But this is the nature of this dynamic landscape, at once strong and fragile, which will always be and remain the "interplay space" of sea and land. The 250-metre condition could therefore be raised to 275 metres to allow for the construction of all or equivalent models of WPPs assessed in this EIA.

As the effects on biodiversity or humans (physical effects such as noise) have been assessed as exclusionary effects in this EIA report, therefore the WPP with the lowest impacts on birds, bats and habitats and no

exceedances of ambient noise have been retained in Alternatives A and B. Accordingly, any WPP allowed should be as efficient as possible, as the main limiting factor in the consultant's view is not to exceed the noise limits.

It should also be noted that the difference between 275 m and 250 m is approximately 10 %, which is not considered to be significant and visually perceptible. As an example, the *Zunda Towers* in Riga have a height of 123 metres for the south tower and 117.5 metres for the north tower, but these height differences are not visually perceptible in everyday life (depending on the distance and the angle of view of the towers). Visually, the difference between a 250 m and a 275 m high WPP is practically invisible, as shown in the landscape assessment of the *K2 Ventum* EIA report²⁷⁵.

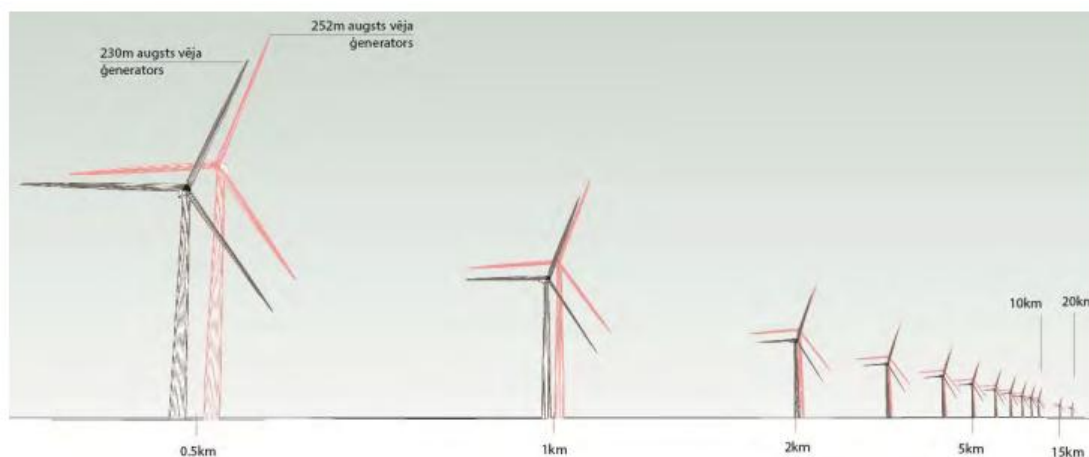


Figure 7.7.8. comparison of 230 m and 252 high WPP detection magnitude versus distance to WPP (schematic)²⁷⁶

7.7.2. Impact on cultural heritage

There are a number of heritage assets within the study area (Chapter 6.5.2 and Figure 6.5.3). The impact of the Proposed Action on cultural heritage has been assessed for the closest cultural monuments to the site of the Proposed Action, as well as for other sites of cultural and historical significance, through individual assessments and in particular the significance of the Proposed Action for potential changes to the landscape.

According to the cartographic information of the information system "Heritage" there are 16 cultural monuments in the study area, 11 of them - archaeological, 5 - art monuments. As the monuments are located indoors - in three churches - the churches are indicated in the cartographic material.

Ceplā vieta

Short description	The site of the baking site on the left bank of the Svētupe River. Ceplis dates back to the modern era. ²⁷⁷
Location	Salacgrīva municipality, Limbaži district, on the bank of the Svētupe River, opposite Zvaigzne. ~ 6,8 km from Svētdciems, ~ 8,7 km from Salacgrīva. Coordinates in the WGS-84 coordinate system: 57.724121, 24.455360.

²⁷⁵ [17_attachment-landscape-architect's-opinion_.pdf](#)

²⁷⁶ <https://k2ventum.lv/ivn/>

²⁷⁷ <https://mantojums.lv/cultural-objects/1477>

Status	Cultural monument of local importance (group: archaeology) Cepļa vieta (no. no. 1477). It was included in the List of Cultural Monuments when it was adopted in 1998. A standard protection zone of 500 m in the countryside. ²⁷⁸
Landscape characteristics	Located in an alluvial forest with thick undergrowth, on the left bank of the Svētupe River, inside a forest loop. The area is marked to the north by a stream flowing into the Svētupe River. In nature, the location of the kiln cannot be clearly read. A floodplain meadow with one outbuilding is located from the monument to the SDA. Although the site of the kiln is not of scenic value, the view contains elements of the cultural and historical landscape - the meandering Svētupe River, the buildings of a group of farmsteads. On the other side of the river, in the immediate vicinity, are two homesteads "Zvaigznes" and "Vedamurgas" and the mouth of the Vedamurgas River.
Availability	Low. Access from the V143 national road, along a natural carriageway in the national forest (approx. 600 m). From the property "Vedamurgas" you have to run roughly along the bank of the Svētupe, first through meadow, then through alluvial forest, crossing a borehole.
Ownership	Owned by a natural person.
Tourism	It is not a tourist attraction and has no potential to become one.
Nearest WPP	0,93 km to the NW (Z1)
Expected impact	Visually high , but with local impact. The site is not identified as a high value viewpoint. The WPP will not be visible from the 'Hat Site' due to overgrowth, the nearest WPP Z1 will affect the available view of the Hat Site from the south-east (see 7.7.9., Figures 7.7.10).
Recommendations	No deforestation in the area of the cultural monument.
Notes	Included in the terms of reference from the NCMP. Surveyed in the field.
Impact taking into account mitigation measures	Minor adverse effects



Figure 7.7.9. Photovisualisation of a potential view of the Cepļa vieta from the floodplain of the left bank of the Svētupe River (Vedamurgs house in the foreground). WPP Z1 is clearly visible, WPP Z4 is partially visible on the right side of the image.

²⁷⁸ Ibid,

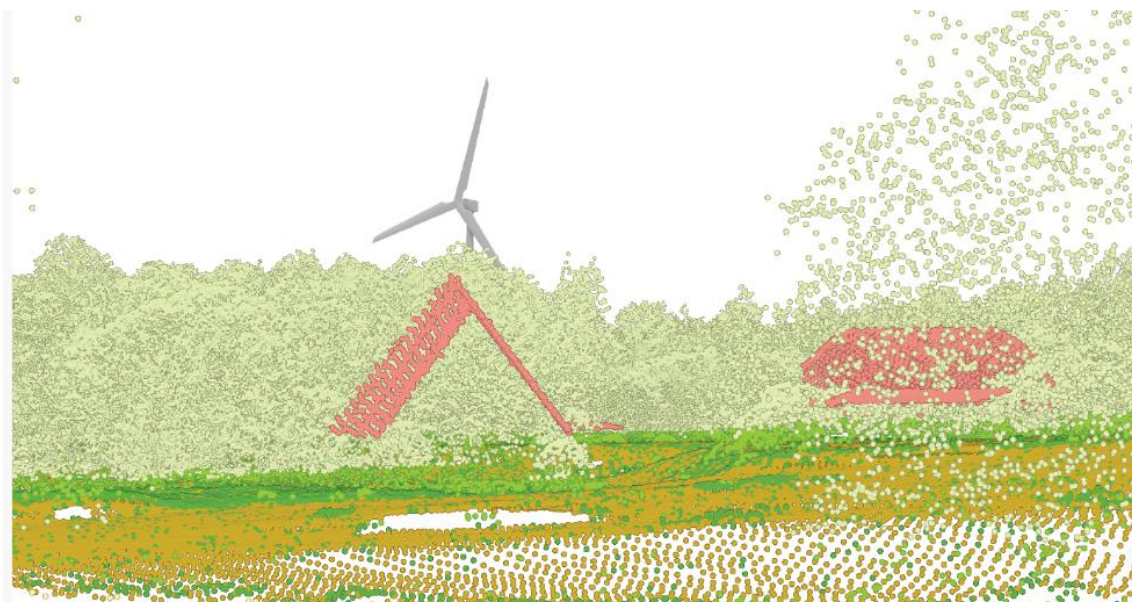


Figure 7.7.10. *Potential view of the Cepļa vieta from the floodplain on the left bank of the Svētupe River (in the foreground the building on the "Vedamurgas" farmstead, in the background the "Zvaigžņu" residential building)*

Kilzumu Ancient Cemetery (Swedish Cemetery)

Short description	Monuments dating from the Middle Ages to the Modern Period. ²⁷⁹ Located between Svētupe and the V143 road, on the left bank of the river.
Location	Salacgrīva municipality, Limbaži district, between the national road V143 and Svētupe, opposite Vējiņi houses. ~ 6,6 km from Svētdciems, ~ 8,6 km from Salacgrīva. Coordinates in the WGS-84 coordinate system: 57.719978, 24.467175.
Status	Cultural monument of regional importance (group: archaeology) Kilzumu Ancient Monuments (Swedish Cemetery) (aiz aizs. no. 1473). It was included in the List of Cultural Monuments when it was adopted in 1998. A standard protection zone of 500 m in the countryside. ²⁸⁰ Part of the monument is located in a micro-reserve created for the protection of birds.
Landscape characteristics	Located in a spruce forest with dense undergrowth, lots of fallen trees. A larger hole is visible in nature. Not considered to be of scenic value. The location also does not provide valuable views to or from it. The territory is bordered by the Kulaurga valley to the W, the Svētupe valley to the N and the V143 road to the S. Directly to the north of the monument site is the Svētupe steep bank, which offers an overgrown view to the NNW. (see Figures 7.7.11 and 7.7.12)
Availability	Medium. It is located in the immediate vicinity of the national local road V143, but there is no infrastructure to access it (you have to cross a small ditch on the side of the road).
Ownership	State property.
Tourism	It is not a tourist attraction and has no potential to become one.
Nearest WPP	1,09 km to D (D1)
Expected impact	Unlikely. The site is not identified as a high value viewpoint. The view to and from the monument is currently not compromised. It could be threatened by deforestation in and around the monument. The upper part (wings) of WPP Z5 would be visible from the steep bank of the Svētupe River within the monument's protection zone.

²⁷⁹ <https://mantojums.lv/cultural-objects/1473>

²⁸⁰ <https://mantojums.lv/cultural-objects/1476>

Recommendations	Preserve the existing forest within the monument and, according to the forest transparency model (developed by Estonian researchers ²⁸¹), preserve the forest in a 70 m zone around the boundary of the monument.
Notes	Included in the terms of reference from the NCMP. Surveyed in the field.
Impact taking into account mitigation measures	D1 is not recommended. Minor adverse effects



Figure 7.7.11. View north-east of the Kilzumu ancient burial mounds (in the foreground).



Figure 7.7.12. View to the north-west of the Kilzumu ancient burial mounds (in the foreground).

Lībiešu Upuralas

Short description	Located in the Svētupe valley, on the right bank of the river. The natural and cultural monument consists of several outcrops, ranging from 2.5 to 6.5 m high, on the slope of the right bank of the Svētupe River. There are two rather large caves on the Svētupe cliff. The entrance to Lībiešu Upuralas is 2.9 m high and 3.3 m wide, with three branches at the depth of the cave. According to Guntis Eniņš' measurements, the largest cave was 46 m long. The other cave is shorter, up to 20 m long. A little further down the river, in
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²⁸¹ <https://www.mdpi.com/2072-4292/13/21/4455>

	<p>a small outcrop 4 m long and 2 m high, there is a wide niche³⁹ Archaeological excavations show that the cave was used for cult purposes from the 14th century. One of the few caves in Latvia that can be defined as a specific group of archaeological and natural monuments. 2023. in 2010, it was named Archaeological Monument of the Year. It is a unique testimony to the ancient sacredness of the Liv culture. The largest number of petroglyphs dated to the 17th-18th centuries in Latvia has been found in the Svētupe river valley⁴⁰</p>
Location	<p>Salacgrīva municipality, Limbaži county, on the bank of the Svētupe River, near Kuiķuļi. ~ 8 km from Svētdciems, ~ 10 km from Salacgrīva. Coordinates in the WGS-84 coordinate system: 57.716390, 24.489939.</p>
Status	<p>Cultural monument of national importance (group: archaeology) Libiešu Upuralas - cult site (aiz aizs. no. 1476). Protected since 1967. It was included in the List of Cultural Monuments when it was adopted in 1998. A standard protection zone of 500 m in the countryside is established.⁴¹</p> <p>protected geological and geomorphological natural monument "Kuiķuļu Upuralas (Libiešu Upuralas)". Protected since 1977 (as a protected geological site), with its current status since 2001.</p>
Landscape characteristics	<p>As the site is accessible from the left bank of the Svētupe River, this landscape is mostly described. A gravel path leads from the left bank of the river (Svētdciems Cemetery). On the left bank of the river is a floodplain meadow, with some tourist facilities directly opposite the river. The meadow (maximum width NNE-SSW 200 m) is located inside the meander loop or Kuiķuļi Bay. From here you have a particularly high view of the cave, a sandstone outcrop situated right on the riverbank (see Figure 7.7.13), which is topped by a belt of trees, in which the foreland stands out. This view is also described as valuable by the NCA in the description of the geological monument: "The sandstone cliffs stand out well against the backdrop of the Svētupe River and the flora, significantly enriching the landscape"⁴²</p> <p>Another valuable viewpoint is a smaller outcrop to the south-east.</p> <p>On the right bank is the homestead Kuiķuļi, from which a difficult dirt road (tracks) leads along the riverbank. A belt of trees and shrubs obscures the view directly above the cave, but a high-quality view can be obtained from the steep bank south of the cave (above the smaller outcrop). Unfortunately, the view is obstructed by overgrowth (see Figure 7.7.14).</p>
Availability	<p>High. Infrastructure (about 300 m of gravel footpath (theoretically passable by car, but a barrier has been created)) for access from the left bank, which offers the best views. It is also easily accessible for water tourists boating on the Svētupe River.</p> <p>For legal reasons (private owner's "No Entry" sign) it is not accessible from the right bank of the river, although historically there was also a nature trail (now evidenced by railings).</p>
Ownership	<p>The river and the floodplain of the left bank belong to the municipality of Limbaži, while the steep bank of the right bank belongs to natural persons (2 properties).</p>
Tourism	<p>A tourist attraction since the 16th century (!!!)⁴³ Included in various tourist materials. Minimal tourist infrastructure and stands, accessibility. Directions to the site from national roads A1, P12 and V143.</p> <p>Both the Latvian Archaeological Society and the NCA draw attention to the fact that the tourist load causes damage to the site.</p> <p>According to the <i>Strava</i> app, tourists can access the area both by walking and by boating on the Svētupe River.</p>
Nearest WPP	<p>1,41 km N (from the cave; Z8 - <i>name of the WPP</i>) 1,27 km NW (from the boundary of the geological monument; Z7)</p>
Expected impact	<p>High. The site has also been identified as a high-quality viewpoint of Limbaži.</p> <p>The main view (high quality landscape) from the floodplain (see Figure 7.7.15) is impaired by the WPP Z7 blades.</p> <p>The view of the southern outcrop from the floodplain will be impaired by WPP D16, which will have the top of the tower visible.</p>
Recommendations	<p>Considering the recommendations of landscape experts and consultations with the municipality of Limbaži, the original planned location/height of the WPP was changed.</p>

	<p>Do not foresee the construction of WPP Z7</p> <p>Do not foresee the construction of WPP D1, D2, D15, D16.</p> <p>Reduce the height of D8, D9, Z8, Z9, Z11.</p> <p>Retain tree cover above the cave itself. Develop the viewpoint above the outcrop on the D side (at the site of the Kuiķuļi Svētozols Grove) by clearing overgrowth.</p>
Notes	<p>Included in the terms of reference from the NCMP. Surveyed in the field.</p> <p>Limbaži Municipality, at the request of LVP, has expressed its^{opinion44} on the WPP proposal, stating that it has no objection if WPPs Z11, Z8, Z9 are advanced for Environmental Impact Assessment, despite the fact that they are within the two-kilometre buffer zone around the Lībiešu upuralas, provided that their height does not exceed 250 metres and that WPP Z7 is not planned.</p>
Impact taking into account mitigation measures	<p>Z7, Z8, D1, D2, D15, D16 - construction is not recommended.</p> <p>Z9, D8, D9 - reduced height limit recommended.</p> <p>(no WPPs are currently recommended for the southern part)</p> <p>Minor adverse effects</p>



Figure 7.7.13. Current view of Lībiešu upuralas and the largest outcrop to the NW.



Figure 7.7.14. Current view of the Lībiešu Upuralas and the larger outcrop to the NNE from the southern escarpment (at the site of the Svētozols Grove).

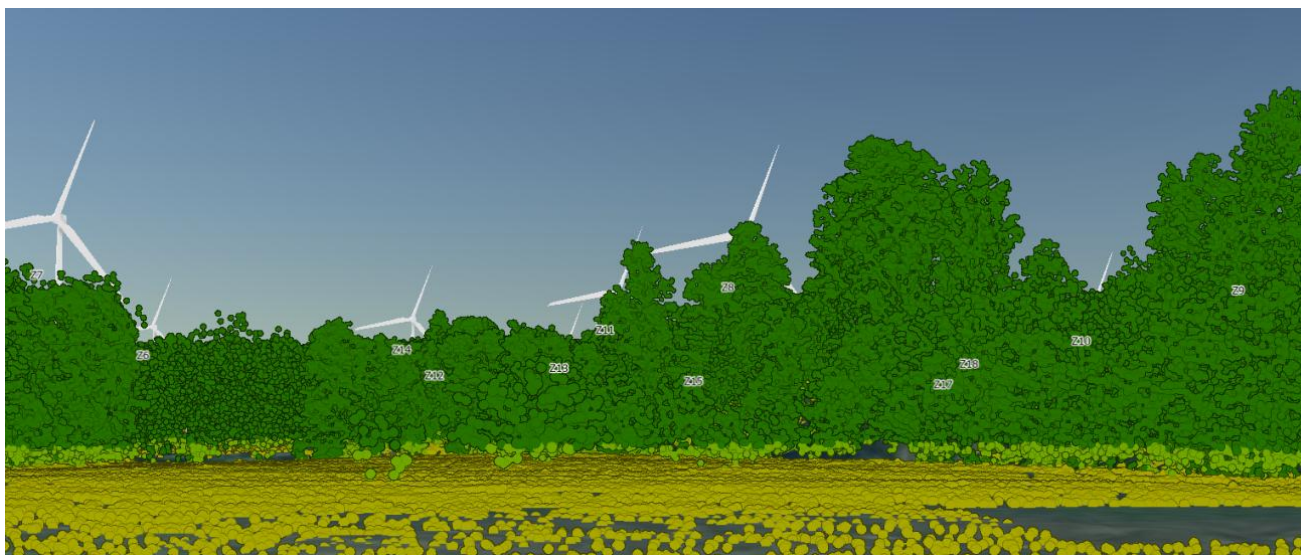


Figure 7.7.15. Modelled view of the outcrop in the N direction, from a viewpoint at floodplain level (maximum deployment scenario 37 WPP with a height of 300 m).

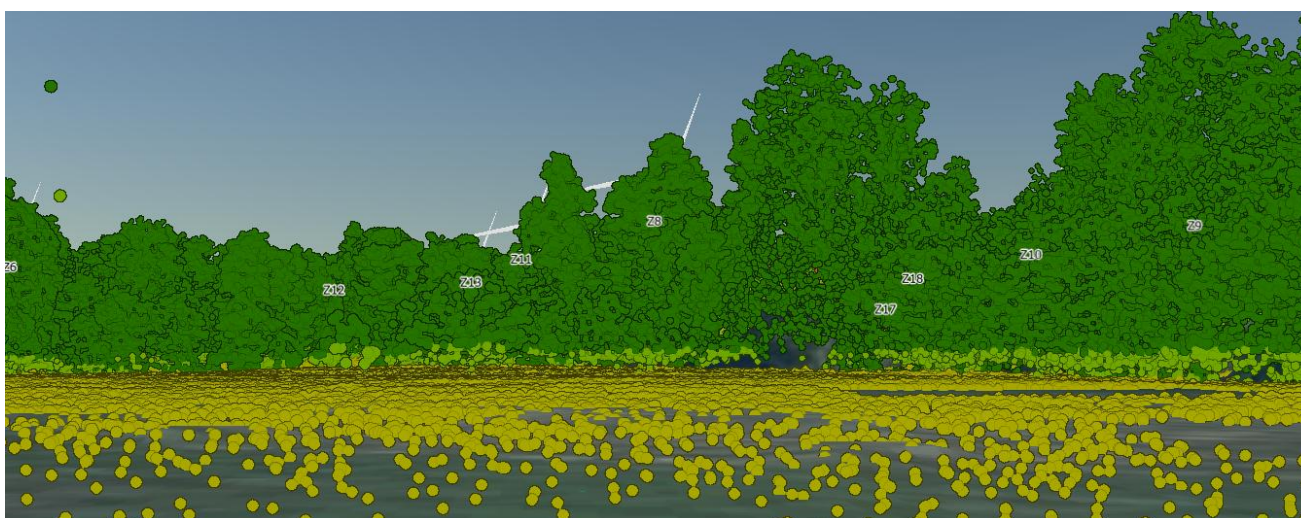


Figure 7.7.16. Modelled view of the outcrop and cave in the N direction, from the viewpoint at floodplain level, scenarios A and B - WPP height 250m.

The site of Kuiķuļu svētozolu birzs

Short description	Located on the steep bank of the Svētupe, on the right bank of the river. Located south of the Lībiešu upurālas (see above), in its conservation area. 1973. archaeological excavations led by Juris Urtāns in 2007 uncovered a layer of ash up to 0.3 m thick, probably from the burnt oaks. According to legend, offerings were placed in the hollows of these oaks. The location of the grove is currently not visible in nature. ²⁸²
Location	Salacgrīva municipality, Limbaži county, on the bank of the Svētupe River, near Kuiķuļi and Lielkuiķuļi. ~ 8,3 km from Svētiems, ~ 10,3 km from Salacgrīva. Coordinates in the WGS-84 coordinate system: 57.714562, 24.488922.
Status	Cultural monument of local importance (group: archaeology) Kuiķuļi sacred grove site - cult site (no. no. 1475). It was included in the List of Cultural Monuments when it was adopted in 1998. A standard protection zone of 500 m in the countryside. ²⁸³

²⁸² <https://www.senvietas.lv/kuikulu-svetozolu-birzs-vieta/>

²⁸³ <https://mantojums.lv/cultural-objects/1475>

Landscape characteristics	The site of the holly grove itself is located in a small mixed forest with shrubs (possibly: overgrown farmland) in a narrowing of the Svētupe meander, near a steep bank. There are no visually detectable cultural features in nature. A terrain model of the site shows several potholes. The site itself is not of scenic value. This is also recognised by the website "Svētvietas.lv". ²⁸⁴ As the site is located in close proximity to the Lībiešu upurālas, the steep slope of the protected area of the sacred grass grove offers a high-quality view of the river and the sandstone outcrop with a view perspective to the north. Unfortunately, the view is obstructed by overgrowth (see Figure 7.7.14 above).
Availability	Low. For legal reasons (private owner's "No Entry" sign) it is not accessible from the right bank of the river. From the Kuikuli homestead there is a difficult to drive dirt road (rutted) of about 300 m.
Ownership	Owned by a natural person.
Tourism	It is not a tourist attraction and has no potential to become one. However, the potentially valuable viewpoint of the Lībiešu Upurālas is located within its protection zone, although it is currently not legally accessible to tourists.
Nearest WPP	1,53 km to the SW (D1)
Expected impact	Medium. The WPP will not be visible from the conservation area, a few metres away, at the Lībiešu upurālas (see Figure 7.7.15 above). The next ones will show a significant part of the tower and the blade.
Recommendations	See the recommendation in the context of Lībiešu upurālas.
Notes	Included in the terms of reference from the NCMP. Surveyed in the field.
Impact taking into account mitigation measures	Minor adverse effects (no WPPs are currently recommended for the southern part)

Priecuma senkapi

Short description	Monuments dating from the Middle Ages to the Modern Period. ²⁸⁵ Located by the Priecumu Lake.
Location	Salacgrīva municipality, Limbaži district, near Priecumu lake. ~7,8 km from Pale, ~10,6 km from Korgenes. Coordinates in the WGS-84 coordinate system: 57.723844, 24.561544
Status	Cultural monument of local importance (group: archaeology) Priecumu senkapi (aiz aizs. no. 1472). It was included in the List of Cultural Monuments when it was adopted in 1998. A standard protection zone of 500 m in the countryside. ²⁸⁶
Landscape characteristics	Located on the edge of a mosaic landscape where former meadows/pasture intermingle with forest clusters. The ancient remains are hidden by a cluster of deciduous trees. There are several large boulders and potholes in the area. The site is located next to a shallow but distinct depression (200 m wide) containing Priecumu Lake (130 m from the monument) and small marshes. 300 metres to the east is a small hilltop where a small quarry has been established.
Availability	Low. Accessible from the national road V143, via a dirt road and tracks into a meadow (2,8 km). Located at the end of a difficult dirt road.
Ownership	Property of a natural person.
Tourism	It is not a tourist attraction and has no potential to become one.
Nearest WPP	2.71 km to the N (Z21)
Expected impact	Unlikely. The WPP will not be visible from the monument but will be visible from the buffer zone.
Recommendations	<i>Not proposed.</i>

²⁸⁴ <https://www.senvietas.lv/kuikulu-svetozolu-birzs-vieta/>

²⁸⁵ <https://mantojums.lv/cultural-objects/1472>

²⁸⁶ Ibid,

Notes	Not included in the terms of reference from the NCMP.
Impact taking into account mitigation measures	The nearest WPP are at Priecumu Lake: Z19, Z20, Z21 are not recommended. No impact

Krogkalni baznīkalns

Short description	3-4 m high elevation - Baznīkalns, ancient graves dating back to the Late Bronze Age - Early Iron Age. ²⁸⁷ The monuments consist of individual stones, clusters of stones and mounds made of stones. The largest and most prominent mound is at the N end of Baznīkalna. There is also a second, less distinct mound. Around the mounds there are many individual stones, small heaps or clusters of stones, micro-relief formations. In the legends, this place is known as Baznīkalns, or the hill on which the church used to stand. Stone barrows testify to the 1st century BC. and AD. I for the ancient cemeteries. ²⁸⁸
Location	Salacgrīva municipality, Limbaži county, on the left bank of the Arupīte River, between the homestead "Āpškalni" and the ruins of the homestead "Krogkalni". ~ 7,3 km from Ķirbiži, ~ 11,4 km from Pāles. Coordinates in the WGS-84 coordinate system: 57.676121, 24.553467
Status	Cultural monument of national importance (group: archaeology) Krogkalnu Ancient Monuments (Baznīkalns) (aiz aizs. no. 1474). It was included in the List of Cultural Monuments when it was adopted in 1998. A standard protection zone of 500 m in the countryside. ²⁸⁹
Landscape characteristics	The hill stands out against the flat landscape of the surrounding area in the relative valley of Arupīte between two forest massifs. It is situated on a low (3-4 m high) mound oriented roughly NW-SE. The whole area of the hill (about 60-70 m long, 30-40 m wide) is covered with trees and bushes, and there are individual stones, clusters of stones and mounds made of stones. Around the mounds there are many individual stones, small heaps or clusters of stones, micro-relief formations. ²⁹⁰ A public view of the mountain from the municipal road "Utkas-Zeltiņi".
Availability	Very low. Accessible from the V142 national road, then from the access road "Kulle 1". From home, 700 m along tracks, 400 m along a meadow. However, there is a public view of Baznīkalns from the municipal road "Utkas-Zeltiņi" (300 m away).
Ownership	Property of a natural person.
Tourism	Currently not a tourist attraction, it might seem attractive to tourists with a specific interest profile; this is most affected by inaccessibility.
Nearest WPP	4.37 km to the NW (D11)
Expected impact	The site is not identified as a high value viewpoint. The WPP will not be visible from the site itself but will be visible from the buffer zone. For example, a public view from the Zeltiņi-Untes municipal road westwards will show the towers of seven WPPs and the blades of another WPP.
Recommendations	<i>Not proposed.</i>
Notes	Not included in the terms of reference from the NCMP.
Impact taking into account mitigation measures	Minor adverse effects (no WPPs are currently recommended for the southern part)

²⁸⁷ <https://mantojums.lv/cultural-objects/1474>

²⁸⁸ <https://www.senvietas.lv/krogkalnu-baznickalns/>

²⁸⁹ <https://mantojums.lv/cultural-objects/1474>

²⁹⁰ <https://www.senvietas.lv/krogkalnu-baznickalns/>

Zviedru ceļš

Short description	Zviedru ceļš dating from the Middle Ages to the Modern Period. ²⁹¹
Location	Salacgrīva municipality, Limbaži district, between the homesteads "Graudiņi" and "Ķulles 1". ~ 7,3 km from Ķirbiži, ~ 11,4 km from Pāles. Coordinates in the WGS-84 coordinate system: 57.685177, 24.551345
Status	Cultural monument of regional importance (group: archaeology) Zviedru ceļš (aiz aizs. no. 6152). It was included in the List of Cultural Monuments when it was adopted in 1998. A standard protection zone of 500 m in the countryside. ²⁹²
Landscape characteristics	Located in a deciduous forest (scrub) near a small river (ditch). The Lidar elevation model shows a faint embankment. Both the property where it is located (Graudiņi) and the neighbouring property (Ķulles) have undergone, are undergoing, landscape alterations (excavation of ponds, older quarry, etc.).
Availability	Low. Accessible from the V142 national motorway, via the access road "Ķulēm 1". From this road it is located 200 m along the forest edge.
Ownership	Property of a natural person.
Tourism	It is not a tourist attraction and has no potential to become one.
Nearest WPP	4,27 km to the R (D11)
Expected impact	Unlikely. The site is not identified as a high value viewpoint. The site of the monument is not affected. Although the WPP will be visible from the buffer zone, given the nature of the monument, no harm will be caused to the surrounding landscape.
Recommendations	<i>Not proposed.</i>
Notes	Not included in the terms of reference from the NCMP.
Impact taking into account mitigation measures	Minor adverse effects (no WPPs are currently recommended for the southern part)

Salaca pilskalns

Short description	Salaca (also Vecsalaca, Salacgrīva) Pilskalns. Dates from the Middle Ages to the Modern Period (14th-18th centuries). ²⁹³ After being blown up in the early 18th century, only the ramparts of the fortress have survived to the present day. The castle was built on an older hillfort. ²⁹⁴
Location	Limbaži district, Salacgrīva town, near Baznīcas street. Coordinates in the WGS-84 coordinate system: 57.754460, 24.363534
Status	Cultural monument of national importance (group: archaeology) Medieval Castle of Salacgrīva (aiz aizs. no. 1478). It was included in the List of Cultural Monuments when it was adopted in 1998. A standard protection zone of 500 m in the countryside. ²⁹⁵
Landscape characteristics	Located in the town of Salacgrīva, between Baznīcas Street and Salaca. Located on the right bank, on the artificially modified main bank of the river. Plantations of lime trees around the perimeter, several of which are grand lime trees. The plaza is covered with lawn, swings and a few benches. A water tourist resting place has been created on the river terrace at the river's edge. On the other side of the street there is a small parking area and an information board.

²⁹¹ <https://mantojums.lv/cultural-objects/6152>

²⁹² Ibid,

²⁹³ <https://mantojums.lv/cultural-objects/1478>

²⁹⁴ https://lv.wikipedia.org/w/index.php?title=Salacas_pils

²⁹⁵ <https://mantojums.lv/cultural-objects/1478>

	From the edges of the castle mound, you can enjoy a high quality view both towards the Salaca estuary and the bridge, and towards the opposite bank - Salacgrīva promenade (Krasta Street). Salacgrīva is defined in the municipality's master plan as a high-quality viewpoint .
Availability	High. Accessibility. There are stairs leading up to the hill from a small parking area, as well as several paths.
Ownership	Municipal property.
Tourism	Tourist site with good access.
Nearest WPP	5.09 km to the A (Z2).
Expected impact	Unlikely. From the edge of the mound closest to the Salaca River, the upper parts of the WPP will be visible, and several more will have visible blades. Visibility would increase during the leaf-free period. WPP Z1 and D1 will be the most visible. Also, Z4, Z9, Z5 in the leaf-free period. D2, D4, D10 will show the blades or parts of blades.
Recommendations	Taking into account the importance of the site, if possible - adjust the planned location of WPP Z1, reduce the height of wind WPP D1 or do not foresee its construction.
Notes	Not included in the terms of reference from the NCMP. Surveyed in the field.
Impact taking into account mitigation measures	D1 is not recommended, and the southern part of the WPP is currently not recommended. Minor adverse effects.

Church of Brīdaga

Short description	The Lutheran House of Prayer of the Lielsalaca Brethren Church, or the Brīdaga Lutheran Church. The building of the house of prayer was built in 1879, in 1939 the construction of the church building began, which was consecrated only in 1939. It is located next to the Brīdaga Cemetery, which has cultural and historical significance - the owners of Ķirbiži Manor are buried there. The nature conservation plan of the nature reserve "Vitrupe ieļēja" designates this area as culturally and historically significant . ²⁹⁶
Location	Vilķenes parish, Brīdaga church, Limbaži municipality. 2.1 km from Ķirbiži. Coordinates in the WGS-84 coordinate system: 57.651772, 24.470415
Landscape characteristics	Located on the edge of the pine woods and the cemetery of Brīdaga, as well as on the NE edge of the village ²⁹⁷ . Situated on an elevation (near the Vitrupe steep bank). In accordance with the Limbaži municipality development strategy, it is located in a high-quality landscape area.
Availability	High. Publicly available. Access from national road V138, 400 m section on the municipal road "Brīdaga-Kapi".
Ownership	Property of a legal person.
Tourism	A little-known tourist attraction.
Nearest WPP	1,07 km to the NE (D9)
Expected impact	Medium. While the view of the church is unaffected by the WPP, the view of the church to the NW is significantly altered by WPP D6. Near the church you will be able to partially see WPP D9.
Recommendations	Re-siting or no-build of WPP D6.
Notes	Not included in the terms of reference from the NCMP. Surveyed in the field.
Impact taking into account mitigation measures	D6 is not recommended. Minor adverse effects.

²⁹⁶ SIA "Estonian, Latvian & Lithuanian Environment" 2005. *Nature conservation plan of the nature reserve "Vitrupe Valley"*. JSC "Latvia's State Forests". (expired in 2013).

²⁹⁷ Village in the sense of settlement, not in the sense of addressing.

Ķirbiži Manor and its buildings

Short description	<p>The manor house of Ķirbiži manor was built in 1753 and rebuilt in the 2nd half of the 19th century. From a cultural and historical perspective, it is significant that Bauman Kārlis, the author of the Latvian national anthem, briefly worked here as a home teacher. Until 2001 it was a school, in 2006 the manor was privatised and then landscaped.</p> <p>The manor barn has been retained in the ownership of the municipality. It has been a Forest Museum since 1989 and, according to local residents, is scheduled to close on 1 January 2024. The associated Ķirbiži Forest Nature Trail is nearby (see other tourist attractions). The nature conservation plan of the nature reserve "Vitrupe ieleja" designates this area as culturally and historically significant.²⁹⁸</p>
Location	<p>Vilķenes municipality, Ķirbiži, Ķirbižu manor.</p> <p>Coordinates in the WGS-84 coordinate system: 57.651697, 24.494718 (manor), 57.651037, 24.491403 (Forest Museum)</p>
Landscape characteristics	<p>It is located in the area between the V138 motorway and the left bank of the Vitrupe River. In a flat landscape. Opposite the manor house, restored and in good condition, the historic manor avenue - a high-quality landscape towards the manor. Landscape Park with paved paths and historical and new plantings, pond on Vitrupe.</p> <p>In accordance with the Limbaži municipality development strategy, it is located in a high-quality landscape area.</p>
Availability	Medium. The manor house is open to the public from the outside (160 m away), the territory is fenced and privately owned. Access from national road V138(<i>de facto</i> on the side of the road). A small, asphalted parking area (incl. For the forest nature trail).
Ownership	Property of a legal entity (manor house); property of the municipality (Forest Museum building).
Tourism	<p>Manor house - tourist attraction (view from outside, distance).</p> <p>The Forest Museum building - an object of architectural interest. Tourism is most affected by the Ķirbiži Forest Educational Trail</p>
Nearest WPP	1,07 km to the NE (D9)
Expected impact	<p>Unlikely.</p> <p>The most valuable view, the view of the estate, will not be affected. However, it will affect the view from the estate. From the front of the Manor House, the gondola and wings of WPP D9 and D8 will be visible through the trees. During the leafless period, the wings of several WPP (D11, D12, D14, D15) will be visible. Currently, tree planting around the perimeter of the estate (along Vitrupi) suppresses visual intrusion.</p>
Recommendations	Reduce the height of D9.
Notes	Not included in the terms of reference from the NCMP. Surveyed in the field.
Impact taking into account mitigation measures	<p>D9 height reduced, and no WPPs are currently recommended for the southern part</p> <p>Minor adverse effects.</p>

Vecsalaca manor buildings

Short description	<p>The present manor buildings were built in the 19th century. Only part of the outbuildings has survived. The park (8.8 ha) has 33 exotic plant species.²⁹⁹The manor house burnt down in 1915. Located in the nature park "Salacas ieleja".</p>
Location	<p>Niedru iela 10, Vecsalaca, Salacgrīvas pag., Limbažu nov.</p> <p>Coordinates in the WGS-84 coordinate system: 57.755161, 24.411346</p>

²⁹⁸ SIA "Estonian, Latvian & Lithuanian Environment" 2005. *Nature conservation plan of the nature reserve "Vitrupe Valley"*. JSC "Latvia's State Forests". (expired in 2013).

²⁹⁹ Baltic Environmental Forum 2005. Nature management plan for the Salaca Valley section of the North Vidzeme Biosphere Reserve. Limbaži district Salacgrīva municipality.

Landscape characteristics	<p>Located in the village built-up area and park on the right bank of the Salaca River. The outbuilding with the arcade is the most architecturally valuable. There are still some inhabited buildings (some of them could be rebuilt manor houses), as well as ruins of manor houses. A high-quality park.</p> <p>In accordance with the Limbaži municipality development strategy, it is located in a high-quality landscape area.</p> <p>On the slope of the Salaca steep bank, next to the residential building at Parka iela 8, there is a recreational viewpoint created by local residents.</p>
Availability	High. The manor's outbuilding is accessible from the outside. The park is also open to the public.
Ownership	The site is owned by several natural persons.
Tourism	Included in some local tourism material. There is no tourism infrastructure.
Nearest WPP	2,61 km to the SE (Z2)
Expected impact	Unlikely. As the development is located in a park, the WPPs would not actually be visible surrounded by trees.
Recommendations	<i>Not proposed.</i>
Notes	Not included in the terms of reference from the NCMP. Surveyed in the field.
Impact taking into account mitigation measures	No impact.

Annasmuiža Bridge

Short description	<p>Annasmuiža reinforced concrete bridge over the Salaca River (3 km from Salacgrīva). Built in 1908 (opened 1909). One of only two bridges of the early reinforced concrete era in the Latvian land roads that have been partially preserved intact.³⁰⁰</p> <p>Located in the nature park "Salaca ieleja".</p>
Location	<p>Salacgrīva municipality, Limbaži county, bridge over the Salaca River on the V144 national road (3 km from Salacgrīva).</p> <p>Coordinates in the WGS-84 coordinate system: 57.750625, 24.402145 (bridge), 57.750923, 24.401105 (viewpoint)</p>
Landscape characteristics	<p>A bridge over the Salaca River is asphalted. From the bridge you can see the river valley with islets, the nearest farmsteads, and the edge of Vecsalaca Manor Park. The floodplain is mostly alluvial forest.</p> <p>On the right bank before the bridge, there is a view/rest area with an information board and a bench. The view is of the bridge and the wider surroundings (see Figure 7.7.17). The view is influenced by trees and could be more obstructed in summer. The Salacas ielejas Nature Park Nature Management Plan calls it a "good view", with a [rare] opportunity to see the river valley from the road.³⁰¹</p>
Availability	High. Located on a national road. The viewpoint is accessible from the municipal road.
Ownership	Municipal property (Salaca river), public property (road), private property (viewpoint).
Tourism	Included in the tourist material, the view/rest area with an information stand and a bench is convenient for car and bike tourists (less so for water tourists).
Nearest WPP	2,82 km to the SE (Z2)
Expected impact	Medium. The upper parts of several WPPs (see Figure 7.7.18) will be visible from the viewpoint. Z4 will be the most visible. During the leafless period, approximately 2/5 of Z2, the gondola and wings of Z3 and the wings of Z1 will be visible through the trees. The WPP Z12 and Z13 blades will be visible for a short while.

³⁰⁰ <https://www.redzet.eu/travel/apskates-vietas/tilti/annasmuizas-dzelzsbetona-tilts>

³⁰¹ Baltic Environmental Forum 2005. Nature management plan for the Salaca Valley section of the North Vidzeme Biosphere Reserve. Limbaži district Salacgrīva municipality.

Recommendations	Taking into account the importance of the potential viewpoint, the Limbaži Municipality, at the request of the LVP, has expressed its opinion (letter attached as Annex 2) on the impact of the WPP Park on this viewpoint. The municipality has not expressed any conditions to mitigate the impacts of the proposed WPP from this perspective.
Notes	Not included in the terms of reference from the NCMP. Surveyed in the field.
Impact taking into account mitigation measures	Minor adverse effects.



Figure 7.7.17. *View of Annasmuiža Bridge to the SE from the view/rest area on the right bank of the river.*



Figure 7.7.18. Modelled view from Annasmuiža Bridge towards the SE, deployment scenario A'. WPP are highlighted for better visibility. Photo: Google Street View.

7.8. Impact on tourism and recreation

Worldwide research indicates³⁰² that wind energy development has a negative impact on the aesthetic values of the landscape, to the detriment of the tourism industry. Tourism in this assessment refers to trips outside the permanent place of residence for various purposes (including business trips, sightseeing, attending or participating in sports and cultural events, etc.), while recreation refers to various (primarily) outdoor activities close to the place of residence (e.g. walking, playing sports, mushroom picking, fishing, sunbathing, etc.). Sometimes, however, these lines can be blurred.

Tourists (visitors) often look for less modified landscapes³⁰³. Wind farms have a particularly negative impact on the attractiveness of the landscape, as opposed to stand-alone (isolated) WPPs³⁰⁴. Although there are tourists who would prefer to see wind farms directly, a study in the Czech Republic, for example, suggests that tourists would be most attracted to these sites if special tourist (visitor) centres were created^{305 306} or even if special viewing platforms were created that were accessible to tourists (these have been created in countries around the world, for example in the UK, Austria, Germany, the Netherlands).

A Czech study found that **siting WPPs in suitable locations has little or no negative impact** on tourists' perception of the landscape and their choice of destination. They also found that the creation of WPP, together with good marketing, allows the development of new forms of tourism. In general, tourists have a more negative view of other industrial or infrastructure sites: factories, quarries (mines),

³⁰² Broekel, T. & Alfken, C. 2015. *Gone with the wind? The impact of wind turbines on tourism demand*. *Energy Policy*. 86, 506-519.

³⁰³ Hoppe-Klipper, M., Steinhäuser, U., 2002. Wind Landscapes in the German milieu. In: *Windpower in View: Energy Landscapes in a Crowded World*. Academic Press, New York, 83-99.

³⁰⁴ Ladenburg, J., Dahlgard, J.-O. 2012. Attitudes, threshold levels and cumulative effects of the daily wind-turbine encounters. *Applied Energy*, 98, 40-46.

³⁰⁵ Broekel, T., Alfken, C. 2015. *Gone with the wind? The impact of wind turbines on tourism demand*. *Energy Policy*. 86, 506-519.

³⁰⁶ Frantál, B., Kunc, J. 2011. Wind turbines in tourism landscapes. *Annals of Tourism Research*. 38 (2), 499-519.

telecommunication towers or electricity pylons. Although the vast majority of tourists consider the attractiveness of nature and landscape as the most important consideration when choosing destinations and recognise the sensitivity to unwanted intrusions into the landscape, only 6% said they would not travel because of WPP³⁰⁷.

While the overall situation with tourism could be described as having a less negative impact, studies indicate that the more negative impact is directly on the recreation of local residents. This is particularly important in areas where there are fewer or restricted access to wilderness areas. A study in Norway on the impact of WPPs near recreational areas concluded that the impact of WPPs is negative. The study uses the revealed *preference-travel* cost method (*RP-TCM*) and the stated preference-contingent behaviour method (*SP-CB*) to estimate potential demand under conditions that are outside the range of variation in observed cost or resource characteristics and to predict what study subjects would do in a hypothetical situation. The study was carried out in three recreational areas popular with locals: a mountainous region with an extensive network of trails (assessing the impact of an inland wind farm) and two popular beaches with good tourist infrastructure, located up to 35 km from major towns (a backcountry wind farm). It concluded that the presence of the WPP would significantly reduce the number of recreational trips to both inland and coastal areas and affect the well-being of holidaymakers. The negative impact of the WPP on an area with 200 000 visitors per year is estimated at €10.5 million, or 20 % loss of indirect value, without taking into account downstream impacts (e.g. on neighbouring areas).

Impact on nature tourism sites

Kirbižu forest educational trail: the most notable object in this nature trail is the Vālodzes oak (6.5 m in circumference, one of the largest in Limbaži county), located 940 m from D9.

As the trail is mostly through the forest, the WPP will only be visible at the beginning of the trail (on the left bank of the Vitrupe River, around the former Forest Museum building and stand) and at the Vālodzes oak tree. Although the most scenic view of the beech tree is from the direction of the WPP, the D9 blades will be visible through the trees from the side of the beech tree looking towards the WPP. Due to the nature trail, it is recommended to reduce the height of WPP D9 to 250 m, **WPP for the southern part are currently not recommended.**

Niedrāju-Pilkas purvs trail: located in Pāles parish in Pilkas bog in the nature reserve "Niedrāju-Pilkas purvs". The nature trail is included in the tourist material of national importance. Located on the green "Ainaži-Valmiera" route. The nearest WPP (Z21) from the trailhead will be 4.86 km away in the direction of ZAA. At the end of the bog trail (footbridge) there will be a lookout tower located 5.09 km from WPP Z21.

The WPP will not be visible as you walk towards the lookout tower but will be visible in the opposite direction. As the lookout tower is located behind a belt of taller trees, its view is primarily towards the east or away from the WPP. However, the upper parts and wings of WPP Z19, Z20, Z21 would be visible in the leafless period. Given the distance, the impact can be considered negligible. It is recommended that the tree belt to the E of the tower separating the two open parts of the marsh be retained, but of course this is relevant to the management of the SPNA.

Salaca (water tourism): The Salaca is traditionally considered one of the most popular water tourism rivers in Latvia. The river is suitable for boating with all types of boats.³⁰⁸ The Salaca is navigable in the study area for about 19 km from Tīrmeži (near the former railway bridge) or from the popular Sarkanās klintis. WPP will be visible from Salaca in the stretch from Veckalēji to the mouth of the Gulf of Riga. The nearest WPP

³⁰⁷ Ibid,

³⁰⁸ <https://www.latvia.travel/lv/popularakas-upes-laivosanai>

(Z2) would be 1.43 kilometres away. As the vector of the navigation or river flow is in at least two sections facing directly towards the WPP, WPP Z12, Z14, Z4 and Z3 will be visible in these sections (Z14 is not recommended).

Jaunupe: a canal connecting the Svētupe and Salaca rivers. The entire length (5 km) is navigable. It is usually used to get from Svētupe to Salaca. A recreation area has been created on the bank of the Jaunupe River near Auziņas.³⁰⁹ The entire length of the study area, approximately half of which would have a visible WPP (the nearest (Z1) would be located 1.25 km NE of Indrani). As the boating direction is NW or towards Salaca, the WPP will not affect the view in this direction.

Svētupe: one of the most suitable small rivers for recreational boating experiences (as opposed to the popular Gauja, Abava, Salaca, Irbe). Boat charterers emphasise the unspoilt nature of its shores, which is further embellished by sandstone outcrops, including Lībiežu upurālas, located between Lauva and Kuikuli. The river is easily navigable at higher water levels (spring and autumn).³¹⁰ In the study area, the river flows for 32 kilometres (from Balozi, Pāle municipality). Although theoretically you can start boating higher upstream, the recommended routes are from Pāles or Lauvas to Jaunupe. The stretch from Jaunupe to the mouth of the bay is considered unsuitable for boating.³¹¹ The nearest WPP (Z1) would be located 730 m downstream of Zvaigzne. Downstream of Ķīlumi, WPP Z7 would be 840 m away. WPP will be visible from the river in several places where there are not only forests but also open areas on the banks.

Vitrupe: the least popular among boaters of the four watercourses considered. In the study area, it is navigable from Blome in Vilķene municipality for 24 kilometres to its mouth in the Gulf of Riga. The WPP will be visible in its reclaimed section between the village of Vitrupe and Ķirbiži, which is considered unsuitable for boating, but in the more scenically valuable section, which stretches from Ķirbiži (through the nature reserve "Vitrupe ieleja") to the sea, the WPP will not be visible, as the river flows through the valley here. The only exceptions are the surroundings of the farmstead "Delveri" and the farmstead "Segrumi". The nearest WPP (D9) is planned 950 m from the river (at the Old School). Because of the current, this stretch is recommended for boating only in early spring and for experienced boaters.³¹² The proposed action will have minimal visual impact on the navigable section, and **no WPP are currently recommended for the southern part.**

Impact on hiking/biking routes

Jūrtaka (part of the European long-distance hiking route E9 in the Baltic States): the closest location to the wind park - in Salacgrīva near the Salaca Bridge - Jūrtaka is 5.3 kilometres from the planned WPP (Z2). As the coast is characterised by pine forests that block the view inland, the only two locations on the beach where the WPP will be visible will be at Meleki beach in Salacgrīva municipality (the nearest WPP (D6) will be 7.2 km away) and at Kuiviži near the Kapteiņa osta (the nearest WPP (Z2) will be 7.5 km away): the impact on the landscape will be minor. WPP will also be visible at some points where the Jurtakas route bypasses the beach: at the Rakari recreation complex (5.95 km from D4) and in Salacgrīva (from 22 Sila Street to Lielsalaca Lutheran Church; at the square near the port authority; on Pērnavas Street near Salacgrīva Cemetery). Although the WPP will be visible in some locations, they will not significantly affect the coastal landscape itself, which is the main objective of the Jurtakas route, and therefore no recommendations are made in relation to the proposed activity.

Green Railway Ainaži-Valmiera: a cycling and hiking route along former railway lines in Latvia and Estonia. For most of the route, the green railway passes through forest, which prevents visibility of the WPP. The

³⁰⁹ <https://upesoga.lv/lv/marsruti/river/55-jaunupe>

³¹⁰ <https://piedabas.lv/laivu-noma-svetupe/>

³¹¹ <https://upesoga.lv/lv/marsruti/river/54-svtupe/>

³¹² <https://www.visitlimbazi.lv/lv/vitrupe>

nearest WPP (Z21) will be located 3.5 km from the route at the homestead "Mežvaldes" in Salacgrīva parish. The WPP will also be visible at this location. They will also be seen in other, mostly small, areas: near Mednieki, near the houses "Bites" and "Sargi", in the Pilka swamp near the nature trail, between "Purgaliai" and "Tauriņi" and between "Rozīte" and "Vienībām".

EuroVelo13 cycle route: the nearest WPP (D4, but WPP for the southern part are not recommended at the moment) will be 4.92 km away, at the A1 turn-off to Rakari. In the section from Šķīsterciems to Rakari, where the cycle route follows the old Tallinn highway (the section parallel to the modern motorway), the WPP will be visible and will be an important accent of the landscape, as it will open the view to the east, but in places the view will be blocked by the scenic oak avenue along the highway.

Impact on other recreational opportunities

The proposed activity will not only affect views and noise but will also physically reduce forest areas: for one WPP, up to 2.6 ha of forest will need to be prepared (deforested, cleared), which will fragment the forest, including through the construction of forest roads or cable routes. At the same time, on the positive side, the new road network created for the wind park could theoretically increase accessibility to natural areas.

The construction of the southern array of the IPT "Burlaku sils" of the individually planned territories identified by LVM immediately adjacent to the territory of the proposed activity would adversely affect recreation and reduce the attractiveness of the territory, but it should be noted that **the southern part of the WPP is currently not recommended**.

7.9. Impacts on Natura 2000 sites in the vicinity of the WPP Park

This assessment includes an assessment of the three Natura 2000 impacts as specified in the Programme No 5-03/7/2023 issued by the NRW on 12 September 2023.

A summary of the objectives for the establishment and protection of Natura 2000 sites adjacent to the area of the Proposed Action and the factors that are already adversely affecting them prior to implementation of the Proposed Action is provided in Table 6.4.2 of Chapter 6.4.

Impacts on habitats and protected species in Natura 2000 sites

The proposed action is not planned for a Special Protection Area: the implementation of the action will not have any foreseeable adverse effects on these areas, directly or indirectly, as far as the protection of the habitats and associated plant species included in the areas is concerned. The impact of the planned construction of the WPP, access roads, transmission lines and transformer substations on the protected natural values of Alternative A of the Proposed Action has been fully assessed. No Natura 2000 site assessment for the 8 WPPs in the southern part to be constructed only after additional assessment of vascular plants and moss and lichen species and development of a solution for the connection to the AST and involvement of a freshwater expert for the crossing of the Svētupe.

Alternative A of the proposed action is not planned in Natura 2000 sites and micro-reserves established for the protection of freshwater, grassland, forest or wetland habitats and will not have any direct or indirect foreseeable adverse effects on them.

Impacts on bat species in Natura 2000 sites

The proposed wind farm is unlikely to have any significant impacts on bat populations in the nearest Natura 2000 sites of importance for bats (Salaca ieleja, Vitrupe ieleja), and no significant cumulative impacts are expected, taking into account other wind farms planned in Limbaži municipality.

Impact on bird species in Natura 2000 sites

The effects of Alternative A on bird species in Natura 2000 sites are summarised in Table 7.9.1.

Table 7.9.1. *Impact on bird species in Natura 2000 sites in the surrounding area of Alternative A of the Limbaži WPP Park*

No.	Natura 2000 site	Expected impact
1.	Niedrāju-Pilka purvs	No significant adverse effects are expected on the site as a result of the proposed action. In the case of forest species, it is bounded by the road and surrounding farmland, while noise pollution from the WPP at this distance would be assessed as negligible. The greatest potential impact is predicted to be on the roosting migrant <i>Anser sp.</i> geese roosting in the marsh lakes, however this is an unpredictable value as potential feeding sites can be highly variable from year to year and no long-term observation data are available for such sites around this DL. At the same time, it should be noted that during one observation session in the WPP Park, an intensive migration of <i>Anser sp.</i> in the A-R direction was detected, which may have originated from the Niedrāju-Pilka purvs, but given that no information on birds equipped with GPS transmitters during this particular migration wave has been found, this is only speculative.
2.	Salacas ieleja	No significant adverse effects on the protected bird population of this SPNA are expected from the proposed action. The highest credible contributing factors would be noise pollution and flicker effects.
3.	Vitrupe ieleja	No significant adverse effects on the protected bird population of this SPNA are expected from the proposed action. The highest credible contributing factors would be noise pollution and flicker effects.

Potential impacts on hydrogeological and hydrological conditions in specially protected areas

Given that no construction is planned within the SPNA, no negative impacts of the Proposed Action on the plant species and biotopes of the SPNA are expected. The planned reconstruction works of the drainage system are also assessed as minor and mainly consist of the construction and reconstruction of culverts and fragmentary reconstruction of the existing drainage system. Only in some areas where natural drainage conditions are insufficient will the construction of new soakaways along the WPP access roads be necessary. The construction of these ditches is not expected to have any impact on the hydrological regime of the adjacent SPNAs as they are being constructed to drain rainwater from roads without affecting the functionality of the existing drainage system.

The potential impact on plant species and habitats in the SPNA can therefore be considered to be insignificant, as such minor changes would be insignificant against the background of natural seasonal fluctuations in groundwater levels.

Summary of the assessment of impacts on Natura 2000 sites

Table 7.9.2 below summarises the assessment of impacts on species and habitats in Natura 2000 sites in accordance with Cabinet Regulation No 300 "Procedure for assessing impacts on Sites of European Importance (Natura 2000)".

Table 7.9.2. Impact assessment according to the criteria for Natura 2000 impact assessment on species and protected habitats in sites

No. p.k.	Criteria	Indicator	Projected trend of the project
1.	Habitat area of the specially protected habitat or species	The areas of habitats and species habitats in the nature reserves "Vitrupe ieleja" and "Niedrāju-Pilka purvs" and the nature park "Salaca Valley" will not change, as the proposed activity does not directly affect any of the three Special Protection Areas. Change in habitat area (as a result of the Proposed Action) (ha) and ratio (%) vs:	
		1. the area of habitat of the habitat or species within the Natura 2000 site	Plant species and habitats remain unaffected as they are not directly affected. No change in habitat areas for bird species in Natura 2000 sites
		2) the area of habitat of the habitat or species in Natura 2000 sites in Latvia as a whole	Plant species and habitats remain unaffected as they are not directly affected. No change in habitat areas for bird species in Natura 2000 sites
		3) the total area of habitat of the habitat or species in the country	Plant species and habitats remain unaffected as they are not directly affected. No change in habitat areas for bird species in Natura 2000 sites
		(4) the area of habitat of the habitat or species in the Natura 2000 network of sites in the European Union as a whole	Plant species and habitats remain unaffected as they are not directly affected. No change in habitat areas for bird species in Natura 2000 sites
2.	Population density of the specially protected species	Changes in population density	No change as species and habitats will not be affected
3.	Fragmentation of habitats of specially protected habitats or species	Fragmentation relative to the initial state. There will be no change in the degree, continuity or permanence of fragmentation of habitat areas relative to the baseline, as no direct or indirect effects are expected as a result of the Proposed Action. The action will not affect habitat polygons in Natura 2000 sites, so no habitat fragmentation effects are expected.	There will be no change in the degree, continuity or permanence of habitat fragmentation relative to the baseline, as no direct or indirect effects are expected as a result of the Proposed Action. The proposed action will

No. p.k.	Criteria	Indicator	Projected trend of the project
			not affect SPA habitat polygons in Natura 2000 sites, so no habitat fragmentation effects are expected. In the case of the WPP Park, bird habitats are not divided into smaller, isolated fragments.
4.	Disturbance to specially protected species	Vascular plant species	No change
		For bird species in DL "Vitrupeș ieleja" and DP "Salacas ieleja".	Possible minor noise pollution and flicker effect
5.	Isolation (isolation) of the habitat or habitat of the specially protected species from other habitats or habitats of the same kind	<p>The isolation of the most important habitats protected by Natura 2000 sites from other habitats of the same type is determined by the location of the corresponding ecosystems</p> <p>The isolation of habitats will not change, as the isolation of the most important protected habitats of the Natura 2000 site from other habitats of the same type is determined by the location of appropriate ecosystems (e.g. active areas of raised bog), which will not be affected by the implementation of the Proposed Action.</p>	The location of the ecosystems will not be affected by the implementation of the proposed action
6.	Changes in the habitat quality (structures and functions) of the specially protected habitat or species	<p>No changes in the quality of specially protected habitats are expected as a result of the implementation of the Proposed Action, as the Proposed Action is not expected to affect the quality of habitats in Natura 2000 sites.</p> <p>No changes in the quality of specially protected habitats are expected as a result of the implementation of the Proposed Action, as the Proposed Action is not expected to affect the quality of habitats in nearby Natura 2000 sites. In Natura 2000 sites in the vicinity of the Proposed Action, significant effects are due to localised conditions and factors within the SPA, such as historical use and management of the site or changes to the hydrological regime within these Natura 2000 sites.</p>	No changes in the quality of specially protected habitats are expected as a result of the implementation of the Proposed Action, as the Proposed Action is not expected to be implemented in Natura 2000 sites
7.	Changes in the patterns and interactions that determine the structure and function of an area	<p>Degree of fragmentation, continuity or permanence relative to the initial state.</p> <p>The implementation of the proposed action does not pose a threat to the conservation objectives of protected areas in terms of ensuring a favourable level of protection for protected habitats of EU importance or to the integrity of protected areas at either local or regional level.</p> <p>No changes in the patterns and interactions that determine the structure and function of the sites are expected, as the effects of the Proposed Action are not expected to alter the hydrological, geological or other conditions that characterise the sites, or to have a significant effect on potential species migration corridors or <i>stepping stones</i>.</p>	No changes in the patterns and interactions that determine the structure and function of the sites are expected, as the effects of the Proposed Action are not expected to alter the hydrological conditions, geological or other conditions that characterise the site, nor are they expected to have a significant effect on

No. p.k.	Criteria	Indicator	Projected trend of the project
			potential migration corridors or stepping stones for species. The land units included in the area of the proposed action are currently used for forestry activities.

Taking into account that the planned construction of the wind farm does not directly affect any Natura 2000 sites, it can be concluded that the implementation of the recommended alternative A will not have direct or indirect negative impacts on adjacent areas, including specially protected Latvian or EU habitats in specially protected nature areas - Natura 2000 sites. The implementation of the proposed action is not expected to exacerbate the negative impacts identified in the Natura 2000 sites - drainage and changes in species composition due to vegetation succession.

Based on the impact assessments and calculations carried out, it can be concluded that, as no significant adverse effects are expected on the habitats and species protected by Natura 2000 sites, no significant effects are expected on:

- the objectives of establishing and protecting the Natura 2000 sites referred to above;
The objectives for the creation and protection of the sites are summarised in Table 6.4.2 and neither the habitats nor the species listed as objectives for creation will be affected.
- factors that have already affected these areas prior to the implementation of the Proposed Action;
Factors affecting nature values prior to the implementation of the Proposed Action, such as: grassland overgrowth, succession, agricultural activities, diffuse pollution of surface waters from agricultural and forestry activities, erosion, forestry activities, invasive alien species, etc., summarised in Table 6.4.2, the Proposed Action will not increase the impact of these factors on nature values in Natura 2000 sites.
- the importance of Natura 2000 sites for the coherence of the national and biogeographical network.

Summarising the assessment of impacts on Natura 2000 sites, it can be concluded that no specific mitigation measures are currently identified as necessary in accordance with the Cabinet of Ministers Regulation of 19 April 2011 No 300 "Procedure for assessing impacts on Sites of European Importance (Natura 2000)".

Overall, when assessing the impacts on Natura 2000 sites, the experts concluded that:

- 1) The Proposed Action is not expected to have a direct impact on plant species and habitats of Natura 2000 sites; it will not result in fragmentation of species and habitats, or alteration of characteristic structures and functions;
- 2) no significant adverse effects on the ecological functions, integrity, conservation and use objectives of Natura 2000 sites are expected from the Proposed Action;
- 3) Location of the proposed activity and expected cumulative impact with other wind farms in Latvia and the immediate surroundings in the north of Latvia:
 - ✓ the types of impacts that could overlap with other WPP parks could be related to noise, changes in the hydrological regime, impacts on the landscape, impacts on bird species,

- ✓ In Latvia, there are 82 WPP parks with environmental impact assessments (EIAs) applied for/underway/ongoing/completed at various stages of development (see Figure 14.1, Chapter 14) with a total onshore capacity of ~12 GW (excluding those that have been discontinued). There is no wind parks built in the northern part of Latvia, but there are wind parks for which environmental impact assessments have been carried out or are in various stages of preparation; information on their location in relation to the Limbaži wind park is given in Figure 3.2.4 in Chapter 3.2. The assessment of the cumulative environmental impacts of wind farms is based on publicly available information on these wind parks;

4) Location of the proposed activity and expected cumulative impacts with forestry activities.

Types of impacts that could overlap with forestry activities include site fragmentation (outside Natura 2000 sites), deforestation (reducing foraging areas).

According to *Globalforestwatch*³¹³, the land cover of the Limbaži WPP is divided as follows: natural forests - 1,200 ha, planted forests - 669 ha and other land use - 28 ha (Figure 7.9.1).

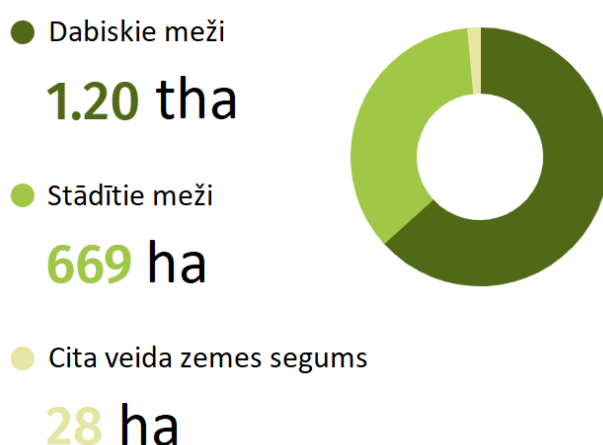


Figure 7.9.1. Land cover distribution of WPP Limbaži according to *Global forest watch*³¹⁴.

Comparing the data published on the portal, it can be concluded that in the period from 2001 to 2023, the area of forest in the LVM study lands of the Limbaži WPP Park decreased by 614 ha or 33% of the total area (Figure 7.9.2).

³¹³ <https://www.globalforestwatch.org/>

³¹⁴ Ibid,

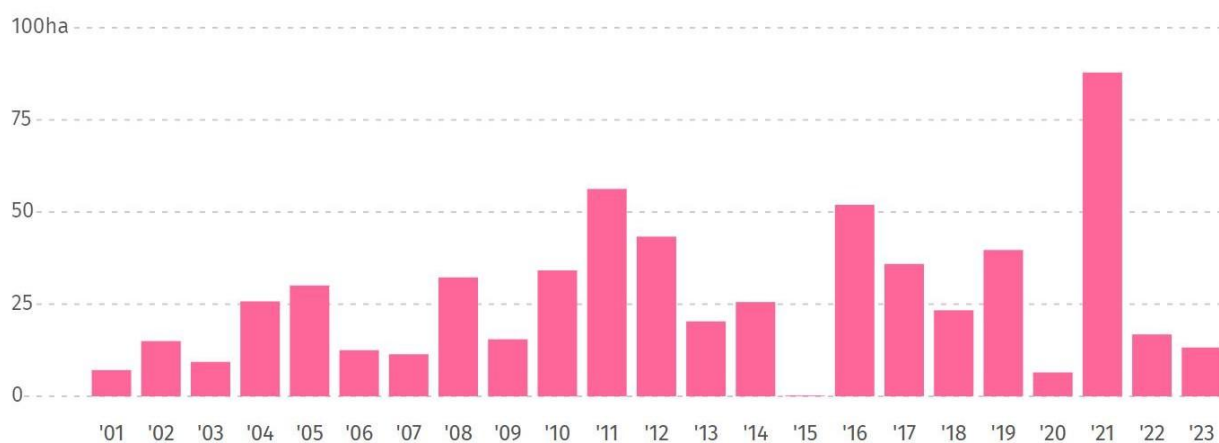


Figure 7.9.2. *Reduction of forest cover in the area of LVM study lands of the Limbaži WPP in the period 2001-2023*

Figure 7.9.3 provides a visual representation of forest land changes in the Limbaži WPP in 2001, 2010, 2020 and 2023. The area of forest stands in the LVM study area of the Limbaži WPP increased by 25 ha between 2000 and 2020, the increase is shown in the map fragment for 2023.

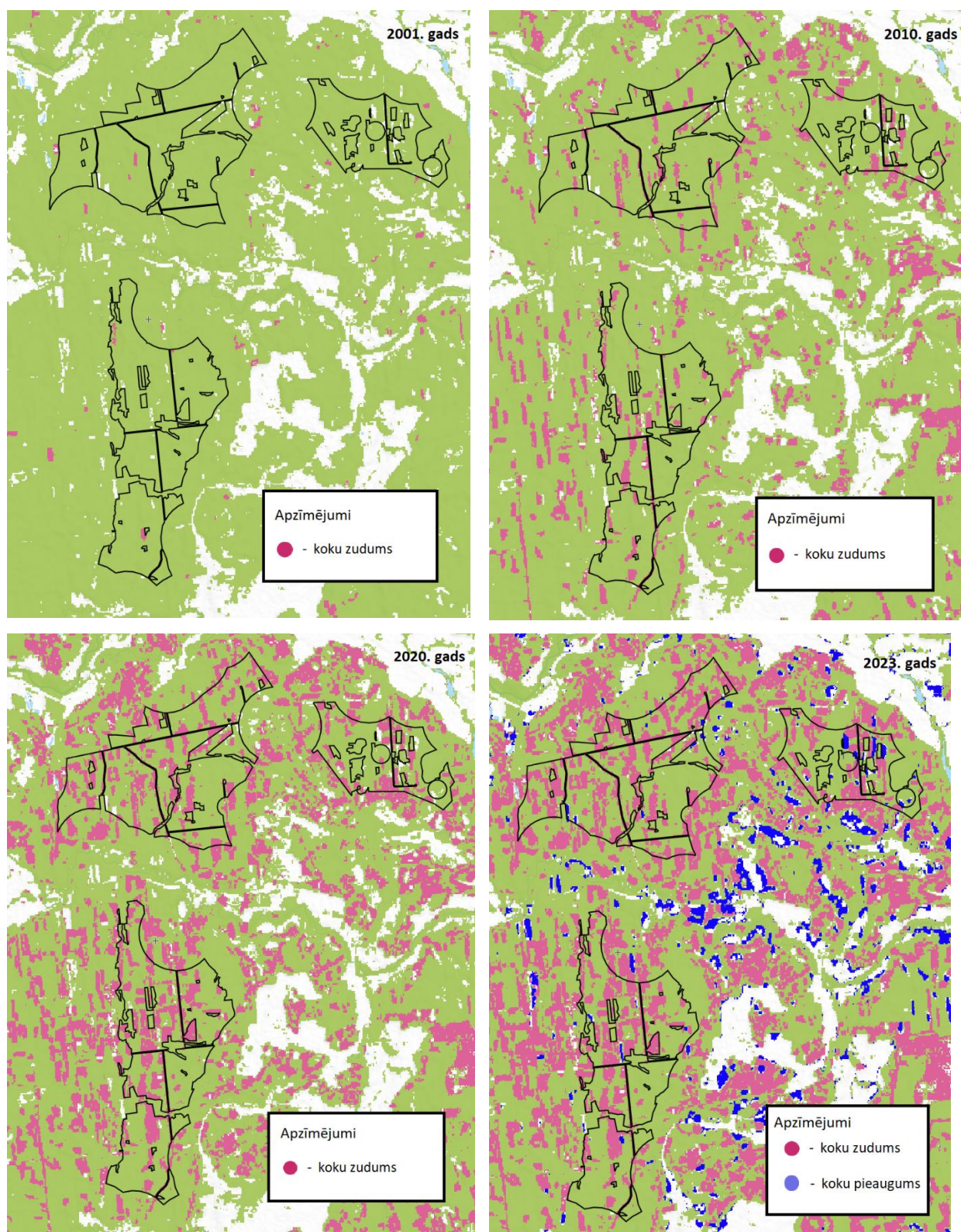


Figure 7.9.3. Changes in forest area in the LVM study area of WPP Limbaži (2001, 2010, 2020 and 2023)

7.10. Potential impacts on changes to hydrological and hydrogeological regimes

The assessment of the construction process has identified the following potential negative impacts on the hydrological and hydrogeological regimes during construction:

- potential impacts on drainage and drainage systems;
- contamination of ground and groundwater and impacts on water abstraction points;
- changes in soil structure and moisture in the area of influence of the proposed activity;
- potential impacts on SPNAs.

Impact on drainage and drainage systems

As already mentioned, the area of the Proposed Action is reclaimed. No major drainage system construction and/or realignment works are foreseen during the construction of the WPP. However, the Proposed Action will require the construction of new access roads to the WPP construction sites. The area around the planned WPPs has high groundwater levels, so to ensure that the roads can be operated in both dry and wet weather conditions, ditches will be created along the roads in areas where natural runoff will be insufficient, the location of which will be determined during construction design.

If the planned roads cross open watercourses, new culverts will need to be built or existing culverts will need to be rebuilt. The requirements of the Cabinet of Ministers Regulation No 329 of 30 June 2015 "Regulations on Latvian Building Standard LBN 224-15 "Melioration Systems and Hydrotechnical Structures"" will be complied with when designing and constructing elements of the drainage system.

According to the TIAN of Salacgrīva parish of Limbaži municipality, the following requirements for the maintenance and installation of drainage systems must be observed when using the territory:

- to prevent overwatering and rising groundwater levels, existing artificial and natural watercourses must be maintained or realigned in accordance with the drainage realignment project, incorporating ditches and watercourses into a single drainage system;
- where a new access road is constructed across an open ditch or watercourse, measures must be taken to preserve or create culverted ditches and watercourses;
- if ditches need to be filled in when the site is developed, new ditches must first be created in their place. If a ditch cannot be created, it can be replaced by a pipeline and, if necessary, additional drainage can be created by designing and approving a drainage system realignment project.

If the construction is carried out in accordance with the requirements of the Law on Land Reclamation, the above-mentioned Cabinet Regulations and the TIAN of Limbaži Municipality Salacgrīvas parish, it is not expected that the construction process of the WPP parks could have a negative impact on the functioning of the drainage systems in the territory of the planned WPP parks or their surroundings.

Contamination of soil and groundwater and impacts on water abstraction points

Given that the area of the proposed activity is not located in the protection zones around water abstraction points, there is no risk of groundwater contamination, and no special measures are required for the construction and operation of the WPP.

Potential swamping processes in the area of the Proposed Action are spatially very limited and will not develop during the construction and operation of the WPP.

Changes in soil structure and moisture as a result of the proposed activity

The areas of the proposed activity are located in woodland, dominated by turf podzolic soils and pseudoglacial soils.

In areas where new roads and sites are planned for the installation of the WPP, as well as in areas where WPP foundations are to be constructed, topsoil will be removed before construction work starts. Given that the removed topsoil could be used for reclamation of the site, no significant changes to the soil structure and moisture in the area of the Proposed Operation are foreseen.

When assessing the impact of ditches along new access roads on adjacent forest land, it can be predicted that no changes in soil moisture are expected in these areas, as a system of drainage ditches has already been established in these areas, the purpose of which is to ensure optimum moisture conditions, allowing for quality conditions for the growth and management of forest stands. The proposed activity has no impact on forestry activities.

7.11. Summary of mitigation measures

A summary of mitigation measures for the WPP included in the recommended alternative EIAs for the construction, operation and operation phases of the WPP is attached as Annex 12 (electronic Excel file due to its size).

8. JUSTIFICATION OF THE CHOSEN ALTERNATIVE IN THE LIGHT OF A COMPARISON OF ENVIRONMENTAL IMPACTS

The aim of the Energy Security Law is to promote the production of renewable energy, to promote the energy security and independence of the Republic of Latvia, as well as to mitigate the processes of negative climate and environmental change. The law provides for a simplified procedure, inter alia, for the construction of WPPs and the infrastructure needed for them. The construction of WPPs is allowed on agricultural and forest land as defined in the municipality's spatial plan.

If the Cabinet of Ministers grants the status of an object of national interest to the proposed WPP park, no municipal approval is required for its construction: once the EIA has been carried out and the opinion of the SEB has been received, the Cabinet of Ministers decides on the approval of the Proposed Action.

The EIA for the proposed action assesses the alternatives for the location of the WPP park and the technological alternatives - height alternatives, three different heights of the WPP.

The implementation of each of the alternatives evaluated will make it possible to achieve the objective of the Proposed Action: to install new WPPs, with a maximum rated capacity of 8 MW per plant.

A summary, taking into account the assessments of an ornithologist, a species and habitat expert, a landscape expert, a bat expert, a hydrologist and an assessment of physical impacts, of the 37 WPP locations is given in Table 8.1. The red shading is used for WPPs and environmental impact areas where significant negative impacts have been identified, the yellow shading for WPPs and environmental impact areas where adverse impacts have been identified and the green shading for environmental impact areas where no adverse or significant impacts have been identified.

For the potential locations of the WPPs in the southern part of the WPP Park, the assessment of additional vascular plant, moss and lichen species and the development of a solution for the connection to the AST, as well as the study of additional impacts on freshwater for the power line crossing over the Svētupe River were not carried out at this stage, therefore the impact assessment for these WPPs is coloured orange.

For all WPPs, undesirable effects have been identified which can be avoided or reduced by conditions or constraints in the design, construction or operation of the WPP (see Annex 12 for conditions and constraints for recommended WPPs).

Table 8.1. Summary of expert evaluation

No. p.k.	WPP	Birds	Bats	Habitats/species	Noise	Flicker	Landscapes	Hydrology
1	D1							
2	D2							
3	D3							
4	D4							
5	D5							
6	D6							
7	D7							
8	D8						250	
9	D9						250	
10	D10							
11	D11							
12	D12							
13	D13							

No. p.k.	WPP	Birds	Bats	Habitats/species	Noise	Flicker	Landscapes	Hydrology
14	D14							
15	D15							
16	D16							
17	Z1							
18	Z2							
19	Z3							
20	Z4							
21	Z5							
22	Z6							
23	Z7							
24	Z8						250	
25	Z9						250	
26	Z10							
27	Z11						250	
28	Z12							
29	Z13							
30	Z14							
31	Z15						250	
32	Z16							
33	Z17						250	
34	Z18						250	
35	Z19							
36	Z20							
37	Z21							

Based on this assessment, recommended alternatives for the location of the WPP park have been defined:

Alternative A: In the N part of the WPP Park study area (**12 WPPs**) **without exclusionary restrictions** - see Chapter 4, Figure 4.1.7;

Alternative B: WPP without exclusion restrictions in Part N and **conditional on WPP in Part D**, to be decided only after further assessment of vascular plant, moss and lichen species and development of a solution for the connection to the AST, as well as additional impacts on freshwater for the study power line crossing over the Svētupe in the study area (**20 WPP**) - see Chapter 4, Figure 4.1.7.

The technological alternatives were evaluated in the following areas: landscape, cultural history, tourism and recreation, noise and flicker.

Comparison of location alternatives A and B in terms of ornithofauna values

In terms of impacts on ornithological values in the area of the proposed wind park, the two alternatives do not differ significantly.

Both alternatives for the proposed operation are assessed as low risk areas for collisions with raptors if all WPPs are equipped with containment chamber systems.

Both Alternatives A and B have the **potential** to have negative impacts on the breeding population of barn owls. According to the results of the pre-construction monitoring, the application of owl protection measures should be assessed: noise restrictions, which are recommended to be addressed by choosing the quietest possible WPP model.

Alternative B WPP D8, D9, D10, D11, D12, D13, D14, D15, D16 pose risks to potential **hen harrier rookeries**, but **the southern WPP are not recommended at this time unless additional moss, lichen and vascular plant surveys are undertaken.**

Impacts on migratory bird species would be low under both alternatives, as migratory species may pass through the WPP Park or stay at low levels in the vicinity of the edge WPP during the migration period. Temporarily high presence of migratory birds is possible.

In order to significantly reduce the risk of collisions with large migratory birds (mainly *Anser sp.* and *Branta sp.* geese as well as swans) that may pass through the WPP park area or stay at low intensity in the vicinity of the edge WPP during the migration period, it is recommended to equip the WPP park with camera system(s) that can, if necessary (depending on the specifics of the particular solution), slow down or stop the rotation of one or more WPP or the turbines of the whole park

Although the proposed WPP park is not considered to be located in a distinct migration route or bird concentration area based on survey information, it is likely to have temporarily high concentrations of birds.

Summary of effects on bat species

If automatic shutdown or non-start-up of the WPP is ensured (see 7.7.2. chapter 7.6.2) and bat monitoring is ensured in the first and second year after the start of operation of the WPP, and if, based on the results of the monitoring, the WPP complies with the WPP operating restrictions, the establishment of a WPP park is allowed for both siting alternatives, as the expert has concluded that the establishment of a WPP park is allowed for all sites except D12 under certain conditions (see Chapter 7.6.3).

Bat activity in the area of the WPP parks may increase significantly after the construction of the WPPs, and bats may appear in large numbers in places where they were not detected during the feasibility study. Bats are strongly attracted to WPP, although the reasons for this have not yet been clearly established.

The northern part of the proposed development (Z1-Z21) is generally considered to be 'safer' in terms of the risk of collisions with bats, provided that the WPPs are not sited close to the quarry in the west of this part of the site, which is currently the case. In the southern part (D1-D16), forests generally have higher bat activity and a higher proportion of suitable foraging and roosting habitats.

Comparison of location alternatives A and B in terms of impacts on habitats and plant species

Overall, if the proposed activity were to be implemented at a scale of 45 WPP without mitigation measures, it would have significant adverse effects on protected habitats and protected species and their habitats at local and regional scales, and significant adverse effects at national scale.

If up to 20 WPPs are deployed, the number and area of habitats and species destroyed would be significantly reduced by mitigation measures.

The updated WPP siting for Alternative A minimises potential impacts on protected natural values by clarifying the configuration of WPP locations and avoiding WPP locations that would result in impacts on larger areas of protected habitats and protected species habitats. Other mitigation measures should be taken during the design process, in the selection of cable route locations and the construction of process areas where they may have an impact on the hydrological regime. Design solutions should take into account recommended mitigation distances based on forest habitat ecology and ensure that side ditches constructed adjacent to infrastructure facilities are not undercut and do not divert water away from habitats and species habitats.

It is recommended to choose Alternative A, taking into account the expert conditions for mitigation measures.

Alternative B is not recommended: the decision on the construction of the WPP should be taken only after additional assessment of vascular plant, moss and lichen species and the development of a solution for the connection to the AST, as well as an additional study of the impact on freshwater of the power line crossing over the Svētupe River in the study area.

Summary of impacts on landscapes, cultural heritage, recreation and tourism

Scenario A, with an initial deployment of 14 WPPs, has the least impact on landscape, heritage, recreation and tourism. In some places, the impact remains high, despite a significant reduction in impact compared to the maximum model. In the expert's assessment, Z1 and Z8 are undesirable. Z8 construction in the last version of the alternatives is not recommended according to the recommendation of the habitat experts

Scenario 'A' has only a slightly higher impact on the landscape at regional level. The differences between scenario A and scenario A' are local, due to the increase in height of the 4 WPP, but as this occurs in the most sensitive locations, this scenario is not desirable.

Scenario B has much greater impacts on landscape, heritage, recreation and tourism, with the addition of 8 WPPs in the southern part of the wind farm to Scenario A. Scenario 'B' has the biggest impact. The differences between scenario B and scenario B' are local.

Adjustments following additional expert assessment of recommended alternatives

Following the additional expert opinions, the assessment of the WPPs to be implemented was revised and significant environmental impact factors - impacts on natural values - were identified for three more WPPs, one of which (Z6) needs to be re-sited at the design stage. After further assessment of the alternative locations defined above, Alternative A has 12 and Alternative B has 20 WPPs, provided that the decision to construct WPPs is only taken after further assessment of vascular plant, moss and lichen species and the development of a solution for the connection to the AST, as well as additional freshwater impact studies for the power line crossing over the Svētupe River in the study area.

Table 8.2. *Alternatives for the location of the Limbaži WPP after additional expert assessment.*

No.p.k.	Name of the WPP site	Alternative A	Alternative B	Habitat expert additions
1	D3		V	Further assessment needed
2	D4		V	Further assessment needed
3	D8		V	Further assessment needed
4	D9		V	Further assessment needed
5	D10		V	Further assessment needed
6	D11		V	Further assessment needed
7	D13		V	Further assessment needed
8	D14		V	Further assessment needed
9	Z1	V	V	
10	Z2	V	V	
11	Z3	V	V	
12	Z4	V	V	
13	Z5	V	V	
14	Z6	V	V	Location to be specified
15	Z8	x	x	The area may significantly affect the habitat 91D0*
16	Z9	V	V	
17	Z10	V	V	

No.p.k.	Name of the WPP site	Alternative A	Alternative B	Habitat expert additions
18	Z11	x	x	Significant adverse impacts on wet forest habitats are expected as a result of the construction of the new road
19	Z12	V	V	
20	Z13	V	V	
21	Z16	V	V	
22	Z17	V	V	
Total		12	20	

Summary of the comparison of the impacts of the recommended alternatives to the proposed action

Impacts assessing the existing situation in the area of the proposed action and the situation expected under the alternative to be implemented:

1. Species and habitats
2. Bats
3. Birds
4. Landscape
5. Cultural history
6. Tourism and recreation
7. Natura 2000
8. Noise
9. Low frequencies
10. Flicker
11. Hydrology
12. Environmental risks and accidents
13. Vibration
14. Climate

A notional numerical characterisation has been assigned to the impact scenario assessment, summarised in Table 8.3.

Table 8.3. Impact rating scale

Rating	Explanation
-3	Significant adverse changes are expected: Violation of environmental quality threshold values or environmental regulatory requirements laid down in regulatory enactments; such effects shall be assessed as an exclusion factor. Where significant adverse effects are identified and the proposed activity is of significant public interest, compensatory measures are required under the legislation.
-2	Slight adverse changes are expected: The proposed activity may result in non-achievement of the environmental quality objectives set out in the regulatory enactments and guidelines or significant qualitatively or quantitatively measurable adverse changes in natural resources or the state of the environment compared to the baseline condition.
-1	Minor adverse effects: There may be minimal impacts on natural resources, which do not generally preclude the achievement of the target or threshold values for environmental quality set out in the regulatory enactments, but there are qualitatively or quantitatively measurable adverse changes in natural resources or environmental status compared to the baseline condition.

Rating	Explanation
0	No impact, ambiguous impact or no detectable impact: No qualitative or quantifiable changes in the functions of natural resources and impacts on public environmental rights are foreseeable.
+1	Slight favourable changes are expected: Possible positive impacts on natural resources, but relatively minor and/or temporary.
+2	Significant positive changes are expected: The magnitude, likelihood and/or duration of the beneficial effects are significant. The proposed action will result in significant quantitative or qualitative measurable improvements in the quality of the environment compared to the baseline condition.
+3	Significant favourable changes are expected: The proposed action will result in significant quantitative or qualitative measurable improvements in the quality of the environment; the environmental quality objectives set out in the legislation and guidelines will be achieved.

Table 8.4. Comparison of recommended alternatives to the proposed action

Object or type of impact	Alternative for location A		Alternative for location B		Notes
	Technological alternative A	A' Technological alternative	Technological alternative B	B' Technological alternative	
1. Species and habitats	-1	-1	-3	-3	As a result of the construction of WPP Park Alternative A , one of the largest areas of habitats and species habitats affected is associated with the construction of connection 1A A and 1A R, forming the road to the substation, while in the case of connection Alternative 2A, the proposed activity will have an overall insignificant adverse effect at local and regional scales - some species individuals and small areas of species habitats and protected habitats will be destroyed but this will not have an adverse effect on species populations and habitat conservation status. The construction of the WPP Park Alternative B, which includes the WPP of the southern part of the WPP Park, is not recommended at the moment, as it has not been subject to an assessment of vascular plant, moss and lichen species and the development of a solution for the connection to the AST, as well as an additional impact study on freshwater for the power line crossing over the Svētupe River. Information to assess the residual effects of the Proposed Action is incomplete for Alternative B.
2. Birds	-1	-1	-1	-1	The main expected impacts are collisions, habitat destruction, habitat use limitation (noise and flicker), barrier effect. If the WPP park is to be constructed, the application of mitigation measures (as recommended in the Annex to Chapter 7.11) during construction and operation is a mandatory condition
3. Bats	0	0	-1	1-	If automatic shutdown or non-start-up of the WPP is ensured (see Chapter 7.7.2); bat monitoring is ensured in the first and second year after the WPP starts operation; and the WPP operation restrictions are respected during the WPP operation based on the monitoring results, the establishment of a WPP park is allowed for both siting alternatives. Construction of WPP D12 is not allowed. The northern part (Alternative A) is generally considered "safer" in terms of the risk of collisions with bats, and it should be noted that the southern part is not currently recommended for WPP, so implementation of Alternative B is not feasible at this time.
4. Landscape	-1	-2	-1	-2	Scenario A with 14 WPPs has the least impact on the landscape. Scenario 'A', at a regional level, has only a slightly higher impact due to the increase in height of the 4 WPPs, but as this occurs in the most sensitive locations, this scenario is not desirable. Scenario B has a much higher impact on the landscape, as 8 WPPs are added to Scenario A in the southern part of the wind farm. Scenario B' has the greatest impact on the landscape. The differences between scenario B and scenario B' are local.

5. Cultural history	-1	-2	-1	-2	Scenario A with 14 WPPs has the lowest impact on cultural heritage. Scenario 'A', at a regional level, has only a slightly higher impact due to the increase in height of the 4 WPPs, but as this occurs in the most sensitive locations, this scenario is not desirable. Scenario B has a much higher impact on cultural heritage, as 8 WPPs are added to Scenario A in the southern part of the wind farm. Scenario B' has the greatest impact on cultural heritage. The differences between scenario B and scenario B' are local.
6. Tourism and recreation	-1	-2	-1	-2	Scenario A with 14 WPPs has the lowest impact on recreation and tourism. Scenario 'A', at a regional level, has only a slightly higher impact due to the increase in height of the 4 WPPs, but as this occurs in the most sensitive locations, this scenario is not desirable. Scenario B has a much higher impact on recreation and tourism, with the addition of 8 WPPs in the southern part of the wind park to Scenario A. Scenario B' has the greatest impact on recreation and tourism. The differences between scenario B and scenario B' are local.
7. Natura 2000					No significant adverse effects on Natura 2000 sites have been identified that would result in any of the WPP park location alternatives not being implemented, however, given that the southern part of the WPP has not been fully assessed for impacts on SPA species and impacts on, the expected impacts on Natura 2000 of implementing Alternative B are currently unlikely.
8. Noise	0	0	0	0	No exceedances of the noise limit values are not expected as a result of the noise calculations
9. Low frequencies	0	0	0	0	For low-frequency noise, the limit values and procedures in Denmark are the basis, as there are no limit values in Latvia. The low frequency outdoor noise modelled in the EIA does not reach the lowest indoor level in any nearby development: 15 dB(A). (see chapter 7.2.2)
10. Vibration	0	0	0	0	There are no laws and regulations in Latvia that regulate the level of vibration in the environment. The proposed activity does not foresee any WPP closer than 800 m to any human dwelling. The vibration magnitude of the WPP at a distance of 300 m was assessed to be lower than the lowest limit value set in the now obsolete Cabinet Regulations for operating theatres at night, i.e. the vibration acceleration should not have been higher than 0.028 m/s ² (see Chapter 7.2.3)
11. Flicker	0	0	0	0	Conditions to reduce flicker impacts have been set for the location of WPP Alternative 3, WPP Alternative A and WPP Alternative 4, WPP Alternative B. The expected impact of flicker effects is negligible for both alternatives.
12. Air	0	0	0	0	No impacts on air quality are expected such that precluding conditions for the implementation of the action can be identified.
13. Hydrology	0	0	0	0	Taking into account that the construction works will be carried out in compliance with the requirements of the Law on Land Reclamation and Cabinet Regulation No 329 "Regulations on Latvian Building Standard LBN 224-15 "Land Reclamation Systems and Hydrotechnical Structures"" and Limbaži Municipality Land Use and Development Regulations, it is not expected that the construction process of the WPP parks could negatively affect the functioning of land reclamation systems in the territory of the planned WPP parks or their surroundings. Potential impacts on specially protected plant species and habitats can be considered to be insignificant, as the changes will be insignificant and little perceptible against the background of natural seasonal fluctuations in groundwater levels.
14. Environmental	0	0	0	0	The proposed activity is located entirely within forest land, with no other sensitive receptors, public facilities or residential dwellings in the vicinity.

risks and accidents					The calculations are based on the risks of natural disasters, mechanical damage, air traffic impact of the WPP fleet and BESS container accident. For each of the predicted risks and emergencies, the EIA defines mitigation measures that, if followed and implemented, are not expected to increase the risk of accidents (see Chapter 5.3)
15. Climate	+1	+1	+1	+1	The biggest savings will come from replacing fossil-fuelled electricity with power generated by WPPs, which have lower GHG emissions from electricity generation. The _{CO2} emission reductions for Alternative A will be: 343 856 t and Alternatives B: 569 102 tonnes CO2 eq. (see Chapter 5.4), it should be noted that the southern part is not currently recommended for a WPP, so that the implementation of Alternative B is currently not feasible.

Overall, the comparison and analysis of the alternatives for the location and height of the WPP in Table 8.4 concludes that Alternatives A and A' can be recommended for construction: 12 In the northern part of the WPP construction study area.

For Alternative B 8 in the southern part of the WPP study area, the following essential preconditions have to be fulfilled: assessment of additional vascular plant, moss and lichen species and development of a solution for the AST connection, as well as additional freshwater impact studies for the power line crossing over the Svētupe River. Information to assess the residual effects of the Proposed Action on species and habitats is incomplete for Alternative B.

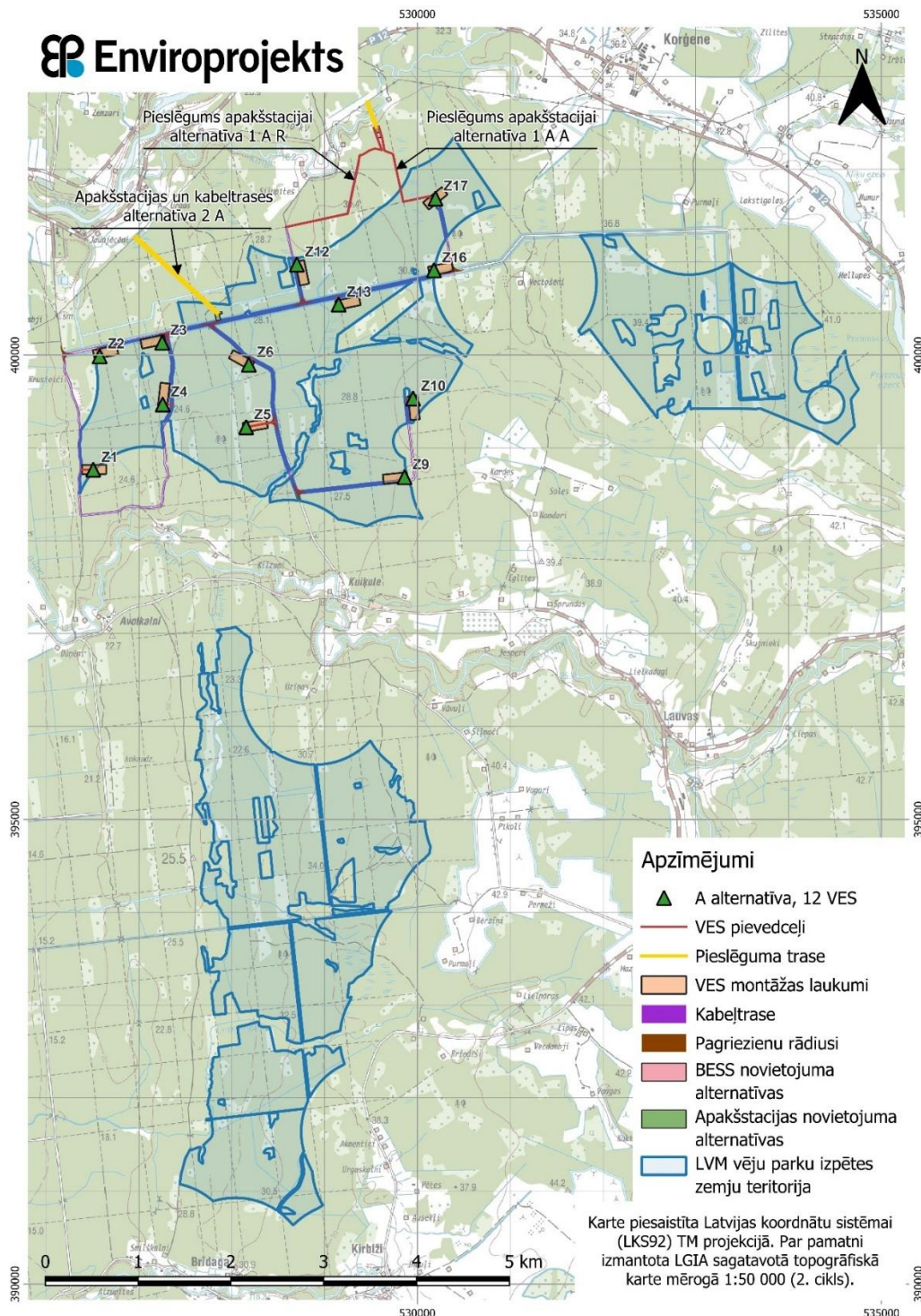


Figure 8.1. Recommended location for the proposed action - Limbaži WPP

9. CROSS-BORDER ASSESSMENT

In the context of transboundary impacts, the Republic of Estonia has been identified as the country likely to be affected by the proposed action. Estonian territory is no closer than 13.2 km to the nearest assessed WPP.

An overview of the transboundary impacts of the Ministry of Climate of the Republic of Estonia and how they have been taken into account in the preparation of the EIA for the Limbaži WPP-Park is presented in Table 9.1.

Table 9.1. Overview of transboundary impacts of the Ministry of Climate of the Republic of Estonia

No.	Aspects of transboundary impacts to be considered in the EIA by the Ministry of Climate of the Republic of Estonia	Posted by	Explanation of how this has been assessed in the EIA report
1.	The proposed action may affect: - movement of game, - noise pollution, - the local population, - power grid stability	Ministry of Economic Affairs and Communications of the Republic of Estonia	An expert opinion on mammals is provided for game. The noise assessment is presented in Chapter 7.2. No transboundary effects have been identified. The local population in the Republic of Estonia is not expected to be affected. The stability of the electricity grid in the Republic of Estonia is not expected to be affected.
2.	The nearest WPPs are likely to be closer than 5 km from the coast of the Gulf of Riga. The coastline up to 5 km away is an important bird migration corridor for both breeding and migratory birds. The EIA report should necessarily assess the impact of the Proposed Action on birds, bats and green corridors (<i>green network</i>), nature conservation values, including the assessment of cumulative impacts. Provide for impact assessment (monitoring) and, if necessary, mitigation measures	Estonian Environmental Administration	The nearest WPP is about 6 km from the Gulf of Riga. According to the methodology for assessing the impacts of birds and wind farms, currently under development ³¹⁵ , the area closest to the seaward edge of 500-1000 m is considered to be the most important for migration. The design of the WPP Park meets the main conditions - the WPP towers are not located less than 500-1000 metres from the shoreline of the Gulf of Riga, the WPP towers are not planned in areas where long-term feeding or roosting sites of migratory birds have been identified or are known in the past. The impacts on the different aspects of nature values are assessed in general in Chapter 7.6. The effects on bats are assessed in Chapter 7.6.4.

³¹⁵ https://lvafa.vraa.gov.lv/projects/1-08_74_2022

Since 27.09.2004, the "Convention on the Transboundary Effects of Industrial Accidents" has been in force, establishing transnational cooperation in the field of industrial accidents. The quantity and hazardousness of chemical substances at the site of the Proposed Activity do not reach the limit values specified in this Convention; therefore the provisions of this Regulation are not applicable to the construction of the Limbaži WPP Park and its associated infrastructure.

10. INFORMATION ON THE FORECASTING METHODS USED IN THE EIA REPORT

The following research methods were applied in the preparation of the EIA report:

- literature analysis on the impacts of similar facilities,
- field studies
- experiments,
- calculations and modelling

In preparing the Environmental Impact Assessment Report, a literature review was carried out, summarising the results of studies carried out so far on the positive and negative impacts of the WPP on the environment and society. Although more than 20 years have passed since the first WPPs were installed in Latvia, there have been practically no studies on the environmental and social impacts of WPPs in Latvia, so the EIA has mainly analysed the experience of other countries with wind energy development and its impacts.

In order to assess the impact of the Proposed Development on cultural and historical assets, an analysis of archival material was undertaken, identifying existing and potential cultural and historical assets, including archaeological assets, located or potentially located within the Proposed Development area.

Field surveys for the assessment have been carried out in and around the area of the Proposed Action by experts on birds, bats, mammals, plant species and habitats, and a landscape expert. During the preparation of the EIA Report, the area of the Proposed Action was also surveyed to record the technical condition of the roads and to assess the drainage systems.

Ornithofauna assessment

The identification of **the study areas** was carried out according to a study methodology agreed by the NCA, applying a 500 m or 3000 m buffer zone to the given locations of the WPP.

Sources of information and cartographic material used in **the chamber survey** (GIS environment) before and after the field survey:

- Cartographic material of the Latvian Geospatial Information Agency LVM GEO and other free access WMS layers: orthophotos, NGR orthophotos, LIDAR vegetation surface model, etc;
- Satellite imagery from the Sentinel-2 programme, the fieldwork project uses the 2022.08.28 composite image;
- Information available in the NCA's nature data management system "OZOLS" (hereinafter referred to as "DDPS "OZOLS", viewed from 20.06.2022) on bird sites, SPNAs and microreserves in the study area or its immediate vicinity;
- information received from the Proponent of the Proposed Action on bird sites and large twig nests from information provided by LVM to the Proponent of the Proposed Action;
- taxing of forest patches in the vicinity of the proposed activity site in open access data;
- the location of inventoried and priority sites for the species group "Woodpeckers" and the species group "Owls", available as a digital annex to the respective nature management plans;^{316 317}

³¹⁶ Avotiņš jun. A. 2019. Conservation plan for the Barn Owl *Glaucidium passerinum*, the Short-eared Owl *Aegolius funereus*, the Barn Owl *Strix aluco*, the Barn Owl *Strix uralensis*, the Long-eared Owl *Asio otus* and the Barn Owl *Bubo bubo*. Latvian Ornithological Society, Riga.

³¹⁷ Bergmanis, M., Priednieks, J., Avotiņš, J., Andris, & Priedniece, I. 2020. *Lesser Woodpecker Dryobates minor*, *Medium Woodpecker Leiopicus medius*, *White-backed Woodpecker Dendrocopos leucotos*, *Great Spotted Woodpecker dendrocopos major*, *Picoides tridactylus*, *Dryocopus martius* and *Picus canus*.

- chamber work in a GIS environment using QGIS (3.22-3.28) in the LKS92 coordinate system (ESPG:3059).

Fieldwork methodology: the methodology used for the fieldwork is described in Annex 18 of the bird expert report (attached as Annex 6). It was agreed on 30 September 2022 with the Nature Conservation Agency, represented by the lead expert of the Monitoring and Planning Unit of the Nature Conservation Department of the Nature Conservation Agency.

Species and habitat assessment

Surveys of the northern part of the WPP Park (recommended for construction Alternative A) have been planned and the potential impacts of the Proposed Action have been assessed taking into account the potential impact zones: for direct impacts (changes to the ground cover and topography associated with the construction of the facilities and movement of machinery) - the area of the construction sites and a 30 m wide corridor for new roads, as well as a 10 m wide corridor for cable routes outside the road right-of-way; for potential impacts on microclimate - a 50 m strip. For potential impacts on the hydrological regime, the maximum potential impact has been assessed according to the recommended impact assessment distances (Table 1b) for a 1.5 m deep ditch according to the forest vegetation type (FAT) in the "Guidelines for certified experts in species and habitat conservation for the assessment of Proposed Activities for the construction of forest roads and the establishment, rehabilitation and reconstruction of forest drainage systems"³¹⁸ :

- 100 m - wet damselfly (Dms), narrow-leaved sedge (As)
- 110 m - marsh (Pv), heath (Kv), mint (Km)
- 130 m - reed grass (Nd), wet sedge (Grs), narrow-leaved sedge (Ks)
- 150 m - wet ox (Vrs), broad-leaved bull (Ap)
- 180 m - wet mint (Mrs), sedge (Db), bent (Lk), heather (Av), mint (Am), broad-leaved sedge (Kp).

Noise assessment methods

In preparing the EIA report and predicting potential impacts, calculation or modelling techniques were widely used to quantify certain impacts. The environmental noise modelling has been carried out by an accredited noise assessment laboratory using the current version of Sound Plan, which complies with the methods set out in Cabinet of Ministers Regulation No 16 of 7 January 2014 "Procedures for the assessment and management of noise" and standard LVS ISO 9613-2:2004 "Acoustics - Sound attenuation by sound propagation in the external environment - Part 2: General calculation method".

Methods for assessing flicker

For the assessment of the flicker effect the Australian guidelines "*Best practice guidelines for implementation of wind energy projects in Australia*"³¹⁹ were used (see chapter 5.4), an experiment was carried out in Latvia in 2010 and WindPRO 3.6.366 by EMD International A/S, Ltd Environment licence (client) No.8797.

Landscape assessment methods

The landscape impact assessment takes into account the Guidelines for Initial Environmental Impact Assessment of Wind Power Plants³²⁰, the Guidelines for Local Landscape Planning approved by the Ministry

³¹⁸[https://environment.lv/assets/upload/Valpene/14.pielikums.Biotopu_ekspertu_atzinuma_kopija_\(updateēts\).pdf](https://environment.lv/assets/upload/Valpene/14.pielikums.Biotopu_ekspertu_atzinuma_kopija_(updateēts).pdf)

³¹⁹<https://assets.cleanenergycouncil.org.au/documents/advocacy-initiatives/community-engagement/wind-best-practice-implementation-guidelines.pdf>

³²⁰<https://www.vvd.gov.lv/lv/media/9969/download?attachment>

of Environmental Protection³²¹, the landscape impact assessment methodology of the Lithuanian and Latvian researchers Abroms, Kamičkaitė and Ziemeļniece wind farms.³²² The assessment also uses methodological material for the study and assessment of Latvian landscapes: "Approaches to Landscape Research and Assessment in Latvia. Methodological material with examples."³²³

Based on the laser scanning data (las format) prepared by the Latvian Geospatial Information Agency (LGIA), a digital surface model (*DSM*), digital terrain model (*DTM*), vegetation elevation model (*CHM*), as well as 3D models of the planned area of the WPP Park and some of the surrounding areas were created.

The raw data produced by the LGIA are obtained by laser scanning (LIDAR). The site in question was laser scanned in 2019³²⁴ (so the analysis does not take into account changes that have occurred since then: e.g. deforestation or new growth). The total density of points obtained shall not be less than 4 p/m² (points per square metre), the average density of the points characterising the ground surface shall not be less than 1,5 p/m².³²⁵ A visibility model of the site has been developed and sight lines from potentially affected features to the WPP have been established, assessing visibility from these viewpoints.

For the visibility analysis, a WPP height of 300 metres was assumed, with additional heights of 275 and 250 metres also assessed for individual WPPs in the scenario analysis. In the area around the planned WPP, where according to the DSM there is currently forest, potential clearing was also included in the model.

A 3D model of the study area was created in ArcGIS Pro using DSM and DEM models derived from LIDAR data, and including all 37 potential WPP in the model at a maximum height of 300 m. A detailed 3D model using LIDAR data has been created for the in-depth study sites and other significant viewpoints, and visualisations have been produced to assess the impact of the WPP on the visual qualities of the landscape. Based on the 3D model and photographs of the existing situation, I am looking at the modelled locations of the WPP. The windPro 4.0 software, widely used in wind park planning, was also used to create the photo visualizations. Google Street View images were also used for the photo visualizations, although they are taken from an average height of 2.5 m.³²⁶

Based on the raw data, a visibility map has been created (see Landscape Expert's report attached as Annex 9). The visibility analysis of the maximum scenario was carried out using QGIS Visibility: Viewshed plug-in, analysing the areas from which the WPPs would potentially be visible, using human eye height as a potential vantage point (assumed to be 1.6 m in the analysis). The GDAL Viewshed analysis tool has also been used to assess the visibility of individual WPP from their surroundings. The results of the Viewshed analysis were post-processed using the resulting CHM values to account for the effect of vegetation on the visibility of WPP in the visibility data.

Methods for assessing hydrological change

The impact of changes in the hydrological regime associated with the construction of the WPP on habitats of EU importance in the area of the Proposed Action has been investigated by cameras, and a site survey has been carried out to assess the potentially affected habitats of EU importance identified in the Habitat Expert Opinion. Based on the results of the camera and survey work, a hydrological expert assessment has

³²¹ https://www.varam.gov.lv/sites/varam/files/content/files/vadlinijas_viet_limenim_2019.pdf

³²² Abroms, J. & Kamičkaitė, J. & Ziemeļniece, A. 2014. *Visual impact assessment of wind turbines and their farms on landscape of Kretinga region (Lithuania) and Grobina townscape (Latvia)*. Journal of Environmental Engineering and Landscape Management.

³²³ Stokmane, I., Skujāne, D., Ziemeļniece, A., Nitavska, N., Īle, U., Vugule, K., Markova, M., Spāge, A., Lāčauniece, I., Klepers, A., Lakovskis, P., Ieviņa, L., 2023. *Approaches to landscape research and assessment in Latvia*. Methodological material with examples. LBTU, Jelgava.

³²⁴ https://www.lgia.gov.lv/sites/lgia/files/document/LV_LAS_shema_1.pdf

³²⁵ <https://www.lgia.gov.lv/lv/digitalie-augstuma-modeļi>

³²⁶ <http://www.educatingsilicon.com/2008/04/18/google-street-view-soon-in-3d/>

been prepared on the location of the WPP and service areas and the construction of access roads and cables to the WPP that could be related to changes in the hydrological regime. A detailed assessment is provided in Annex 10 of the EIA Report, which summarises the opinions of the certified natural experts. In order to assess the potential risks identified, a site survey was carried out to assess the potential impact of hydrological changes on the hydrological regime in wet forest habitats of EU importance, using the currently under development *"Guidelines for certified experts in the field of species and habitat conservation on the assessment of the Proposed Action regarding the construction of forest roads and forest drainage systems, restoration and reconstruction"* (Latvian Environmental Protection Fund funded project No.1-08/29/2023 "Preparation of guidelines and methodological instructions for certified experts and employees of the State Environmental Protection Agency in the field of species and habitat conservation on the assessment of the proposed activities (construction of roads, forest drainage systems, cleaning of water reservoirs)"). The possible distances for the predictions of the impact of dewatering have been determined in accordance with the provisions of the Cabinet of Ministers Regulation No 329 of 30 June 2015 "Regulations on Latvian Building Code LBN 224-15 "Melioration Systems and Hydraulic Structures"".

Technical characteristics

The technical parameters of the WPP have been provided by the Proponent from GE Renewable Energy.

11. TYPES OF SOLUTIONS AND MEASURES TO AVOID SIGNIFICANT ADVERSE EFFECTS ON THE ENVIRONMENT

With regard to landscape, heritage and tourism and recreation, a number of measures are proposed to offset the visual impact of the Proposed Development through the development and maintenance of valuable viewpoints and heritage sites in the vicinity of the Proposed Development. The actions are summarised in Table 11.1.

These are recommendatory measures, and their implementation can be considered in cooperation with the municipality of Limbaži.

Table 11.1. *Recommended measures to compensate for visual impact*

No.	Event	Background
1.	Develop the viewpoint above the outcrop on the south side of Lībiešu upuralas (at t Kuiķuļu Svētozolu site) by clearing overgrowth and creating infrastructure that, while increasing the visibility of the WPP, would primarily improve the view towards the Svētupe and directly towards Lībiešu upuralas area.	Landscape improvement measure in the vicinity of Lībiešu upuralas
2.	In case of construction of the WPP in the southern part of the Proposed Action, in cooperation with LVM and the municipality, assess the possibility of creating IPT or recreational forests in another location in the vicinity of Salacgrīva, further away from the Proposed Action.	Impact on the IPT "Burlaku sils".
3.	Conservation of the forest in the area of the cultural monument "The baking site" (No 1477) and in the immediate vicinity on the left bank of the Svētupe River.	Reducing the visual impact on the view of a cultural monument.
4.	Preservation of the forest in the territory of the cultural monument "Kilzumu Senkapi (Zviedru kapi)" (No 1473) and preservation of the forest in a 70 m zone around the boundary of the monument, in the area to the N of the road V143.	Reducing the visual impact on the view from the monument.
5.	Preservation of trees (overgrowth) above Lībiešu upuralas on the right bank of the Svētupe River (between the steep bank and the houses of Kuiķuļi and Lielkuiķuļi)	Reduction of visual impact on the main view of the cave and outcrop.

12. MEASURES TO MONITOR ENVIRONMENTAL QUALITY

The EIA assesses the potential impacts of the proposed WPPs. Impacts such as flicker effects, noise pollution, safety risks, impacts on habitats and specially protected plant species, hydrological regime of the site can be predicted with a high degree of accuracy by assessing the scope of the Proposed Action and using calculation methods.

During the nature surveys, the impact of the WPP on wild bird and bat populations has been assessed by assessing the significance of the impact. For some wild bird species there is conflicting scientific information on the effects of the proposed WPP on them, so the effects of the proposed WPP on animal groups such as birds and bats should be further assessed through monitoring and, if necessary, the introduction of additional mitigation measures not identified in this report.

The scope of monitoring and the methods to be used are based on the opinions and recommendations of certified natural experts, as well as the experience of other countries and scientific publications in the field.

Bird monitoring

Population monitoring should be planned and initiated prior to the construction of the WPP Park in order to obtain an assessment of the baseline status of the site's birds.

Population monitoring of protected species

Monitoring is required to detect any changes in the population present and to assess any potential impacts within the WPP Park. In order for monitoring to adequately assess species populations and changes and to assess possible causes, and for these data to be comparable between different WPP sites, all monitoring should follow a common framework. For the results to be useful for assessing the impact of the WPP, rather than just describing possible changes in the populations of the monitored species, a comparable control area without the impact of the WPP is also needed.

In order to meet these conditions, at least in the current situation, monitoring in the area should be planned after the final technical design (similar to the preparation of the study design in the context of the opinion, based on the distances indicated in the study methodology around the sites of the Proposed Action or landfills where relocations are possible). This would provide an objective "zero" assessment of the area that would be considered to be affected by the Proposed Action and the bird populations present in it during the pre-construction period. As this area will be reliably different from the study area used for the opinion, it is not possible to make an objective judgement on the extent to which these landfill sites will differ before the final technical design is available. A fixed monitoring study area, defined as the study area in two distance bands, is essential for population estimates within it (or at least population estimates) and for the planning section for a rational arrangement of monitoring stations to obtain unbiased results.

Monitoring, similar to the survey, is planned for the main potentially affected groups of protected species in the study area, following the methodology used in the survey. However, if the monitoring authorities consider that a group of species should not be monitored, or conversely should be monitored for species that have not been studied before (e.g. on the basis of information that may be expressed in forthcoming guidance on WPP research), the experts may take this into account and not monitor or instead monitor these species or groups of species, provided that this is comparable in the long term, including with other aspects of monitoring and the original research.

Monitoring should be carried out during the pre-construction, construction and operational periods. Monitoring should be carried out annually before and during construction, and every second year during operation, covering at least five breeding seasons, if possible, for the entire operation period. However,

the consultant considers that the monitoring programme should be agreed with the NCA, and its necessity and duration should be assessed.

The annual monitoring recommended during the pre-construction and construction periods is mainly justified to allow for local extinctions and recolonisations.

The difference in the monitoring period from the approach of monitoring for five consecutive years during the operational period, which has been more common in Latvian practice so far, is based on the generation turnover time, which for example for diurnal birds of prey is rounded off by about ten years per generation. At the same time, it should also be noted that population-level impact assessment would require monitoring data on at least three generational changes.

Monitoring of dead birds

Given that a very important aspect in the assessment of direct impacts is the determination of the number of birds killed in collisions (including not only protected species) and potentially also the cause of death (physical collision, barotrauma, bird death unrelated to the operation of the WPP), at the same time, the literature^{327 328} suggests that due to the inaccuracy of observer counts, the limited findability under different circumstances, and the presence of scavenged remains, it is recommended that automatic camera systems or similar solutions that detect traumatised or dead birds are used to implement this monitoring point.^{329 330}

Bat monitoring

Monitoring of bats should be ensured in the first and second years after the start of operation of the WPP. The monitoring methodology is developed and standardised by a bat species expert certified by the NCA according to the site specifics and the 2022 Guidelines for assessing the impact of wind power plants on bats in Latvia. The monitoring methodology includes:

1. acoustic monitoring by installing automatic ultrasonic detectors in the nacelles of at least five WPP and/or on the lower wing leading edge level to continuously record bat activity from at least 1 May to 30 September. The placement of WPP recorders shall be random. The number/location of WPP and detectors to be included in the monitoring shall be agreed with a certified bat expert before installation;
- 2) counts of bat fatalities at least at those WPP where acoustic monitoring is carried out (the number of WPP to be surveyed may be increased where possible). The search for dead bats must be carried out by trained searchers, together with the monitoring of the effectiveness of the search and the timing of the disappearance of the carcasses. Monitoring should be carried out 2 or 3 years after the installation of the WPP, depending on the degree of overgrowth.

To facilitate the search for dead bats, it is advisable to create a vegetation-free ground surface around the base of the WPP within a radius of at least 50 m or to ensure regular grass cutting during the monitoring period (if the area is not reforested). There is no need to create a 50 m buffer zone around the WPPs that will be installed in forests, in addition to deforestation.

Monitoring of mammals

Given that there are no assessments of the impact of WPP on non-flying mammals in Latvia based on wildlife studies or monitoring data, the expert does not propose mandatory monitoring requirements for

³²⁷ Rydell, J., Ottvall, R., Pettersson, S., Green, M. 2017. The effects of wind power on birds and bats. Swedish Environmental Protection Agency, Sweden.

³²⁸ Perrow, M. R. 2017. Wildlife and Wind Farms, Conflicts and Solutions: Potential Effects. Onshore.

³²⁹ Ibid,

³³⁰ <https://doi.org/10.3390/jimaging7120272>

the wind farm in question. The expert recommends that the controlling national authorities should require the developers of the North Latvian and Estonian border wind farms (Figure 3.2.5) to jointly initiate specialised monitoring of wild mammals in cooperation with the controlling national authorities and scientific institutions. This need is underlined by all the authors of the scientific publications used in the opinion. Monitoring is carried out in accordance with a monitoring programme developed and agreed with a certified expert.

In the case of mammal monitoring, take into account the basic requirements for monitoring the impact of wild mammals and evaluating the results of the monitoring, as set out in the study "*A synthesis - SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT*".³³¹

³³¹ Helldin J.O., Jung J., Neumann W., Olsson M., Skarin A., Widemo F. 2012. *The impacts of wind power on terrestrial mammals*. A synthesis - SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 6510, 52 pp.

13. PUBLIC OPINION AND OPINION POLLS

13.1. Initial public consultation

The initial public consultation on the Limbaži WPP Park and related infrastructure project took place from 10 to 30 November 2023. The report of the initial public consultation submitted to the NEB on 14 December 2023 is attached as Annex 3. The report on the initial public consultation includes the following information: a notice on the public consultation in the newspaper "Auseklis" No 129 (10726) of 10.11.2023; a report on the notices sent to the residents and the minutes of the meeting of the initial public consultation held on 22.11.2023.

Following the initial public consultation meeting, the SEB forwarded to the operator of the proposed activity the public comments received during the initial public consultation on the proposed activity and the proposals for the environmental impact assessment to be assessed and included in the EIA report on the proposals submitted by the public, indicating how these have been taken into account. An overview of how the proposals have been taken into account is attached in Annex 4.

During the preparation of the Environmental Impact Assessment, in February 2024, consultative working group meetings were held in Salacgrīva on the Limbaži WPP Park on the following topics: "Landscape", "Biodiversity", "Physical impacts of WPP parks" and "Socio-economic feasibility and climate change impacts of WPP parks".

Citizens and other interested parties were given the opportunity to participate in informative working group meetings, where experts discussed various topics related to the impacts of WPP parks, such as socio-economic aspects, biodiversity, landscape impacts and physical impacts. For several weeks, environmental experts from Ltd Enviroprojekts, as well as experts from LVP, met with the residents and presented the results of their studies, as part of the environmental impact assessment, as well as explained the methodology and approach to the aspect under study. In turn, citizens actively asked questions and made their own additions, suggestions and comments.

13.2. Results of citizens' surveys

In January 2024, the research centre SKDS conducted a survey of Latvian citizens on their views on the environment, climate and energy (Annex 13).

According to the survey results, the majority of respondents (77%) believe that new renewable electricity generation plants should be built in Latvia (52% would rather, 25% would definitely). 14% of respondents are of the opposite opinion (9% would rather not, 5% would definitely not). In general, men, Latvian speakers in the family and those concerned about climate change in general are more positive about the issue.

According to the respondents, the main reason why new renewable electricity generation plants should be built in Latvia is to gain energy independence from other countries (52%). The following reasons are also considered important enough: it would contribute to Latvia's economic development by providing a much better electricity supply (43%) and to achieve full energy independence from Russia (37%). Other reasons given are: to reduce the amount of imported electricity and thus improve Latvia's import-export balance (29%), to increase GDP (26%) and to give Latvia the opportunity to become an electricity exporter (24%).

According to the respondents, both wind and solar power plants cause environmental damage. The majority (71%) of respondents feel this way about wind farms (42% rather low harm, 21% rather high

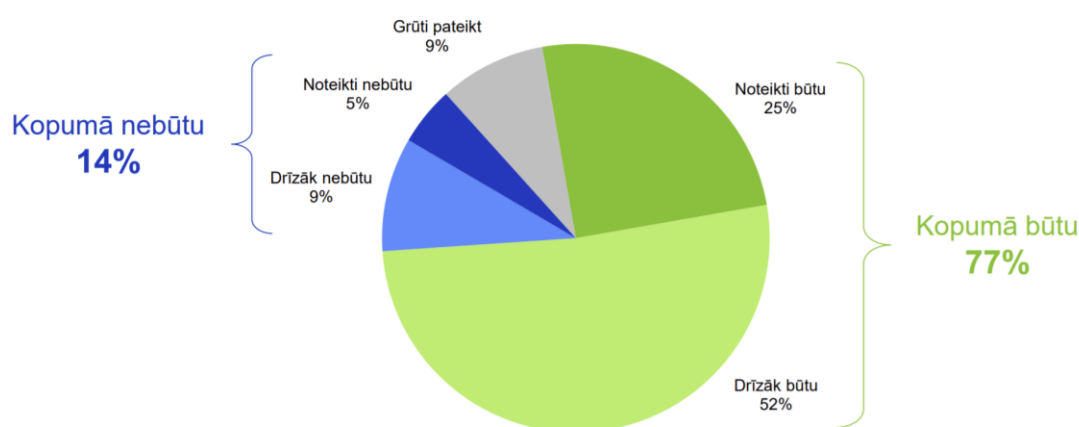
harm, 8 very high harm). More than ½ of the respondents (58%) believe that solar power plants also cause environmental damage (rather small - 47%, rather large - 7%, very large - 4%).

Almost ½ of respondents (47%) would object if there were plans to build a wind park near where they live. Just over ⅓ of respondents (39%) would have no objection. It is noticeable that older respondents and Kurzeme residents would be more likely to object.

In assessing publicly expressed concerns about the negative impact of wind parks on the lives of nearby residents, more than ½ of respondents generally agreed that WPP kill birds (56%), that wind farms negatively affect the value of nearby property (56%) and that WPP generate annoying sound (54%).

When it comes to the best and most suitable locations for new power plants, the best location for wind power is offshore (51%).

«J2. Vai, Jūsaprāt, Latvijā būtu jābūvē jaunas atjaunīgās (t. i., vēja un saules) elektroenerģijas ražošanas stacijas?»



Bāze: visi respondenti, n=1005

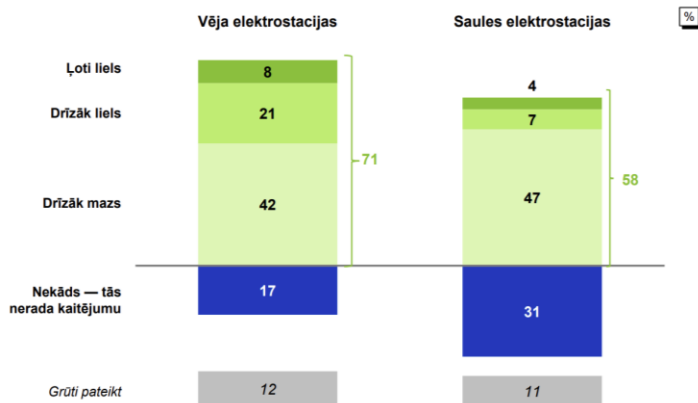
«J3. Kādu iemeslu dēļ, Jūsaprāt, Latvijā būtu jābūvē jaunas atjaunīgās elektroenerģijas ražošanas stacijas?»



Bāze: visi respondenti, n=1005
Vairākatbīžu jautājums (% summa > 100)

SKDS
PĒTĪJUMU CENTRS

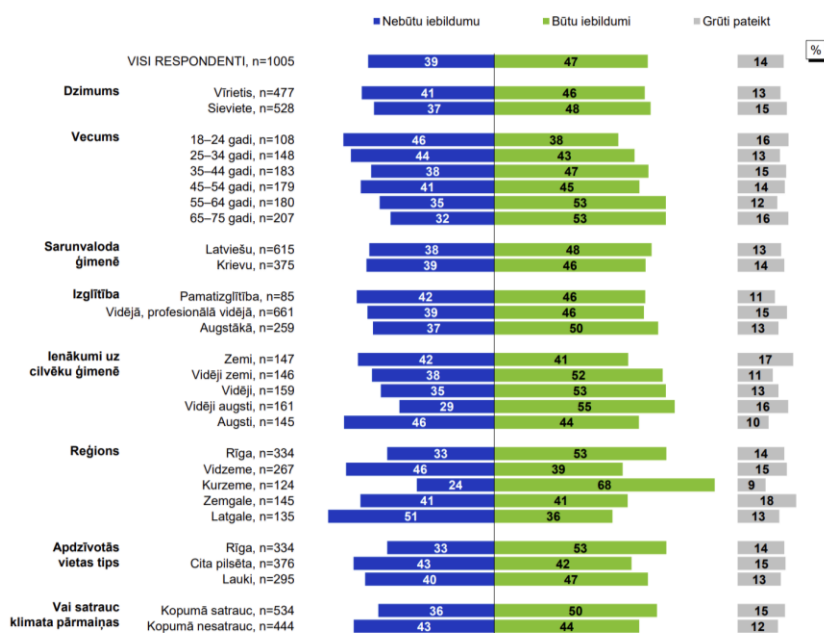
«J6. Ņemot vērā visu, ko Jūs par to zināt, cik lielas problēmas saistībā ar vides aizsardzību rada šādi elektrostacijas veidi? Vai to radītais kaitējums apkārtnējai videi ir...»



Bāze: visi respondenti, n=1005

SKDS
PĒTĪJUMU CENTRS

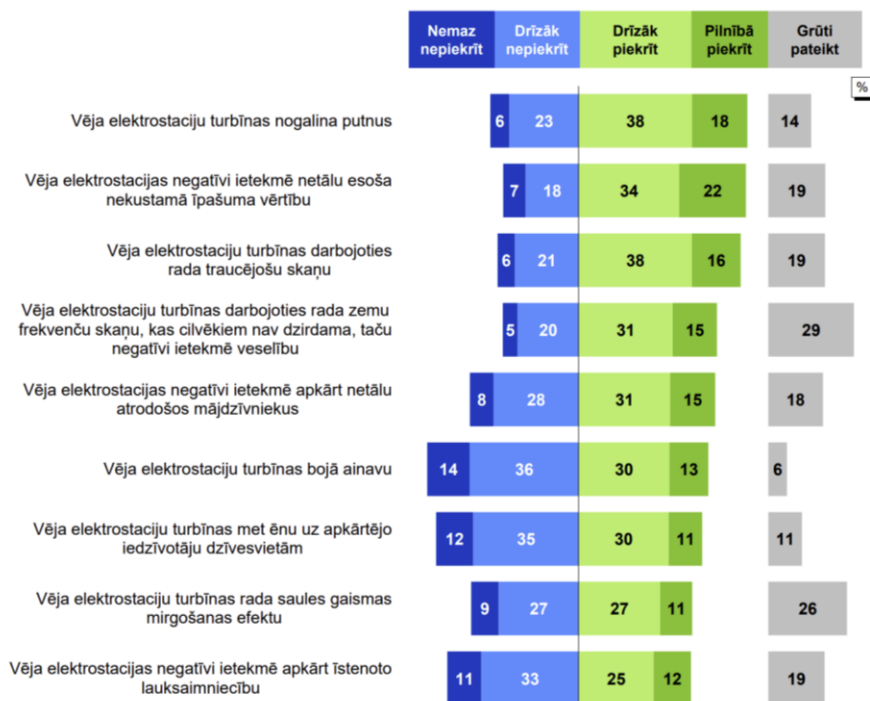
«J7. Gadījumā, ja Jūsu dzīvesvietas apkārtnē parādītos plāni uzbūvēt vēja elektrostaciju parku — t. i., vēja turbīnas atrastos Jūsu tiešās redzamības attālumā — vai Jums pret to būtu vai nebūtu iebildumu?»



Bāze: respondenti attiecīgajās grupās (skat. «n» grafikā)

SKDS
PĒTĪJUMU CENTRS

«J8. Publiski ir izteiktas dažādas bažas par to, ka vēja elektrostaciju parki radot negatīvu ietekmi uz apkārtnējo iedzīvotāju dzīvi. Lūdzu, atzīmējiet, cik lielā mērā Jūs piekrītat šādiem apgalvojumiem?»



Bāze: visi respondenti, n=1005

SKDS
PĒTĪJUMU CENTRS

«J9. Kuras no šīm, Jūsaprāt, ir pašas labākās un piemērotākās vietas, lai Latvijā būvētu jaunas vēja elektrostacijas?»

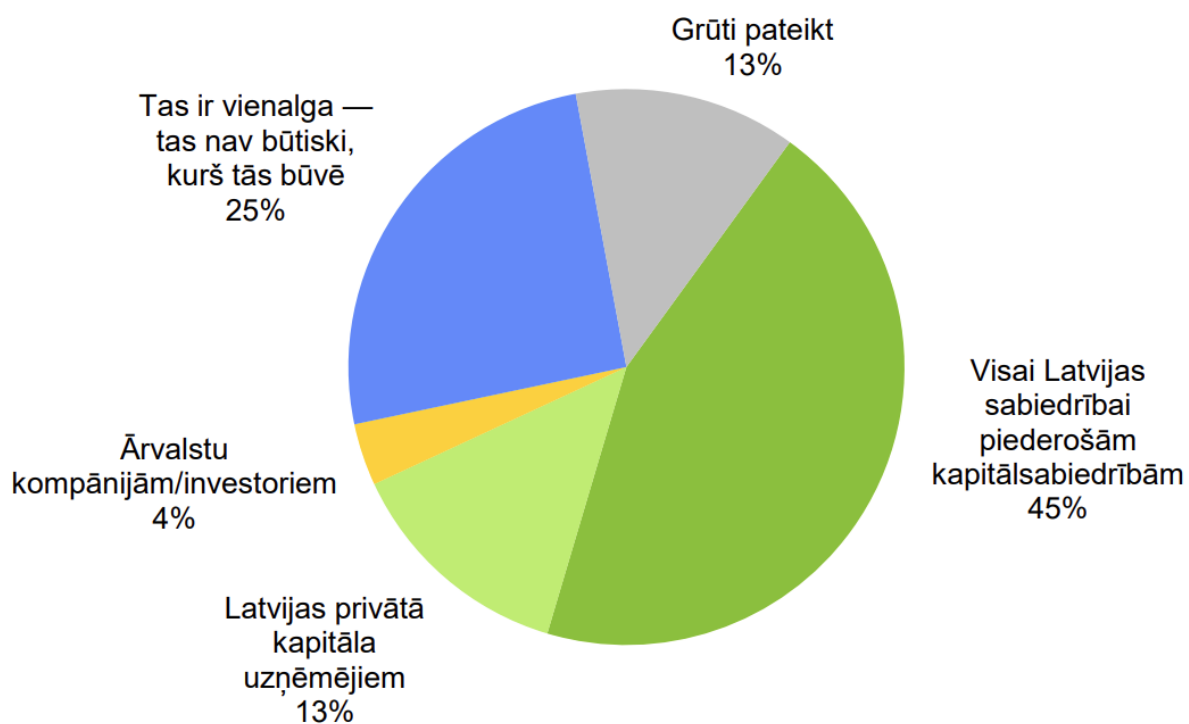
Vēja elektrostacijas



Bāze: visi respondenti, n=1005
Vairākatbilžu jautājums (% summa > 100)

«J10. Domājot par iespējamajiem jaunu vēja elektrostaciju īpašniekiem, kam, Jūsaprāt, Latvijā būtu jābūvē vēja elektrostacijas?»

Vēja elektrostacijas



Bāze: visi respondenti, n=1005

14. SOCIO-ECONOMIC ASSESSMENT OF THE PROPOSED ACTION

The construction and operation of the planned WPPs may have both positive and negative socio-economic consequences, both within the area of the Proposed Action and in the national context. Positive effects include investment in the economy, direct and indirect growth in the number of jobs involved, financial benefits from land leases to the property owner on whose land the WPPs are built, increased energy supply on the market, reduced carbon dioxide emissions, contribution to national energy policy objectives. There may be negative impacts on tourism and recreational resources and on the value of real estate for some residents. As the socio-economic consequences of WPP have not been widely studied in Latvia, the information in this report is largely based on the results of studies in other countries.

LIAA has awarded the LVP project the status of Priority Investment Project.

14.1. Impact of climate policy on socio-economic benefits

Directive 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) (Text with EEA relevance) aims to create a common framework for the use of RES in the Member States of the European Union by setting mandatory targets for the overall share of renewable energy in final energy consumption and transport fuel consumption in the European Union. According to the "Latvian Long-Term Energy Strategy 2030 - Competitive Energy for Society", the share of energy produced from renewable sources in gross final energy consumption is to be increased to 50%. The same objective is enshrined in the Latvian National Energy and Climate Plan 2021-2030, which does not set specific, precise targets for onshore WPPs, but postulates support in principle for their construction in unlimited amounts; the following are the main quotations from the document:

"Desired situation in 2030: 1) sufficient generation capacity is available and the country's energy dependence on imports and fossil resources is reduced; 2) the potential for wind power generation is largely exploited within the capacity of the available infrastructure and, consequently, the share of RES is increased in a cost-effective, market-based manner."

"(..) At the same time, in order to ensure Latvia's energy security and to provide the society with cheap and competitive energy, Latvia should ensure an increase in the share of RES, which should naturally be provided by the most cost-effective technologies. The cost of generating electricity from onshore wind farms has fallen significantly and recent studies show that they are the cheapest of all newly installed technologies, including fossil fuel technologies, for generating electricity."

"It would also be useful to ensure the use of nationally important farmland and forest land for the development of wind farms."

Overall, the Republic of Latvia expresses its unequivocal support for the production of wind energy in free market competition without subsidies, noting that wind energy in Latvia has so far been very little developed and that there are too many unnecessary obstacles to promoting its development. 2024. Latvia's National Energy and Climate Plan 2021-2030, updated in 2010, foresees the installation of onshore WPP parks with a total capacity of up to 1.5 GW by 2030. Currently, there are 82 WPP parks (Figure 14.1) with a total onshore capacity of ~12 GW (excluding those that have been discontinued) with Environmental Impact Assessments (EIAs) submitted/underway/ongoing/completed at various stages of development in Latvia.

IVN Statuss:

- Pārtraukts
- Tiek veikts
- Piemērots
- Pabeigts

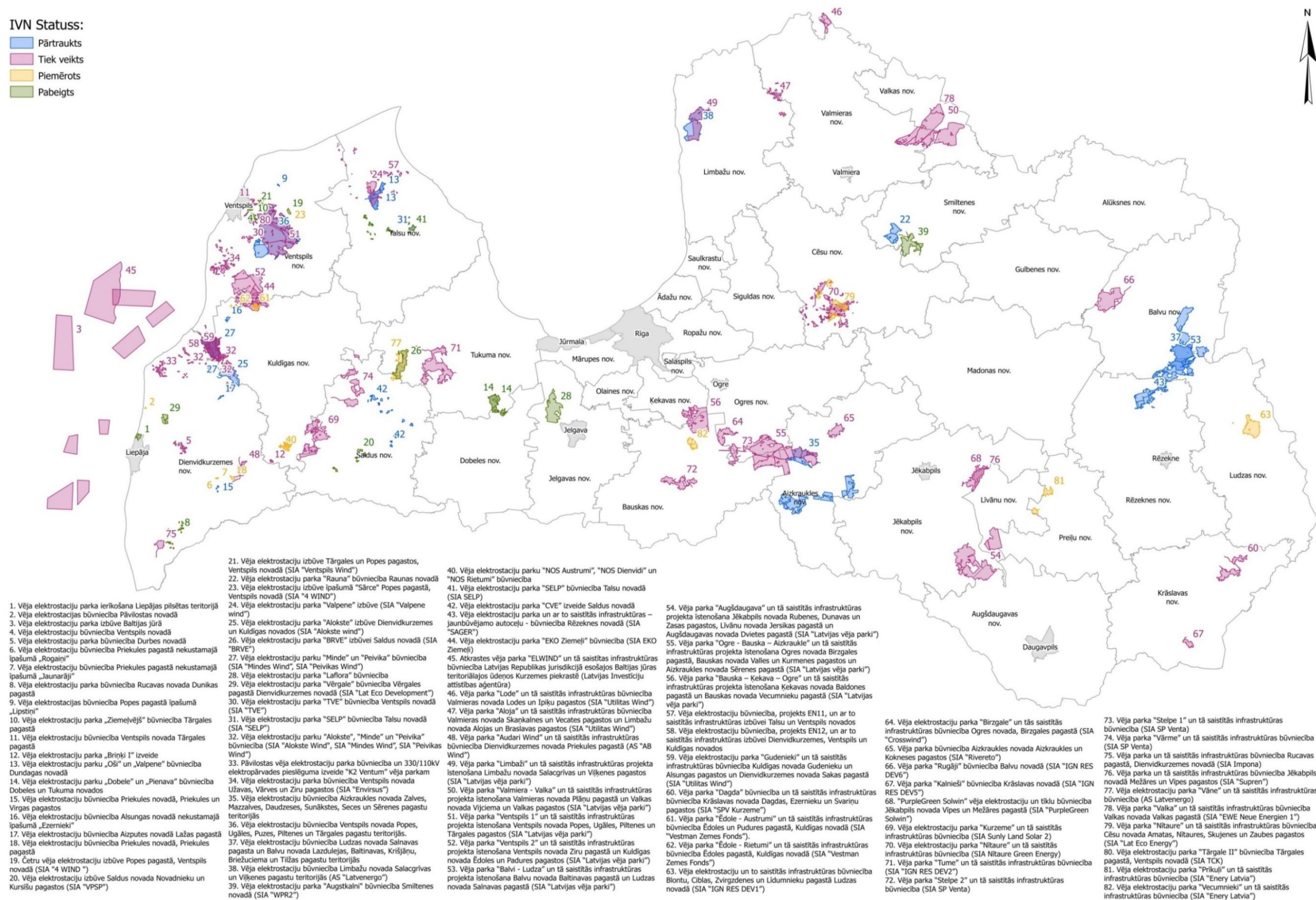


Figure 14.1. Environmental Impact Assessments submitted/ongoing/continued/completed for 82 WPP parks in Latvia at different stages of development³³²

³³² <https://www.vpvb.gov.lv/lv/ietekmes-uz-vidi-novertejumu-projekti>, situation as of 23.09.2024

14.2. Current situation and assumptions

Attracting investment is an important factor influencing the development of the economy, and the construction of a WPP should be evaluated in the same way as any other investment that contributes to economic growth in terms of attracting investment. It is expected that several dozen (the exact number to be implemented is not known before and after the completion of this EIA) The total cost of the construction of the WPPs could reach, respectively, tens of millions of EUR, which is a significant investment project.

Socio-economic returns can be divided into the following impact areas:

- local impacts directly affecting the place where the project is to be implemented (locality, municipality);
- local impact affecting the project area (region);
- national impact, affecting the economy of the country where the project is implemented;
- international spillovers affecting other economies (e.g. in the EU and EEA)

An important aspect to be taken into account when assessing the impact of the Proposed Action on the economy is not only the total amount of investment, but also the increase in jobs associated with this investment. In the context of employment, the WPP construction proposal is linked to the creation of jobs both during the construction process and during operation. Demand for additional labour will be related to the construction and operation of the WPP itself, as well as to indirectly related activities such as mining for road construction, cement and concrete production, and transport. Referring to the statistics published by the International Renewable Energy Agency (hereinafter referred to as IRENA)³³³ on job growth in WPP park construction projects, as well as the estimates of the proponents of the Proposed Action, several hundred persons (depending on the number of WPPs) could be temporarily employed in the construction of WPPs, the number of persons permanently employed during the operation of such WPPs could be up to 10 (as WPPs are highly automated technologies where the main human resource input is mainly in the monitoring and maintenance of the operation).

14.2.1. Socio-economic benefits for society as a whole

Increasing the amount of energy produced in Latvia can also be seen as a potential benefit for society, which can affect the price of electricity for consumers. Latvia's economy consumes almost 7 TWh (6887 GWh in 2023) of electricity, some of which is imported annually. The availability of electricity on the market is one of the factors that has a significant impact on its price. Installing additional capacity, as well as increasing the diversity of electricity generation options, can reduce the impact of adverse weather conditions (droughts, when hydroelectric power plants (HPPs) produce little energy and have to import it) on the price of the electricity they produce. Several dozen WPPs will not, however, rapidly reduce electricity prices for consumers, as Latvia's electricity transmission system is integrated into the broader Baltic Sea region system, so the generation capacity of these WPPs will be significant at the Latvian level (exceeding 10% of Latvia's electricity generation to date), but relatively small in terms of the overall market size.

Potentially negative impacts are considered to be those on tourism and recreational resources and property values. It is difficult to predict the economic impact of the planned WPP on the recreational facilities in the area, as there is a lack of studies of this kind in Latvia, but studies in other European countries show that:

³³³ <https://www.irena.org/Publications>

- when visitors to recreational facilities were surveyed before the construction of the planned WPPs, some indicated that they would no longer visit these recreational facilities after construction^{334 335,336;}
- analysing the dynamics of users of recreational services after the construction of the WPP, no significant drop in turnover can be detected^{337, 338,339.}

These studies reflect the situation for large wind farms close to recreational facilities rather than for a few remote WPPs.

Studies in other countries have shown that the construction of WPPs does not have a negative impact on the value of usable land, due to the fact that WPPs and related facilities occupy a negligible amount of usable land, while all other land remains undisturbed. Forestry land is a productive resource whose price is determined by the amount of income that can be earned from its use.

The construction of a WPP has the potential to affect the value of properties that are primarily used for residential development. Foreign studies^{340, 341, 342} have found a correlation between the proximity of WPP parks and property prices, indicating that WPP parks can potentially reduce property sales prices, while other studies^{343 344, 345, 346, 347, 348} have not found such an effect. In studies where negative impacts have been found, a correlation is observed between the distance from the property to the WPP. The results of the studies suggest that impacts are likely to be occasional, affecting only specific properties that are primarily used for recreation. Studies have also found that the impact of WPP parks on real estate values is more likely to be a deterrent to property appreciation than a direct depreciator. For example, a study in Australia also analysed re-sales and concluded that property values are highly dependent on overall demand in the region and other market fluctuations that are not directly related to the NPS. Factors such as access to services and transport, economic growth and employment in the region, as well as changes in legislation, have a more significant impact on property values. For example, also in Latvia, the information collected by the State Land Service on changes in housing market prices shows that after 2015, when the conditions under which persons can obtain fixed-term residence permits in Latvia were changed, real

³³⁴ https://www.nhsec.nh.gov/projects/2013-02/documents/131212appendix_31.pdf

³³⁵ C. Aitchison, Tourism impact of wind farms, The University of Edinburgh, 2012

³³⁶ V. Braunova, Impact study of wind power on tourism on Gotland, Uppsala University

³³⁷ https://www.nhsec.nh.gov/projects/2013-02/documents/131212appendix_31.pdf

³³⁸ C. Aitchison, Tourism impact of wind farms, The University of Edinburgh, 2012

³³⁹ V. Braunova, Impact study of wind power on tourism on Gotland, Uppsala University

³⁴⁰ Y. Sunak, R. Madlener, The Impact of wind farms on property values: a geographically weighted hedonic pricing model, Aachen, Germany, 2013

³⁴¹ S. Sims, P. Dent, Property stigma: wind farms are just the latest fashion. Journal of Property Investment and Finance, 2007

³⁴² M.D. Heintzelman, C.M. Tuttle, Values in the wind: A hedonic analysis of wind power facilities, Land Economics, 2011

³⁴³ S. Sims et al., Modelling the impact of wind farms on house prices in the UK. International Journal of Strategic Property Management, 2008

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³⁴⁵ B. Hoen et al., The impact of wind energy projects on residential property values in the United States: A multi-site hedonic analysis. Lawrence Berkeley National Laboratory. LBNL Paper, 2009

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³⁴⁷ G. Canning, L. J. Simmons, Wind energy study - Effect on real estate values in the municipality of Chatham Kent, Ontario. Consulting Report prepared for the Canadian Wind Energy Association, Ontario, Canada, 2010

³⁴⁸ Urbis Pty Ltd, Review of impact of wind farms on property values, 2016

estate values decreased more significantly than in the foreign studies on the impact of WPP parks on real estate values.

According to the methodology developed by the European Commission "*Guide to Cost-Benefit Analysis of Investment Projects, Economic appraisal tool for Cohesion Policy 2014-2020*"³⁴⁹, where a quantitative economic impact assessment is not possible, a qualitative description of the wider impact on secondary markets, public funds, employment, gross domestic product, etc. is recommended to better explain the contribution of the development project to the achievement of regional policy objectives.

According to the EIA report, the main socio-economic impact of the WPP development, which is not quantified, is the impact on property values in the area of the WPP development. Given that no studies have been carried out in Latvia on the impact of WPP development on real estate values, an assessment of international experience has been carried out. Abroad, incl. In European countries with more experience with WPP development, a number of studies have been carried out to assess the impact of WPP development on property values in areas adjacent to WPPs. However, the largest study to date has been carried out in the United States, which assesses the impact of WPP development on the value of 500 000 properties in 34 states over a 15-year period (2005-2020). The dataset for this study covers the period from four years before the start of WPP development activities (the WPP development announcement period) in the project area to more than six years after the start of WPP operations.

Overall, the main findings of the study are:

- residential sales prices that are affected after the WPP development announcement period are limited to properties within a 2-mile (~3.2 km) radius of the WPP development site, and even then the impact on properties within a 1-2 mile (~1.6-3.2 km) radius is much smaller than on those in the immediate vicinity of the WPP;
- residential properties located within 1 mile (~1.6 km) of the WPP are devalued by approximately 11% following the announcement of a new WPP development compared to hypothetical properties located 3-5 miles (~4.8-9.0 km) away;

However, those properties that have been devalued by the WPP development quickly recover any losses, returning to the inflation-adjusted level before the WPP development was announced within three to five years of the WPP becoming operational³⁵⁰.

The literature provides mixed data on the number of jobs created by WPP development. *The Hillard G. Huntington study "Creating Jobs With 'Green' Power Sources"* found that the wind energy sector creates between 0.71 and 2.79 jobs per year for every MW of installed capacity.³⁵¹ *Luigi Aldieri Jonas Grafström, Kristoffer Sundström and Concetto Paolo Vinci "Wind Power and Job Creation"*, analysing 17 scientific articles and 10 reports, conclude that the average number of jobs created is 5.38 per MW in the scientific articles and 5.80 per MW in the other reports. The maximum number of staff required for operation and maintenance is given as 3.44 per MW in scientific papers and 0.29 per MW in other reports. Statistics from the International Renewable Energy Agency show that an average of 50-100 workers are employed during the construction of a WPP of up to 200 MW, while the number of permanent employees during the operation of the WPP is 10-15.³⁵² Therefore, the number of jobs created by the Proposed Action could be between 40 and 60 during construction and between 5 and 10 during operation.

³⁴⁹ https://ec.europa.eu/regional_policy/sources/studies/cba_guide.pdf

³⁵⁰ <https://www.sciencedirect.com/science/article/pii/S0301421523004226?via=ihub>

³⁵¹ Hillard G. Huntington, *Creating Jobs With 'Green' Power Sources*, Reprinted from USAEE Dialogue 17(1), 2009.

³⁵² https://www.irena.org//media/Files/IRENA/Agency/Publication/2017/Jun/IRENA_Leveraging_for_Onshore_Wind_Executive_Summary_2017.pdf

14.2.2. Socio-economic impacts of the Limbaži WPP Park

The proposed activity is planned in the administrative areas of Salacgrīva and Viļķenes parishes of Limbaži municipality. Detailed socio-economic impact calculations have been prepared for the two alternatives for the specific WPP Park and are attached in Annex 11. The socio-economic impacts have been assessed for the Limbaži WPP Park Alternative A - 12 WPPs and Alternative B - 20 WPPs: if the number of WPPs is reduced by 2-3 units, the socio-economic benefits will decrease accordingly according to the calculations of the indicative impact per WPP in Annex 11.

The administrative areas of the WPP development - Salacgrīva and Viļķenes municipalities - are characterised by negative dynamics of the declared population.

2020. In 2010, the share of jobseekers/unemployed among economically active population aged 15-74 in Salacgrīva municipality was 6.8%, while in Viļķenes municipality it was 7.4%, which is in line with the Limbaži municipality average of 7.2%. Both areas show a significant decrease in the share of jobseekers/unemployed between 2017 and 2020.

The overall demographic situation of the administrative areas of the WPP development indicates the potential of the WPP development areas to accommodate new jobs related to the development and operation of the WPP, which would employ the population declared in these areas, as well as, if necessary, new population whose migration would be directly or indirectly related to the development and operation of the WPP.

In the context of the business sector, the dominant enterprises (34% of the total number of enterprises in Limbaži municipality) in the administrative areas of the WPP development are those providing agricultural, forestry and fisheries activities, although enterprises providing other types of economic activities included in the NACE classification are also relatively well-represented.

In general, the WPP development administrative areas are characterised by a dynamic and diversified business environment, which, taking into account the demographic situation, indicates a readiness to accept the socio-economic challenges associated with the development of WPPs, including the provision of the workforce needed to create jobs during the development and operation phase, servicing the non-local workforce and other services essential and necessary for the development and operation of WPPs.

It should be noted that data on impacts on recreational resources, ecosystem services (mushroom picking, berry picking, etc.) are not quantified in the socio-economic impact assessment due to the quality of available data. They are assessed in other impact assessments, for example recreation in the landscape assessment, ecosystem services in the habitat assessment.

The assessment of the socio-economic factors to be assessed qualitatively suggests that, based on international experience, short-term negative impacts on properties in the vicinity of WPP development sites are likely to be medium-term (within three to five years from the start of operation of the WPP) and do not lead to significant negative impacts in the long term.

The benefit-cost analysis of the socio-economic assessment uses a socio-economic discount rate of 5%, which discounts future income and losses, to determine the value of the project at today's prices.

14.2.3. Socio-economic benefits - Community levy

Latvian Wind Parks Ltd has supported a local community development payment or "community payment" aimed at improving the well-being of the local community in whose territory the WPP development takes place, as a result of which community payments can be attributed to the socio-economic benefits of the WPP development project.

2024. On 5 January 2011, the Amendment to the Electricity Market Act entered into force, Article 221 "Payments for wind power plants for local community development" of which stipulates the following:

"An electricity producer whose wind power installation is located on the territory of the Republic of Latvia, in the internal maritime waters, in the territorial sea or in the exclusive economic zone and whose installed capacity is equal to or greater than one megawatt shall pay wind power installation payments for local community development for the total installed capacity of each installation.

The Cabinet of Ministers shall determine the amount of the payments provided for in paragraph 1 of this Article, the procedure for their payment and monitoring, the deadlines, as well as the purposes for which the payments are used."

The following assumptions are used to calculate the size of the community charge:

Charge per MW of WPP capacity: EUR 2 500/year;

The total installed realistic nominal capacity of the WPP according to the indicative capacity parameters of the WPP provided by Ltd Latvijas vēja parki - 6.8 MW:

- For alternative "A" (12 WPP): 81,6 MW;
- For alternative "B" (20 WPP): 136 MW.

According to the authors' calculations, the annual monetary amount of socio-economic benefits for the community in which the WPP development takes place will be as follows:

- For alternative "A": 81.6 MW x EUR 2500 = EUR 204 000/year;
- For alternative "B": 136 MW x 2500 EUR = 340 000 EUR/year.

The total benefits of community payments, expressed in discounted monetary socio-economic benefits over the project lifetime of 25 years, will be:

- For alternative "A": EUR 2 252 767;
- For alternative "B": EUR 3 754 611.

14.2.4. Conclusions on socio-economic benefits

In terms of quantifiable socio-economic benefits and losses, all alternatives show a very significant overall net present value and an internal rate of return well above the socio-economic discount rate of 5% used in the calculations, which means that the long-term socio-economic benefits compensate for the short-term losses, including the short-term losses. In terms of GHG emissions. In terms of socio-economic returns to the development of the WPP, Alternative A performs slightly better, with a total net present value of EUR 89 398 054 and an internal rate of return of 18.66% (see Annex 11). However, not all projects are implemented at their proposed capacities even after the EIA has been completed.

Table 14.1. *Monetary results of the Limbaži WPP Park alternatives, discounted over the lifetime of the WPP*

Alternative/ Indicator	A (12 WPP)		B (20 WPP)	
	Net present value, EUR	GHG emission reductions, tonnes _{CO2} eq.	Net present value, EUR	GHG emission reductions, tonnes _{CO2} eq.
CO2 emissions				
Transformation of the WPP development site	-2 676 058	-16 000	-5 301 440	-30 480
Partial afforestation of the WPP development area	591 150	2 736	946 576	4 382
CO2 emissions during the WPP production phase	-19 863 928	-136 704	-33 106 547	-227 840

Alternative/ Indicator	A (12 WPP)		B (20 WPP)	
	Net present value, EUR	GHG emission reductions, tonnes _{CO2} eq.	Net present value, EUR	GHG emission reductions, tonnes _{CO2} eq.
CO2 emissions during the installation phase of a WPP	-1 003 884	-6 144	-1 673 141	-10 240
CO2 emissions during the operational phase of a WPP	-2 288 166	-10 752	-3 813 611	-17 920
Electricity substitution	108 687 905	510 720	181 146 508	851 200
Total CO2 emissions	83 447 018	343 856	138 198 346	569 102
Employment growth				
Additional salary income	3 698 269		6 163 782	
Community payments				
Community payment	2 252 767		3 754 611	
Total	89 398 054		148 116 740	
Internal rate of return, %	18,6579%		18,6257%	

Table 14.2. Monetary results of the Limbaži WPP Park alternatives, discounted over the lifetime of the WPP, relative to 1 WPP in each alternative

Alternative/ Indicator	A (1 WPP)		B (1 WPP)	
	Net present value, EUR	GHG emission reductions, tonnes _{CO2} eq.	Net present value, EUR	GHG emission reductions, tonnes _{CO2} eq.
CO2 emissions				
Transformation of the WPP development site	-223 005	-1 333	-265 072	-1 524
Partial afforestation of the WPP development area	49 262	228	47 329	219
CO2 emissions during the WPP production phase	-1 655 327	-11 392	-1 655 327	-11 392
CO2 emissions during the installation phase of a WPP	-83 657	-512	-83 657	-512
CO2 emissions during the operational phase of a WPP	-190 681	-896	-190 681	-896
Electricity substitution	9 057 325	42 560	9 057 325	42 560
Total CO2 emissions	6 953 918	28 655	6 909 917	28 455
Employment growth				
Additional salary income	308 189		308 189	
Community payments				
Community payment	187 731		187 731	
Total	7 449 838		7 405 837	

11.annex also includes a table summarising the socio-economic impacts of WPP development by their indicative impact types: international, national, local and indigenous.

15. SUMMARY OF THE ENVIRONMENTAL IMPACT ASSESSMENT OF THE PROPOSED ACTION

The Executive Summary is provided as a separate Annex, see Annex 14.

16. AUTHORS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

Līga Blanka, Master of Environmental Sciences, Project Manager

Pēteris Blumats, Master of Social Sciences

Valdis Felsbergs, Master of Environmental Sciences, Physical Impacts Expert

Ieva Anna Arāja, Master of Environmental Sciences

Laine Roziņa, Master of Environmental Sciences

Tatjana Sorokina, Certified Hydrogeologist

Juris Saprovskis, Acoustic Engineer

Krišjānis Ralfs Veinbergs, Master of Environmental Sciences, GIS expert

Atis Cirpons, Physical Influences and Computer Modelling Expert

Dāvis Immurs, Landscape Expert

Haralds Punculis, Landscape Expert

Andis Lazdiņš, Doctor of Forestry

Viesturs Vintulis, certified expert, certificate No 070

Jānis Ozoliņš, certified expert, certificate No 160

Plant species and habitat experts:

Anete Pošiva-Bunkovska, certificate No 116 (habitat groups: forests and heaths, bogs; species groups: vascular plants, mosses)

Daina Bojāre, certificate No 099 (habitat group: forests and heaths; species group: vascular plants)

Toms Daniels Čakars, certificate No 182 (habitat groups: forests and heaths)

Līga Mihailova, certificate No 156, (habitat groups: forests and heaths; bogs)

Field surveys were also carried out and information on the areas surveyed was provided by:

Ilze Kukāre, certified expert, certificate No 115

Bird experts:

Dāvis Ūlands, Certificate No 209;

Māris Strazds, Laboratory of Ornithology, Institute of Biology, University of Latvia

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