«Ukrecoconsult» LLC

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«DNEPRO-BUGSKY WIND POWER PLANT»

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT (ESIA)

KYIV – KHERSON – 2018

PERSONS RESPONSIBLE FOR PREPARION OF ESIA

This ESIA Report is prepared by the «Ukrecoconsult» Limited Liability Company, in partnership with National Aviation University, Private Enterprise «EKOBUDSFERA» and «Mott MacDonald» consultant company.

Leading Ukrainian experts in relevant fields with many years of experience in developing ESIAs were involved in the preparation of ESIA, namely:

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In preparation of the ESIA project also participated:

Anzhela Hai, PhD (Physics and Mathematics), Associate Professor of the National Aviation University, Deputy Head of the Department of Ecology of the National Aviation University.

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The year-long monitoring of the impact of «Dnepro-Bugsky wind power plant» and overhead power line on birds and bats was carried out by a group led by **Olga Yaremchenko** PhD (Biology), the Ukrainian Society for the Protection of Birds, a representative of BirdLife International in Ukraine).

Detailed investigation of bats on the territory of construction site of the «Dnepro-Bugsky wind power plant» was performed by **Drebet Mykhailo** (Senior Scientist of National Natural Park «Podilsky Tovtry», expert the of Ukrainian center of bats protection, which is a member of BatLife Europe).

The scientific archaeological surveys (exploration) of land plots was carried out by the employees of Scientific and Research Center «Lukomorie» Scientific and Research Center «Guard Archeological Service of Ukraine» of the Institute of Archeology of the National Academy of Sciences of Ukraine under the leadership of **Kyryl Horbenko**.

Also in the preparation of ESIA were involved students of the Educational and Research Institute of Ecological Safety and laboratory assistants of the environmental safety laboratory of the Scientific and Training Center «Ecobiosafety» of the National Aviation University: **Oleksandr Husiev, Kateryna Zhurbas, Inokentii Horobtsov, Yuliia Kartash, Vladyslav Shcherbachenko, Mykhailo Yurkiv**.

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LIST OF SYMBOLS, UNITS, ABBREVIATIONS AND TERMS

˚C	–	Degrees by Celsius
μTl	–	Microtesla
μW/cm^2	–	MicroWatts per square centimeter
ALARA	–	As Low As Reasonable
Atm.	–	Atmosphere
BMP	–	Biodiversity management plan
CMS	–	Condition Monitoring Systems
CTS	–	Central transformer substation
CWIF	–	Caithness Windfarms Information Forum
dB	–	Decibel
«DB WPP»	–	Dnepro-Bugsky Wind Power Plantr
dB(A)	–	Noise level with maximum permissible volume
DEM	–	Digital evaluation model
dm	–	Decimetre
E.L.	–	Eastern Longitude
EBRD	–	European Bank of Reconstruction and Development
EEC	–	European Economic Community
EIA	–	Environmental Impact Assessment
ESIA	–	Environmental and Social Impact Assessment
EMF	–	ElectroMagnetic Field
EMR	–	ElectroMagnetic Radiation
EU	–	European Union
GHz	–	Gigahertz
GW	–	Gigawatt
HAWT	–	Horizontal axis wind turbine
HP	–	Horsepower
Hz	–	Hertz
IFC	–	International Finance Corporation
ISA		International standard atmosphere
ISO	–	International Organization for Standardization
IUCN	–	International Union for Conservation of Nature
l/sec	–	Liters per second
LCU	–	Land Code of Ukraine
LLC	–	Limited Liability Company
MF	–	Magnetic field
mG	–	MilliGaus
MPa	–	Megapascals
MPL	–	Maximum Permissible Levels
MSK-64	–	Medvedev–Sponheuer–Karnik scale, 1964
MW	–	Megawatt
N.L.	–	North latitude

NAMS of Ukraine	–	National Academy of Medical Sciences of Ukraine
NASU	–	National Academy of Sciences of Ukraine
NPP	–	Nuclear Power Station
OHPL	–	Overhead Power Line
OHS	–	Occupational Health and Safety
PE	–	Private enterprise
PL	–	Power line
PSZ	–	Public Safety Zone
RTO	–	Radio-Technical objects
SI	–	State Institution
SUNPP	–	South-Ukraine Nuclear Power Station
TLP	–	Threshold level of perception
UHFA	–	Ukrainian Hunting and Fishing Association
UN	–	United Nations
USA	–	United States of America
VAWT	–	Vertical axis wind turbine
VESC	–	Valued environmental and social components
WGS-84	–	World Geodetic System 1984
WHO	–	World Health Organization
WPP	–	Wind power plant
WT	–	Wind turbine

INTRODUCTION

As of today, emissions of thermal power stations into the atmosphere, consisting of sulfur oxides (76%), nitrogen oxides (53%) and particulate matters, constitute 26% of total emissions from stationary sources of Ukraine. Irreversible water losses in operation of one nuclear power station (NPP) are 30 million m^3 per year. The assessment made by the Institute of Renewable Energy of National Academy of Sciences of Ukraine (NASU) showed that planned construction of wind power stations of total capacity 16 000 MW until 2030 will decrease average annual emissions of carbon dioxide to 32 million tons, resulting in the annual savings of 14,4 billion m^3 of natural gas.

Planned construction of «Dnepro-Bugsky Wind Power Plant» (hereinafter – «DB WPP») and overhead power line (hereinafter – OHPL) is consistent with «Energy strategy of Ukraine until 2030» [122] and «National Action Plan for Renewable Energy until 2020». Development of capacities for renewable energy generation corresponds to national obligations of Ukraine to the United Nations Framework Convention on Climate Change. During the negotiations in Paris, Ukraine has declared the goal to reduce the air emissions up to 40% until 2030, comparing to greenhouse gases emissions in 1990. As of January 1, 2018, installed capacity of wind power plants (WPP) in Ukraine was only 514 MW (or 0.93% from total generating capacities that produced over 1171 million kW·h of electric energy in 2014). The further increase of wind power capacities looks promising for the South of Ukraine due to high wind potential in this region.

The «Dnepro-Bugsky Wind Power Plant» will consist of twenty five wind turbines Nordex N 149/4.0-4.5. The Wind Turbines Nordex N 149/4.0-4.5 (with nominal capacity 4.4 MW and height the rotor axis 105 m, manufactured in Germany) is main generating equipment. It is also planned to build a OHPL with a voltage of 150 kV from the central substation of «DB WPP» to the power supply substation 150/35/10 kV Posad-Pokrovska with a total length of approximately 27.3 km. The wind turbine (WT) consists of a hollow steel tower topped with a nacelle containing an electric generator, rotor, and blades. Because of their large dimensions, the completely manufactured components of wind turbine will arrive to the «DB WPP» construction site unassembled. The tower sits on a foundation, designed individually for each wind turbine – a monolithic reinforced concrete slab resting on piles.

Construction and operation of «DB WPP» and the OHPL do not belong to activities of high environmental hazard in accordance to Ukrainian legislation: Law of Ukraine «On Environmental Impact Assessment», DBN A.2.2-1-2003 («Composition and content of materials for environmental impact assessment (EIA) in design and construction of enterprises, buildings and structures») [78]), and European environmental legislation (the EIA Directive 2014/52/EU).

Construction and operation of «DB WPP» and the OHPL will not cause significant environmental impacts. Some insignificant impacts are possible:

1. On the stage of construction:

– Soil damage (construction of transformer substations and WT foundation and the OHPL, cable laying, etc.);

- Some losses of vegetation cover (construction of WT foundation and the OHPL, transformer substations, cabling, etc.);
- Minor losses of agriculture lands (construction of WT foundation and the OHPL, transformer substations, communications, etc.);
- Partial fragmentation of the landscapes (construction of WT foundation and the OHPL, transformer substations, communications, etc.);
- Slight change of usual landscape (installing of the transformer substations and WTs of height 105 m);
- Temporal air pollution by emissions from construction equipment;
- Random local water and soil pollution in the cases of accidental spills of fuels, lubricants, and operational losses (operation of construction equipment and automobile transport, storage of fuels and lubricants.

2. On the stage of exploitation «DB WPP» and the OHPL within buffer zone operation:

- Increased noise level in the vicinity to wind turbines (caused by movement of WT blades and operation of generator) within buffer zone of noise impact;
- Slightly elevated electromagnetic radiation nearby wind turbines and the OHPL, cables, and transmission lines (from generator of electric energy, transformer substations) within buffer zone of electromagnetic impact;
- Possible detachment of blades and/or ice fragments from rotating blades (in extreme weather conditions) of the third party risk;
- Remote shadow flickers are glistering of blades (during movements of WT blades) negligible beyond «DB WPP» buffer zone;
- Slight visual impacts on human modified landscapes (change of aesthetic perception and landscape view caused by presence of WTs of 105 m in height and the OHPL);
- Sporadic bird deaths from collision with WT rotors (from rotor movement at the height of 105 m, in particular in the extreme weather conditions);
- Random local deterioration of water quality and soil in case of accidental spills of fuel, lubricants and transformer liquids.

1 LEGISLATION AND REGULATIONS RELEVANT FOR THE PROJECT

The investment project is developed for construction and operation of the Dnepro-Bugsky Wind Power Station (hereinafter – Project) of installed capacity of 110 MW and 150 kV overhead power line on the coast of the Dnipro-Bugsky Estuary and the border with Mykolaiv Region in the western part of Kherson Region of Ukraine. The power output of the «DB WPP» will be carried out through the OHPL to the energy system of Ukraine.

The measured wind characteristics shows the availability of high wind potential at the «DB WPP» site that ensures the potential sustainability of Project operation, significant profitability of Project and minimizes the risks of project failure for investor resulting from decrease of power generation by «DB WPP».

The Parties, taking part in implementation of the Project, shall work in compliance with the requirements of the national environmental legislation of Ukraine and the terms of a contract with an investor (investors) based on the agreed positions of the parties, procedures and the relevant treaties. The requirements for the environmental impact assessment are mandatory as in Ukrainian as international legislation.

1.1 Regional/global conventions and agreements, to which Ukraine is a contacting party, relevant for the investment project Dnepro-Bugsky Wind Power Plant

Regional/global conventions and agreements include (but not limited to): UN Framework Convention on Climate Change, Convention on Long-range Transboundary Air Pollution (hereinafter UN CLRTAP), the Protocol on the Reduction of Sulfur Emissions by 30% to UN CLRTAP, the Protocol on Limitation of Nitrogen Emissions or its Transboundary Flux to UN CLRTAP, Bern Convention, the Directive on the Environmental Impact Assessment of the European Union (EU) (Directive 2014/52/EU of the European Parliament and the European Council of 16 April 2014 [11]), the Paris Agreement to the Framework Convention on Climate Change, etc.

One of the most important document in this area is the Association Agreement between Ukraine and EU. It envisages the development of the intensive dialogue between Ukraine and the European Union that covers a wide range of issues, starting from discussion of the prospects of development of certain sectors and up to consultations on issues of regulation in certain spheres and disputes resolution. Such areas include, in particular, energy and environment, especially, the development of renewable energy facilities. The reduction of emissions of greenhouse gases and polluting substances will have essential effect from such innovations.

1.2 Investor's participation in the project

The participation of an investor in the planned project will be based on negotiations between the stakeholders in compliance with requirements of Ukrainian legislation. The legal basis of foreign investment activity at the territory of Ukraine is established by the Law of Ukraine «On the regime of foreign investment», 1996 [99] with changes, namely:

- for foreign investors, the national regime of foreign investments and other economic activities is established at the territory of Ukraine, with the exceptions stipulated by the legislation of Ukraine and international agreements of Ukraine.
- preferential treatment for foreign investments and other economic activities may be granted to separate subjects of entrepreneurial activity (such as investment projects with involvement of foreign investments) that are implemented in accordance with state programs concerning development of priority economic sectors, social sphere and territories.
- laws of Ukraine determine the territories at which the activities of foreign investors and enterprises with foreign investment are limited or prohibited, based on the national security provisions.

By this law, the state of Ukraine guarantees to foreign investors that:

1. If, in case of a change in the special legislation of Ukraine on foreign investments, the guarantees of protection of foreign investments, specified in this Law, change, then at the request of a foreign investor, within a period of ten years from the day of such legislation entering into force, the state guarantees of protection of foreign investments, specified in this Law, shall be applied. The legislation of Ukraine, which is in force at the time of conclusion of production-sharing agreement, shall be applied to the rights and obligations defined by this agreement, during the time of its validity. These guarantees are not applied to changes in legislation related to defense, national security, civil order protection, environmental protection.
2. Foreign investments in Ukraine are not a subject to nationalization. Public authorities have no right on requisition of foreign investments, except for cases of salvage and rescue measures during natural disasters, accidents, epidemics, epizootics. The specified requisition may be performed based on decisions from bodies authorized by the Cabinet of Ministers of Ukraine. The decision on the requisition of foreign investments and the terms of compensation may be appealed in court according to this Law.
3. Foreign investors have right on compensation of losses, including lost profits and moral damage, inflicted to them in result of actions, inaction or inadequate execution by the state authorities of Ukraine or their officials, of the obligations provided by the legislation concerning a foreign investor or an enterprise with foreign investments, in accordance with the legislation of Ukraine. All incurred expenses and losses of foreign investors, resulting from actions referred to in the first paragraph of Article 9, shall be reimbursed on the basis of current market prices and/or a reasoned assessment certified by an auditor or audit firm. The compensation paid to a foreign investor shall be fast, adequate and effective.
4. Compensation paid to a foreign investor resulting from actions specified in Article 9 of this Law is determined at the time of termination of the right of ownership. Paid to a foreign investor compensation, resulting from actions described in part one of this article shall be determined at the time of the actual implementation of the decision on damages. The amount of compensation must be paid in the currency, in which the investment was made or in any other currency, acceptable for foreign investor, in accordance legislation of Ukraine.

5. From the moment of the compensation right occurrence and until its payment, the interest on the amount of compensation is calculated in accordance with the average interest rate, on which London banks provide loans to the first-class banks in the Euro currency market.
6. In case of termination of investment activity the foreign investors have right of recovery of their investments in natural form or in the currency of investment (no later than six months from the date of this activity termination) in the amount of the actual contribution (with a possible reduction of the authorized capital) without payment of customs duties, as well as income of these investments in cash or commodity form by the actual market value at the moment of the termination of investment activity, unless otherwise provided by law or international treaties of Ukraine.
7. Foreign investors, after paying taxes, fees and other mandatory payments, are guaranteed unrestricted and prompt transfer (abroad) of their profits, income and other funds in foreign currency, obtained on the legal grounds because of foreign investments. The procedure for abroad transfer of profits, income and other funds, received from foreign investments, is determined by the National Bank of Ukraine.

For producers of electricity in business or private entities, using alternative energy sources, the «green» tariff is established until January 1, 2030. The fixed minimal size of the «green» tariff for business entities and private households is expressed in euro, calculated according to the requirements of this Law, as of January 1, 2009 by official exchange rate of the National Bank of Ukraine at specified date.

The «green» tariff for business entities that produce electric energy from wind energy is set as the retail tariff level for consumers using transient overvoltage Installations of Category II January 2009, multiplied at the coefficient of «green» tariff for electricity generated from wind power plant. The «green tariff» is set by the national commission authorized to impose the state regulation on electric energy produced at electric power facilities in energy sector and municipal utilities, including commissioned stages of construction of power plants (put in operation) from alternative energy sources (except for blast furnace and coke gases, and in case of hydropower facilities – only for electricity produced by micro-, mini- and small hydroelectric power plants).

To ensure safety for population living near industrial power installations the buffer zones are established. Size and procedure for establishing such zones is governed by legislative and regulatory acts and embedded into project designs according to the established order.

1.3 The procedures of international financial institutions used for this Environmental Impacts Assessment

This Environmental and Social Impact Assessment Report is prepared in full compliance with the requirements of Law of Ukraine «On Environmental Impact Assessment», DBN «Composition and content of materials for environmental impact assessment (EIA) in design and construction of enterprises, buildings and structures», as well as well as «Indicative EHSIA Structure for EBRD Category 'A' Projects» [29], which corresponds to the requirements of European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy, May 2014 [13].

According to the EU Guidance on EIA Screening June 2001 [17], for each possible impact factor, the screening procedure (determining the significance of the impact in the context of the proposed project) applies requires the answers on the following questions:

1. Will there be a large change in environmental conditions?
2. Will new features be out-of-scale with the existing environment?
3. Will the effect be unusual in the area or particularly complex?
4. Will the effect extend over a large area?
5. Will there be any potential for transboundary impact?
6. Will many people be affected?
7. Will many receptors of other types (fauna and flora, businesses, facilities) be affected?
8. Will valuable or scarce features or resources be affected?
9. Is there a risk that environmental standards will be breached?
10. Is there a risk that protected sites, areas, features will be affected?
11. Is there a high probability of the effect occurring?
12. Will the effect continue for a long time?
13. Will the effect be permanent rather than temporary?
14. Will the impact be continuous rather than intermittent?
15. If it is intermittent will it be frequent rather than rare?
16. Will the impact be irreversible?
17. Will it be difficult to avoid, or reduce or repair or compensate for the effect?

1.4 Country of project, Ukrainian and European legal acts: used standards, guidelines and agreements

Country of project – Ukraine. The global practice of project development and large wind power plants construction implies that development of the project at early stages is carried out at the expense of local (Ukrainian) investors and assumes attraction of co-financing by other investors (including foreign investors) at the further stages of project development and construction. Such investment scheme facilitates attraction of additional investments into the country.

The assessment of impacts of the planned activities of Project on the environment, health, social and economic conditions has been carried out with the aim of identifying potential negative factors and levels of impacts of planned activities on the environment, population health, as well as economic and social consequences of those impacts in order to prevent or mitigate them according to the European Bank for Reconstruction and Development's Guidelines on Environmental and Social Policy 2014, European and Ukrainian legislation.

1.4.1 List of used legislative acts and international agreements

The list of legislative acts of Ukraine and international agreements is presented in Table 1.1.

Table 1.1 – The list of used legislative acts and international agreements considered during of the environmental impact assessment of the Project

Title of document	Adoption/Ratification Date and Number
NATURAL ENVIRONMENT	
Laws of Ukraine	
On Environmental Protection	25.06.1991 № 1264
On Air Protection	16.10.1992 № 2707
On Land Protection	19.06.2003 № 0962
On Nature Reserve Fund of Ukraine	16.06.1992 № 2456
On Flora	09.04.1999 № 0591
On Fauna	03.03.1993 № 3041, 13.12.2001 № 2894
On Environmental Impact Assessment	18.12.2018 № 0045
On the National Program for Creating the National Ecological Network of Ukraine for the Years 2000-2015	21.09.2000 № 1989
On Ecological Network of Ukraine	24.08.2004 № 1864-IV
Codes of Ukraine	
Commercial Code of Ukraine	16.01.2003 № 436-IV
Land Code of Ukraine	25.10.2001 № 2768-14
Water Code of Ukraine	06.06.1995 № 213/95
Air Code of Ukraine	04.05.1993 № 3167-12
Code of Civil Protection of Ukraine	02.10.2012-№ 5403-VI (5403-17)
International Conventions and Agreements	
Convention on the Conservation of European Wildlife and Natural Habitats	29.10.1996 № 436/96
Convention on Biological Diversity	29.11.1994 № 257/94
Convention on Wetlands of International Importance, especially as Waterfowl Habitat	29.10.1996 № 437/96
United Nations Framework Convention on Climate Change	29.10.1996 № 435/96
Paris Agreement under the United Nations Framework Convention on Climate Change	14.07.2016 № 1469-VIII
Convention on the Conservation of Migratory Species of Wild Animals	19.03.1999 № 535-XIV
European Landscape Convention	07.09.2005 №2831-IV
SOCIAL ENVIRONMENT	
Laws of Ukraine	
Fundamentals of the Legislation of Ukraine on Health Care	19.11.1992 № 2801
On Ensuring Sanitary and Epidemic Safety of the Population	24.02.1994 № 4004

Title of document	Adoption/Ratification Date and Number
On Local Self-Government in Ukraine	21.05.1997 № 280/97
State Regional Development Strategy of Ukraine till 2020	6.08.2014 №385-2014-п
On Information	02.10.1992 № 2657
International Conventions and Agreements	
Association Agreement between the European Union and the European Atomic Energy Community and their member states, of the one part, and Ukraine, of the other part	27.06.2014 № 1678-VII
Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters	06.07.1999 № 832-12
TECHNOGENIC ENVIRONMENT	
Laws of Ukraine	
On Land Management	22.05.2003 № 0858
On Land Reclamation	14.01.2000 № 1389
On Wastes	05.03.1998 № 0187
On the Use of Nuclear Energy and Radiation Safety	08.02.1995 № 0039
On Radioactive Waste Management	30.06.1995 № 0255
International Conventions and Agreements	
Radiation Protection Convention	17.12.1997 № 736/97
Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	30.04.2000 № 1688-III

1.4.2 List of used regulatory-methodological and regulatory-technical documents of Ukraine and recommended regulatory-technical documents of the European Union

Regulatory-methodological and regulatory-technical documents of Ukraine:

– «Regulations on professional education and training on the issues of technical operation of electric power facilities» approved by: Ministry of Fuel and Energy of Ukraine, decree № 75 dated 9.02.2004, Registered by: Ministry of Justice of Ukraine, dated 05.04.2004, № 418/9017;
– DBN A 2.2-1-2003 «Composition and content of materials for environmental impact assessment (EIA) during the design and construction of enterprises, buildings and structures» Kyiv: State Committee for the Construction of Ukraine, 2004. 25 p.;
– DBN B.1.1-14:2012 «Composition and content of the detailed plan of the territory» Kyiv: «Dipromisto» Institute of the Ministry of Regional Development, Construction and Housing and Communal Services of Ukraine, 2012. 22 p.;

– DBN B.2.1-10-2009 «Bases and foundations of buildings and structures. Basic design provisions» Kyiv: State Enterprise «State Research Institute of Building Structures» (SRIBS) 2009. 161 p.;
– «State sanitary norms and rules of protection of the population from the influence of electromagnetic radiation»;
– «State sanitary norms and rules during the work with a non-disabled electrical voltage to 750 kW inclusively»). [Effective as of 1997-09-07] - Kyiv: Ministry of Health of Ukraine, 1997. - 23 p.;
– «State sanitary rules of planning and building of settlements», 1996. [Effective as of 31.08.2009] K. : Ministry of Health of Ukraine, 1996 (normative document of the Ministry of Health of Ukraine);
– «State sanitary rules during the work with sources of electromagnetic fields») . [Effective as of 2003-0104]. - Kyiv: Ministry of Health of Ukraine, 2003-16 p.;
– «Noise. Terms and definitions» [Effective as of 01.01.1995];
– «Turbogenerator wind systems. Part 1. Safety requirements» (IEC 61400-1:1999, IDT) [Effective as of 01.07.2003].K. «Energy saving», 2003. – 50 p. (State Standard of Ukraine IEC);
– «Labor Protection. Organizational and methodological documents»;
– Energy Strategy of Ukraine for the period till 2030;
– «Sanitary norms of noise production: ultrasound and infrasound». [Effective as of 1.12.1999] – Kyiv: Ministry of Health of Ukraine, The main sanitary and epidemiological administration, 1999. – 79 p. (normative document of the Ministry of Health of Ukraine);
– «Sanitary norms of permissible noise in the premises of residential and public buildings and in the residential area»;
– «Wind power generation. Wind farms land plots. Selection requirements»;
– Maximum permissible concentrations of chemical and biological substances in the atmospheric air of populated areas in the form of a text document with a note «Approved. Acting chief state sanitary doctor of Ukraine S.V. Protas. 3rd of March 2015»;

The recommended regulatory-technical documents of the European Union:

– Environmental Quality Standards, Directive 2008/105/EU;
– Air Quality Standards, Directive 2008/50/EU;
– Environmental Quality Standards Applicable for Surface Waters, Directive 2008/105/EU;
– Directive 2002/49/EU of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise.

In accordance with the order of the Cabinet of Ministers of Ukraine dated January 20, 2016. № 94-p «On the recognition of acts of sanitary legislation that have become invalid and those that are not applied on the territory of Ukraine», from January 1, 2017 the following regulatory acts are void, namely:

– acts of sanitary legislation issued by the central authorities of the executive power of the Ukrainian Soviet Republic, including their officials, which approved sanitary, sanitary-hygienic, sanitary-anti-epidemic, sanitary-

epidemiological, anti-epidemic, hygienic rules and norms, state sanitary and epidemiological norms and sanitary regulations;
- acts of sanitary legislation issued by the central executive bodies of the Union of Soviet Socialist Republics (USSR), including their officials, which approved sanitary, sanitary-hygienic, sanitary-anti-epidemic, sanitary-epidemiological, anti-epidemic, hygienic rules and norms, state sanitary and epidemiological norms and sanitary regulations.

With the entry into force of new legal regulatory documents of Ukraine, the above list will be updated and taken into account. Since in its majority, the existing norms of Ukraine are only slightly different from the European, the use of especially dangerous substances is not foreseen in the Project, and expected levels of physical exposure are insignificant, the only slight modifications in overall assessment are expected.

1.4.3 Public consultations and interaction with the public

In accordance with the provisions of the Aarhus Convention and in order to ascertain the attitude of the local population to the construction of the «Dnepro-Bugsky WPP», the requirements of Ukrainian legislation (Law of Ukraine «On Regulation of City Planning Activity», the resolution of the Cabinet of Ministers of Ukraine dated May 25, 2011 № 555, DBN A.2.2-1-2003 «Composition and content of materials for environmental impact assessment (EIA) during the design and construction of enterprises, buildings and structures», etc.) and taking into account the requirements of the EBRD's Environmental and Social Policy in, the following steps have been undertaken:

1) Public consultations with representatives of the community of the village Oleksandrivka were held, namely:
- Meeting with people deputies of Oleksandrivka Village Council;
- Meeting with the staff of the kindergarten of Oleksandrivka Village;
- Meeting with the pedagogical staff of Oleksandrivka secondary school;
- Meeting with the heads of agricultural enterprises that carry out business activities at the territory of the Oleksandrivka Village Council;
- Study tour of the representatives of community of Oleksandrivka Village to the operating wind power plant in the Kherson Region.

2) Consultations were held with representatives of regional and district authorities and representatives of the scientific community of the region:
- Meeting with the leadership of the Kherson Region State Administration;
- Presentation of the Project on construction of «Dnepro-Bugsky WPP» in Bilozerskyi District State Administration;
- Meeting with the leadership of the Main Department of Regional Geological Cadastre in the Kherson Region;
- Meeting with the leadership of the Department of Ecology and Natural Resources of Kherson Region State Administration;
- Meeting with the leadership of the administration and architecture department of Kherson Region State Administration;
- Scientific seminar and discussion on the EIA report of «Dnepro-Bugsky WPP» Draft Project at the National Aviation University, Kyiv.

3) Public hearings on the development of detailed plan of territory and EIA of the «Dnepro-Bugsky WPP» were held to consider public interests.

4) The information about «DB WPP» was disseminated through the mass media means:

- Publications in the local newspaper «Prydniprovska zirka»;
- Publications in the local newspaper «Nadnipryanska pravda»;
- Publications on official Internet sites.

Social and economic activities were published in the newspaper «Prydniprovska zirka» and on the official website of the Bilozerskyi District State Administration.

During November 2016-March 2017, about 40 meetings with authorities of different levels and residents of Oleksandrivka village were held. To familiarize the community with the work of a similar wind power plant, a visit to the existing wind power plant in Kherson Region was arranged.

In addition, during 2017-2018, around 200 meetings were held with the owners and users of land involved for Project construction within the territory of Oleksandrivska, Pravdynska and Posad-Pokrovska village councils to ensure awareness of affected persons.

Consultation with public and stakeholders were held over several stages of the Project, among which are public hearings during development of a detailed territory plan, environmental impact assessment and inventory of land plots.

Format of consultations were individual and group ones. Consultations were held with all land owners and users and included, among other things, information on the issues relating to land use during construction and operation of a wind power plant and an overhead line, the rights and obligations with regard to the Project, information on compensation for losses incurred, the peculiarities of entering into easement agreements, etc.

Extensive communication process was carried out at local authority's level, especially at the early stages of the Project implementation. The premises of Oleksandrivska Village Council, Pravdynska Village Council, Pravdyne Village cultural centre, Posad-Pokrovske Village Council, farming enterprise of Kravets Mykola Pavlovych, farming enterprise «EcoLand» LLC (former name – «Super-Nyva» LLC), farming enterprise of «Tavria Pravdyne» LLC, private households of residents of Oleksandrivka, Pravdyne and Posad-Pokrovske Villages of Bilozerskyi District of Kherson Region were used to inform citizens about the Project and to discuss land issues.

Heads of Oleksandrivska, Pravdynska, and Posad-Pokrovska Village Councils, land surveyors of Oleksandrivska, Pravdynska, and Posad-Pokrovska Village Councils, MPs of Oleksandrivska, Pravdynska, and Posad-Pokrovska Village Councils, certified land surveyors eligible to develop land management and land allocation documentation were involved to clarify certain nuances during consultations.

The list of consultations and measures taken to inform the public during the lease of public land for the placement, construction and operation of DB WPP facilities is given in Table 1.2.

Table 1.2 – The list of consultations and measures taken to inform the public

No.	Date	Name and place of event	Number of people involved	Result of the meeting
Consultations and measures taken to inform community of Oleksandrivka Village				
1	14.02.2017	Meeting with the members of Oleksandrivska Village Council	17	Positive
2	20.02.2017	Meeting with the staff of kindergarten in Oleksandrivka Village	19	Positive
3	20.02.2017	Meeting with the teaching staff of Oleksandrivka secondary school	24	Positive
4	22.02.2017	Meeting with the heads of agricultural enterprises conducting business on the territory of Oleksandrivska Village Council	7	Positive
5	18.04.2017	Visit of Oleksandrivka community representatives to existing wind power plant in Kherson Region	12	Positive
6	01.06.2018	Meeting with the farmers of Oleksandrivska Village Council	7	Positive
7	14.06.2018	Meeting with the farmers of Pravdino Village Council	5	Positive
8	28.06.2018	Meeting with the farmers of Pravdino Village Council	5	Positive
9	03.07.2018	Meeting with the farmers of Posad-Pokrovska Village Council	3	Positive
10	20.07.2018	Meeting with the farmers of Pravdino Village Council	5	Positive
11	23.07.2018	Meeting with the farmers of Posad-Pokrovska Village Council	3	Positive
Consultations and measures taken to inform regional and district authorities and representatives of the scientific environmental community				
1	11.11.2016	Meeting with the executive officials of Kherson Regional State Administration	11	Positive
2	01.02.2017	Meeting with the management of JSC «Khersonoblenergo»	5	Positive
3	21.09.2017	Meeting with the head of Kherson State Administration	7	Positive
4	22.03.2017	Presentation of «DB WPP» Project in Bilozerskyi District State Administration	42	Positive
5	31.03.2017	Meeting with executive officials of the Main Department of State Service of Ukraine for Geodesy, Cartography and Cadastre in Kherson Region	8	Positive
6	13.04.2017	Meeting with the executive officials of the Department of Ecology and Natural Resources of Kherson Regional State Administration	7	Positive
7	22.05.2017	Meeting with the executive officials of the Department for Urban Planning and Architecture of Kherson Regional State Administration	5	Positive
8	22.06.2017	Scientific workshop to discuss the EIA report in respect of «DB WPP» Project at the National Aviation University	11	Positive

No.	Date	Name and place of event	Number of people involved	Result of the meeting
9	29.09.2017	Participation in the X International Investment Forum of Kherson Region «Tavria Horizons: Cooperation, Investment, and Economic Development»	Forum participants	Positive
10	02.11.2017	Meeting with the Head of the canals of the Ingulets Irrigation System	3	Positive
11	06.11.2017	Meeting with the Head of «Ukrtelecom» JSC Kherson branch	3	Positive
12	06.11.2017	Meeting with the head of «Khersongaz»JSC	5	Positive
13	20.11.2017	Meeting with the leadership of the road service in the Kherson Region	5	Positive
14	06.02.2018	Meeting with the leadership of the Department of Construction and Infrastructure Development of the Kherson Regional State Administration	3	Positive
15	26.06.2018	Meeting of representatives of the company «Dnepro-Bugsky Wind Power Plant» LLC and investors with the deputy chairman of the Kherson regional state administration Rischuk Ye.N.	15	Positive
16	26.07.2018	Meeting with the leadership of the Department of Ecology and Natural Resources of the Kherson Regional State Administration	6	Positive
17	27.09.2018	Meeting with the leadership of the Department of Ecology and Natural Resources of the Kherson Regional State Administration	7	Positive
18	01.10.2018	Meeting with the leadership of the Bilozerskyi District State Administration and the heads of the Oleksandrivka, Pravdino and Posad-Pokrovska Village Councils	10	Positive
Informing the public through the media and the Internet				
1	16.12.2016	Publications in the local newspaper «Prydniprovska zirka»	2000 copies	Positive
2	24.03.2017	Publications in the local newspaper «Prydniprovska zirka»	2000 copies	Positive
3	14.04.2017	Publications in the local newspaper «Prydniprovska zirka»	2000 copies	Positive
4	05.05.2017	Publications in the local newspaper «Prydniprovska zirka»	2000 copies	Positive
5	22.09.2017	Publications in the local newspaper «Prydniprovska zirka»	2000 copies	Positive
6	22.03.2017	Publication on http://bilozerka-rda.gov.ua/ – the official website of Bilozerska District State Administration	Website visitors	Positive
7	24.03.2017	Publication on http://bilozerka-rda.gov.ua/ – the official website of Bilozerska District State Administration	Website visitors	Positive
8	05.05.2017	Publication on http://bilozerka-rda.gov.ua/ – the official website of Bilozerska District State Administration	Website visitors	Positive

No.	Date	Name and place of event	Number of people involved	Result of the meeting
9	31.03.2017	Publication on http://khersonska.land.gov.ua/ – official website of Main Department of State Service of Ukraine for Geodesy, Cartography and Cadastre in Kherson Region	Website visitors	Positive
10	13.04.2017	Publication on http://ecology.ks.ua/ – the official website of Department of Ecology and Natural Resources of Kherson Regional State Administration	Website visitors	Positive
11	25.04.2017	Public hearings taken to consider public interests when elaborating detailed territory plan and environmental impact assessment in respect of «DB WPP»	82	Positive
12	01.08.2018	Publication on http://eia.menr.gov.ua – the official website of the Ministry of Ecology and Natural Resources of Ukraine	Website visitors	Positive
13	02.08.2018	Publications in the local newspaper «Nadnipryanska pravda»	8893 copies	Positive
14	03.08.2018	Publications in the local newspaper «Prydniprovska zirka»	2000 copies	Positive
15	03.08.2018	Publication on http://bilozerka-rda.gov.ua/ – official website Bilozerskyi District State Administration	Website visitors	Positive
16	31.08.2018	Publication in http://eia.menr.gov.ua – the official website of the Ministry of Ecology and Natural Resources of Ukraine	Website visitors	Positive
17	01.10.2018	Publication on http://bilozerka-rda.gov.ua/ – official website Bilozerskyi District State Administration	Website visitors	Positive
18	03.10.2018	Publication at http://eia.menr.gov.ua – the official website of the Ministry of Ecology and Natural Resources of Ukraine	Website visitors	Positive
19	05.10.2018	Publications in the local newspaper «Nadnipryanska pravda»	8893 copies	Positive
20	05.10.2018	Publications in the local newspaper «Prydniprovska zirka»	2000 copies	Positive
21	05.10.2018	Publication on http://bilozerka-rda.gov.ua/ – official website Bilozerskyi District State Administration	Website visitors	Positive
22	23.10.2018	Publication on http://bilozerka-rda.gov.ua/ – official website Bilozerskyi District State Administration	Website visitors	Positive
23	23.10.2018	Public hearings taken to consider public interests when elaborating environmental impact assessment in respect of the OHPL for the Project	63	Positive

Issues discussed during consultations:

Land lease and easement for a part of the land plot.

The concepts of «land lease», «easement for a part of the land plot», the difference between the land lease and the easement for a part of the land plot were explained to the land owners and users. Land owners and users were familiarized with the provisions of the Land Code of Ukraine (Articles 98 - 102), the Civil Code of Ukraine (Articles 401 - 406), the Law of Ukraine «On Land Lease».

Use of agricultural land for placement of power transmission facilities.

The concept of power transmission facilities as well as the legality of their placement on land with any designated purpose was explained to the land owners and users based on the Law of Ukraine «On Energy Lands and Legal Regime of Special Zones of Energy Generating Facilities». The fact that the land plot as a whole would not be withdrawn from the owner and could be used for its designated purpose was separately emphasized, under condition of the use only with restrictions according to the easement agreement.

Conclusion and registration of the easement agreement.

Land owners and users got explanations on the procedure for technical documentation development in the terms of the easement right for a part of the land, approval and agreement of technical documentation and signing the easement agreement, registration of the easement right in the State Land Cadastre, and registration of the easement agreement in the State Register of Property Rights to Immovable Property.

Land owners and users were familiarized with the provisions of the Law of Ukraine «On Land Management», the Law of Ukraine «On State Land Cadastre». Emphasis was placed on the need to strictly adhere to the procedure for technical documentation development and for registration activities. Separate emphasis was placed on the need to agree with the lessee of the land plot (if available) the technical documentation on easement creation.

Calculation of fair compensation amounts for a particular type of easement.

To ensure involvement of the land owners, a number of consultations were held on calculation of fair compensation amount at creation of following easements:

- placement of support structures of wind turbines;
- temporary siting of machinery during construction;
- laying of underground cable line and arrangement of passage, passway;
- placement of support structures of the OHPL.

Lease agreements of land plots by Oleksandrivska, Pravdynska and Posad-Pokrovska Village Councils were analysed in terms of rent amount and possibility of its application for easement agreements.

As a result, to engage land owners in easement agreement conclusion and to minimize the number of persons rejecting agreement conclusion, there was applied the base cost of one square meter of land of Oleksandrivska Village Council as well as the factors depending on type and term of land use under the easement agreement.

Explanation of the concept of «protection zones» and the list of works prohibited in the protection zone of an overhead power line.

Provisions of the Electrical Grid Protection Procedure, approved by the Resolution of the Cabinet of Ministers of Ukraine No. 209 dated 04 March 1997 were explained to land owners and users. The main focus was on the area of the protection zone for 110 kV overhead power line of 25 meters along the entire line on both sides and on inadmissibility of fires, landfills, building houses and structures, storing flammable materials, etc. within the protection zone.

Explanation of the procedure for works in protection zones and explanation of the compensation procedure for damage caused to the land owner/user when working in protection zones.

Provisions of the Terms and Conditions of Works within Protection Zones of Electrical Grids, approved by the Resolution of the Cabinet of Ministers of Ukraine No. 209 dated 04 March 1997 were explained to land owners and users. Clause 12 of the above terms and conditions was emphasized stipulating obligation of the energy company to compensate all losses to land owners and users, as well as to bring land into condition suitable for its use according to the designated purpose.

Provisions of the Procedure for Loss Compensation Caused to Land Owners and Users, approved by the Resolution of the Cabinet of Ministers of Ukraine No. 284 dated 19 April 1993 were explained to land owners and users. According to the explanations, amount of damages is calculated based on an act of a special committee supervised by the regional state administration after revealing the caused damage; the losses shall be compensated within 30 days after the act is prepared and signed. In addition, it was emphasized that no losses would be compensated in case of non-compliance by land owners and users with the restrictions in terms of their land plots.

Clarification of the status of title documents of land owners and the need to bring them in line with applicable laws; clarification of relevant inheritance process, development of technical documentation for the restoration of the land boundaries, assigning the land cadastral number; description of the possible nuances in bringing the title documents into compliance with the applicable laws.

The land owners facing uncompleted inheritance process were provided with consultations on necessary actions to come into inheritance in accordance with the current civil laws of Ukraine and were provided with contact details of notaries, etc.

The owners with obsolete title documents (documents issued earlier, under the former standard no longer effective) were provided with consultations on the need to assign a cadastral number and register data on the land plot in the State Land Cadastre, and to have the technical documentation developed on restoration of land boundaries. Possible change was emphasized regarding configuration and area of the land plot during the procedure of boundaries restoration.

Some issues that were solved during group or individual consultations on land issues as well as some pictures of such consultations are presented in the Annex B.

Materials used during consultations:

- Printed texts of legal acts (from the official website of the Verkhovna Rada of Ukraine - http://rada.gov.ua/).
- Draft agreements in respect to easement creation for each type of land use (texts were distributed to land owners and users).
- Sample technical documentation on the part of the land subject to the easement right.
- Sample technical documentation on restoration of the boundaries.
- Sample extract from the State Land Cadastre.
- Sample extract from the State Register of Property Rights to Immovable Property and other property rights.

Consultation outcomes.

The owners of the land plots were identified in accordance with the master layout plan of Dnepro-Bugska Wind Power Plant and the OHPL; the owners agree to conclude easement agreements under the terms and conditions agreed during the consultations.

Within transfer of the land plots for use, land owners and users were thoroughly informed about the construction project and the work methods of «DB WPP» LLC.

Land owners and users received complete information about the applicable land laws in terms of use of land plots of any designated purpose for placement of electric power transmission facilities.

The investment project «Dnepro-Bugsky Wind Power Plant» after development of Feasibility study in accordance with the Law of Ukraine «On Ecological expertise» (the law has lost its force 18.12.2017) has received a **positive Conclusion of the State Environmental Expertise.** For the construction the OHPL, a **positive Conclusion on the Environmental Impact Assessment is reached**, Annex A.

2 PROJECT DESCRIPTION

2.1 Geographical location of project

The Project will be located alongside the banks of the Dnipro-Bugsky Estuary at the territory of Oleksandrivka Village Council in Bilozerskyi District of Kherson Region on the Southern Ukraine (Fig. 2.1).

Coordinates of conditional center of «DB WPP» wind field in coordinate system WGS-84 are 46°38'59.45" of northern latitude and 32°03'8.82" of eastern longitude.

Fig. 2.1. Location of Project on map of Ukraine

Bilozersky District is located in the south-western part of the Kherson Region within the Black Sea Lowland. The total area of the Bilozerskyi District is 1.7 thousand km². The area of «DB WPP» wind field, suitable for placement of WTs is approximately 4 500 ha (Fig. 2.2).

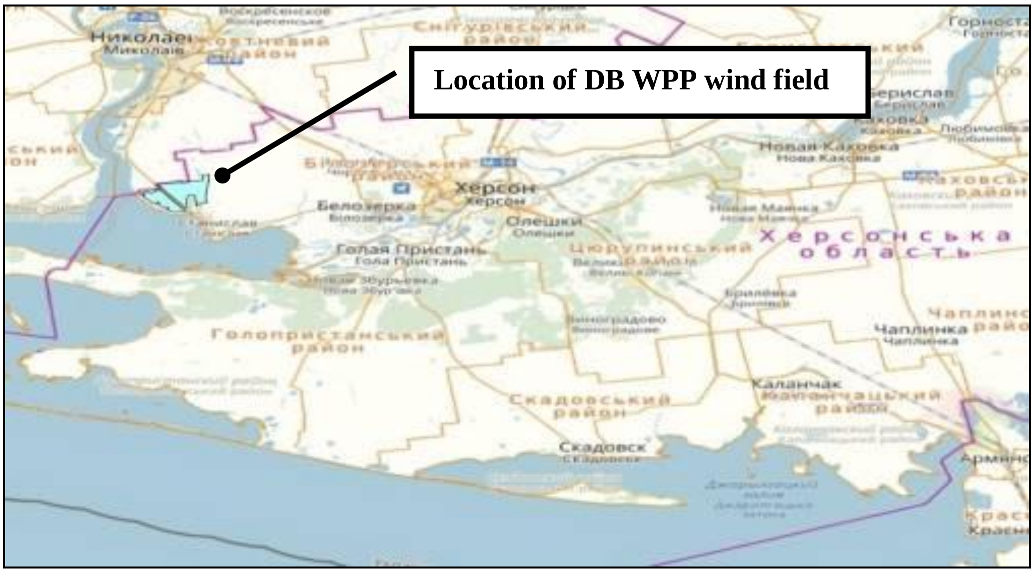


Fig. 2.2. Location of «DB WPP» wind field on map of the South of Ukraine

2.2 Description of lands used for placement of the Project objects

The EBRD Performance Requirement 5 on Land Acquisition, Involuntary Resettlement and Economic Displacement (hereinafter – PR 5) applies to this Project, the main goals of which are as follows:

- to avoid or, when unavoidable, minimize, involuntary resettlement by exploring alternative project designs;
- to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of and access to assets and land by:
  - providing compensation for loss of assets at replacement cost;
  - ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected;
  - ·to improve or, at a minimum, restore the livelihoods, income earning capacity and standards of living of all displaced persons, including those who have no legally recognisable rights or claims to the land, to pre-displacement levels or to levels prevailing prior to the beginning of Project implementation, whichever is higher.

For the purpose of this Project the Livelihoods Restoration Plan (LRP) will be prepared which will take into consideration the requirements of the Ukrainian legislation and EBRD PR 5. The project will not cause physical displacement; all impacts are limited to short term and long term temporary easements and restrictions to be imposed due to installation of supporting structures of towers, overhead lines, and other project related works. Other impacts include the damage to standing crops and partial loss of productivity of affected agricultural lands.

A total of 279 land parcels will be affected out of which 138 are registered/legalized, 141 are legalizable. There no non-legalizable/unauthorized land parcels. Total land required for the Project is 1,131,000 square meter (sqm) equivalents to 113.1 hectare (ha). Out of the total land required, 920,000 sqm (92 ha) is private land and 210,100 sqm (21.1 ha) is state land. Total number of agricultural parcel is 279. None private non-agricultural parcels are affected by the Project. No trees will be affected due to use of private land for the Project. Total area of 920,000 sqm (92.00 ha) is affected by cereals crops. No structures are affected.

No cases of residential tenants have been recorded. There are no households, who will lose more than 10% of their productive asserts due to land related impacts in the Project. No cases of vulnerable households have been recorded. Total number of affected households is 295.

The summary of impacts related to land acquisition is given in Table 2.1.

Table 2.1 – Summary of Impacts related to Land Acquisition

№	Impacts	Unit of Quantification	Quantity
1	Total Land Requirement	Square meter (Hectare)	1,131,000 sqm (113.1 ha)

№	Impacts	Unit of Quantification	Quantity
2	Private Land	Square meter (Hectare)	920,000 sqm (92 ha)
3	State Land	Square meter (Hectare	210,100 sqm (21.1 ha)
4	Land parcels	Number	279
5	Registered Parcel	Number	138
6	Legalizable Parcel	Number	141
7	Non-legalizable/unauthorized Parcel	Number	0
8	Agricultural Land Parcel	Number	279
9	Non-Agricultural Land Parcels	Number	0
10	Area of Agricultural Land (Registered and Legalizable)	Square Meter	920,000 sqm (92 ha)
11	Area of Agricultural Land (Non- Legalizable)		0
12	Area of Non-Agricultural Land	Square Meter	0 sqm (0 ha)
13	Area under Cereals Crop Cultivation	Square Meter (Hectare)	920,000 sqm (92 ha)
14	Area under Vegetables Crop Cultivation	Square Meter (Hectare)	0 sqm (0 ha)
15	Fruit Tress	Number	0
16	Non Fruit/Timber Trees	Number	0
17	Total number of structures	Number	0
18	Residential Houses	Number	0
19	Commercial Structures/ Shops	Number	0
20	Structures needing Relocation	Number	0
21	Severely Affected Households	Number	0
22	Vulnerable Households	Number	0
23	Affected Households	Number	295

Source: Census Survey, November, 2017 to November, 2018

The households living in the Project area are not having a good quality of life. Due to the lack of active business activity in the area of development of the Project many families or some family members moved to the nearest cities (Kherson or Mykolaiv) or abroad in search of work. For example, Oleksandrivka and Pravdino village councils are geographically located in the steppe zone of southern Ukraine with no industrial enterprises and transport infrastructure which limits the employment and income-generating opportunities for the local population. At the same time, if we compare the level of employment and income of the population of these villages with Posad-Pokrovske

Village, the standard of living of the local population of the latter is somewhat higher, since the M-14 Odessa-Melitopol-Novoazovsk international road passes through its territory.

The main activity of the households, living in the Project area, is growing of agricultural crops (vegetables and fruits), breeding of cattle, hens. The source of income is the proceeds from the sale of grown products, obtained sour-milk products, eggs and meat in local markets.

The average monthly expenses of households are at the level of about 3,500 UAH, while their largest part (40%) is spent on food. Other expenses, such as health care, clothing, water and electricity make an average of 60%. The majority of local population relies on pensions for their main source of income. The proposed Project will benefit the local population as this will bring development to the area in terms of local employment during the Project implementation. The local community is eager to be employed for the Project related works.

During 2017-2018, around 200 consultation meetings were held with the owners and users of land involved for Project construction within the territory of Oleksandrivska, Pravdynska and Posad-Pokrovska village councils to ensure awareness of affected people. Consultations with public and stakeholders were held over several stages of the Project, among which are public hearings during development of a detailed territory plan, environmental impact assessment and inventory of land plots.

Format of consultations were individual and group ones, which involved both men and women participants. Consultations were held with all land owners and users and included, among other things, information on the issues relating to land use during construction and operation of a wind power plant and an overhead line, the rights and obligations with regard to the Project, information on compensation and entitlements for losses incurred, the details of signing servitude agreements. The consultations will be continued throughout the Project cycle.

The project information will be further disseminated through disclosure of LRP. LRP will be translated to Ukrainian language and will be made available at the «DB WPP» LLC office and at affected village level upon request.

A grievance mechanism is established to allow affected people to appeal any disagreeable decision, practice or activity arising from land or other assets compensation. The affected people will be fully informed of their rights and of the procedures for addressing complaints whether verbally or in writing during further consultations and during the compensation payment. The affected people may file a complaint to the office of «DB WPP» LLC. The contact person for receiving complaints, objections and proposals from the affected households is the Head of «DB WPP» LLC. The affected people can approach the court of law at any time.

The legal and policy framework of the Project is based on national legislations related to land in Ukraine and EBRD’s PR 5. Based on the analysis of applicable laws and policies and EBRD’s Policy requirement, Project related principles have been adopted. The affected people entitled for compensation and livelihoods rehabilitation provisions under the Project are: (i) who have formal legal rights to the land (including customary and traditional rights recognised under national laws); (ii) who do not have formal legal rights to land at the time of the census, but who have a claim to land that is recognised or recognisable under national laws; or (iii) who have no recognisable legal right or claim to the land they occupy.

Key Policy Principles to be adopted by the Project are:

– Efforts must be made to avoid and minimize involuntary resettlement impacts whenever possible – especially physical displacement. When resettlement cannot be avoided, mitigation of potential impacts is required;

– Ensure that the affected households without titles to land are eligible to resettlement assistance and compensation for the loss of non-land assets;

– If resettlement impacts occur, the resettlement or/and livelihood restoration plan need to be prepared, specifying the affected persons' entitlements, livelihoods restoration strategy, institutional arrangements, monitoring and reporting requirements, budget, and time-bound implementation schedule;

– Extend the compensation and provide other resettlement entitlements before physical and economic displacement take place;

– Meaningful consultations need to be carried out with the affected people, which involves consulting affected parties on their entitlements and rights;

– Special provisions should be made for those affected people who belong to the vulnerable groups, so as to improve their living standards and well being;

– Ensure that the project monitors and assesses the resettlement outcomes, impacts on standards of living of the affected people, and if the objectives of the resettlement and/or livelihoods restoration plan have been achieved;

– A grievance redress mechanism needs to be put in place to receive and facilitate the resolution of affected people's concerns;

– In cases when temporary easements or other forms of restrictions are imposed on land plots, the project needs to ensure that the affected people are compensated for temporary impacts associated with the easements/restrictions and the affected lands are restored to pre-project level.

All compensation related costs will be considered an integral part of the Project cost. The total estimated cost for the LRP for Project is approximately 23,32 million UAH equivalents to Euro 728725,00.

«DB WPP» LLC will have lead responsibility for implementation of the Project as well acquisition of land and implementation of the LRP. «DB WPP» LLC is assisted by a number of private agencies in the design, construction and operation of the Project. The Project will cover three villages in one administrative district.

The time for implementation of the LRP will be scheduled as per the overall project implementation. All activities related to the economic displacement must be planned to ensure that compensation is paid prior to displacement and commencement of civil works, where it is possible. Public consultations, monitoring and grievance redress will be undertaken throughout the Project duration. «DB WPP» LLC will monitor and assess the progress of implementation of the LRP. The extent of monitoring activities will be commensurate with the Project's risks and impacts. In addition to recording the progress in compensation payment and other land acquisition activities, «DB WPP» LLC will prepare an annual monitoring report to ensure that the implementation of the LRP has produced the desired outcomes. The results will be communicated to the EBRD annually.

Immediately after the implementation of the LRP the «DB WPP» LLC will prepare the Completion Report, which will be submitted to EBRD for review and approval.

In Annex B to this ESIA contains summary on land acquisition and resettlement impacts.

2.2.1 Lands for the construction of the «DB WPP»

Construction of the «DB WPP» implies installation of 25 wind turbines with sites of maintenance and technological roads alongside field windbreaks and agricultural roads. The average distance between WTs is approximately 470-1700 m (5-7 diameters of WT rotor) in compliance with the WT installation limits, set in urban planning rules and other legal acts of Ukraine.

All objects of «Dnepro-Bugsky WPP» will be placed entirely on state-owned lands, not designated to use (land reserve). The land reserve at the territory of Oleksandrivska Village Council belongs to the category of agricultural lands. Therefore, the requirements of the Article 23 of the Land Code of Ukraine (LCU) «Priority of lands for agricultural purposes» will be taken into account during «DB WPP» placement [101].

A central transformer substation (CTP) with control point (CP) will be placed on the lands of reserve classified as pastures. Project design foresees allocation of 25 land plots (20x50, area 0,1 ha) in planned and existing field windbreaks and territories of pastures and abandoned farm backyards. The size of each land plot to be allocated in field windbreaks is determined by the actual width of field windbreak with an attached agricultural road of appropriate length to ensure necessary space for WTs placement. For installation of the «DB WPP» wind turbine, the planned and existing field windbreaks will be used. The territory of 1.8 ha allocated for placement of central transformer substation and control point consist of two parts:

– for placement of CP – 0.6 ha;
– for placement of CTS – 1.2 ha.

During construction period, the short-term use of additional state owned and private lands (based on the contract of easement), without changing the land use category is provisioned. For the period of each object construction, the additional land plots among state owned lands and lands of private ownership will be allocated. These land allocated in short term use without changing their category (purpose). Allocation of lands is based on easements agreement (Article 98 of LCU). In order to organize internal technological roads and roads for construction equipment, the allocation of the already existing and designed economic paths and agricultural roads with width of 5 m is planned (based on the agreement of easement).

The additional short-term use of private lands (based on the contract of easement) of area up to 0.8 ha (around already allocated plots of area 0.1 ha in windbreaks for long-term rent to install WTs) and additional land plots from state-owned lands in windbreaks of area 0.2 ha is planned for WTs installation.

The total area of lands in the long-term rent is 4.3 ha. These lands meet the urban-planning requirements and restrictions of special planning. Information about lands for «Dnepro-Bugsky WPP» is presented in Table 2.2.

Table 2.2 – Lands for «Dnepro-Bugsky WPP»

Number of land plot for WTs	Cadastral number of plot	Area of land plots, ha
2	6520380500:02:001:0151	0.1
3	6520380500:02:001:0150	0.1
4	6520380500:02:001:0172	0.1
5	6520380500:02:001:0149	0.1
6	6520380500:02:001:0160	0.1
7	6520380500:02:001:0143	0.1
8	6520380500:02:001:0152	0.1
9	6520380500:02:001:0175	0.1
10	6520380500:02:001:0142	0.1
11	6520380500:02:001:0159	0.1
12	6520380500:02:001:0158	0.1
13	6520380500:02:001:0141	0.1
14	6520380500:02:001:0140	0.1
16	6520380500:02:001:0168	0.1
17	6520380500:02:001:0169	0.1
18	6520380500:02:001:0148	0.1
19	6520380500:02:001:0139	0.1
21	6520380500:02:001:0138	0.1
23	6520380500:02:001:0156	0.1
25	6520380500:02:001:0155	0.1
32	6520380500:02:001:0144	0.1
34	6520380500:02:001:0133	0.1
35	6520380500:02:001:0134	0.1
36	6520380500:02:001:0135	0.1
37	6520380500:02:001:0136	0.1
CTS and CP	6520380500:02:001:0163	1.8
TOTAL		**4.3**

During «DB WPP» construction, in accordance with the construction phase and start complexes of construction, the short-term use (up to 3 years) of private land plots, adjacent to WT sites (approximately 1 ha near each WT), is envisioned. These sites (crane mounting sites) will be used for placement of construction and installation equipment, assembling of WT components (tower sections, nacelle with rotor, blades, and rotor hub), and temporary storage of soil and construction wastes during the period of construction and installation works. The already existing and designed state-owned agricultural roads of 5 m in width will be used for organize internal technological roads. In addition, the temporary easements on agricultural roads (on construction period) for cable laying and coating arrangement will be established. The private lands used during construction phase will be returned to landowners and land holders after the completion of construction.

The lands under public roads are state-owned, and after completion of construction will remain in public use. The limitations, applied for WTs installation (in compliance with the urban planning rules and other legal acts) are presented in Table 2.3.

Table 2.3 – Limits applied for WT installation in compliance with the urban planning rules and other legal acts of Ukraine

Type of limitation	Distance, m
WT distance from public roads	200
WT distance from the shoreline of the Dnipro-Bugsky Estuary	500
WT distance to the shoreline of the Lake Solonets	500
Noise buffer zone (SPZ) for «DB WPP»	700
WT distance from the territory designated for Khablivsky leg of Habliv Klim of Dnipro-Bugsky Estuary Channel (HKBDEC) – 6˚	80
WT distance from the Landscape Reserve «Oleksandrivskyi»	100
WT distance from the buffer zones of archeological objects	150

In addition, the temporary assesment for arrangement of technological gravel roads (or any other paved roads), used for transportation of construction and installation equipment and WT components will be established.

The configuration of «DB WPP» wind field and the typical location scheme of land plots for the objects of «Dnepro-Bugsky WPP» are presented in Fig. 2.3 and Fig. 2.4, respectively.

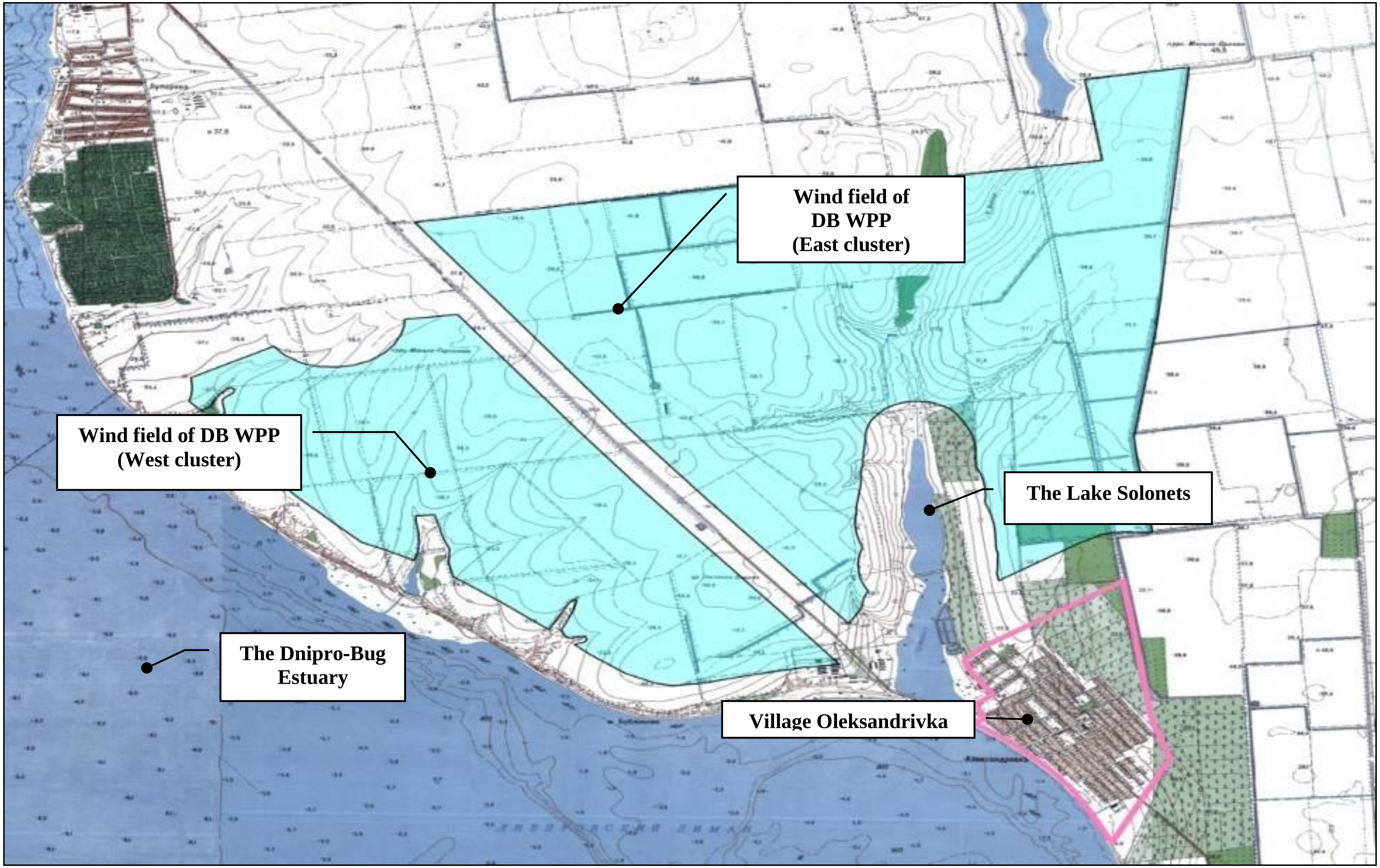


Fig. 2.3. Configuration of «DB WPP» wind field

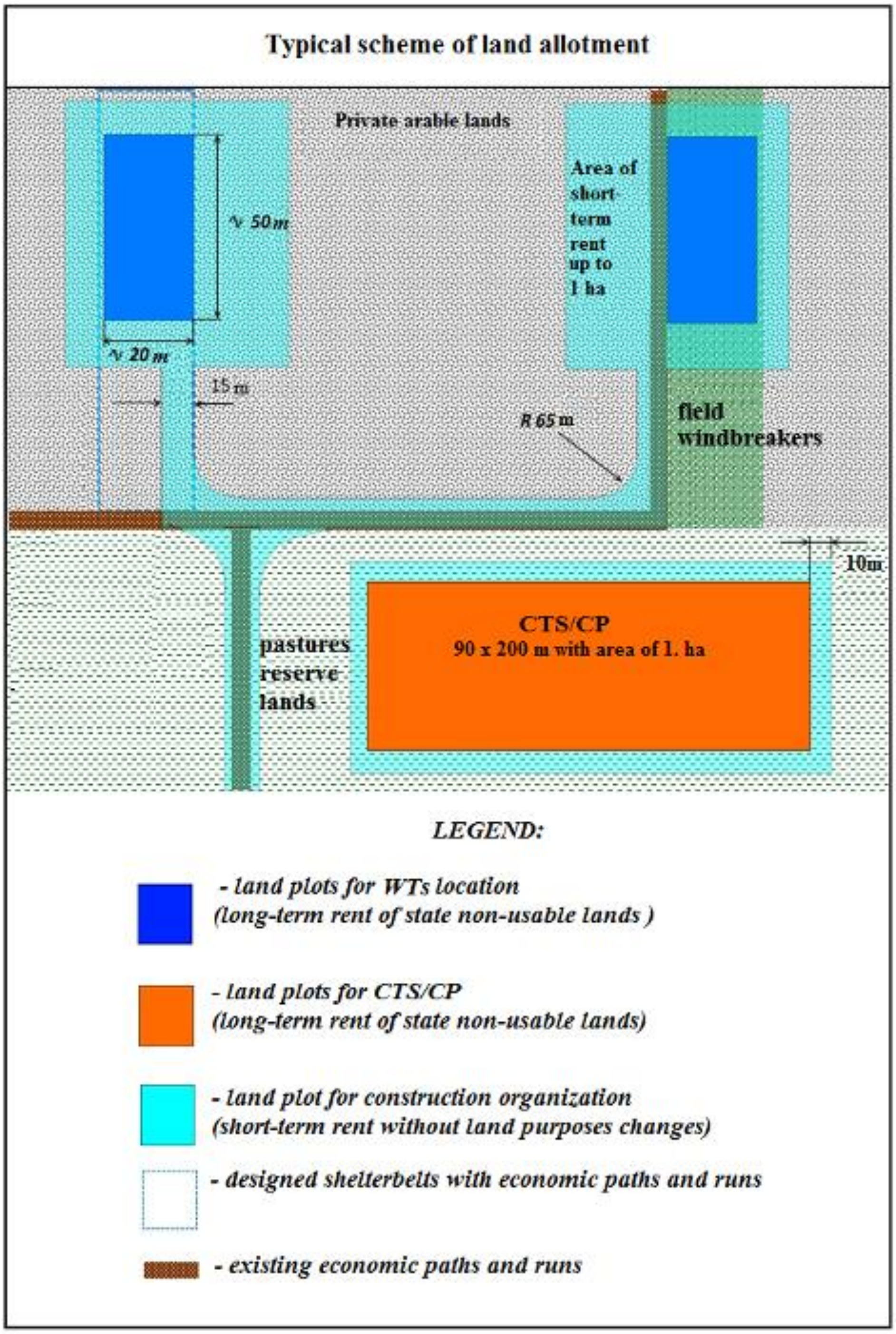


Fig. 2.4. Typical scheme of land plots designated for main objects of «Dnepro-Bugsky WPP»

A number of measures, offered by the project for implementation, will prevent any impact of «DB WPP» on the specially protected areas. Construction and operation of «DB WPP» is not classified as activities and objects of high environmental hazard and will not have significant environmental impact, according to Ukrainian legislation (DBN A. 2.2-1-2003 [78]) as by European environmental laws (the EIA Directive 2014/52/EU).

Conclusion: construction and operation of «DB WPP» will not cause significant impacts on the lands of the local communities.

2.2.2 Lands for the construction of the OHPL

Estimated sizes of land plots under the pylons of the OHPL are given in Table 2.4.

Table 2.4 – Estimated size of land plots under the pylons of the OHPL

№	Type of pylon	Sketch of the land plot under the pylons	Pylons base, m	A', m	Area of permanent land allocation, m^2	Area of temporary land allocation, m^2
1	У 110-2	scheme 1	4.8×4.8	5.52	50.7	400
2	У 110-2+5	scheme 1	6.3×6.3	7.02	74.3	400
3	У 110-2+9	scheme 1	7.5×7.5	8.22	96.4	400
4	У 110-2+14	scheme 1	9.0×9.0	9.72	128.1	400
5	У 220-2В	scheme 1	5.2×5.2	5.95	57	550
6	У 220-2В+5	scheme 1	6.7×6.7	7.45	81.9	550
7	У 220-2В+9	scheme 1	7.9×7.9	8.65	105.1	550
8	У 220-2В+14	scheme 1	9.4×9.4	10.15	138.1	550
9	П 150-2В	scheme 2	2.8×2.8	3.2	23.04	400
10	П 150-2В+4	scheme 2	3.2×3.2	3.6	27.04	400

The pylons of the OHPL will be located on the lands of private and state ownership. The plot along the route of the OHPL of 10 m in width, respectively, of total are about 27.215 hectares will be used during construction and installation works. The total area of the territory of village councils, within the territory of which the OHPL pass is 206.5 km^2. Technological passes for the OHPL are not foreseen in the time of operation.

The sizes of the land plots under one pylon for all types of possible use of the pylons (without taking into account the foundation part) are given on Fig. 2.5.

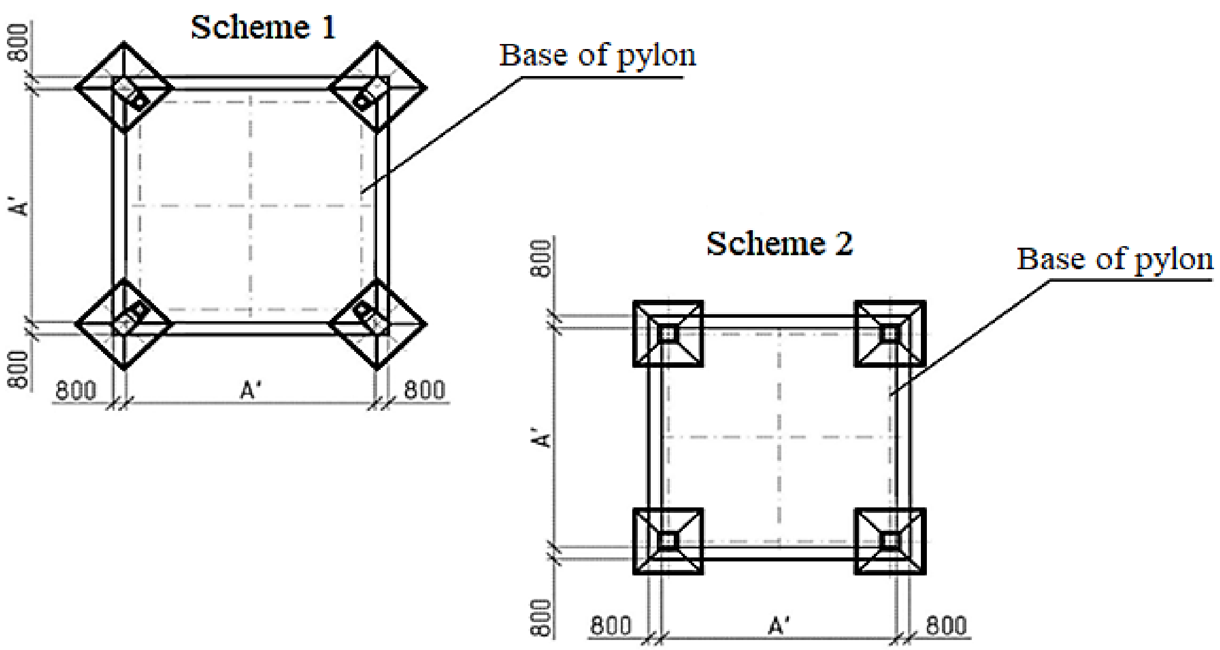


Fig. 2.5. Schemes of sketches of land plots of pylons of the OHPL

The land plots about 20.5 hectares in total will be used for the construction purposes. The distance between the pylons of the OHPL will be between 100 and 150 meters, depending on the distance between the angles of the OHPL. Distribution the pylons of the planned OHPL at the territories of Oleksandrivska, Pravdinska and Posad-Pokrovska village councils is given in Table 2.5.

Table 2.5 – Distribution of the pylons of the planned OHPL on the territories of the Oleksandrivska, Pravdinska and Posad-Pokrovska village councils

№	Type of pylon	Village councils		
		Oleksandrivska	Pravdinska	Posad-Pokrovska
1	У 110-2	2	3	4
2	У 110-2+5	7	3	1
3	У 110-2+9	-	-	1
4	У 110-2+14	-	4	3
5	У 220-2В	4	4	-
6	У 220-2В+5			
7	У 220-2В+9	-	-	2
8	У 220-2В+14	-	1	-
9	П 150-2В	40	81	32
10	П 150-2В+4	-	-	2
Total		**53**	**96**	**45**

Information on the lands area allocated for the installing of the OHPL pylons, within the boundaries of the Oleksandrivska, Pravdinska and Posad-Pokrovska village councils is given in Table 2.6.

Table 2.6 – Areas of land allocated for the installation of the OHPL pylons

Land area	Village councils		
	Oleksandrivska	Pravdinska	Posad-Pokrovska
	1771.1 m^2	3119.74 m^2	1759.36 m^2

By the Resolution of the Cabinet of Ministers of Ukraine «On Approval of the Rules for the Protection of Electric Networks» No. 209 of March 4, 1997, security zones along the OHPL are established. These zones have form of a land plot and airspace limited by vertical planes, which are remote on both sides of the line from the extreme wires provided that they are not rejected their position at a distance of 25 m for the OHPL with a voltage of 150 kV.

In the security zones it is prohibited or limited: to growg trees or vineyards, to conduct earthworks, to build structures, to irrigatate crops, etc.

Conclusion: the construction and operation of an air power transmission line will not lead to significant impacts on the lands of the local communities.

2.3 Short description of «DB WPP» objects and their placing

2.3.1 Description of the objects of the «DB WPP»

The main objects of «Dnepro-Bugsky wind power plant» are:
- wind turbines;
- central transformer substation (CTS) 150/35 kV;
- control point of «DB WPP» (CP);
- cable lines (CL) 35 kV and cable management and communication lines.

General Scheme of «DB WPP» objects location is presented in Annex C.

The installation of WTs was done by the specialized Spanish firm «EREDA», with consideration of:
- existing and future development of residential area in Oleksandrivka village;
- avoidance of mutual wind shading effect;
- optimal territorial development;
- sanitary-protection zone (700 m from residential area);
- abrasion prevention distance (500 m from coastal line of the Dnipro-Bugsky Estuary and the Lake Solonets);
- buffer zone (100 m from the boundaries of the Landscape Reserve «Oleksandrivskyi»);
- existing relief;
- protection zone of archaeological objects;
- restriction sector of the Zadnii Chablivskyi lighthouse – 6 degree;
- boundary of the buffer zone of engineering infrastructure (200 m from the road section № 0220225: border of Mykolaiv region - Stanislav-Bilozerka);
- convenience of service and access of vehicles.

The Central Transformer Substation 150/35 kV with a control point (CTS/CP) will be placed in the central part of «DB WPP» wind field. The WTs Nordex N 149/4.0-4.5 (of nominal capacity 4.4 MW and height to the rotor axis 105 m, manufactured in Germany) are main generating equipment of the Project.

An essential feature of this WT model is the low speed of rotor rotation. Due to innovations in the design of powertrains, the speed of rotor rotation is reduced to 7.9-14.4 rpm. This design significantly reduces the noise level of wind turbines and, in addition, decrease risk of bird collisionss with the moving blades of WTs. The offered WT model can operate provided average temperatures in the normal climatic range, and even at temperatures not lower than -20 °C. Due to the improved design of generator cabin, the work area is safe and spacious with expanded evacuation and rescue exits. The set of wind turbines supply consist of: gondola, rotor, gearbox, gearbox shaft, generator, cooling and filtration system, braking system, hydraulic system, rotary system, mast and base, package for connection to external networks, control and safety system, lightning protection, operational control system, fire extinguishing means, emergency autonomous lighting.

Main technical information about WT Nordex 149/4.0-4.5 is presented in Table 2.7.

Table 2.7 – Main technical information about WT Nordex N 149/4.0-4.5

Operating data		
1	Rated power (Nominal capacity)	4 400 kW
2	Cut-in wind speed	3.0 m/s
3	Cut-out wind speed	20 m/s
Rotor		
4	Diameter	149.0 m
5	Swept area	17.460 m²
6	Operating range rotational speed	7.9–14.4 rpm
7	Rater rotational speed	12.6 rpm
8	Tip speed	86.2 m/s
9	Speed control	Variable via microprocessor
10	Overspeed control	Pitch angle
Gearbox		
11	Type	3-stage gearbox
Generator		
12	Construction	Doubly fed asynchronous generator
13	Cooling system	Liquid/air cooling
14	Voltage	660 V
15	Grid frequency	50/60 Hz
Brake systems		
16	Main brake	Aerodynamic brake
17	Holding brake	Disc brake
Lighting protection		Fully compliant with IEC 61400-24
18	Hub height	105 m

The project design foresees distribution of «DB WPP» construction on 4 stages, Table 2.8.

Table 2.8 – Queues of «DB WPP» start complexes construction

Options	Company-manufacture	Capacity of WPP by taks, MW	Nominal capacity of one WT, MW	Total					
				1-st start stage	2-nd start stage	3-rd start stage	4-th start stage	Number of WTs, un	Capacity of WPP, MW
1	Nordex Energy Gmbh (Germany)	110	4.4	№ 16, 17, 18, 19, 21, 23 (6 un.)	№ 10, 11, 12, 13, 14, 25, (6 un.)	№ 2, 3, 4, 5, 6, 7, 8, 9 (8 un.)	№ 32, 34, 35, 36, 37 (5 un.)	25	110

First stage includes:

- construction of central transformer substation (design is carried out by an individual project);
- construction of a control point;
- construction of an access road to CTS and CP;
- installation of six wind turbines N 149/4.0-4.5 with a nominal capacity 4.4 MW each (WTs – 16, 17, 18, 19, 21, 23) with arrangement of building and assembly sites and construction of technological roads (entrances);
- construction of cable lines 35 kV and cable lines of communication.

Second stage includes:

- installation of six WTs N 149/4.0-4.5 with a nominal capacity 4.4 MW each (WTs – 10, 11, 12, 13, 14, 25) with arrangement of building and assembly sites and construction of technological roads (entrances);
- construction of cable lines 35 kV and cable lines of communication.
- arrangement of adjacent technological roads to the highway 0220225.

Third stage includes:

- installation of eight WTs N 149/4.0-4.5 with a nominal capacity 4.4 MW each (WTs – 2, 3, 4, 5, 6, 7, 8, 9) with arrangement of building and assembly sites and construction of technological roads (entrances).

Fourth start complex includes:

- installation of five WTs N149/4.0-4.5 with a nominal capacity 4.4 MW each (WTs – 32, 34, 35, 36, 37) with arrangement of building and assembly sites and construction of technological roads (entrances);
- construction of cable lines 35 kV and cable lines of communication.

The own energy needs of «DB WPP» will be covered from existed PL 35/10 «Oleksandrivska» and «DB WPP» CTS 150/35 kV.

Individual WTs will be connected by cable power lines into united electrical engineering unit of «DB WPP». The electrical networks of «DB WPP» from wind turbines to CTS will consist of electrical cables 35 kV, earth hidden in trenches of medium width 1.6 m and depth 1.0 m, under or between technological roads and field windbreakers.

At the territory of the central substation the following objects will be placed:

- general station control point (GSCP);
- open switchgear 150 kV (OS 150 kV);
- emergency oil collector;
- control point building (CPD);
- checkpoint (CP);
- fire extinguishing pumping station;
- water storage tank V=150 m^3;
- household wastewater tank V=10 m^3;
- on-site containers for domestic and industrial solid wastes;
- covered garages for service vehicles;
- artesian well.

Reinforced concrete fence will surround the territory of central transformer substation. Also, at the territory of CTS, the water supply network, household sewage system and oil drainage network will be mounted. Due to small volume of sewage waste waters (2.0 l/s, 1.02 m^3/hour, 2.4 m^3/day) and considerable distance from the settlements with central canalization and treatment facilities, the household waste water will be collected at the territory of CTS and exported to treatment facilities. The insignificant volumes of solid household wastes will be transported to the specialized sites designated for these purposes by the local authorities. Location of specialized sites will agree with relevant executive authorities during the design stage of «DB WPP». The overall duration of «DB WPP» construction will not exceed 12 months. The Project provides creation of temporary working places during construction works (approximately 250 places). It is planned that 50-70 people can be simultaneously involved in construction process. Temporary warehouses for the period of construction are planned at the project site. They will preferably be used to store construction materials and office space. The list of main construction equipment and mechanisms used for construction of «DB WPP» is presented in Table 2.9.

Table 2.9 – List of main construction equipment and mechanisms used for «DB WPP» construction

№	Machine, mechanisms	Amount
1	Automatic concrete mixer	18
2	Automatic concrete pump	12
3	Automobile hydraulic lifter, lifting height – 12 m	4
4	Automobile hydraulic lifter, lifting height –28 m	3
5	Motor grader of medium class, capacity – 135 hp	7
6	Motor grader of medium class, capacity 165 hp	5
7	Automatic tar sprayer, capacity 7000 liters	2
8	Dropside truck, load capacity – 5 t	13
9	Dropside truck, load capacity – 8 t	13
10	Dropside truck, load capacity – 15 t	10
11	Dumptruck, load capacity – 7 t	13
12	Forklift truck, lifting capacity –5 t	5
13	Welding unit, mobile, with petrol engine, and rated welding current 250-400 A	8
14	Welding unit, mobile, with diesel engine, and rated welding current 250-400 A	10
15	Welding and cutting gas apparatus	3
16	Bucket for concrete, capacity 2 m^3	10
17	Bulldozer, power 108 hp	5
18	Bulldozer, power 130 hp	4
19	Bulldozer, power 180 hp	4
20	Bulldozer, power 80 hp	5
21	Deep vibrator	19
22	Surface vibrator	20
23	Jack hydraulic, lifting capacity 100 t	1

№	Machine, mechanisms	Amount
24	Single-skid diesel excavator on crawler, capacity of a bucket – 0.65 m^3	7
25	Single-skid diesel excavator on crawler, capacity of a bucket – 0.5 m^3	8
26	Single-skid diesel dredger on a pneumonia-chainsaw, capacity of a bucket – 0.25 m^3	12
27	Mobile power station, capacity – 10 kW	3
28	Mobile power station, capacity – 4 kW	4
29	Mobile power station, capacity – 2 kW	4
30	Mobile compressor with internal combustion engine, pressure 686 kHa (7 atm.), productivity 2.2 m^3/min	6
31	Mobile compressor with internal combustion engine, pressure 686 kHa (7 atm.), productivity 5.0 m^3/min	6
32	Diesel pile hammer with diesel hammer of mass 2.5 t	3
33	Cam follower roller, weight 8 t	6
34	Self-propelled vibratory road roller, weight – 13 t	8
35	Self-propelled vibratory road roller, weight 8 t	9
36	Crane automobile Liebherr LTM 1200/11, Q=200 t	2
37	Crawler cranes Liebherr LR 1600/2, Q=600 t	2
39	Crawler-mounted crane, lifting capacity – 50-63 t	5
40	Crawler-mounted crane, lifting capacity 25 t	5
41	Crawler-mounted crane, lifting capacity up to 16 t	1
42	Portable crane, lifting capacity 1 t	8
43	Pipe-laying crane	1
45	Electric pulling winch, pulling force 2 t	3
46	Electric pulling winch, pulling force 3.2 t	4
47	Electric pulling winch, pulling force 5 t	3
48	Drill crane truck, drilling depth 3.5 m	2
49	Street washer, capacity 6000 L	8
50	Electric Grinding machine	2
51	Air hammer, working from mobile compressors	10
52	Single action crank press	4
53	Combined press scissors	4
54	Spreader of gravel and crashed stones	5
55	Trailer scraper (with crawler), bucket capacity 8,0 m^3	6
56	Pumping station for driving of hydraulic jacks	1
57	Crawler, capacity 108 hp	6
58	Pneumatic tamping machine working from compressor	8
59	Tamping machine, manual	15
60	Welding transformer with rated welding current 315-500 A	6
61	Truck tractor, load on the fifth wheel coupling, 14.5 t	13
62	Machine for borehole drilling up to 30 m, diameter up to 600 mm	3
63	Electric arch hand welder (constant current)	10

2.3.2 Description of the objects of the OHPL

2.3.2.1 Wires and cables

On the OHPL, which is being designed, is intended for hanging cables of the brand AC-240/32 EOCT 839-80E (one wire in phase) and a lightning protection cable with a built-in fiber-optic module.

The section of the steel part of the wire is made on the basis of icing loads in accordance with 2.5.89 ПУЕ:2017.

The maximum voltage in the wires is based on the strength of the projected pylons, with the normalized distances between the wires and the cable, as well as the dimensions of the wires to the intersecting structures.

Maximum voltage between the anchor-angle pylons for the new wire of the brand AC 240/32 is adopted 122 MPa. The maximum voltage in the wires on the anchor sections with intermediate supports must be reduced to 70 MPa, based on the strength of the intermediate metal pylons.

According to the norms for limiting the asymmetry of currents and voltages OHPL 150 kV is performed with the opposing alternation of the phases of the circles (the adjacent phases of the different circles must be different). Protection of the OHPL 150 kV from direct lightning strikes is carried out by lightning protection cable with built-in fiber-optic module on 24 optical fibers (OKTG-24).

The main design parameters of the wires and cables that are required to complete the working documentation are given in Table 2.10.

Table 2.10 – Basic design parameters of wires and cables

Wire/cable brand	**Un.**	**AC 240/32**	**OKTG-24**
Diameter	mm	21.6	12Д
Section	mm	275.7	82
Section of the aluminum part	mm^2	244	34
Section of the steel part	mm^2	31.7	34
The ratio of cross sections of aluminum and steel	–	7.69	1
Weight is 1 km	kg	921.0	375.0

2.3.2.2 Insulation and linear fittings

The type and dimensions of the insulators, as well as the structural performance of the suspensions were determined by the magnitude of the electromechanical load acting on the suspension, as well as the dimensions of approaching the grounded parts of the support with the deviation of supporting suspensions by the wind.

In order to reduce the length of supporting pendants, their complete set is made of dirt-resistant insulators.

Wires of the OHPL are fixed to the pylons by means of insulating pillars with the following number of glass insulators, Fig. 2.6.

Type of suspension	Type insulator	Number of insulators, units.
Stretch Single Chain	ПСВ120Б	13
Stretch single-link to the portal	ПСД70Е	13
Supporting Single Chain	ПСД70Е	13
Single Chain for Stroke Loop	ПСД70Е	13

Fig. 2.6. Glass insulator

The tensioning and supporting clamps that are necessary for fixing the optical cable of the OKGT-24 must be made with spiral and provide long and reliable cable operation, eliminate cable movement in the clamp, and do not cause damage to the cable during operation, which is suspended on the pylons of the OHPL.

The cable tensioning in tensile, retaining clamps and other mounting fittings must be carried out in accordance with the installation instructions to be provided by the cable manufacturer or clamps.

For direct merging of the construction lengths of the rope OKGT-24, special couplings are used. The height of the placement of the coupling sleeves on the supports of the submarine must be not less than 5 m from the base of the support, but not higher than the height of the upper crossbar.

The construction of the clutches and materials from which it is made must be hermetic and resistant to shelling of hunting weapons, mechanical loads and the following climatic conditions:

- high temperature of the environment, taking into account the heating of the sun not lower than +70° C;
- reduced ambient temperature to - 60° C;
- cyclic temperature action;
- rain, wind, ice and combination of ice and wind;
- ultraviolet radiation and aggressive media;
- vibration loads;
- clamping the ends of the cables coming out of the sleeve must be resistant to bending and torsion.

The coupling sleeves are fixed on the pylons by means of special fasteners manufactured by the installation organization according to the drawings drawn up in the working documentation. The couplings are completed according to the types and number of connecting fiber optic cables. With the agreement of the customer and the supplier, together with the kit of the clutch, additional parts and mounting devices for the coupling can be supplied.

The length of the shutters OKGT-24 to the couplings are provided taking into account the possibility of mounting the couplings on the ground and the required technological stock. When attaching slopes to the pylons, the minimum acceptable radius of bending of the optical cable must be observed. Spacers of the optical cable on the pylons are mounted with special clamps.

2.3.2.3 Positioning and repositioning of the pylons

The arrangement of the pylons is made on the basis of engineering surveys for the metal intermediate support P150-2B with height to the lower traverse 19 m, wires AC 240/32 with the estimated voltage = 70 MPa, proceeding from the maximum allowable wind run for the intermediate support of 150 m and the minimum calculated size to the ground – 6,5 meters for the uninhabited area.

In accordance with the terms of reference, the Project provides installation of 196 pylons, of which:

- 156 intermediate pylons of type П 150-2В and П 150-2В +4;
- 40 anchor angle pylons of type У 110-2 and У 220-2 with pylons +5, +9, +14 meters.

Anchor angle pylons of type У 110-2 with angle of deviation 70°. Anchor angle pylons of type У 220-2 angle of deviation 70°-90°. River crossing are executed in a single-keel performance to comply with the size, which is normalized by the given technical conditions.

On the pylons of the OHPL at an altitude not lower than 1.5 m from the ground should be applied: the serial number of the pylons, the symbol of the OHPL on the pylons, which limit the runway intersection with motor roads, as well as on all the pylons of the segments the OHPL, which run parallel, if the distance between their axes is less than 200 m, as well as posters indicating the distance from the pylons of the OHPL of the cable line on the pylons installed at a distance less than half the height of the pylons to the cables. On pylons adjacent to the transpositional pylons, a color staining of the phases shall be applied.

On the pylons of the OHPL, in case of placing on them an optical cable coupling (OK), the symbol of the fiber optic communication line (FOCL) and the serial number of the coupling sleeve shall be applied.

At the pylons on which the couplings for the OKGT are installed, there should be a place for the installation of mounting equipment, and they should be provided with access to vehicles with welding and measuring equipment at any time of the year.

Construction of the OHPL is planned to be carried out in one turn. The works will be carried out in the following technological sequence:

1) the development of the soil and the installation of the wells of the pits;
2) installation of the soles;
3) the reverse falling of the sinuses of the pits;

4) collecting and assembling the pylons;
5) installation of pylons;
6) installation of wires and a cable.

The technology of construction of the OHPL does not require external sources of water and electricity. For temporary electricity supply, mobile diesel power stations will be used: 100 kVA – 2 un.; 50 kVA – 2 un.

Route of passing of the 150 kV OHPL from CTS «DB WPP» to SS «Posad-Pokrovska» is presented in Annex D.

3 PROJECT ALTERNATIVES

3.1 Energy generation alternatives

All technologies of electricity generation have advantages and disadvantages. Techologies for renewable energy generation, such as solar and wind plants, allows to use «free» resources and don't produce harmful greenhouse gases, but the are not always available and require significant amounts of land. Technologies, such as coal and nuclear, produce electricity in large quantities reliably around the clock, but result in significant greenhouse gases (in the case of coal) and long-term waste disposal considerations (in the case of nuclear), Fig. 3.1.

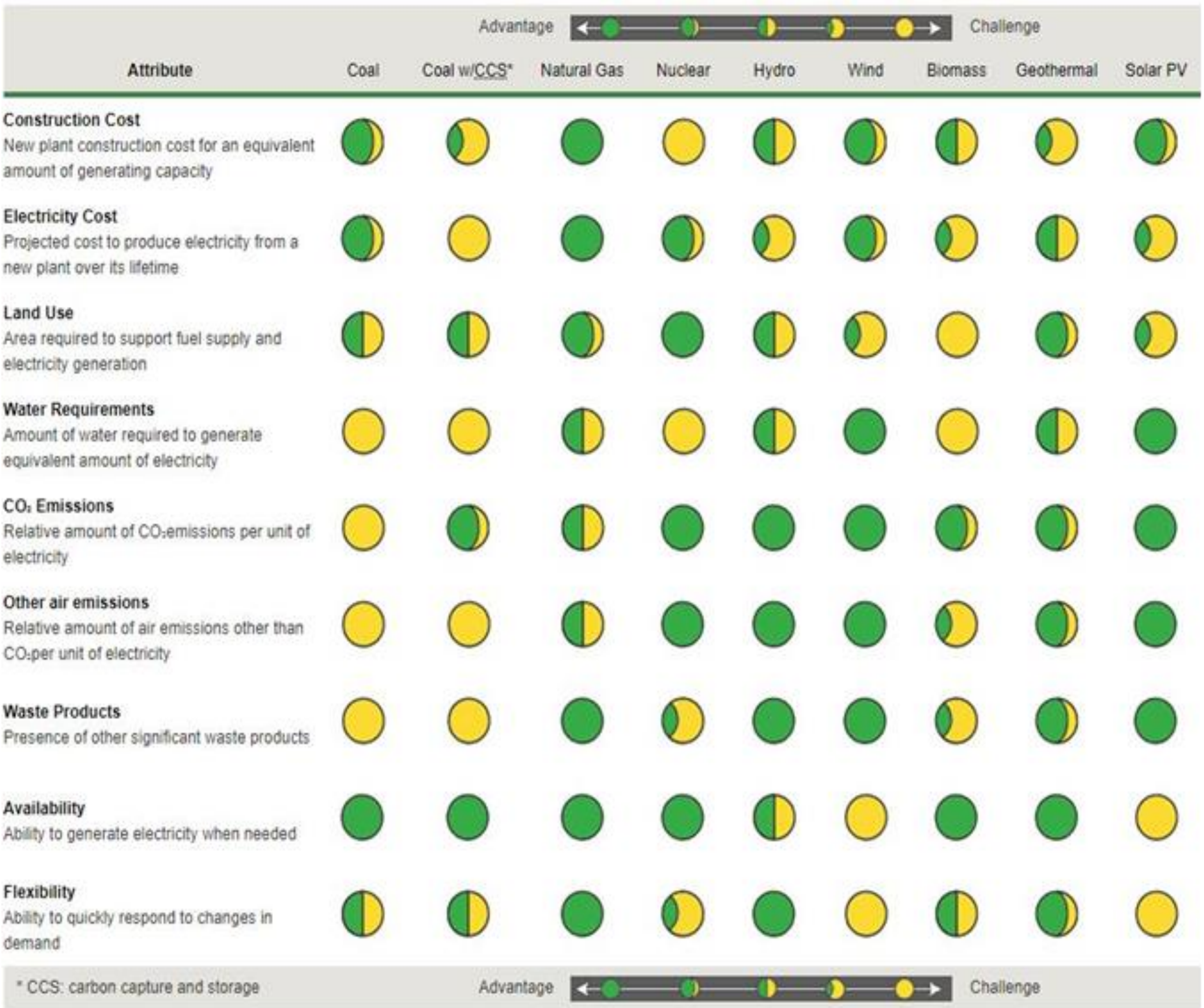


Fig. 3.1. Estimation of relative advantages and impacts of power generation technologies[1]

[1] http://sites.epri.com/refcard/comparison.html

The specific feature of electricity supply to consumers in the Kherson Region is the lack of diversification of energy supply sources.

Almost all volume of electricity, consumed in Kherson Region, is generated by one enterprise – the South-Ukraine Energy Complex. The South-Ukraine Energy Complex consists of South-Ukraine Nuclear Power Plant (SUNPP), Olexandriys'ka Hydroelectric Power Plant (OHEPP) and Tashlyts'ka Hydro-Accumulating Power Plant (THAPP).

South-Ukraine Nuclear Power Plant provides a significant part of the electricity (95 %) for Kherson, Odessa and Mykolaiv Regions with the possibility of energy delivery to European countries. The installed capacity of the SUNPP is 3000 MW (three nuclear reactors WWER-1000 to 1000 MW introduced: the nuclear reactor № 1 – in December 1982, nuclear reactor № 2 – in January 1985, nuclear reactor № 3 – September 1989).

The first starting complex of Tashlyk HAPP consists of two hydraulic units, the total installed capacity of which is 302 MW. The Oleksandriys'ka Hydroelectric Power Plant consists of two power blocks of total capacity of 11.5 MW. These power blocks were put into operation in April 1999. The Tashlyts'ka Hydro-Accumulating Power Plant and Oleksandriys'ka Hydroelectric Power Plant are auxiliaries in the power generation system of the nuclear power plant.

One of the alternative ways of developing power generation in the region is the commissioning of another WWER-1000 reactor at the South Ukrainian nuclear power plant. The operational period of nuclear reactor WWER-1000 is 20-30 years [131]. Now, some countries in the world with «atomic energy» are working on programs aimed at extension of the lifetime of their high-tech equipment.

The development and implementation of such a program requires time and funding. These two factors are devastating for Ukraine. In addition, currently it is difficult to say how many reactors will pass the test on «stability» [131]. In any case, no later than in 15-20 years, Ukraine will have to decommission the nuclear reactors.

Another obstacle to the development of nuclear energy in the region may be the resistance of environmentalists and a significant part of the population. This is confirmed by the experience of other countries (under the pressure of the public a number of European countries – Germany, England, Belgium, Denmark has already taken a decision to stop the development and to start gradual curtailment of this industry. In Ukraine, the environmentalist movement resulted in cessation of the construction of the Scholkins'ka NPP in the Eastern Crimea and the fourth nuclear reactor of SUNPP, Table 3.1.

Table 3.1 – Schedule for the extension of operation the reactors of SUNPP

No. of nuclear reactor	**Electric power, MW**	**Type**	**Date of commissioning**	**Designed expiration date**	**Extension of operation till**
1	1000	B-302	31.12.1982	02.12.2013	02.12.2023
2	1000	B-338	09.01.1985	12.05.2015	31.12.2025
3	1000	B-320	20.09.1989	10.02.2020	Planned

In the case of prolongation of operation of reactors, the risks, associated with their operation, also increase.

The environmental community of the Kherson Region, as well as the powerful environmental organizations of Ukraine and a number of leading specialists in energy sector oppose the prolongation of the lifetime of the third reactor of SUNPP and categorically against construction of new reactors. Their activities create serious obstacles for development of nuclear energy in the region. Under certain unfavorable conditions, Kherson Region, as well as the whole South of Ukraine, can turn from energy-rich to energy deficient area until 2029. For these reasons, the development of wind energy in the Kherson Region is the most promising.

Second of the alternative ways of developing power generation in the region is the developing of the hydroenergetics.

Construction of a hydroelectric power plant (HPP) with a installed capacity of 100 MW in the south of Ukraine is theoretically possible only on the Dnipro river. Other rivers in this region (Southern Bug, Ingul, Ingulets) do not have sufficient hydropower potential to operate a HPP of such capacity.

The Dnipro River is the most regulated river in Ukraine. During the 20-th century, on the Dnipro river the six powerful HPPs with artificial reservoirs were constructed. It caused virtually complete control of the river. The lowest flow from the cascade of the Kakhovka-HPP located in the central part of the Kherson region. Its capacity is 334.8 MW, and the area of the reservoir is 2150 km^2. According to the ratio of total capacity to the reservoir area, Kakhovka-HPP has the worst index in Ukraine and one of the worst in the world. It is connected with natural conditions of the Dnipro River in the lower part of the basin, in particular in the Kherson Region, where basin has exceptionally flat character, which does not contribute to the construction of efficient hydroelectric power plants.

In general, it is considered that the hydropower potential of the Dnipro River is used by 90 %. However, such an assessment was carried out in relation to a cost-effective hydropower potential, while not taking into account the environmental constraints on the regulation of the Dnipro River. The result of the regulation of the Dnipro River was the degradation of its ecosystems, which is particularly acute in recent decades. In particular, it is a large-scale flowering of water, its chemical and bacteriological contamination, the disappearance of valuable species of fish and the massive loss of fish, sedimentation of basisn and abrasion of their shores, etc.

The lower part of the riverbed of the Dnipro River and the coastal areas are included in the objects of the Emerald Network, which determines the priority of their preservation and the prohibition of the construction of hydro-energy objects. A significant part of the lower reaches of the Dnipro River also falls within the boundaries of the Nizhnedniprovsky National Nature Park, which also excludes the possibility of building hydroelectric plants within its boundaries.

The negative effects from creation of new reservoirs can significantly outweigh the benefits of the hydroelectric power plant operation. In particular, the construction of a hydroelectric power plant and the creation of reservoirs leads to flooding of valuable lands, loss of agricultural land, destruction of the most valuable natural resource of Ukraine – black soils («chernozem»).

In addition, the creation of reservoirs is accompanied by significant costs for the construction and operation of protective dams and protected arrays. At the same time, there are processes of flooding of surrounding territories, activating destructive exogenous processes, destroying of shores, destroying of coastal ecosystems, forest vegetation, black soils («chernozem»), buildings and structures, roads and communications.

Water reservoirs and HPPs lead to a change in the river flow regime: they violate the flow, the dynamics of water exchange, lead to the formation of stagnant zones, the loss of the river's ability to self-purification, changes in physical and chemical regimes, and cause flowering of water. Together with creation of reservoirs occurs conditions favorable for the development of new types of bacteria, which in turn predetermines specific diseases of humans and animals.

The construction of a HPP and the creation of a large-scale reservoir will lead to to relocation of not one settlement, loss of local businesses, jobs, etc.

Creation of a reservoir on the Dnipro River will lead to the flooding of archaeological sites, centers of ancient civilization at the territory of Ukraine, ancient Cossack-Sich cemeteries, which are widespread within the Kherson region, precisely on the banks of the Dnipro River.

The greatest man-made threat to the construction of a hydroelectric power plant is the threat of destruction of the dam reservoir. It is worth taking into account the cumulative effect of the presence of 6 large dams on the Dnipro River, the destruction of any of them will lead to the possible destruction of downstream, as well as threatens the settlements and the lives of their inhabitants, infrastructure and other objects. Under the influence of a shock wave industrial objects near the river, oil, gas and other product pipelines, may occurbe.

Third of the alternative ways of developing power generation in the region is the development of the solar power plant (SPP).

Natural and historically favorable conditions for the development of solar energy exist in Ukraine:

– favorable climatic conditions;
– sufficient scientific, technical and technological potential;
– production capacities for more than 10 % of world volumes of monocrystalline silicon for photovoltaic converters (100 MW of power plants were produced in previous years and 2 MW of autonomous solar power plant with efficiency at the present day world level of 14-16%).

The average annual amount of total solar radiation per 1 m^2 of surface, on the territory of Ukraine is within: from 1070 kWh/m^2 in the northern part of Ukraine, up to 1400 kWh/m^2. m and higher in the south of Ukraine. The potential of solar energy in Ukraine is high enough for the wide introduction of both heat and power equipment and photovoltaic equipment practically throughout the country.

Nevertheless, there are a number of shortcomings without doubtful advantages of the construction of SPP:

1. High initial costs of materials and long-term installation;
2. For placement SPP needs lots of space;
3. Need for additional equipments – solar power plants don’t work at night, so there is a need of a large battery bank;

4. Visual perception of SPP by human – some people think that SPP are ugly;
5. Cost of individual devices - devices that run on DC power are more expensive;
6. Size of solar panels – depending on geographical location the size of the solar panels vary for the same power generation;
7. Dependence on weather conditions – in cloudy days SPPs don't produce much energy;
8. Dependence on the season – SPPs are less efficient in winter months.

One of the important parameters of an electric power source is the average power density (is measured in W/m^2). This parameter characterize the amount of energy that can be obtained from the unit of energy storage area. The construction of solar power plants requires large areas of lands due to limitations for photocells of the first and second generation.

For large solar power plants with a capacity more than 100 MW it may be necessary to plot an area of several tens of square kilometers. The construction of solar power plants of such power can lead to a change in the microclimate on surrounding area. Because of construction of a powerful solar power plants may happens loss of large areas of agricultural land, which in turn will lead to a decreasing of the incomes of the local population. Another problem of SPP is collection and proceeding of water with detergents used for washing solar panel.

Conclusion: development of wind energy in the Kherson Region is the most promising option.

3.2 Technology alternatives

As of today the two main types of wind turbines are use, namely horizontal axis wind turbine (HAWT) and the vertical axis wind turbine (VAWT). Of these, HAWTs are the most extensively used for large scale wind farm developments, due to their various advantages, such as high energy generation capacity, better efficiency, adjustable tower length to capture large amounts of wind energy, variable pitch blade capacity, etc.

According to the EIA report, at an early stage of the Project was supposed to use four models of wind turbines, namely: Vestas V126-3.45 MW, Siemens SWT 130-3.3 MW, Goldwind's GW 2.5 MW, Nordex N 131/3900. However, after further research, the designer decided to install 25 WTs Nordex of model N 149/4.0-4.5.

One of the main parameter at choosing of final WT model was height of WT. Height of current WT (N 149/4.0-4.5) is 105 m, which is much lower then height of previous WTs (120 m). Decreasing of WT height on 15 m will have a positive effect on reducing the flicker effect and visual impact.

When choosing a technical alternative to the construction of the OHPL, several options were considered, namely:

1. *Laying an underground cable line.* Considered the use of single-conductor cable APEEGAP-150 1x630 type. This alternative was rejected due to occurrence of significant environmental impacts, namely: digging the ground for laying of underground cable lines, destroying the vegetation because of earthworks, the possibility of animals entering the trenches at night, the need for additional land plots for the storage of soil, and the greater amount of construction machinery

involved in performing work on this alternative and, consequently, higher emissions of pollutants. In addition, this alternative is significantly more expensive in construction and operation due to the high cost of the cable and the necessity in installing of additional equipment to compensate ground currents.

2. *Use of concrete* pylon*s for the construction of the OHPL*. The use of concrete pylons SK-26 (fixed conical) with metal traversing was considered. This alternative was rejected due to the fact that when using concrete pillars, the distance between them should be about 70 m, which in turn will increase the amount of pylons for the OHPL in 1.5-2 times compared to use of metal pylons. This will lead to an increase in the number of plots of land on which the pylons will be located. This alternative also could cause additional negative environmental impacts, namely, violations of soil and vegetation, and the creation of additional obstacles on migration routes of animals.

3. *Use of metal pylons for the construction of the OHPL*. It was planned to install 196 metal pylons, the distance between the pylons of the OHPL will be 100-150 meters. The advantages of this alternative are relatively insignificant environmental impacts due to the decrease in the extent of destruction of soil and vegetation, obstacles to the migration of animals, emissions of pollutants from the construction machinery involved in the construction and installation work.

Conclusion: given the reduction of the number of wind turbines to 25 and the use of metal pylons for construction of the OHPL, the Project uses the most feasible technology.

3.3 Site and layout alternatives

The wind potential of the territory is a key factor in determining the potential maximum energy that can be generated by «DB WPP». In the framework of preparation for the project realization, the measurements of the wind characteristics at the site of the planned «DB WPP» were carried out. Wind measurements for the Project were conducted by one meteorological mast installed at the center of the site. Information on location of meteorological mast and overall period of measurements are given in Table 3.2.

Table 3.2 – Position (UTM WGS 84, zone 36 N), period of measurement and height above ground level

Station	UTM (X), m	UTM (Y), m	Period of measurement	Height
Dniproo-Burgsky01	427491	5166696	2017/01/16 - 2018/02/01	99/95/80/60

The meteorological mast consists of four levels for wind speed measurement and three levels for wind direction measurement. They are located at different heights: 99, 95, 80 and 60 meters for anemometers, and for blades – 95, 80 and 60 meters. Temperature/humidity sensor and the barometer locate at height 93 m and 21 m respectively.

The meteorological mast has a system for data collection and transmission. This sytem allows to perform measurements of wind speed, wind direction, air pressure, air temperature and humidity at each level and records the following values: mean, standard deviation, minimum and maximum value every 10 minutes.

Some images of the meteorological mast and installed sensors are shown below, Fig. 3.2.

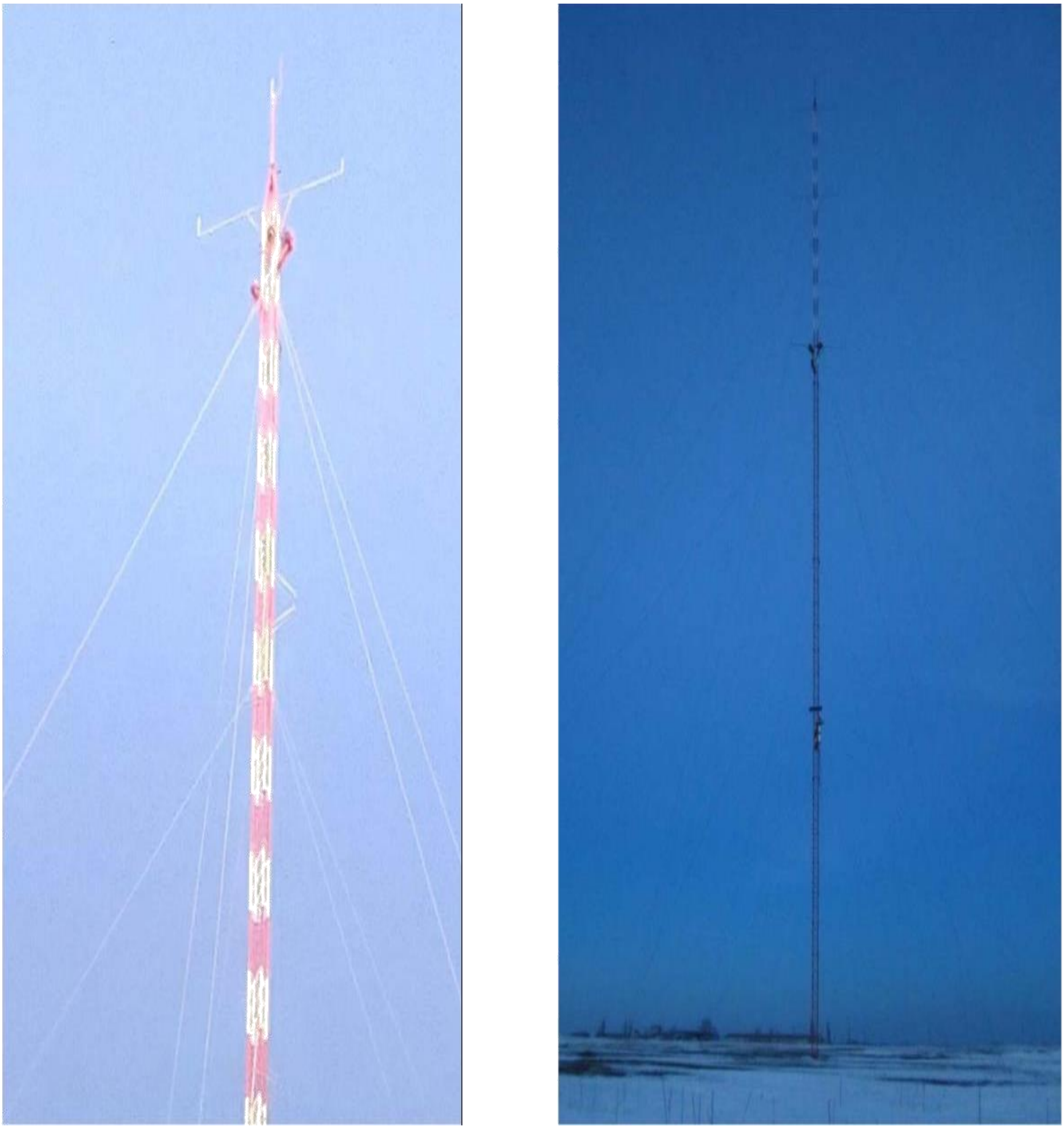


Fig. 3.2. Arrow deployment and sensor installation

3D view of the location of the meteorological mast platform of «DB WPP», Fig. 3.3.

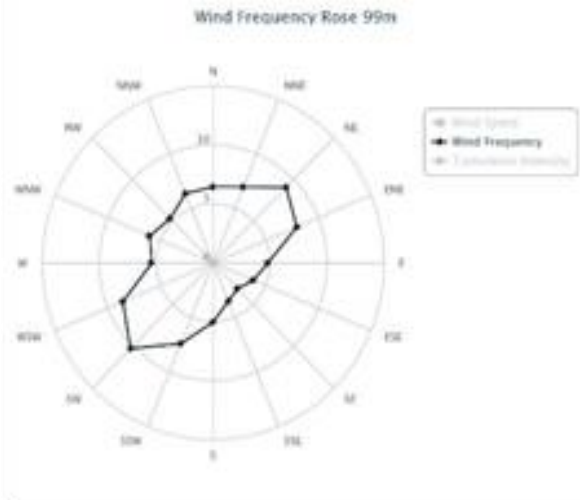
Fig. 3.3. 3D view of the location of the meteorological mast platform «DB WPP»

Results of measurements of the Average, maximum and minimum values and wind speed standard deviation at different levels of meteorological mast are given in Table 3.3.

Table 3.3 – Average, maximum and minimum values and wind speed standard deviation at different levels of meteorological mast

Station	**Height**	**Average speed, m/s**	**Standard deviation**	**Max. m/s**	**Min. m/s**	**N. rec.**
Dniproo-Burgsky	WS99	7.61	3,28	22.08	0.26	54.778
	WS95	7.50	3,24	21.76	0.21	54.772
	WS80	7.29	3,09	20.68	0.25	54.761
	WS60	6.93	2,88	19.72	0.25	54.791

Information on wind directions and wind speed on the site are given in Fig. 3.4 and Fig. 3.5.



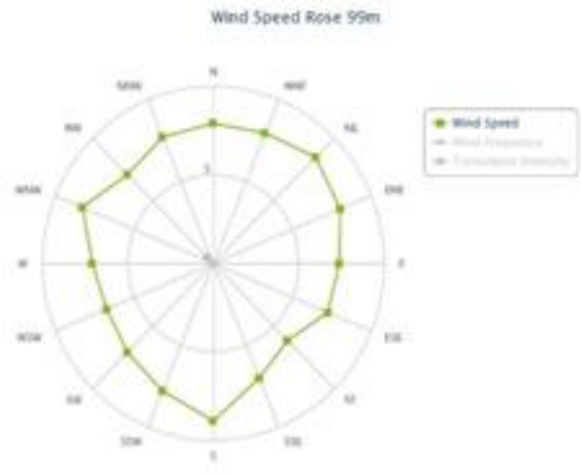


Fig. 3.4. The average wind direction at a height of 99 m during the period under study

Fig. 3.5. Average wind speed at a height of 99 m during the period under study

At the territory of «DB WPP» the southwest and north-east winds are prevail. Their frequency is 10.26 % and 9.06 % respectively, and average speed is 7.10 m/s for northeastern winds and 8.47 m/s for southwest winds, Fig. 3.6.

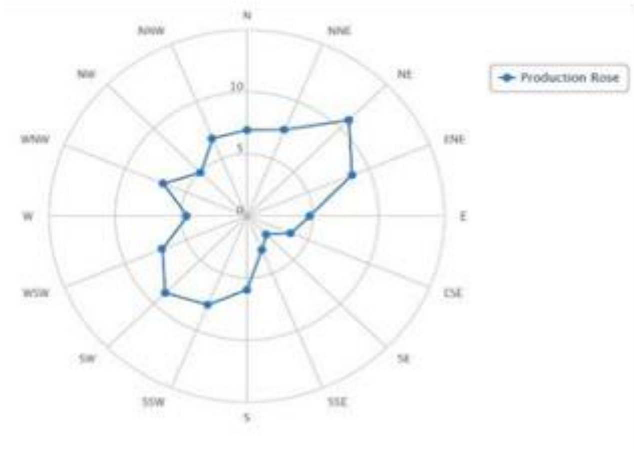


Fig. 3.6. Rose of Wind at height 99 meters

The results of the measurements confirm possibility of use choosen territory for the construction of «DB WPP».

Separately, for the site of «DB WPP», a «micrositing» of the WTs was conducted by the Spanish company «EREDA», according to (IPCC, 2011), which is very important for maximizing/optimizing energy production and minimizing environmental and social impacts. The wind turbine micrositing was defined by «EREDA» taking into account site definition and constraints.

In the scope of micrositing studies conducted for the «DB WPP», mainly the following criteria were taken into consideration:

- legal restrictions such as buffer zones, location of cultural heritage sites, etc.;
- technical criteria (geotechnical conditions, minimum distances between turbines (provided by the turbine supplier); existing roads and paths to minimize access road construction, etc.);

– social considerations, including current land ownership status, locations of nearest settlements.

Taking into account these criteria, the first base location of the WTs wes led to the location of 28 WTs, Fig. 3.7.

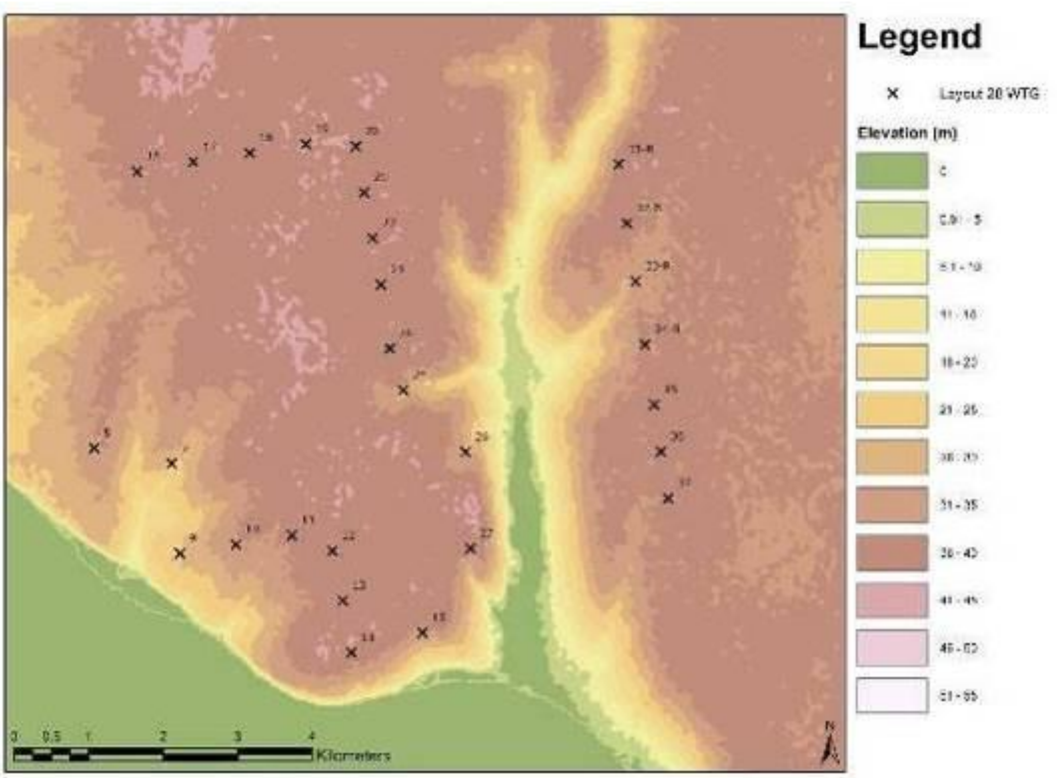


Fig. 3.7. Preliminary location of the 28 WTs

At the next stages of design, the number of turbines was reduced to 25 WTs, while the installed power of one WT was increased to 4.4 MW. The project design was also modified to accommodate 25 turbines to optimize energy generation and minimize impacts on environment and population. From the arrangement scheme, the turbines № 15, 27 31 were removed.

Turbine No. 15 was removed due to the close location of the wind turbine to the farm's security home, located near the turbine (less than 500 m).

Turbine No. 27 was removed in connection with the warnings of experts on the assessment of noise pollution in relation to the close location of the wind turbine to the settlements.

Turbine No. 31 was removed due to poor ground conditions of site.

The changes made to reduce the number of turbines have resulted in:

– minimized land use and biodiversity impacts due to reduced number of WT and elimination of access roads to WTs;
– reduced amount of earthworks and materials requirements;
– reduced number of construction machinery/equipment to be operated, which minimize the amount of greenhouse gas, air emissions and fuel consumption;
– reduced number of traffic movements required for the transportation of turbines and other WPP components.

At the previous stages of the Project, the «Dnepro-Bugsky WPP» considered three options for a territorial alternative to power generation:

1. *The planned OHPL with a total length of approximately 32 km can pass through the territory of Bilozerskyi District of the Kherson region, from the CTS ««DB WPP»» throught the SS «Posad-Pokrovska» – to the Substation «KhNPZ», with connection in the section of this OHPL.* This alternative was rejected due to an increase in the total length of the OHPL at 5.3 km compared to option 3, which leads to an increase in the number of land plots for the placement of pylons and materials for the construction of the OHPL, as well as to negative environmental impacts for the environment. In addition, the connection in the section of this OHPL leads to a decrease in the reliability of the existing transit line, which, in turn, reduces the reliability of electricity supply.
2. *The planned OHPL of a total length approximately 36 km can pass the territories of Bilozerskyi District of Kherson Region and Vitovsky District of Mykolaiv Region, from the CTS «DB WPP» throught the SS «Posad-Pokrovska» – SS «Oktyabrskaya» with the connection in the section of this OHPL.* This alternative was rejected due to an increase in the total length of the OHPL by 9.3 km compared to option 3, as this leads to an increase in the number of land plots for the placement of pylons and materials for the construction of OHPL, and due to more significant negative environmental impacts during construction and operation (e.g higher probability of injury or death of birds and bats from collision, injury or death of wildlife from road traffic, temporary habitat loss and degradation, etc.). In addition, the connection in the section of this OHPL leads to a decrease in the reliability of the existing transmission line, which in turn reduces the reliability of electricity supply.
3. *The planned OHPL of a total length approximately 27.3 km in the area of the Bilozerskyi District of the Kherson Region (Oleksandrivskaya, Pravdinska, Posad-Pokrovska Village Councils), from Substation «DB WPP» to the Substation «Posad-Pokrovska».* The advantage of this territorial alternative is the reduction of the length of the OHPL, the reduction of the impact on the environment and the management of agriculture. Reducing the total length of the OHPL will minimize the environmental impact associated with the construction and operation of the OHPL, including reducing land withdrawal and land use change along the route of the OHPL, violations of soil and vegetation cover of the territory, reducing emissions of pollutants into the atmosphere from construction machinery and mechanisms, reducing the number of cuttings and crowning green plantations, reducing the losses of habitats, reducing the risk of collisions of birds and bats.

Conclusion: for the final territorial location of the Project, two-year measurements of the site's wind potential were made by specialists of the Spanish company «EREDA».

3.4 No project alternative

Project, as an energy generation based on renewable resources, will provide public benefits by safeguarding the increasing energy demand of the country. The following potential economic, environmental and social perspectives will be lost if the Project will not be developed.

Environmental perspectives:

A) Improvement of the state of biota. The assistance in strengthening the structural components of national environmental network through the creation or optimization of existing specially protected areas of the Nature Reserve Fund of Ukraine in the area of the location of the Project as well as promotion of the environmentally friendly agricultural practices, in particular, by programs of sustainable agriculture and organic farming. Hunting bans at the territory of the «DB WPP» will contribute to preservation of undisturbed ecosystems as a whole, and individual species, and critical habitats in particular.

B) Budgetary savings. Reduction of gas and coal purchases for energy generation will result in savings in of the state and local budgets of Ukraine and reduce energy dependence of Ukraine for external sources of hydrocarbons. The increased revenues to the local budgets will allow to improve quality of life of population in rural areas of Kherson Region. The objectives of the Project investment fully correspond to the priorities of the «National Energy Strategy of Ukraine till 2035».

C) Energy and resource saving. Estimated savings of energy resources due to Project operation and energy-saving measures at the «DB WPP» objects will constitutes:

- average annual saving of conventional fuel 139.0 thousand t;
- average annual saving of gas 375.3 million m^3.

D) Clean production. Electricity production by wind power plants is the most environmentally friendly production.

E) Institutional capacity building. The additional tax revenues and rental payment for land use (during the construction and operation of the Project) to the local budget and the concluding of the contract about social partnership during implementation of the project between the Oleksandrivka Village Council and the «Dnepro-Bugsky Wind Power Plant» LLC will contribute to more efficient functioning o of local authorities, solution of many issues of socio-economic development, ensure effective interaction with the local community.

F) Capacity building in other sectors. Support of creation or optimization of existing specially protected areas of Nature Reserve Fund of Ukraine at the territory of the Project, including the development of the Landscape Reserve «Oleksandrivskyi» will contribute to solution of the environmental issues both at the territory of the Project and adjacent lands, if such will emerge. The presence of «DB WPP» highly qualified personnel trained in high tech specialties will be beneficial for local educational institutions specialized in energy conservation and transition of Ukraine to environmentally safe energy sources.

Social perspectives:

A) Creation of temporary and permanent working places in the framework of the Project. The investment project will create about 250 temporary working places with simultaneously working 50-70 people in the construction phase. After the completion of the construction, the estimated number of personnel on «DB WPP» will be 36 employees.

B) Contract and subcontract opportunities for local companies. Construction companies of Kherson Region, including Bilozerskyi District will have contract and subcontract opportunities through the tender procedures.

C) Opportunities for local companies to supply goods and services. Local companies of village Oleksandrivka and companies of the Bilozerskyi District and Kherson Region, supplying, producing or extracting the necessary building and other materials necessary for the construction of Project (including companies providing transport, accommodation and other services), will be also participate in the construction of the Project. As assumed, production of some components structures of wind turbines will be organized at the enterprises of Kherson Region and neighboring regions.

D) Opportunities to provide accommodation services for non-resident employees of «DB WPP» at necessity. Employees for works not requiring special skills will be recruited among local residents. Non-resident employees in the construction phase will live in village Oleksandrivka, providing opportunity to local population to deliver food and other services to them.

E) Support for local educational institutions. The agreement about social partnership during implementing of investment project between Oleksandrivka Village Council and «Dnepro-Bugsky Wind Power Plant» LLC includes provisions for allocation of financial resources for support of the secondary schools, preschools, kindergarten, etc. The additional tax revenues and rental payments for land use (during construction and operation of Project) to the local budgets create more opportunities for improvement of the conditions in local educational institutions.

***Conclusion**: for selection of optimal place of Project location (WTs, OHPL, CTS/CP, cable lines and technological roads) the following criteria were used:*

- ***compliance with the national priorities of Ukraine in development of electric power industry of Ukraine;***
- ***presence of high wind potential in the area of Project location (taking into account its long-term forecasts;***
- ***presence of territory, sufficient for placement of large-scale industrial WPP;***
- ***availability of the necessary number of state-owned land plots of land reserve, not designated for production use;***
- ***possibility of dealing with a single land owner (state) for long term rent of lands;***
- ***minimal damage of natural plant groups and vegetation cover on the territories of Project location – this criterion refers to field windbreaks and existing agricultural roads, where WTs and roads will be located;***

- *maximally possible distance from places of high natural value for flora and fauna – this criterion corresponds to the distance to the shoreline of the Dnipro-Bugsky Estuary and the Lake Solonets (not less than 500 m) and the distance from the boundaries of the Landscape Reserve "Oleksandrivskyi" (not less than 100 m);*
- *maximal distance to the village Oleksandrivka (sanitary-protective zone of the DW WPP is not less than 700 m);*
- *absence of complicated relief (it absence reduces the difficulties of delivery and installation of WTs, as well as minimizes the energy losses from the shadowing of WT by elements of relief;*
- *possibility of effective solution of logistics issues;*
- *presence of electrical grids for transmission of electricity, generated by «DB WPP» to the United Energy System of Ukraine, that do not require significant investments in their modernization;*
- *support of project by local population; the results of public discussion indicate the support of the construction of the «DB WPP» by the local community;*
- *interest of the regional and local authorities in investments, that confirmed by all necessary permits and assistance in issues emerging during the design process.*

4 DESCRIPTION OF NATURE AND TECHNOGENIC ENVIRONMENT

4.1 Climate

4.1.1 Baseline conditions

The climate of Kherson Region is moderately continental, and arid. The prevailing air masses arrive from North Africa, Asia Minor and the Balkan Peninsula in summer, and arctic air masses arriving in winter sometimes causing early frosts in late autumn and early spring as well. In Kherson Region, the eastern winds formed under the influence of Asian anticyclone are dominant. The winter season is warm, with little snow, the autumn; and spring seasons are often dry and sunny. The average annual temperature in Kherson Region is +10˚C, maximal temperature is +40˚C and minimal temperature reaches -31.5˚C. The average duration of frost-free period is 179 days per year. The average annual amount of precipitations varies between 300 and 420 mm. In the area of Project, construction the northeastern and the northwestern winds prevail. Sometimes, winds are transformed into dust storms and lead to soil blowing and crops damage:

North-eastern winds	in the cold period
North-west winds	in the warm period
Average annual wind speed	4.2-4.3 m/sec.
Number of days with strong winds (per year)	10-20

The wind situation at the construction site of Project depends on following factors:

- The north-eastern winds formed by movement of air masses from Asian and Azov high-pressure zones to the low-pressure zone above the Black Sea. These winds are cold, dry, and blow usually in winter and spring periods.
- The south-western winds from the Mediterranean Sea, blowing mostly in the winter and spring periods.
- The western winds from the Atlantic Ocean, blowing mostly in the summer period.
- Local winds (breezes), blowing in the summer and autumn periods. As marine as estuary breezes are felt over the «DB WPP» territory. The speed of such winds is high – 9 m/sec and more. The breezes spread at 20-30 km over the Project territory.

The long-term meteorological observations show stability of all listed conditions of wind formation. The prevailing wind directions, in the region of Project location are illustrated by Fig. 4.1. The main share of precipitations (70%) occurs in the warm period of year, mainly as heavy rains, causing crops damaging, contributing to soil crust formation and causing water erosion of soils:

Amount of precipitations per year, mm	340
Biggest amount of precipitation	June
Least amount of precipitation	March

The snow cover is unstable:

Average height of cover in period, cm	3-5
Biggest accumulation (February), cm	3-6

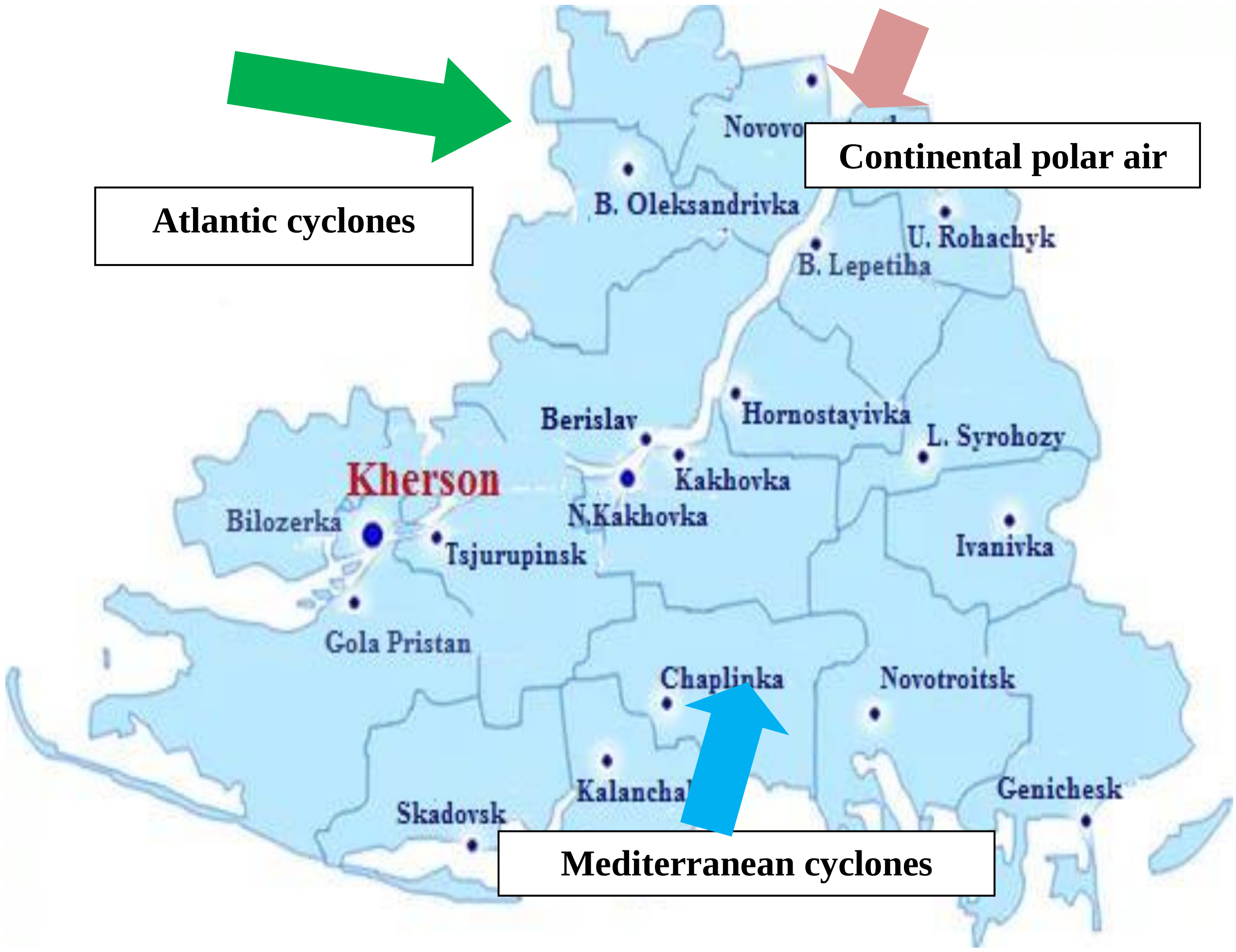


Fig. 4.1. Prevailing wind directions in «DB WPP» wind field

The soil freezing begins in the first days of December and reach:

Average depth, cm	38-43
Maximal depth, cm	120-140
Minimal depth, cm	10-20
Complete soil defreezing	mid of March.

Described climatic features show the climatic conditions that have impact on Project objects, namely:

- temperature alteration (temperature change from plus to minus), and strong winds leading to formation of ice layering, and scattering of ice pieces or to the WT destruction;
- precipitation can lead to breakdowns the lines of the OHPL;
- heavy rains causing to soil erosion.

4.1.2 Impact mitigation and management

The measures for mitigation and prevention of harmful impacts on climate of Project are not provisioned due to absence of any such factor, significantly affecting climate.

4.2 Geomorphology, geology and water resources

4.2.1 Baseline conditions

4.2.1.1 Geomorphological conditions

The construction site of Project is located within Black Sea Lowlands, which belongs to the most lowered plains at the territory of Ukraine. The territory of Project is located in the southern part of the South Bug – Dnipro interfluves. By the surface typology, the lowlands is a plateau with slight southward incline towards the sea.

Eroded by ravines and gullies plateau, formed in the Neogene, and is bordering the valleys of the Dnipro and the South-Bug rivers. The absolute marks of the territory of «DB WPP» above the earth's surface vary between 35-45 m (typical absolute marks above earth's surface for most of planned WTs) and 15-25 m (lowering towards of the Dnipro-Bug Estuary, Fig. 4.2.

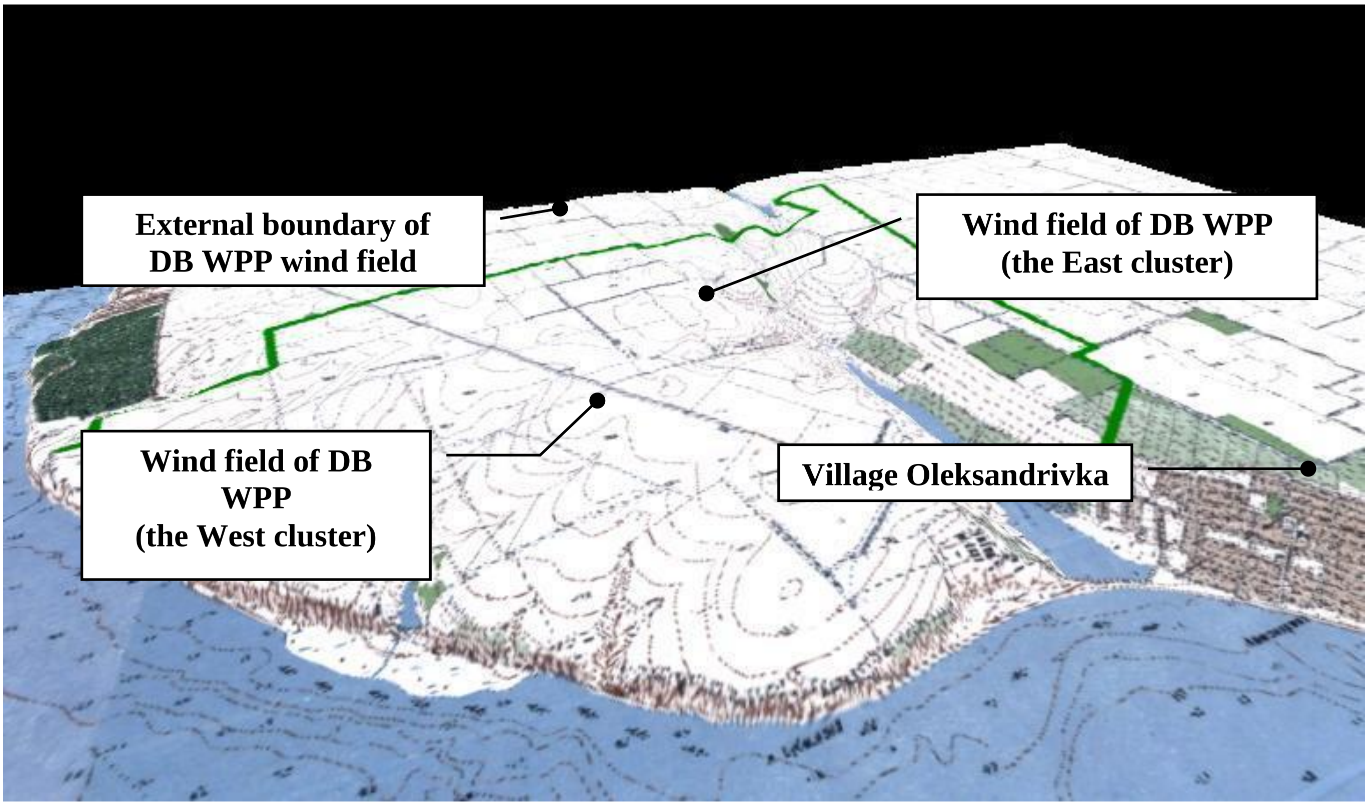


Fig. 4.2. Relief of «DB WPP» territory

According to geomorphological zoning of Ukraine [113], territory of the construction site of «DB WPP» belongs to the:

- Black Sea region of stratum-accumulative and stratum-denudation lowlands:
  - ✓ Subregion of the Black Sea stratum-accumulative lowland above the Neogene sediments:
    - ➢ Bug-Dnipro slightly divided flat accumulative-denudative plain.

In genetic sense, the relief of plain watershed is accumulative. The plateau is composed by Loess-loamy thickness up to 30 m. The relief of the southern part of the «DB WPP» territory corresponds to the decline of relief-forming formations of the

Neogene age. In the vicinity of coastline of the Dnipro-Bug Estuary the relief of the «DB WPP» territory has the abrupt breached ledge. The plain character of plateau resulted from geological structure and arid climate, creating unfavorable conditions for formation of hydrographic network and current exogenous processes. By the density of horizontal relief dismemberment (< 0.1) and isogepsometric coefficient (< 0.25) the relief of territory belongs to the least dismembered territories in Ukraine (confirmed by the weak development of erosion network). At the surface of the plateau, there are widespread enclosed slightly marshy flat-bottom depressions (sags), which have dimensions between 0.2 and 4-6 km in diameter and different shapes [113]. Their surface in 2-4 meters lower than surrounding territory. The sags are representation of zones of increased permeability of sedimentary formations in the relief; and their genesis, more likely, is connected not so much with loess formations but with flow of solid material due to increased permeability of sediments.

The ravine-gully erosion at the territory of Project is observed alongside the coastline of the Dnipro-Bugsky Estuary. Erosion is presented by the perpendicular to the coast ravines of insignificant length (1 km and less), and significant in the length of Vovcha Gully with its spurs. The contemporary development of ravine-gully network is connected with activity of the surface runoff. There are no constant streams on the bottom of ravines and gullies of Project territory (only the Vovcha Gully can be considered as an exception). The Lake Solonets is located in the mouth of the Vovcha Gully.

The OHPL is located in the southern part of the southern Bug-Dnipro interfluves. The nature of the surface of the lowlands is a flat steppe plain (plateau), hollow in a southerly direction towards the sea. Absolute markings of the surface of the OHPL make up 30-40 m, decreasing at the section of the section of the Vovcha Gully up to 10 m, Fig. 4.3.

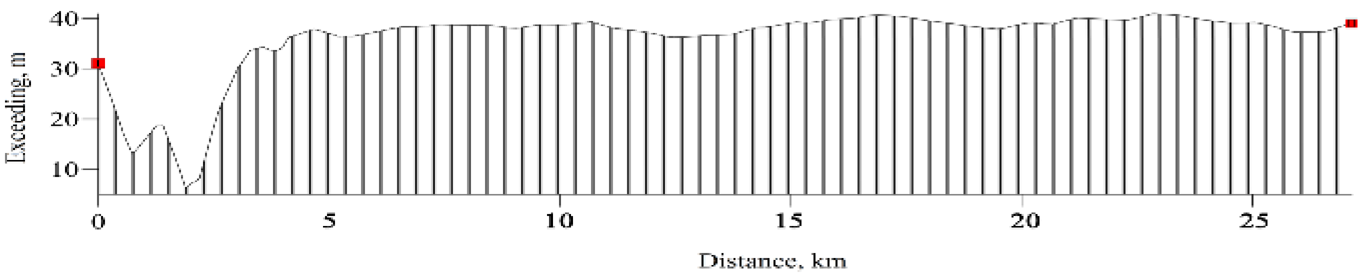


Fig. 4.3. The longitudinal profile of the relief of the OHPL

4.2.1.2 Geological structure

The construction site of Project is located within the boundaries of northern wing of the Black Sea depression. The bedding depth of the Precambrian foundation is above 2 km.

Monoclinally overlaid powerful formations of sedimentary rocks of the Cretaceous, Paleogene and Quaternary systems, are gradually sinking southward with increasing thickness form the geological structure of the Project territory.

At the Project construction site, the explored deposits of mineral resources are absent. There is Stanislavske sand deposit at the territory of Oleksandrivska Village Council (according to geological survey in the scale 1:200 000, sheet L-36-IX) that belongs to the middle-upper Pliocene deposits. Presently the sand pit of total area 5.0 ha does not operate, and is temporarily close.

The tectonic conditions of territory are characterized by block structure of the Precambrian foundation cracked by series of fractures and prevailing subsidence. The zone of prevailing subsidence is an elongated strip above 50 km in width alongside the Black and Azov coasts divided by zone of slight elevations. Tectonically, movements in the Quaternary period had caused the reconstruction of river network of this territory. In the beginning of the Quaternary period, the river Dnipro flowed along the line Kakhovka - Novooleksiyivka – Zalizniy Port. In the middle-Quarternary period, the river became deeper and the Dnipro valley shifted to the North. In the Upper Quaternary period, the river Dnipro sharply turned to northwest near Kakhovka city and formed new valley, existing nowadays.

The Neogene system. At the territory of construction site, the powerful Neogene sedimentary rocks are located at the depths up to 300 meters. They are represented by mid- (the Tortonian stratum) and upper (the Sarmatian and the Meiotic strata) Miocene formations and by the Pliocene formations (the Pontic and the Cimmerian strata) (Fig. 4.4). The Tortonian stratum (N_1t) is composed of clays and limestones with interlayers of marl, fine-grained sand, clay. The latter has waterproof properties. The thickness of sedimentary rocks reaches 25 m. The Sarmatian stratum (N_1s) is represented by lower, middle and upper substrata. The Lower Sarmatian substratum (N_1s_1) is represented by clays, sands, sandstones. At the territory of Project, their thickness is insignificant, likely up to 10 m. The Middle-Sarmatian substratum (N_1s_2) is transgressively located on the Lower Sarmatian sediments. The substratum is composed of limestones, clays, sands, sandstones. The thickness substratum reaches 60-70 m. The Upper Sarmatian sub stratum (N_1s_3) is composed of limestones and sandy clays, oolitic-detritus limestone, marls, limestone clays with sand interlayers. The thickness of formations is 30-50 m. The sands inlayers are well-developed narrow stripes along the boundaries of distribution.

Legend:

18 – location of WTs and other object of Project, their numbering;

– the OHPL

Fig. 4.4. Geological map of the pre-Quaternary sediments at the Project territory (according to geological survey in the scale 1:200000)

The Meiotic stratum (N_1m) is regressively located on the Upper Sarmat sediments and represented by continental sandy-clayish and marine shallow water limestone-clayish sediments. The stratum thickness is 10-25 m. At significant part of wind field territory (Fig. 4.4) the stratum is the first one from the surface in the Neogene formation.

The Pontic stratum (N_2p) is mainly composed of organogenous shell-rock limestones, and clays. The stratum is more developed on watersheds. The thickness of sediments is up to 10-15 m. The Pontic stratum at the territory of wind field looks like elongated strip along meridian, widening in its central part (see Fig. 4.4). In the southern part of wind field, the strip sharply narrows, but significant part of objects of wind power plant is located within the boundaries of the Pontic stratum. The Cimmerian stratum (N_1k) develops locally. Small areas of its distribution were recorded near the village Oleksandrivka (Fig. 4.4).

The stratum is represented by clays, sands, sandstones. The undivided thickness of the Lower Pleistocene-Upper Pliocene sediments (N_2^2+Q_1) is represented by alluvial sediments of ancient rivers (sands, clays), and red-brown clays. The alluvial sediments can be seen as strips from the North to the South, filling valleys of ancient rivers (pre-rivers). They are located uncoordinated on sediments of the Pontic and the Meotys formations and in places of the sharpest deepening on the Sarmatian sediments.

The sediments of red-colored formations are considered as regional aquitards and represented by strata of clays and hidden soils. The strata are widely spread on whole territory of the wind field, and blurred only in the valley of the Vovcha Gully. The thickness of sediments can reach up to 45 meters. In the South of Ukraine, these sediments are characterized by inconsistency of lithological composition. In these sediments, the sandy lenses and interlayers are observed. The sharp decrease in thickness of sediments (related to ancient valleys of rivers and gullies) also could be seen in these sediments.

Quaternary system. The Quaternary sediments are widespread over whole territory of wind field (Fig. 4.5). The sediments are represented, mostly, by the continental Aeolian-deluvial formations with interlayers of alluvial sediments of hidden soils (vd, e $P_{I–III}$). In lithological sense, it is loess-like loams, rarely sand pipes and clays, loesses. Two layers of loess rocks (the Upper and the Lower), corresponding to the Bug and to the Dnipro climatolites, can be distinguished. The loess horizons overlie the compacted loams and clays that play role of local aquitards. In the vicinity of wind field area, the land marks of the second aquitard changes from 25 m to 22.5 m and decreases towards south.

Summary cross-section of the Aeolian-deluvial stratum is described by the results of detailed survey at the territory of Ingles irrigation system and has following features:

Upper part of aeration zone (sediments $P_{IV–III}$):

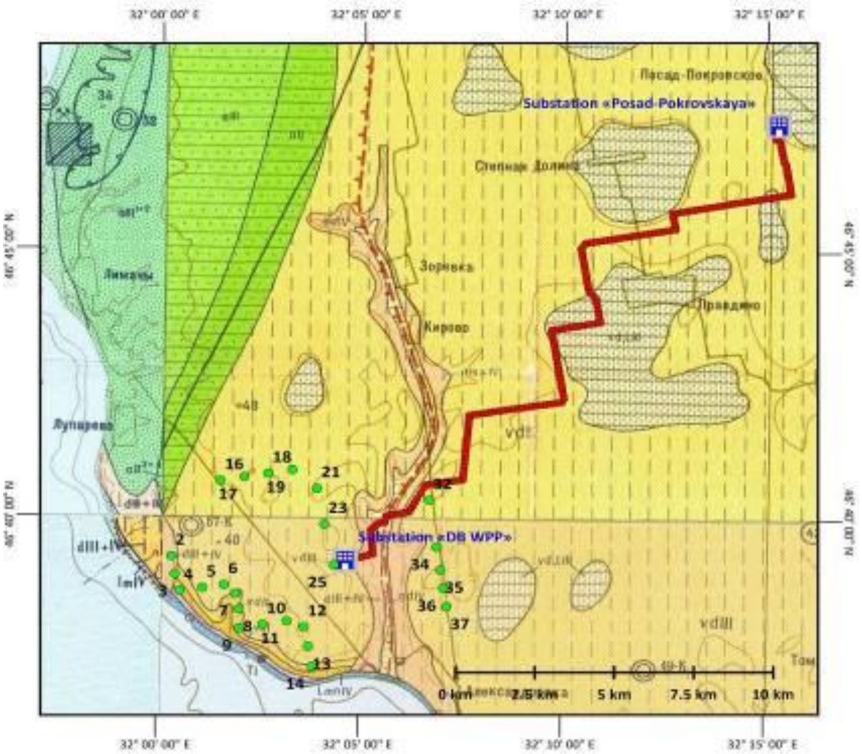
1. The layer of compact degraded loess loams, mostly heavy and medium.

Middle part of aeration zone (sediments $P_{III–II}$):

2. The layer of loess sediments.
3. The layer of compact heavy loams and clays (the first aquitard from the surface).

Lower part of aeration zone (sediments $P_{IV–I}$):

4. Lower layer of loess sediments.
5. The layers of red-brown loams (second aquitard from the surface).



Legend:

18 – placement of WTs and other object of Project, their numbering

– the OHPL

Fig. 4.5. Geological map of the Quaternary sediments at the Project territory (according to geological survey in the scale 1:200000)

The described strata cover the lower Pleistocene-upper Pliocene clay-type red-colored formation.

At the slopes of gullies, coasts of estuary and in the valleys of gullies the deluvial (d) and alluvial-deluvial (ad) sediments are widely spread local strips. Their thickness is insignificant and increases up to 10 m from upper to bottom edges of slopes. The deluvial sediments are represented by loams, with interlayers of sandy loam and alluvial-deluvial sediments with sand lenses, less with gravel and pebbles.

They overlie the sediments of different age from the Quaternary to the Sarmatian. Carried out studies proved highly corrosive property of soils for steel constructions at depths 1.0-3.0 m.

4.2.1.3 Erosion phenomena

In Ukraine, the typical erosion is formed by surface runoff, wind and river flow. Evaluated surface runoff for the flat part of Ukraine is between 0.35 and 0.55 mm/year. The surface runoff is a multifactor process resulting from: hydrometeorology, relief, soil infiltration. Intensity of surface runoff depends on velocity of flows from surface, vegetation covers and anthropogenic impacts. In Ukraine, the soil erosion is significantly accelerated by land plowing. So called «irrigation erosion» is widely spread in Ukraine. «Irrigation erosion» is caused by crops watering used in the majority of irrigated territories in Ukraine.

The loesses and loess-like sediments that form the upper geological environment of the territory of wind field are highly susceptible to erosion processes due to impact of non-riverine and temporary watercourses on plain areas. Land powering contributes to the formation of new ravines. The density of ravine-gully erosion in the Black Sea region has increased by 5-11 times during last 100-300 years. According to some assessment, approximately 75% of ravines have anthropogenic origin.

Widening of ravines and smoothing of their slopes reduce the intensity of gravitational processes. Development of ravines is accompanied by collapse of upper ledge. However, ravines, developing nearby Project territory and alongside the coastline of the Dnipro-Bugsky Estuary, are characterized by steep ledges, and have signs of recent collapses.

All WTs of Project will be located at the distance no less than 300 meters from places of potential ravines development, However, on the stage of engineering and geological surveys more targeted studies of potential impacts of erosion on «DB WPP» constructions will be needed and application of preventive measures against ravine erosion, related to «DB WPP» constructions, are required.

Risks of intensification of soil erosion caused by Project are related with destruction of earth's surface during construction and cable laying works. It should be noted that the loamy Aeolian-deluvial sediments under soil-vegetation layer are quite loose in humid conditions that create preconditions for intensive erosion, in particular under intensive surface runoff. Uncovering of these sediments can increase intensity of the Aeolian erosion (wind erosion).

During Project construction, it is necessary to minimize destruction of landscape surface during earthworks, namely, restore the soil-vegetation cover after the completion of construction and cable laying works. In case of observed development of soil erosion, it is necessary to apply protection measures such as restoration of fertile soil layer and vegetation cover.

Development of soil erosion process, beside of negative phenomena such as alteration of relief, landslides, activation of other negative phenomena, can also cause negative impact on engineering infrastructure and geological conditions of territory and technical conditions of constructions. Probability of development of erosion phenomena during designing of the foundations should be assessed for each WT individually in accordance to DBN B.2.1-10-2009 «Bases and foundations of buildings and structures. Basic design provisions».

During construction of the OHPL, it is important to minimize the disturbance of the surface for landscape when conducting earthworks, to restore the soil-vegetation layer after the completion of the construction of the pylons.

4.2.1.4 Shoreline abrasion of the Dnipro-Bugsky Estuary

The shoreline abrasion of the Dnipro-Bug Estuary (Fig. 4.6) occurs because of mechanical destruction of rocks by water waves and currents.

Methods/models of calculations. Construction and operation of Project do not affect on activation of estuary shoreline abrasion. The planned Project will be located at the sufficient distance from the shoreline of the Dnipro-Bug Estuary and the sites of abrasion development. It allows to exclude the abrasion impact on the Project objects and the impact of Project on the abrasion processes of shoreline.

Fig. 4.6. The shoreline cliff of the Dnipro-Bugsky Estuary
(to the west of the village Oleksandrivka)

The depth of the Neocene limestone occurrence is more than 20-25 m in most parts of the construction site. A layer of low permeable clay rocks covers the limestone. Possible impact of karst processes on the Projects objects in those areas is almost excluded in these areas.

Taking into account significance of the typical horizontal layered structure of sedimentary rocks for the potential activation of dangerous karst processes, the lowered parts of the earth surface (ravines, gullies), where karst-forming rocks are located closely to the earth surface or on the earth surface, shall be paid proper attention. First, it is true for Vovcha Gully.

Assessment criteria. The territory of Project construction is characterized by low risk of hazardous karst development according to the territorial zoning of Ukraine.

Impact assessment. Construction of the planned Project does not have impact on karst intensification. Assessment of the karst formation intensity for the individual construction sites is possible after special engineer-geological surveys. These surveys are required only in case of availability of signs of karst development and technogenic karst activation in the phase of engineering-geological surveys. The most objects of Project will be located at significant distance from gully axes, where potential for karst development exists.

The probability of karst development at the plain areas of WTs foundations is low. Provided minimization of technological water losses, prevention of accumulation of surface water, avoidance of infiltration, the selection of Project territory is quite favorable to avoid karst processes.

4.2.1.5 Soil subsidence

Soils of plains that occupy the largest part of Project territory are the Quaternary Aeolian-Deluvial Loess loamy soils. Their thickness could reach up to 20 m. Their typical feature is subsidence upon compaction under their own weight due excessive moisture or additional loads. Subsidence depends on thickness, conditions, structure, and properties of Loess soils, loads, soaking ability. Due to the variability of lithological composition of Loess soils, the profile and area the subsidence is uneven.

In the southern Ukraine the upper layer of the Loess stratum (usually up to 1.5 m) does not subside without external loads however, is the additional load itself. The downward of soil profile the relative subsidence coefficient increases under own soil weight (up to depth of 3-4 mm, sometimes up to 10 m), and then naturally decreases. Comparing to sandy loams, the light and medium loams have higher subsidence ability.

Findings of preliminary engineering-geological surveys showed that stratum thickness without subsidence is 11.5-15.5 m and the possible subsidence under its own weight is 20.0-32.1 cm. The main canal of the Ingulets irrigation system with numerous branches is located on the boundaries of the eastern wind field cluster, some of them on the western part of wind field cluster. Since the beginning of 2000s it had not functioned, nowadays it is destroyed. Water losses in long period of irrigative system operation (was built in 1960s) increased infiltration recharge, changed soil moisture, formed so called «verkhovodka» (water-saturated interlayers in the aeration zone), caused elevation of groundwater level or formed an aquifer in the Quaternary formations if it did not exist in the undisturbed natural environment. Although the irrigation system does not operate, its past operation could affect engineering-geological conditions of Project (state of Loess deposits in aeration zone, conditions of soil water bearing layer), (state of Loess deposits in aeration zone, conditions of soil water bearing layer). It could cause subsidence and compaction of Loess deposits in previous period and increase the probability of subsidence nowadays, especially under the additional loads from WTs foundation.

According to schematic map, the most vividly unfavorable engineering-geological conditions could appear at locations of WTs 32, 34-37 alongside of the irrigation canal as well as at the locations of WTs 16-19 where the remains of irrigation system were found (Fig. 4.7, Fig. 4.8).

Impact description. Due to soil soaking, loess deposits from their surface to another Loess layer (total thickness 11.5 – 15.5 m) possess ability to subsidence under their own weight. According to preliminary data, the total soil subsidence under its own weight (due to soaking conditions) changes from 20.0 to 32.1 cm. This is subsidence of the second type. Subsidence ability should be considered during Project design taking into account WTs own loads (type I) to predict and prevent the negative impact. Possibility of Loess soils subsidence under WTs additional loads threatens WTs stability and safety, as well as may provoke activation and development of other dangerous processes, partially, soil erosion.

Assessment methods/model. The soil ability to subside will be assessed during engineering-geological surveys in the following designing stages.

Assessment criteria. Soil subsidence parameters should be included during WTs foundation design.

Fig. 4.7. Abandoned irrigation canal, the eastern part of «DB WPP» wind field (area of WT 34 location)

Fig. 4.8. Irrigation system remains on the northern edge of the «DB WPP» wind field (500 m on the east from WT 19)

The construction route of the OHPL crosses the channels of the Ingulets irrigation system, part of which is operating, and part of the beginning of the 2000s is not functioning and is in a destroyed condition. During the long period of functioning of the irrigated system, which was built in the early 60's of the last century, there were water losses that led to an increase in infiltration supply, changes in the humidity regime of soils, the formation of «harness» (water-saturated layers in the aeration zone), raising the levels ground water or the formation of a groundwater aquifer in Quaternary sediments in the absence of it in natural unbreakable conditions.

Despite the fact that at present the irrigation system on the construction route of the OHPL is not partially working, its previous exploitation could affect the engineering and geological conditions (state of the forest deposits of the aeration zone, the regime of the ground aquifer), which could lead to the depletion and consolidation of forest deposits in the previous period, and also increase the probability of development of subsidence at present, especially in conditions of additional load.

The most noticeable violation of engineering geological conditions may be areas along the irrigation canals (Fig. 4.9).

Fig. 4.9. Irrigation canal near the OHPL

4.2.1.6 Seismic features

To prevent seismicity increase, resulting from of groundwater elevation caused by water logging, it is necessary to exclude the technological water losses at the stages of Project construction and operation.

Impact description, seismic features. According to DBN 1.1-12:2014 «Construction in seismic regions», seismicity of Projects territory ranges from 5 to 7 points. Ground water elevation in areas, susceptible to waterlogging, can result in increase of seismicity.

Methods/Models of assessment. To assess seismic intensity, the international seismic schedule MSK-64 is used Table 4.1. At design of Project for determination of seismicity of territory, the map ЗСР-2004-А is used. According to given map the seismicity of territory is evaluates as 5 point for middle soils (II category).

Assessment criteria’s. To assess seismic intensity, the international seismic schedule MSK-64 is used.

Table 4.1 – Seismic intensity in points of MSK-64 scale on Projects territory

Map (DBN B.1.1-12)	Seismicity, degree	Probability of earthquake, %	Probability of earthquake, years	Period of repeatability, years
ЗСР-2004-А	5	10	50	500
ЗСР-2004-Б	6	5	50	1000
ЗСР-2004-С	7	1	50	5000

4.2.1.7 Surface waters

The surface water bodies bordering the Projects construction site are the Dnipro-Bugsky Estuary and the Lake Solonets, Fig. 4.10. The surface waters are not suitable for drinking water use. The Dnipro-Bugsky Estuary is an open oligogaline estuary in northern part of Black Sea, at the territories of Kherson and Mykolaiv Regions of Ukraine. The main port of the Estuary is Ochakiv. The Dnipro-Bugsky Estuary consists of the Dnipro Estuary, elongated in sub-latitudinal direction (length 55 km, width up to 17 km), and the narrow curved Bug Estuary, elongated in sub meridian direction estuary (length 47 km, width from 5 to 11 km). The average depth of estuary is 6-7 meters and biggest depth is 12 meters (Stanislavska pit). The Dnipro-Bugsky Estuary was formed during transgression (transgression is the advance of sea on dry land during earth's crust immersion) of the Black Sea waters in lower flows of the Dnipro and South-Bug rivers. The Dnipro-Bugsky Estuary connected with the Black Sea by strait (width 3.6 km) between Ochakiv cape and Kinburska spit. The coasts of the Dnipro-Bugsky Estuary have following features: the South coast of estuary has low, sandy shores; the northern coast of estuary has mostly high-steep shores (up to 20-35 m) formed from clay-sandy rocks; in some areas sandy-shell spits are observed. The bottom around spits is sandy and covered by loamy sandy muds at the depth. The surface runoff in the Estuary consists of discharge of the rivers Dnipro – 93.5 %; South Bug – 5.7 %; Ingul – 0.5 %; Ingulets – 0.3%.

The average salinity of the Dnipro-Bugsky Estuary is 3.6 % (before construction of the Kakhovsky Reservoir the salinity had been about 2 ‰).

In the different parts of the estuary, the salinity differs depending from prevailing freshwater or sea water masses:

- the eastern part (Dnipro) – 1-3.3 ‰ sometimes 1 ‰ after significant discharges from Kakhovsky reservoir);
- the central – 1-6 ‰;
- the western – 1-11 ‰;
- the Bug – 2-10 ‰.

The Lake Solonets is situated at the territory of Oleksandrivka Village Council in Bilozerskyi District of Kherson Region in natural gully at the outskirts of Oleksandrivka village. The total area of the Lake Solonets is 76 ha. The lake waters are suitable for public water use. The main use of lake is fish farming and recreation. According to the Water Code of Ukraine, the coastal protection zones of estuaries is 2 km and lakes – 50 m.

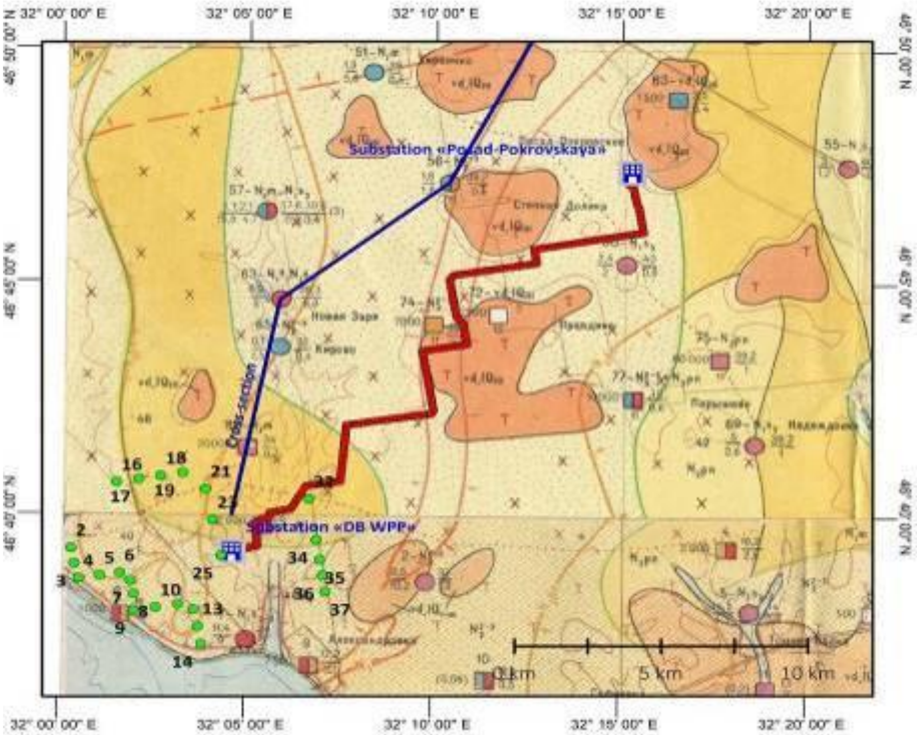
The construction of wind energy objects belongs to permitted human activities within the coastal buffer zones of estuaries and lakes. The planned distance from WTs to coastal buffer zones of estuary is 500 m (taking into account of probability of development of ravine erosion alongside the estuary coasts).

Conclusion: the impact of Project on the geological environment of the Dnipro-Bugsky Estuary and the Lake Solonets is excluded. The impact from pollution and littering of surface waters is also excluded.

Fig. 4.10. Water objects in the area of the Project

4.2.1.8 Groundwaters

In hydrogeological terms, construction site of Project is located within the Black Sea Artesian Basin. Water-bearing layers of the upper part of the geological environment are confined to the Neogene and Quaternary sediments, Fig. 4.11.



Legend

18 – places of potential construction of WTs and other structures of Project, and their numbering

– the OHPL

Fig. 4.11. Hydrogeological map of the Project location
(Based on of hydrogeological survey with a scale of 1:200000)

The aquifer recharge occurs mainly through the infiltration of atmospheric precipitation as well as the infiltration of irrigation water from the canals of the irrigation system at the sites of their functioning and directly during watering of agricultural lands. Groundwater discharge into the valleys of rivers, gullies, seas.

Water-bearing horizons of the upper part of the geological environment are confined to the Neogene and Quaternary deposits, Fig. 4.12.

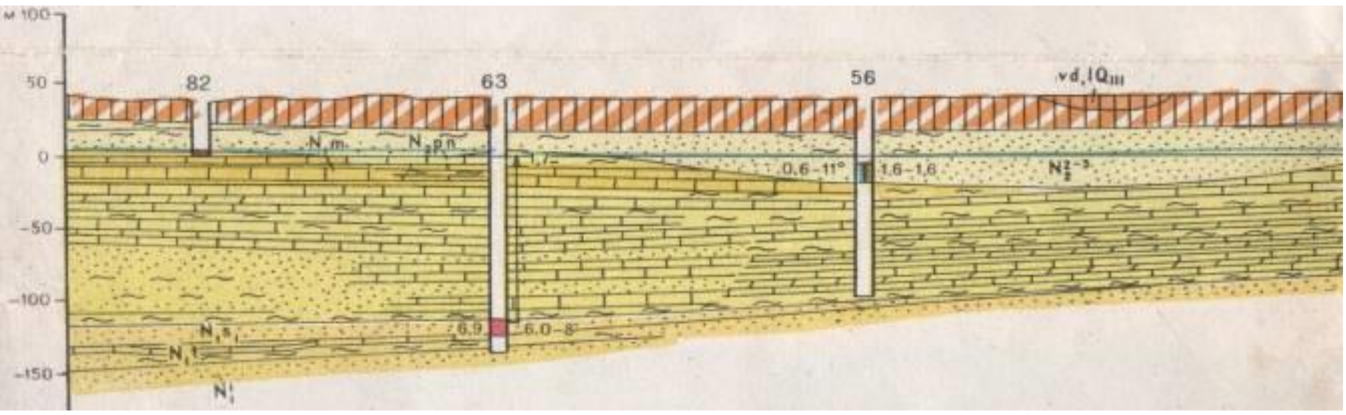


Fig. 4.12. Hydrogeological section the construction territory of the OHPL
(on materials of hydro-geological survey scale 1:200000)

Artificial factors have significant influence on the groundwater regime, among which the main ones are melioration and abstraction of groundwater at water intakes. In general, at the Project territory, in the upper part of the geological environment, the following aquifers are present:

- aquifer of the aeolian-deluvial sediments (vd, e $P_{I–III}$);
- aquifer complex of eopleistocene-pleiocene alluvial sediments of ancient river terraces (N_2-E);
- aquifer complex of sarmati-meotitis-pontic sediments (Ns+m+p).

Characteristics of water-bearing rocks and their schematic cross-section in detail are given above in the description of the geological conditions of the territory. The formation of groundwater in these sediments depends on economic activity, in particular, on the conditions and intensity of irrigation.

The capacity of the water saturated zone of the aeolian-deluvial sediments depends on the degree of waterlogging of the territories, and, as a rule, is maximal nearby main irrigation canals. The filtration coefficients of deposits vary between 0.05 and 0.5 m/day, depending on their lithological composition and structure. The filtration coefficient of red-brown loam and clay, which underlie in the lower part of the layer, is 0.001 m/day and less. In Kherson Region, pollution of the aquifers of aeolian-deluvial deposits with heavy metals (manganese, mercury, lead) as well as persistent pollution with nitrogen compounds, and periodically – with petroleum products is recorded, which proves the low protection of the aquifer from surface contamination. Colorful red-brown clays, the first layer of the surface of regional aquitard, underlay the deposits.

Due to the low water content and occasionally high mineralization, the aquifer is not essential for water supply. During geotechnical surveys, groundwater are found in the aeolian-deluvial layer on some sites along the former canal of the irrigation system in the eastern part of the wind field (WTs 35 and 37). The latter confirms the sporadic uneven distribution of the groundwater aquifer. At a fixed depth of 11,5 m the loess sediments of the pre-Dnipro age are water saturated. According to chemical analysis, groundwater is aggressive to concrete. The dry residue comprises 2.9-3.3 g/dm^3, Table 4.2.

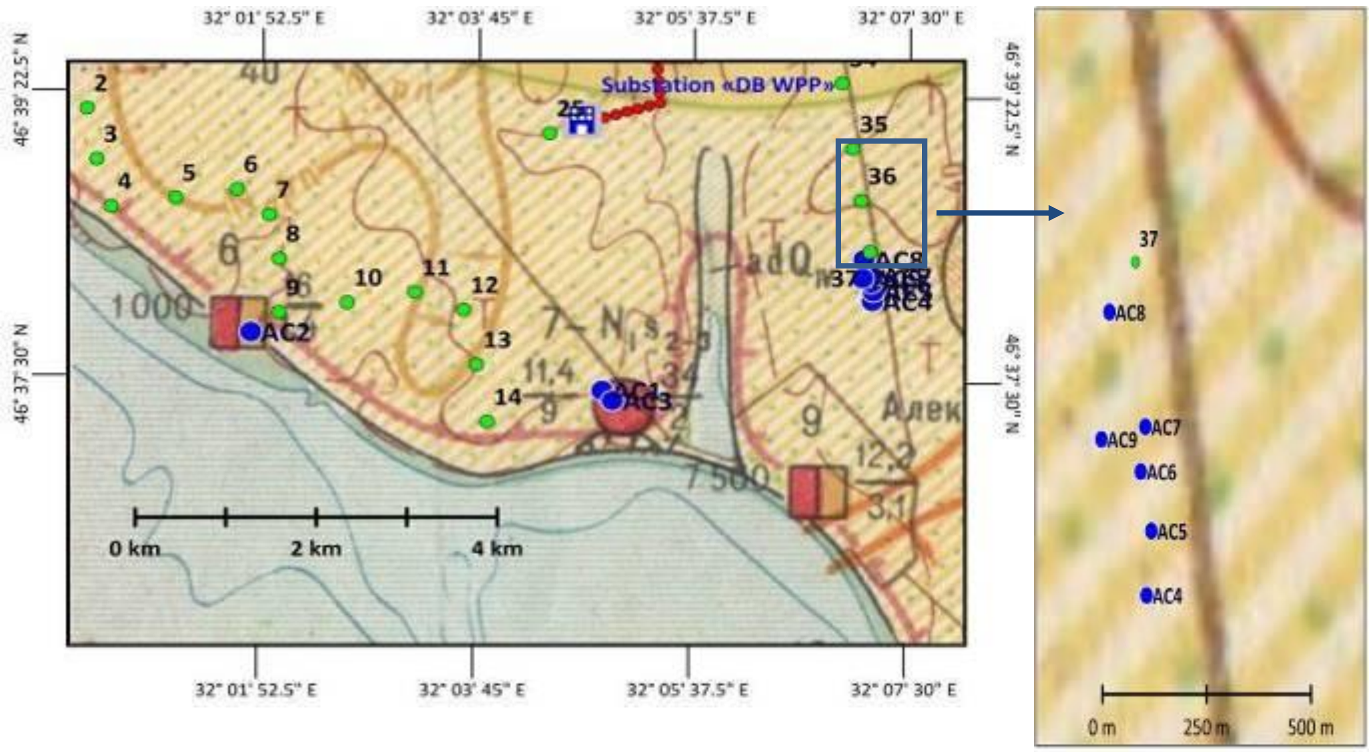
Table 4.2 – Characteristics of groundwater at the territory of the Project

Hydrological indicators	**Characteristics**
Stable level	11,5 m
Absolute mark	25,6-26,4 m
Host rocks	Aeolian-deluvial sediments
Aquifer recharge	Infiltration of precipitation and irrigation
Local unloading	Flow into lower sediments
Total unloading	The Dnipro-Bugsky Estuary
Relative aquitards	Dense Quaternary aeolian-deluvial loams (clays); clay of the Neogene-Quaternary Age

The water-bearing layers of the eopleistocene-pliocene alluvial sediments of the ancient river terraces (N_2-E) are clearly expressed by the buried river valleys of Pre-Inhaul and Pre-Ingulets that used to discharge into the Dnipro-Bugsky Estuary. Sediments are not saturated everywhere. As a rule, only the lower part of the layer located below the contemporary basis of erosion, is water saturated. As a rule, multi grained sand, often with gravel, interlayers and lenses of clay are saturated. Usually, this water is freshwater. The aquifer is used very seldom for the purposes of local water supply. The Sarmat-Meotys-Pontic complex is the main aquifer complex used for water supply.

In natural, undisturbed conditions, ground water in this complex has the lowest mineralization among all the aquifers; however, in most cases mineralization exceeds 1 g/dm^3. Three layers of sediments, represented by limestones and sands, are water saturated. As a rule, this complex is free flowing or has a slight pressure up to 3 m, but within the Pliocene terrace, it acquires a pressure. Water-bearing rocks are characterized by a high variability of filtration properties, both horizontally and vertically that is typical for karst limestones. The coefficients of sand filtration are 0.3-4.5 m/day, limestone – 50-400 m/day. Water conductivity of the complex increases from 200 to 5000 m^2/day. Debits of wells vary between 6.5 and 50 l/sec with increasing depth up to 0.8-3.0 m. As a rule, this water is hydrocarbonate chloride water with mineralization between 1 g/dm^3 and 3 g/dm^3.

The water-bearing complex of the Sarmat-Meotys-Pontic rocks is the main source of drinking water supply in Kherson Region. At the same time, the intensive and long exploitation of Kherson aquifers resulted in increased water mineralization. The water of this aquifer complex is a source of centralized water supply to the village Oleksandrivka. There are 9 wells on the territory of Oleksandrivka Village Council. Three of them № 1-215, № 1-343 and № 1-429 are currently used for water supply, in the schematic map they are numbered as № 4, 6 and 9, respectively, Fig. 4.13.



● – WTs and their numbering
● – artesian wells and their numbering

Fig. 4.13. Schematic map of artesian wells nearby the village Oleksandrivka

Operating wells are located in north-eastern part of the village Oleksandrivka, not far from each other. The water-bearing layers is open at a depth of 59 m, covered by a powerful layer of the Neogene-Quaternary (33 m) and the Neogene (10 m) clays, and is well protected from surface contamination in the watershed areas. Groundwater mineralization is 0.65-0.76 g/dm^3, this water is hydrocarbonate – chloride.

Thus, based on analytical findings, the following conclusions are made:

1. Groundwater, potentially suitable for household and municipal use, is not protected from surface contamination. During Projects construction, it is crucial to minimize contaminant release into the soil in order to prevent the groundwater pollution.
2. Groundwater of the Upper Sarmat aquifer, used for water supply, is protected from surface contamination. At the same time, restrictions regarding the buffer zones of operational wells should be taken into account during the Project construction. This aquifer can potentially be used for Projects water supply by transporting water from Oleksandrivka water supply system with water intake from existing artesian wells or by design and construction of a separate well.
3. The construction and operation of Project do not imply seismicity increase. According to Table 4.1 the soils in the area of the planned construction are classified as the soils of the III and II categories by their seismic parameters. The seismic intensity of the construction site must be taken into account during designing the Project.
4. On the Project construction site, the risk of development of the following dangerous geological processes exist, namely: subsidence of loess soils, soil erosion, less – water logging, karst formation, abrasion-landslides of the estuary coasts, ravines and gullies.
5. The loess sediments that make up the upper part of the geological environment in the area of Project construction are characterized by quite significant subsidence manifested itself upon increased pressure and soaking of sediments. In spite of termination, the long-term operation of the abandoned Ingulets irrigation system at the Project territory still may pose a risk of water logging, the probability of changes in the engineering and geological properties of loess sediments, in particular, when manifested by the increased risk of loess soil subsidence or its compaction. The ability of soils to subsidence must be taken into account when designing Project.
6. Upon designing of Project objects, it is necessary to take into account not only the ability of soils to subsidence, manifested by the load increases and water logging but the aggressiveness of soils and groundwater for concrete constructions and underground infrastructure that shall be assessed in the surveys. The assessment of high corrosive properties of soils for steel constructions at depths of 1.0-3.0 m as well as aggressiveness of groundwater for concrete has been preliminary assessed.
7. In order to avoid the development of soil erosion, it is necessary to minimize the disturbance of landscapes during the WTs construction, to restore the soil-vegetation cover in the places of destruction and to prevent the soil subsidence.
8. The development of the ravine and gully network and ravine erosion takes place

in active form along the coastline of the Dnipro-Bugsky Estuary. Some WTs are planned to locate at the distance of some hundred meters from the developing ravines. It is important to exclude possible impact of Project on the development of ravines and ravine erosion. The abrasion of the banks of the Dnipro-Bugsky Estuary will not affect the facilities of the Project, and the opposite impact is unlikely.

9. Construction and operation of Project will not affect the processes of intensification of karst formation. The possibility of intensification of karst formation is avoided in the planned activities due to minimization of Project man-made water losses.

4.2.2 Impact mitigation and management

The planned Project construction and operation will not provoke the activation of karst processes. As expected, construction and operation of Project will not have any impact, resulting in intensification of the karst processes, in particular, due to absence of the significant technological water loses. Probability of surface water accumulation and increase of infiltration is negligible.

The main managerial decisions should be:

– Minimization of technological losses of water during Project implementation eliminates the possibility of soil subsidence due to excessive soil moisture.
– Construction and operation of Project do not result in the negative impacts on the engineering and geological conditions causing increase of seismicity of territory due to absence of the technological water losses as such. e.g., by increasing groundwater level.
– Consideration of soil subsidence, manifested by increased load and soil moisture, as well as soils and groundwater aggressiveness for concrete and cable infrastructure is necessary in the Projects design.
– Ground water, potentially suitable for industrial and household purposes, is poorly protected from surface contamination. At construction and operation of Project it is necessary to minimize release of pollutant substances into the soil.

Taking into consideration the probability of soil erosion, the conditions of land plots around and under wind turbines and central transformer shall be carefully monitors, aiming at early detection of soil erosion process and their prevention.

Conclusion: consideration of specific features of the Project and the OHPL construction and operation allows make a conclusion about feasibility of selected site and absence of significant negative impacts of planned activities on the geological environment and surface water.

4.3 Lands

4.3.1 Baseline conditions

The territory of Bilozerskyi District belongs to very arid, moderately hot, agroclimatic zone. The relief of the District is represented by plains with numerous rocks.

Within boundaries of territory of planned Project, the most soils of plains are presented by the quaternary Aeolian-deluvial loess loams, thickness of which can reach 20 m.

At the territory of the district, the chernozems (black soils) and dark chestnut soils (69.7 % of area) prevail. The total area of lands of Bilozerksyi District is 153.4 thousand ha, including agricultural lands – 142.7 thousand ha, consisting of:

- arable land – 99.2 thousand ha;
- irrigated land – 29.0 thousand ha;
- forest area – 4384.5 ha;
- pastures – 6088.7 ha;
- perennials – 3879.0 ha;
- hayfields – 134.4 ha.

The objects of Project will be located exclusively on the state owned lands, that are not in use (state owned land reserve). The majority of WTs will be located at agricultural lands that are not arable, namely, in windbreaks.

Such location ensures the preservation of fertile lands for commercial agricultural production and contributes to the strengthening of protective function of windbreaks.

The state owned land reserve at the territory of Oleksandrivka Village Council belongs to agricultural lands. During selection of locations for Project objects, the requirements of article 23 of Land Code of Ukraine «Priority of agricultural lands» are complied with [101].

4.3.2 Impact mitigation and management

The measures for mitigation and prevention of probable impacts on land use will not be necessary because the lands, designated for Project are not used in the agricultural production and belong to the state land reserve of Ukraine.

4.4 Biodiversity

4.4.1 Sources of data and information

For collection of baseline information about biodiversity on the site of Project, the field surveys in 2016, 2017 and 2018 were made.

All species and habitats recorded within the study area were subject to a screening exercise to determine if priority biodiversity features or critical habitat triggers are present, as defined in EBRD PR6 (EBRD, 2014a). The literature and online sources consulted include but are not limited to:

- International Union for Conservation of Nature (IUCN) Red List of Threatened Species (IUCN, 2018);
- The European Red List (IUCN, 2015);
- The Red Data Book of Ukraine (Ministry of Ecology and Natural Resources of Ukraine, 2009);
- Protected Planet (UNEP-WCMC, 2018);
- Catalogue of Life (Catalogue of Life, 2018);
- Integrated Biodiversity Assessment Tool (IBAT, 2018);

- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (The Habitats Directive);
- Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds (The Birds Directive) Additionally, consultation with local ecologists involved with the surveys, including BirdLife Ukraine, has been undertaken to inform the screening exercise.

4.4.2 Study area and habitat mapping

The total Project footprint is 52 ha, of which 47.9 ha is for temporary construction sites (Section 2.2). The study area defined for this screening is the Project footprint and 500 m buffer zone.

Following field surveys, a habitat map of the Project site was produced for the ESIA, according to the EUNIS habitat classification system. Additionally, «Mott MacDonald» prepared a land-cover/habitat classification for the study area to inform this Supplementary Biodiversity Assessment and enable the quantification of habitat loss. Suitable imagery for the classification were identified from the Sentinel-2 (10 m) satellite with one recent cloud-free Sentinel-2 satellite scene providing complete coverage of the «DB WPP» study area selected (acquired 14 July 2018).

The selected image was ortho-rectified using a global digital evaluation model (DEM), an atmospheric correction was applied, and bands with a resolution of 20 m were resampled to 10 m. The land cover classification system that was used:

- surface standing water;
- perennial calcareous grassland and basic steppe;
- anthropogenic herb stands;
- highly artificial broadleaved deciduous forestry plantations;
- regularly or recently cultivated agricultural, horticultural and domestic habitats;
- transport networks and other constructed hard-surfaced areas;
- estuaries.

The classes were then assessed and merged where necessary and assigned to the classes in the land cover classification system. The landcover classification was refined afterwards using Open Street Map data as the 10 m resolution of the Sentinel-2 image was not sufficient enough to bring out roads, anthropogenic herb stands, artificial forestry plantations due to their narrow width.

4.4.3 Biodiversity screening

Each biodiversity feature known to occur in the study area was assessed to identify conservation priorities for the Project in consideration of EBRD PR6 and Guidance Note 6 (EBRD, 2014a; EBRD, 2014b).

In particular, screening was undertaken for «priority biodiversity features» or potential «critical habitat» triggers within the study area, with results presented in this section. Results of this screening were used to determine the sensitivity of each feature to inform the impact assessment (Section 4.4.4).

4.4.3.1 Flora

4.4.3.1.1Baseline conditions

Impact description. The main factors that will cause negative impact on flora in vicinity of the Project construction site are mechanical destruction or damage of vegetation in the places of: technological roads and organization of the construction plots; locations of «DB WPP» objects and the OHPL construction (locations for WTs foundations, central substation, pylons of the OHPL); underground cable lines; soil and waste storage places.

Used assessment methods/models. The basis of the work is the materials of field research of the region of the Project carried out during 2016-2018. In this time more than 10 expeditionary trips were carried out, during which collected about 80 sheets of the herbarium, which is stored in the collection of the Kherson State University (KHSU). The work is based on the critical generalized herbarium fees from the research area stored in the KHSU. Herbarium, and floristic information contained in the publications related to the DB WPP cover of the region. The routes of botanical research were located along the WTs, the OHPL and protected areas Fig. 4.14. During the study of the species diversity of the flora a classic morphological and ecological-geographical method was used.This method has found wide application in the practice of floristic research. It includes: the study of morphological features, their diagnostic significance at different taxonomic levels; analysis of geographical distribution, ecological and eco-topological nature of the species; attitude towards anthropo-persecution.

The basis of the allocation of a rare species of flora is 7 environmental documents, namely:

- The Red List of Kherson Region (Chervonyi spysok Khersonskoi oblasti (2013). Rishenia XXVI sesii Khersonskoi oblasnoi rady VI sklykannia № 893 vid 13.11.2013. Kherson: 13 p. (in Ukrainian))
- The Red Data Book of Ukraine. Vegetable Kingdom (2009). Didukh Ya.P. (ed). Kyiv: Globalconsaltyng, 912 p.;
- European Red List of Vascular Plants (2011). Luxemburg: Publication Office of European Union, 130 p.;
- The IUCN Red List of Threatened Species: http://www.iucnredlist.or;
- Appendix I - Strictly protected flora species/Convention on the Conservation of European Wildlife and Natural Habitats (1979): https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=0900001680304354.
- Appendices I, II and III valid from 4 October 2017 / The Convention on International Trade in Endangered Species of Wild Fauna and Flora) [Електронний ресурс] – Access mode : https://cites.org/sites/default/files/eng/app/2017/E-Appendices-2017-10-04.pdf.
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora – OJ L 206, 22.7.1992).

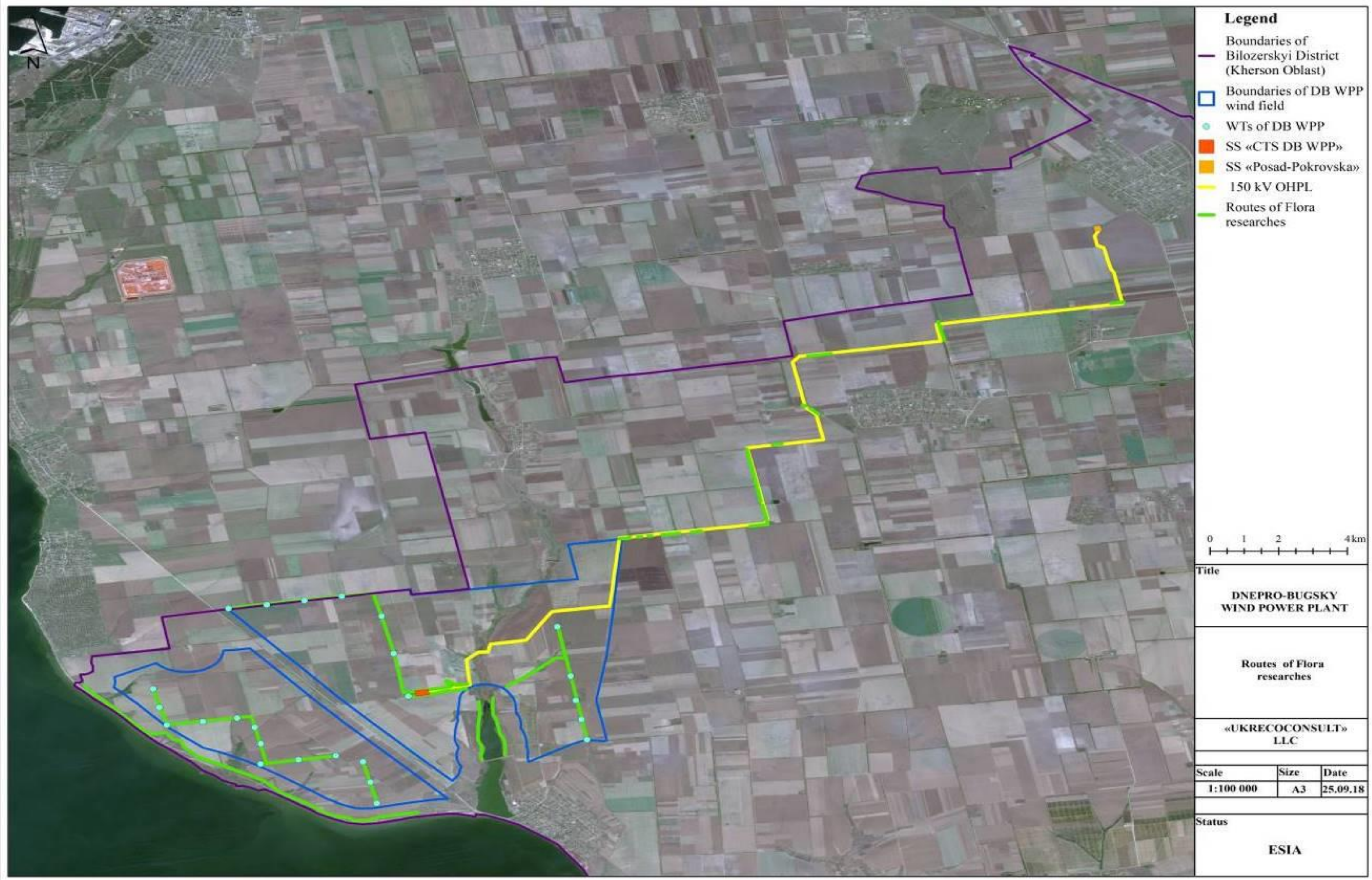


Fig. 4.14. Schematic map of botanical researches on Project site

During the study of ***dendroflora***, the species composition, qualitative state, quantitative and morphometric indices of vegetation of windbreaks in the places of planned location of the foundations of structural elements of the WTs (hereinafter – the sites) were investigated. Area targeting was carried out using a GPS receiver, and maps of the area with the applied polygons and the lines of the location of the foundation WTs and pylons of the OHPL. The morphometric parameters of the dendrological objects were defined by a certified roulette and fixed to the field diary. Determination of taxonomic affiliation was carried out using specialized literature and magnifying optical devices. Proceeding of information was made in the Laboratory of Biodiversity and Environmental Monitoring. of the Kherson State University of JK Pachosky. Statistical processing of data was performed using MS Excel software. The photos are taken with the camera of the mobile phone.

The study of ***vegetation*** was based on the floristic approach of Brown-Blanche. The description of the plots was carried out in the natural limits of phytocenosis, in typical conditions for a specific site on an area of 100 m^2. In identifying syntaxons, we used syntaxonomic schemes of foreign and domestic geobotany [Solomakha, 1996; Matuszkiewicz, 2001; Moravec, 1994; Westhoff, 1973].

Investigation of ***bryophytes*** was carried out according to standard methods of bryophytic research [Boyko, 1999a; Zagorodniuk, 2011; Barsukov 2015]. Collection of herbaceous material of ***mosses*** was carried out using the expeditionary-route method. Particles of each type were collected in a separate paper bag, sunburned in advance. A manual magnifying glass (X 2.5) was used for detailed examination of the samples. On a package or a separate label that was put into the package, the geographical point where the sample was collected, the environmental conditions, including the nature of the substrate on which the species grow, the species of the tree (genus, species or family), mountain rock, illumination, humidity conditions, exposition of the place of collection, surname and initials of the collector. The composition and structure of moss yeasts were determined on fragments of tree trunks in the size of 20×150 cm, 30×150 cm; on the surface of the soil – 50x50 cm, in the rocky structures – 25×25 cm. Types of mossy affected in the field diaries by the appropriate code, specification of the species belonging – conducted in laboratory conditions.

Details of anatomical and morphological structure of plants were studied using standard optical-optical technique: MBS-1 and BioLam-2 microscopes. The samples were determined by a standard comparative anatomical-morphological method using flora, determinants and monographic treatments with dichotomous keys [Bachurina, Melnichuk, 1987, 1988, 1989, 2003; Virchenko, 1989; Boyko, 2009; Frahm, 2009, 2011]. The names of species and their position within the limits of super-taxa were specified in the Second Checklist of Bryobionta of Ukraine [Boiko, 2014]. The belonging of the bryophyte to the apophytic fraction of bryophlore was determined by the classification developed by M.F. Boyko for the brioflory of Ukraine [Boyko, 2005]. The basis of this classification is the ability of bryophytes to grow in ecotopes of anthropogenic origin or anthropogenically transformed. Ecological plasticity of species was determined by the index of ration: the ratio between the number of anthropogenically created or transformed ecotopes, in which the species was found, to the total number of substrate-ecotopic differences, in which the species is able to inhabit. Also taken into account is the typology of ecotope.

The following criteria were used:

- changes of species richness and species abundance of plant groups in succession processes (number of species per unit area);
- spatial and temporal changes of species composition and structure of populations;
- changes in number of species average density and abundance of plantss in local species populations, etc.

According to geobotanical zoning of Ukraine, the wind field of Project belongs to Bilozerskyi District of Odessa-Kherson Region, namely, to the strips of fescue-feathered steppes. In the past, the territories between estuaries had been covered by fescue-feathered steppes. Presently their residuals are preserved mostly on the slopes of the Dnipro-Bugsky Estuary and in gullies, namely, in the areas bordering «DB WPP» construction site.

The territory of Project is placed within the agricultural lands. The main part of wind-field territory is the arable lands. Also at the territory, such human made habitats as hard cover roads (between village Oleksandrivka in Kherson Region and village of Limany in Mykolaiv Region), agricultural roads, field windbreaks (sometimes with remains of irrigation systems), insignificant residential places (lighthouse, chemical warehouse, and farm), heathlands (instead of the former farms, etc.) and upper reaches of several gullies are present. The weeds prevail in vegetation cover. At these lands dominate weeds of species: *Amaranthus retroflexus; Amaranthus albus; Ambrosia artemisiifolia* and evapophytes – *Chenopodium album; Salsola tragus; Convolvulus lineatus*.

The roadside habitats are formed predominantly by resistant plants of class *Plantaginetea majoris,* namely: *Polygonum aviculare; Atriplex tatarica; Eragrostis minor; Aegilops cylindrical; Cuscuta campestris; Amaranthus albus; Setaria viridis; Taraxacum officinale; Psammophiliella muralis.*

The vegetation cover of other habitats at the territory Project (abandoned lands, residential areas and upper parts of gullies) is also synanthropic and formed from above described weeds. There are also recorded few synanthropic species, namely: *Echium vulgare*; *Cirsium vulgare*; *Verbascum sp.*; *Heliotropium europaeum*; *Geranium pussilum*.

The natural steppe zones are preserved at slopes of gullies closely to the Dnipro-Bugsky Estuary, however, they do not belong to the territory of wind field. The vegetation cover of steppe zones characterized by dominant turf grasses of: *Festuca valesiaca*; *Stipa capillata*; *Koeleria cristata*; *Agropyron pectinatum* and half shrubs: *Artemisia lerchiana*; *Kochia prostrate*. The steppe motley grasses are represented by xerophilic plants: *Artemisia austraica*; *Carduus uncinatus*; *Coronilla varia*; *Galatella villosa*; *Limonium alutaceum*; *Otites densiflora*; *Potentilla argentea*; *Salvia nemorosa*; *Seseli tortuosum*; *Artemisia lerchiana*; *Tanacetum millefolium*; *Thymus dimorphus*. At the open spaces of field windbreaks, scattered or in small clusters of the steppe plantss, representatives of the class *Festuco-Brometea* grow. Among them hemiapophytes dominate: *Artemisia austriaca*; *Coronilla varia*; *Marrubium praecox*; *Otites densiflora*; *Potentilla argentea*; *Salvia nemorosa*; *Salvia aethiopis*; *Jacobea ericifolia*; *Seseli tortuosum*; *Poa bulbosa*; *Euphorbia agrarian*; *Hypericum elegans*; *Falcaria vulgaris*. Only few non-synanthropic plants grow in the region: *Festuca valesiaca*; *Koeleria cristata*; *Artemisia lerchiana*.

The field windbreaks will be main place of WTs location. Total length of field windbreaks in the vicinity of wind field is 50 km, Fig. 4.15.

Fig. 4.15. View of field windbreaks, in which the location of WTs is planned

The land plots of widths of field windbreaks and average length 50 m are selected for WTs installation.

Grasses of the field windbreaks have three groups of habitats:

– field windbreak habitat with forest stand;
– open field windbreak habitats;
– roadside habitats.

The vegetation cover is characterized by prevailing of ruderal weeds from classes *Elytrigietea* repensis and *Artemisietea*, namely: *Elytrigia repens*; *Poa angustifolia*; *Calamagrostis epigeios*; *Tragopogon major*; *Convolvulus arvensis*; *Atriplex oblongifolia*; *Berteroa incana*; *Bromopsis inermis*; *Artemisia absinthium*; *Melilotus albus*; *Melilotus officinalis*; *Medicago falcate*; *Rumex patientia*; *Chondrilla latifolia*; *Sisymbrium loeselii*; *Lactuca tatarica*; *Cichorium intybus*; *Lactuca serriola*; *Lepidium draba*; *Onopordon acanthium*; *Cirsium arvense*; *Galium humifusum*; *Euphorbia virgata*; *Achillea setacea*; *Hypericum perforatum*; *Achillea pannonica*; *Chondrilla juncea*; *Linaria biebersteinii*; *Cynoglossum officinale*; *Echium vulgare*; *Grindelia squarrosa*; *Poa compressa*.

Species of class *Chenopodietea*, growing in places with damaged vegetation cover form solid thickets, namely: *Ambrosia artemisiifolia*; *Chenopodium album*; *Chenopodium strictum*; *Stellaria media*; *Atriplex tatarica*; *Atriplex sagittata*; *Consolida paniculata*; *Bromus squarrosus*; *Xeranthemum annuum*; *Centaurea diffusa*; *Anisantha tectorum*; *Conyza canadensis*; *Salsola tragus*; *Erodium cicutarium*; *Nigella arvensis*; *Anthemis ruthenica*; *Buglossoides arvensis*; *Crepis rhoeadifolia*; *Cyclachaena xanthiifolia*; *Kochia scoparia*; *Solanum nigrum*. It is also noted few synanthropic species, namely: *Echium* *vulgare*; *Cirsium vulgare*; *Verbascum sp.*; *Heliotropium europaeum*; *Geranium pussilum*. In the woody area, the 10 species of plants were recorded, namely: *Robinia pseudoacacia*; *Ulmus pumila*; *Ulmus campestris*; *Gleditsia triacanthos*; *Acer negundo*; *Populus deltoids*; *Populus nigra f. Pyramidalis*; *Fraxinus excelsior*; *Quercus robur*; *Fraxinus pensylvannica*.

At the territory of field windbreaks also presented: *Armeniaca vulgaris*; *Elaeagnus angustifolia*. The thinned underwood, formed by species of: *Prunus stepposa*; *Rosa canina; Sambucua nigra*. The majority of windbreaks are in very bad conditions. Namely, the most widespread windbreaks with *Robinia pseudoacacia*, are almost completely cut down; individual dominant species forms outgrowth bushes of 3-4 m in height. The situation is even worth in the wind breaks with tree species that do not have outgrowth or have weak outgrowth (for example, species of *Populus*, *Quercus*, *Fraxinus*, *etc.*) because such windbreaks are extremely thinned and have only few trees left. Among the wetland vegetation there are the species of: *Bolboschoenus maritimus*; *Schoenoplectus tabernaemontani*; *Xanthium albinum*; *Phragmites australis*; *Elytrigia elongate*; *Typha laxmanii*; *T. latifolia*. Due to high level of water mineralization, the aquatic vegetation of the Dnipro-Bugsky Estuary is represented mainly by groups of *Zostera marina*. In addition, here can be found species of: *Potamogeton pectinatus*; *Ruppia maritima; Zannichelia major*. In the downstream of the Dnipro-Bugsky Estuary the *Ruppia cirrhosa* was recorded.

On the territories of land plots allocated for Project construction, the 10 species of aerophytic algae were defined. Defined species belong to 7 genus: *Oscillatoria*, *Pleurococcus, Trentepohlia, Klebsormidium, Stichococcus, Trebouxia, Interfilum*, 7 families *(Oscillatoriaceae, Trebouxiaceae, Prasiolaceae, Chaetophoraceae, Ulotrichaceae, Klebsormidiaceae*, *Trentepoh Liaceae*, and 3 classes:

- green algae – *Chlorophyta* (8 species),
- streptophyta algae – *Streptophyta* (1 specie),
- blue-green (cyanophyte) algae – *Cyanophyta* (1 specie).

Distribution of aerophyte algaes relative to forofites presented in Table 4.3.

Table 4.3 – Distribution of aerophyte algae's relative to forofites

Species	**Forofit (substrate)**		
	Quercus robur	*Robinia pseudoacacia*	*Elaegnus angustifolia*
Oscillatoria lacustris			*
Pleurococcus vulgaris	*	*	*
Pleurococcus olivaceus	*	*	*
Trentepohlia aurea	*	*	
Klebsormidium flaccidum	*	*	
Stichococcus bacillaris	*	*	*
Stichococcus chodatii		*	*
Stichococcus minor			*
Trebouxia arboricola	*	*	*
Interfilum terricola		*	
Total:	**6**	**8**	**7**

Due to the research carried out following biotopes, or habitats (according to EUNIS) are presented on the wind field:

- C.1.1. Surface standing waters;
- E.1.2. Perennial calcareous grassland and basic steppes;
- E.5.1. Anthropogenic herb stands;
- G.1.C. Highly artificial broadleaved deciduous forestry plantations;
- I.1. Regularly or recently cultivated agricultural, horticultural and domestic habitats;
- J.4. Transport networks and other constructed hard-surfaced areas;
- X.01. Estuaries.

Characteristic of the distribution of biotopes in the Projects territory:

- *E.5.1. Anthropogenic herb stands.* This biotope is a synatropic grass group outside of agricultural land. There are narrow stripes along roads and forest strips, around structures in degraded (completely devoid of woody plants) sections of forest strips and on the slopes of the Vovcha Gully. There are no rare species in the habitats.
- *G.1.C. Highly artificial broadleaved deciduous forestry plantations.* Natural woody vegetation for the territory of the Project is not characteristic, that is, this area is naturally woodless. All tree plantations within the Project and its surroundings are artificial. Occurs this habitats narrow strips along roads and field-protective plantations. In general, they are very degraded with the destroyed woodland. There are no rare species in the settlement.
- *I.1. Regularly or recently cultivated agricultural, horticultural and domestic habitats.* This habitat combines agricultural land. Occupies the largest area among other types of habitats. In general, agricultural land within the wind field occupy more than 90% of the territory.

4.4.3.1.2 Clarification of vegetation of the areas allocated for Project territory

Syntaxanomical scheme of vegetation and its characteristic:

1) Class *Robinietea* Jurko ex Hadac et Sofron 1980 (syntaxon № 1).
2) Transitional groupings of classes *Robinietea* and *Agropyro intermedio-repentis* (syntaxon № 2).
3) Class *Agropyro intermedio-repentis* (Oberd.et all.1967) Muller et Gors 1969 (syntaxon № 3).
4) Class *Artemisietea vulgaris* Lohmeyer, Preising et R. Tüxen ex von Rochow 1951 (syntaxon № 4).
5) Class *Stellarietea media* Tüxen et al. ex von Rochow 1951 (including *Secalietea* Br.-BI. 1951) (syntaxon № 5).

Phytocenotic characteristic of the sites allocated for WTs installation is presented in Annex E. The WTs of «Dnepro-Bugsky Wind Power Plant» will be located, mostly, in the field windbreaks. Vegetation of the field windbreaks belong to the Class *Robinietea* Jurko ex Hadac et Sofron 1980 (Annex E, syntaxon № 1).

This is a class of synatropic vegetation, which combines artificial forest plantations of the steppe zone. However, for today, most fireld windbreaks belong to transition group *Robinietea* and *Agropyro intermedio-repentis*. Such changes happened because of an absence of management by windbreaks and tree degradation. Typically groups of *Robinietea* belong to the field wind breaks with preserved trees plantation, Fig. 4.16.

Trees layer is formed mainly by: *Robinia pseudoacacia*; *Acer negundo*; *Elaeagnus angustifolia; Fraxinus pensylvannica; Gleditsia triacanthos; Sophora japonica; Ulmus pumilla*. Only the one specie of indigenous plants (*Quercus robur)* was obderved in tree stand. The shrub layer is also formed by young species of *Quercus robur*. Except this in the tree stand the following species also are presented: *Prunus divaricata*, *Rosa canina* and *Sambucus nigra*. In grass cover dominates weeds of class *Robinietea, namely Anisantha sterilis* and *Galium aparine*. The subdominants are represented by: *Elytrigia repens; Poa angustifolia; Ballota nigra; Artemisia absinthium; Atriplex saggitata; Rumex patentia*.

Fig. 4.16. Groups of Class *Robinietea*

Vegetation cover of preserved areas of artificial plants is formed by synanthropic. Not synanthropic or rare species were not found in the groupings.

Groups of Class *Agropyro intermedio-repentis* are mostly presented on non-forest areas, or on areas with fully degradated trees plantations, Fig. 4.17.

Trees plants is represented only by the one tree of *Armeniaca vulgaris* (projective coverage – 3%). There prevails a shrub layer formed by shrubs: *Rosa canina; Prunus divaricata)*, and juvenile, or subcenyl (because of damage by fire and cutting) tree species: *Robinia pseudoacacia; Acer negundo; Fraxinus pensylvannica; Gleditsia triacanthos; Armeniaca vulgaris; Quercus robur*.

Projective coverage of shrub layer is 2-15 % (Annex E syntaxon № 2). The herbal layer prevails among the vegetation layer, in accordance with the features that are typically for Class *Agropyro intermedio-repentis*.

Fig. 4.17. Groups of Class *Agropyro intermedio-repentis*

Root plants are dominant in vegetation cover: *Elytrigia repens; Poa angustifolia; Artemisia austriaca*. The other type of plants (diagnostic for this class) are also noted: *Cardaria draba; Convolvulus arvensis; Falcaria vulgaris; Salvia nemorosa*. The subdominants are represented by: *Cardaria draba; Sysimbrium loeselii; Anisantha tectorum; Bromus squarrosus; Anisantha sterilis; Galium aparine; Cirsium arvense; Lactuca serriola; Linaria biebersteinii.* Small percent of projective coverage but high constancy have: *Achillea setacea; Rumex patientia; Chondrilla juncea; Coronilla varia; Euphorbia agraria; Seseli tortuosum.* Also in small number there is presented steppe gemiapophytes: *Achillea setacea; Coronilla varia; Potentilla argentea; Potentilla recta; Hypericum elegans; Seseli tortuosum*.

They are presented on open stabilized areas. Not synanthropic or rare species were not found in the groupings. Groups of Class *Agropyro intermedio-repentis* spreads not only on territories allocated for WTs but also on the territories allocated for construction of CTS (Annex F). Most of the sites, where the planned installation of turbines, belong to degraded forest plantations. Degradation of forest plantations happens because of antropogenic factors (deforestation, frequent fires) and unfavorable situation for tree growth (lack of moisture, high temperatures, dry weather, etc.), Fig. 4.18.

Fig. 4.18. Transitional groups of Classes *Robinietea* and *Agropyro intermedio-repentis*

As a result of falling trees, the open areas (lawns with ruderal groupings of the Class *Agropyro intermedio-repentis*) are formed. Thus, the vegetation of these sites is represented by a mosaic combination of the two previously described classes *Robinietea* and *Agropyro intermedio-repentis.*

The above description of these classes also characterize these transitional groupings, so there is an only slight supplement of their description below.

The presence of new species in these groupings is primarily caused by the large number of described areas. There are noted only two species among the tree plants - *Armeniaca vulgaris* and *Malus domestica*. In shrub tier there are observed: *Amorpha fruticosa; Lonicera tatarica; Prunus stepposa.*

Also there is observed steppe species of plants, namely: *Agropyron pectinatum; Medicago falcata; Otites densiflora; Potentilla laciniosa.*

Including not synanthropic species: *Festuca valesiaca; Koeleria cristata; Galatella villosa*. Protected plant species are absent (Annex E, syntaxon № 3).

Trees vegetation in floristic composition of groups is absent (Fig. 4.19). In the herbal tier of Class *Artemisietea vulgaris the* high caudate plants of *Artemisia absinthium* and *Onopordon acanthium* are dominate.

Fig. 4.19. Groups of Class *Artemisietea vulgaris*

The subdominants are represented by: *Atriplex saggitata; Sisymbrium loeselii; Artemisia austriaca; Achillea pannonica; Anisantha tectorum.*

More detailed information about number of subdominant is presented in Annex E, (syntaxon № 4). The non synanthropic or rare species were not found in the groupings

A ceratin vegetation class *Stellarietea media* is a groupings located among the fields (Fig. 4.20). Totally, the six such sites have been investigated. All fields are stationed with winter wheat (*Triticum durum).*

The basis of the vegetation is *Triticum durum.* The herbaceous vegetation cover is poorly developed, probably because of the use of herbicides. There are observed such individuals: *Helianthus annuus; Chenopodium album; Capsella bursa-pastoris; Consolida paniculata; Conyza canadensis; Amaranthus albus; Amaranthus retroflexus; Fallopia convolvulus; Setaria viridis*. The non synanthropic or rare species were not found in the groupings *Stellarietea media* (Annex E, syntaxon № 5).

Fig. 4.20. Groupings of class *Stellarietea media*

29 species of epiphytic lichens and 3 species of lichen fungi were identified in areas where cutting and crowning of trees are planned (area of the crossing of the OHPL with forest strips). The lichen group includes two associations common in southern Ukraine: *Rinodino pyrini-Calogayetum lobulatae* (Khodosovtsev et al. 2017) and *Amandineo punctati-Xanthorietum parietinae* (Khodosovtsev et al. 2017) relating to the *Xanthorion parietinae* (Ochsner Alliance in 1928, Physsietea Tomaselli et DeMicheli 1952).

The dominant species that form the main epiphytic groups are *Phaeophyscia orbicularis* (up to 60% of the projective coverage), *Physcia adscendens* (up to 40% of projective coverage), *Xanthoria parietina* (up to 20% of the projective coverage).

The most representative species are *Physcia adscendens* (90%), *Phaeophyscia orbicularis* (80%), *Lecanora carpinea*, the smallest *Melanelixia subaurifera* (10%), *Physconia grisea* (10%), *Ramalina farinacea* (10%), *Scoliciosporum chlorococcum* (10%), Fig. 4.21.

Conclusion: study of the vegetation of the plots, (at land plots, where the wind turbines and the OHPL pylons of Project is planned) by the Brown-Blanca method of floristic classification of vegetation showed that the vegetation had a pronounced synanthropic character. The Plant have no sozological value.

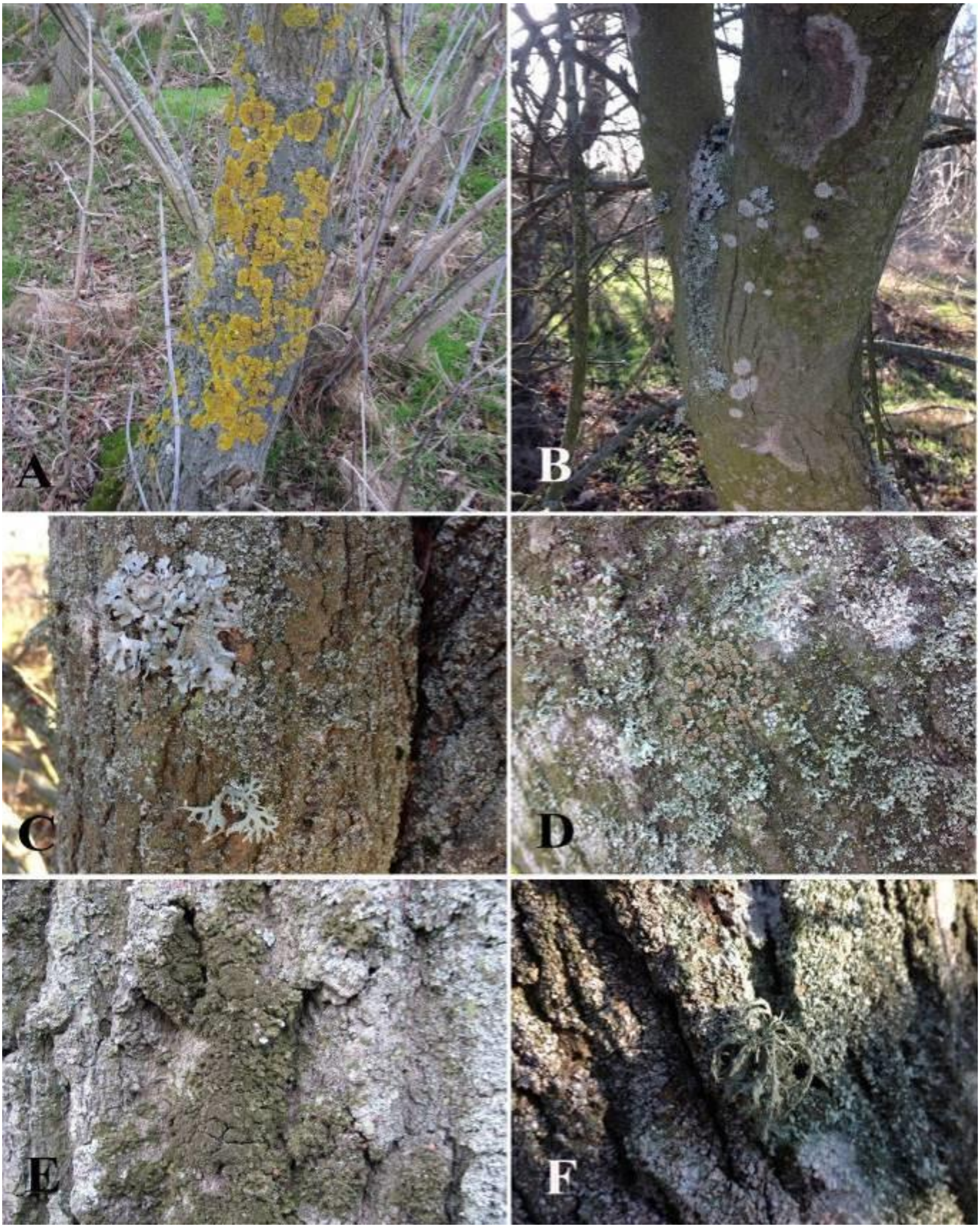


Fig. 4.21. Epiphytic lichens and lichen mushrooms in monitoring sites:
A – *Xanthoria parietina*; B – *Athelia arachnoidea*; C – *Parmelia sulcata, Evernia prunastri* та *Physcia adscendens*, D – *Lecanora carpinea, Physcia adscendens*; E – *Melanelixia subargentifera*; F – *Ramalina* cfr. *europaea*

4.4.3.1.3 Alien and invasive species

Not all alien invasive species are highly invasive. Much of them are widespread locally over the territory, or even not found (that is, probably they disappeared). However, a certain group of adventitious plants is more or less dangerous and capable to widespread into agricultural lands or into natural ecosystems, causing significant damage to the recipient territory. Significant danger also caused by the invasive species of adventitious plants that are in a state of expansion.

During the 20-th century, at the Northern Black Sea terrestrial area there was an expansion of 27 non-native types of vascular plants. Among them, only 7 anthropophytes capable for expansion have stabilized, while 20 species continue active invasion in the region, Table 4.4.

Non-native species in the stage of invasion are marked on the territory of the Project: *Acer negundo L., Amaranthus albus L., Ambrosia artemisiifolia L., Amorpha fruticosa L., Centaurea diffusa Lam., Chenopodium strictum Roth, Cyclachaena xanthifolia (Nutt.) Fresen., Elaeagnus angustifolia L., Fraxinus pennsylvanica Marshall, Grindelia squarrosa (Pursh) Dun., Ulmus pumila L., Xanthium albinum (Widd.) H.Scholz.*

Invasive species capable of ecosystem transfomation are marked at the territory of Project: *Ambrosia artemisiifolia L.* (Fig. 4.22)*, Amorpha fruticosa L., Anisantha tectorum (L.) Nevski, Centaurea diffusa Lam., Elaeagnus angustifolia L., Erigeron canadensis L., Grindelia squarrosa (Pursh) Dun., Xanthium albinum (Widd.) H.Scholz.*

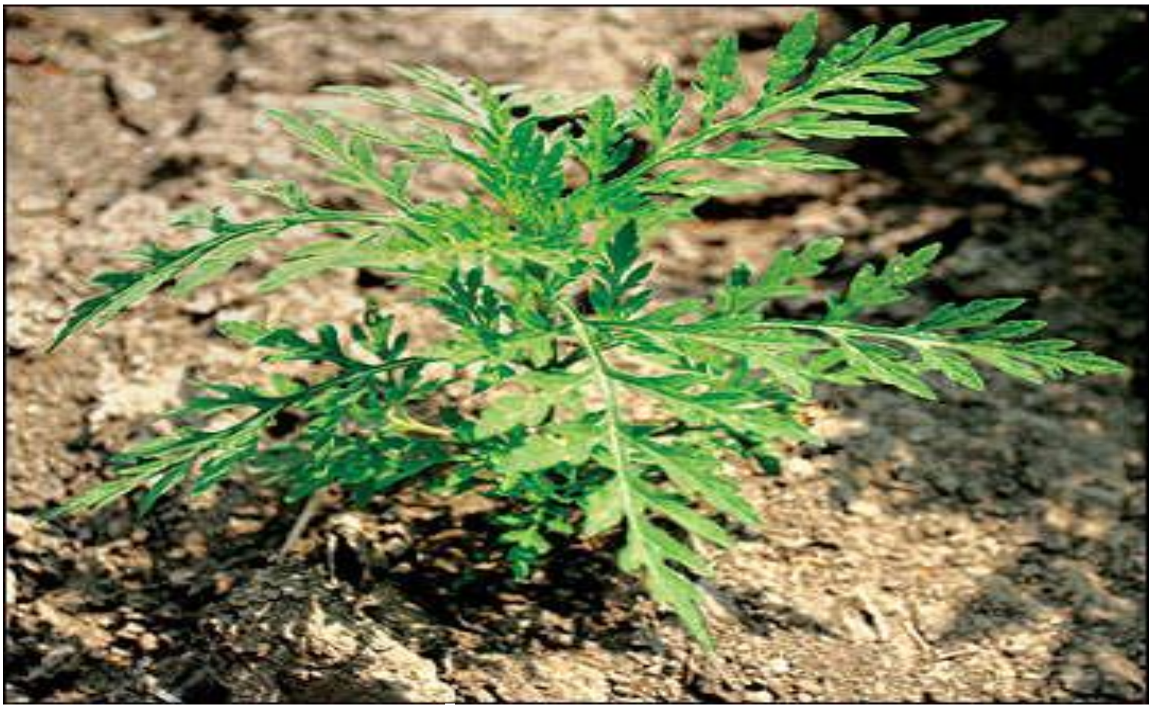


Fig. 4.22. *Ambrosia artemisiifolia L.*

At the territory of Project,the 84 species of adventitious vascular plants (or 40% from the total number of shows the high level of environment transformation in the area of the Project) were noted. There were also noted 12 species which are in the stage ofinvasion and 8 species of invasive transformers.

Table 4.4 – Participation of species of adventitious plants in expansions at the territory of the Northern Black Sea Coast in XX – XIX centuries

№	The name of the species	Second half XIX century	1900-1940	1941-1975	1975-2010
1	*Amaranthus albus*	+	+		
2	*Centaurea diffusa*	+	+	+	
3	*Diplotaxis tenuifolia*	+	+	+	
4	*Acer negundo*		+	+	
5	*Amaranthus blitoides*		+	+	
6	*Elodea canadensis*		+	+	
7	*Cyclachaena xanthifolia*		+	+	+
8	*Chenopodium strictum*		+	+	+
9	*Lepidotheca suaveolens*			+	
10	*Ambrosia artemisiifolia*			+	+
11	*Artemisia annua*			+	+
12	*Galinsoga parviflora*			+	+
13	*Grindelia squarrosa*			+	+
14	*Xanthium albinum*			+	+
15	*Xanthium pensylvanicum*			+	+
16	*Lepidium densiflorum*			+	+
17	*Cenchrus longispinus*			+	+
18	*Solanum cornutum*			+	+
19	*Ulmus pumila*			+	+
20	*Amaranthus powellii*				+
21	*Bidens frondosa*				+
22	*Elaeagnus angustifolia*				+
23	*Amorpha fruticosa*				+
24	*Oxybaphus nyctagineus*				+
25	*Fraxinus pennsylvanica*				+
26	*Corynephorus canescens*				+
27	*Ailanthus altissima*				+
	Total	-	8	18	20

It was established, that the presence of dense vegetation, formed mainly by perennial grass plants, significantly reduces the probability of anthropophytes distribution in this territory. Outside the settlements it is more rational to create multispecies quasitual steppe vegetation groups. The *Quasiparous* steppe groups should be created on the open area of Project construction sites. On the sites of the former plantations that will be restored, it is necessary to restore trees plantation. For this purpose, it is necessary to use indigenous plants, or non-invasive tree plants. In order to prevent the spread of invasive herbaceous plants, it is proposed to carry out the following activities:

- monitor the spread of invasive species;
- in the case of the detection of invasive species in the process of construction, prevent the formation of seeds by invasive species. This can be achieved by various methods: cutting, mechanical soil cultivation, use of herbicides, mechanical removal, etc.;
- after the completion of the construction it is offered in open areas of the soil, where the spread of invasive species is possible to sow grass mixture from local perennials. Since local plant species are better adapted to local conditions, such quasitational groups are resistant to invasive plants penetration into them.

In general, for avoidance of anthropophytes distribution, it is necessary to create quasitual steppe groups on the construction sites, and to restore the trees plantations with use of indigenous plants, or non-invasive tree plants.

4.4.3.1.4 Dendroflora inventory for the areas, where foundations construction for the Project is planned

The species spectrum of the investigated specimens is quite common for the territory of the «DB WPP». It has the 14 taxons, among which are the 11 species of woody vegetation and the 3 species of shrubs. Detailed information about the taxonomic structure of investigated specimens is presented in Table 4.5.

Table 4.5 – The dendroflora of land plots allocated for construction of WT foundations

Type № by order	TREES	SHRUBS
SPECIES		
1	*Armeniaca vulgaris*	*Amorpha fruticosa*
2	*Prunus divaricata*	*Sambucus nigra*
3	*Ulmus pumila*	*Rosa canina*
4	*Gleditsia triacanthos*	
5	*Pyrus communis*	
6	*Quercus robur*	
7	*Acer platanoides*	
8	*Acer negundo*	
9	*Elaeagnus angustifolia*	
10	*Robinia pseudoacacia*	
11	*Fraxinus pennsylvanica*	

In the course of conducting research for the OHPL, 8 pilot and 8 monitoring sites were selected and surveyed, in which 508 species of plants related to woody and shrub vegetation were found in total, Fig. 4.23.

Fig. 4.23. Map of study routes of the dendroflora of the OHPL

The common species of the total species list are not included in the nature consrvation documents of the regional and national levels. This excludes the possibility of conflicts and legal liability of persons involved in cleaning out sites allocated for placement of wind turbines and pylons. Information on the quality status and morphometric indices of dendrological coverage on the sites allocated for WTs and pylon placement is presented in inventory cards, Annex H.

The Inventory Card number corresponds to the site number. On the sites № 1, 28, 29, 30 – arrangement of WTs are not planned. On the sites № 2, 3, 20, 21, 22, 23 – there are not any dendrological objects. The analysis of the dendrological quality of the plots, in most cases, indicates their unsatisfactory conditions, as evidenced by a multiple increase in the number of the root grass in relation to the separate specimens of the woody vegetation species. Such feature is typical for places with significant anthropogenic pressure and reveals in the form of unauthorized uncontrolled tree felling and fires.

Mosaic-like occurrence of some species indicates that they are distributed naturally (self-seeding, development of the root vein), and their elimination on sites will not have a significant negative impact on conditions of regional ecosystems, and their restoration is a matter of time. The summary data on the species composition of trees in satisfactory state, designated for felling in the corresponding sites, are presented in Table 4.6.

Table 4.6 – Summary data on the species composition of trees in satisfactory state designated for felling

№ Plots	The tree species and the number of trees > 5 cm in diameter more tha in satisfactory state with a diameter designated for cutting down							
	Robinia pseudoacacia	*Ulmus pumila*	*Acer platanoides*	*Quercus robur*	*Fraxinus pennsylvanica*	*Prunus divaricata*	*Elaeagnus angustifolia*	*Gleditsia triacanthos*
4	2							
5	7	10						
7	1							
8	1							
9	8							
10	8							
12	1		2					
13	1							
14	8							
17	1							
18				1	1	1		
19				7	14			
25	5						3	
Total	43	10	2	8	30	1	3	2
All together								84

Among the investigated specimens, 490 are in unsatisfactory state, 9 trees require replanting in case of cutting down, and 7 are in satisfactory condition, but their morphometric parameters do not allow for compensation in the event of their elimination, Table 4.7.

Table 4.7 – Number of trees of satisfactory state to be felling for laying the OHPL

No. Plots	The name of the breed and the number of trees of satisfactory condition diameter > 5 cm, which are subject to liquidation							
	Armeniaca vulgaris	*Ulmus pumila*	*Acer negundo*	*Fraxinus pennsylvanica*	*Morus alba*	*Elaeagnus angustifolia*	*Gleditsia triacanthos*	*Populus nigra*
Experimental site 1			2	1			2	
Experimental site 2						1		
Experimental site 3								
Experimental site 6					1			
Experimental site 7								1
Experimental site 8		1						
Total		1	2	1	1	1	2	1
All together	9							

The overall assessment of the permanent loss of dendroflora during Project realization is given in Table 4.8.

Table 4.8 – The number of trees to be felling for the construction of the Project

The name of the species and the number of trees of satisfactory state with a diameter > 5 cm to be felling	Number of trees
Robinia pseudoacacia	43
Ulmus pumila	11
Acer platanoides	2
Quercus robur	8
Fraxinus pennsylvanica	31
Prunus divaricata	1
Elaeagnus angustifolia	4
Gleditsia triacanthos	4
Armeniaca vulgaris	
Acer negundo	2
Morus alba	1
Populus nigra	1
TOTAL	**93**

After completion of the construction works, the Project provides for the a Reforestation Program. Reforestation Programme will be developed to compensate the trees loss as part of construction activities. The Project Company will collaborate with the governmental authorities to plan and implement the Reforestation Programme.

Conclusion: dendroflora inventory in the areas oj foundations construction of the Project to be placed, shows that there are no any dendrological objects on the sites allocated for WTs construction (sites №. 2, 3, 20, 21, 22, 23). The analysis of state of dendrological coverage on other sites in most cases, indicates its unsatisfactory condition.

4.4.3.1.5 Protected, rare and endangered species (populations)

At the territory that will be used for location of «DB WPP» and the OHPL objects, protected, rare or endangered species (populations) of flora are absent.

Due to the very high level of anthropogenic transformation, only synatropic habitats are represented at this territory. In general, there are 3 types of identified synanthropic habitats, according to EUNIS classification, namely:

- *E 5.1. Anthropogenic herb stands;*
- *G.1.C Highly artificial broadleaved deciduous forestry plantations;*
- *I.1 Regularly or recently cultivated agricultural, horticultural and domestic habitats.*

Immediately on the territory of the wind power plant the habitats belonging to the Habitat Directive (they are included in the Habitat of the Berne Convention) are not represented. Instead, in the vicinity of the object there are 2 habitats that belong to the mentioned lists, namely:

- *62C0. Pontic-Sarmatian steppes (according to the Bern Convention – E 1.2 Perennial herb calcify groups and steppes).* The Pontic-Sarmatian steppes are represented as a part of a landscape reserve of national significance «Oleksandrivskiy». They occupy the coastal part adjacent to the estuary. On the territory of planned objects the vegetation of steppes and limestone outcrops is dominated. The horizontal surfaces and slopes of the terrace, ravines and beams are occupied by the steppe vegetation of the steppe grasses, represented by dominated species, namely: *Agropyron pectinatum*, *Festuca valesiaca*, *Koeleria cristata*, *Stipa capillata*, *S. lessingiana* and *S. Ucrainica*, relating to the habitat of the Berne Convention E 1.2 «Perennial herbs calcified groups and steppes». On the steep slopes of loess debris the higher vegetation is absent (often covered with lichens and mosses). Also they represented by a rarefied and poor vegetation of semi-desert type. The following plants,typical for polystyrene semi-deserts, are dominates, namely: *Artemisia lercheana*, *Agropyron pectinatum* and *Kochia prostrata*. These ecosystems are poorly researched in Ukraine. Previously, they were relocated to habitats of type E6 Continental saline steppes. 15 species of plants have regional, national and international protection status, including 9 rare species within the Oleksandrivka Village Council.
- *1130. Estuaries (according to the Berne Convention – X01 Estuaries).* Habitat 1130. The estuaries are represented by the shore and water area of the Dnipro

Estuary. Wate area of the estuary already has the official status of Emerald object «Dnipro-Bugsky Lyman» (Site_code UA0000109).

As with rare species, rustic habitat are located at a sufficient distance from the objects of the elements of the «Dnepro-Bugsky WPP» and the OHPL, which is why they will practically not suffer as a result of the construction of the Project. As Table 4.9 shows the construction of the Project will not have a negative impact on the rare habitats met in the region.

Table 4.9 – Assessment of the impact of the Project on protected plant species

№	The name of the species	Grounds for protection	Availability on the territory of the Project	Presence in the vicinity of the Project	Impact assessment (high, medium, low, absent)
1	*Astragalus borysthenicus*	Red Book of Ukraine	–	+	Absent
2	*Stipa capillata*	Red Book of Ukraine	–	+	Absent
3	*Crambe maritima*	Red Book of Ukraine	–	+	Absent
4	*Tulipa gesneriana*	Red Book of Ukraine	–	+	Absent
5	*Prangos odontalgica*	Red list of Kherson Region	–	+	Absent
6	*Ephedra distachya*	Red list of Kherson Region	–	+	Absent
7	*Vinca herbacea*	Red list of Kherson Region	–	+	Absent
8	*Ferula capsica*	Red list of Kherson Region	–	+	Absent
9	*Limonium platyphyllum*	Red list of Kherson Region	–	+	Absent

In Table 4.10 and Table 4.11 is given an assessment of the impact of the Project on the grouping of protected plants and Habitat of the Bern Convention (Habitat Directive).

Table 4.10 – Estimation of the impact of the Project on the grouping of protected plants

№	The name of the grouping	Grounds for protection	Availability on the territory of the Project	Presence in the vicinity of the Project	Impact assessment (high, medium, low, absent)
1	*Stipetea capillatea*	Green book of Ukraine	–	+	Absent

Table 4.11 – Assessment of the impact of the Project on the habitats of the Berne Convention and the Habitat Directive

№	The name of the habitat is in accordance with the EU Habitat Directive	Name of the habitat in accordance with the Berne Convention	Availability on the territory of the Project	Presence in the vicinity of the Project	Impact assessment (high, medium, low, absent)
1	1130 Estuaries	X 01 Estuaries	–	+	Absent
2	62C0. Pontic-Sarmatia steppes	E 1.2 Perennial herb calcify groups and steppes	–	+	Absent

Totaly, at the territory of the Landscape Reserve «Oleksandrivskyi» were observed, 23 types of vascular plants from the Red Book of Ukraine, 4 species from the European Red List, 4 species from the World Red List or the Red Book of IUCN and 13 species from the regional Red list of Kherson Region, Annex J.

In addition, there are 5 formations of vegetation, included in the Green Book of Ukraine, namely: *Stipeta capillatae*; *Stipeta lessingianae; Stipeta pulcherrima*; *Stipeta asperellae*; *Stipeta ucrainica*.

Among observed mosses, the one specie, included in the Red List of Kherson Region and and protected at the local level. Overall assessments of the status of populations of species within the Kherson Region and Ukraine as a whole were not conducted, therefore its status can be designated as «DD» (insuffifient information). The natural flora and vegetation of territory adjacent to Project territory have the unique botanical and environmental value. Excessive grazing of virgin steppes and meadows, plowing and afforestation of slopes, traditional burning of dry grasses, have esulted in the significant anthropogenic impacts on natural flora and vegetation.

Conclusion location of «DB WPP» and the OHPL at the safe distance from the Landscape Reserve «Oleksandrivskyi» prevents any impacts on flora and vegetation cover of this landscape reserve as well as adjacent territories.

4.4.3.2 Fauna

4.4.3.2.1Baseline conditions

Insect search was carried out using visual transect examination, visual inspection of leaves, flowers and possible shelters, storage facilities, etc.. Determination of the types of imago and their clutches was carried out according to the typical determinants of Mamaev's insects and others. (1972, 1976), Yermolenko and Klochko (1971), «The Determiner of Insects...» (1986, 1988), by Kluge (2000). Determination of the traces of damage was carried out by determiners Pikusheva and others. (2013), Gusev and Rimsky-Korsakov (1951), Petrova and others. (2011).

The main methods of relative counting of reptiles are counting on routes, recording on test sites. The most common and easiest to use is the method of recording on routes, it is the method of transect, the method of test tapes. The width of the transect depends on the nature of the area: in areas densely overgrown with herbaceous vegetation, it is unlikely to exceed 1 m. The length of the route is arbitrary and determined by the possibilities of the plot and the nature of the work. It is very important to get the route right and choose the optimal time for it. It is necessary to take into account that the route should lie in the typical parts of the habitats, which are fundamentally different from the rest of the territory. To be fully confident that the time of the highest activity of animals is selected, the record could be repeated several times at different times and in different weather conditions.

The fauna records provided for research in two directions: 1-records of the species composition of the fauna, 2-counting of the number. In inventory surveys, all means of recording species, such as direct observation and trapping of animals, and counting for traces of the presence of one or another species in the investigated area are used for counting. In the latter case, attention is drawn to the holes, footprints, sound communication of animals, animal remains in the fodder remnants of predators, and others like that. The routes of fauna research were located along the WTs, the OHPL and protected areas, Fig. 4.24.

The following criteria are used:

– changes of species diversity and species abundance of groups in succession processes (number of species per unit area);
– spatial and temporal changes of species composition and structure of populations;
– changes in average density species and abundance in local species populations, etc.

Fig. 4.24. Schematic map of fauna researches on Project site

4.4.3.2.2Terrestrial invertebrate animals

Besides typical species of insects, in the field windbreaks the following butterflies from the Red Book of Ukraine can be randomly observed, namely: *Marumba quercus Schif.*; *Acherontia atropos L.*; *Daphnis nerii L.*; *Proserpinus proserpina Pall.*; *Hemaris tityus L.*; *Callimorpha quadripunctaria Poda*; *Papilio machaon L.*; *Parnassius mnemosyne L.*; *Iphiclides podalirius L.*; *Zerynthia polyxena Schif.*; *Polyommatus daphnis Schif.*; *Catocala fraxini L.*

Among the species of *Hymenoptera,* the protection is necessary for fairly rare species of: *Bombus fragrans Pall.*; *Bombus argillaceus Scopoli*; *Bombus paradoxus Dalla Torre; Xylocopa valga Gerstaecker*; *Xylocopa violaceae L.*; *Melitturga clavicornis Latreille*; *Scolia maculata Drury*; *Scolia hirta Schranck*. Observance of biggest wasp of Ukraine *Scolia maculata Drury* is relatively frequent, but occurrence of *Scolia hirta Schranck* is less frequent.

The field windbreaks is the main reserve and source for resettlement species of *Carabidae* (significant part of which are typical forest and wood-marshy species) into the agricultural fields. Among the 584 species of observed beetles, the 158 species of beetles belong to the class *Carabidae*. In comparison with open fields, at wind-protected fields the environmental diversity of class *Carabidae* (with many effective entomophages*)* in 4-20% higher. There are many species of *Ichneumonoidea*. Their larvae are parasites of many pests, namely: *Geometridae, Pyraustidae, Tineina, Curculionidae Latreille, Melolontha Fabricius, Chrysomelidae Latreille, Hemiptera, Aphidoidea,* etc). On the plants and trees, the representatives of two main groups of insects – pollinators and phytophagus were found. The pollinators were represented by numerous species of class *Hymenoptera*, namely: *Halictidae Thomson* (Fig. 4.25), *Megachilidae Latreille* (Fig. 4.26), which, in addition to pollination and pollen collection, partially damage the leaves and petals of the flowers of some plants (by cutting out material from plants for the construction of nests). Also, the insects of Families *Syrphidae Latreille*, *Muscidae Latreille, Empididae*, *Nymphalidae Rafinesque*, *Pieridae Swainson*, *Noctuidae Latreille*, *Geometridae* were found.

Fig. 4.25. *Halictidae* on flowers

Fig. 4.26. *Megachile* on flowers

The pests of order *Coleoptera* were also found. They were represented by families *Tenebrionidae Latreille* (*Omophlus*, Fig. 4.27), *Cantharidae Imhoff*, and *Scarabaeidae Latreille*, (for example *Anomala dubia and Tropinota hirta)*, Fig. 4.28.


Fig. 4.27. *Omophlus spesies* on flowers


Fig. 4.28. *Tropinota hirta* on flowers

On other part of plants, the species of the families *Curculionidae Latreille* (*Larinus vulpes*, Fig. 4.29), *Linnaeus (Harpalus rufipes)*, *Malachiidae Fleming*, *Coccinellidae Latreille*, *Ptinidae Latreille* and *Chrysomelidae Latreille* were found.

There are also found representatives of the order *Hemiptera* (family *Scutellaridae)*, namely: *Eurygaster integriceps*, *Lepyronia coleoptrata*, *Pentatomidae Leach*, *Dolycoris baccarum (*Fig. 4.30), *Pseudococcidae Heymons* (Fig. 4.31).


Fig. 4.29. *Larinus vulpes*


Fig. 4.30. *Dolycoris baccarum*

The insects *Tettigoniidae Krauss* (Fig. 4.32), *Acrididae MacLeay*, *Chorthippus dorsatus*, *Gryllidae Laicharding*, *Gryllus campestris* were also found. They are main representatives of order *Orthoptera* on studied sites.

Fig. 4.31. Eating of leaves by *Pseudococcidae*

Fig. 4.32. Nymph of *Decticus verrucivorus*

On open areas, the nests of ants *Formica pratensis Retzius*, (Fig. 4.33) and ants *Messor structor* (Fig. 4.34) were found.

Fig. 4.33. Nest of *Formica pratensis*

Fig. 4.34. Ants *Messor structor*

During observations, the mass flight of mosquitoes of the family *Chironomidae* was observed (Fig. 4.35).

On inspected area, the 75% of trees have traces of leaf damage by the representatives of the family *Chrysomelidae*, and mineras of the family *Nepticulidae*, *Gracillariidae*. All inspected oaks have traces of leaf damage by the insect.

On the leaves of Quercus robur (typically oak) the numerous galla of *Cynips quercus folii* and *Neuroterus numismalis Fourc* (Fig. 4.36) were found.

Fig. 4.35. Mosquitoes (*Chironomus spesies)*

Fig. 4.36. Damages of oak leaves by the *Cynipoidea*

Terrestrial invertebrate species may fall into numerous traps (ditches, pits, etc.) and die under the wheels of trucks during the Project construction and operation works. Due to powerful illumination during construction works at night, the probability of interference into spatial structure of insect populations (inhabiting virgin land plots) is exists. It happens due to insect mass migration to the illumination sources.

Part of these insects will be eaten by predators (birds, small mammals, etc.) in the morning. Such «washing out» of biomass can affect abundance of the local entomophages, in particular species under conservation.

Maximum number of species was registered on the coast of estuary and on the agricultural fields, the minimum – in the field windbreaks, where installation of «DB WPP» wind turbines and the OHPL pylons are planned. Since on flashing lights will be mounted on the WTs (on operation phase), the attraction of insects to the illumination sources at night will be insignificant.

There is no data about number of terrestrial invertebrates, killed during construction works of WPP and transport movement. The impact is temporary, only during construction period.

Taking into account fact that entomofauna species are good indicators of environment state, it is expedient to monitor individual groups of entomofauna species at the final stage of design, (as well as during the construction and operation of the Project). Such monitoring is necessary for further study of impact of «DB WPP» on this species at the Southern Ukraine.

Conservation status and faunistic value of terrestrial invertebrate presents in Table 4.12.

Table 4.12 – Conservation status and faunistic value of terrestrial invertebrate

№	Species	IUCN Red List	European Red List	The Bern Convention	The Red Book of Ukraine	Vulnerability
1	*Marumba quercus Schif*			-	+	R
2	*Acherontia atropos L*			-	+	R
3	*Proserpinus proserpina Pall*			-	+	R
4	*Hemaris tityus L*				+	R
5	*Callimorpha quadripunctaria Poda*				-	
6	*Papilio machaon L*				+	V
7	*Parnassius mnemosyne L*				+	V
8	*Iphiclides podalirius L*				+	V
9	*Zerynthia polyxena Schiff*				+	V
10	*Polyommatus daphnis Schiff*					V
11	*Catocala fraxini L*				+	V
12	*Bombus fragrans Pall*	+	+		+	V
13	*Bombus argillaceus Scopoli*	+			+	V
14	*Bombus paradoxus Dalla Torre*	+			-	
15	*Xylocopa valga Gerstaecker*	+			+	R
16	*Xylocopa violaceae L*	+			+	R
17	*Melitturga clavicornis Latreille*	+			+	V
18	*Scolia maculata Drury*				+	I
19	*Scolia hirta Schranck*				-	

r – rare, v – vulnerable, i – invaluable.

4.4.3.2.3 Amphibians and reptiles

Amongst the amphibians, on coasts of the Dnipro-Bugsky Estuary, the following species are observed: *Rana ridibunda*; *Bufo viridis*; *Bombina bombina*; *Pelobates fuscus*; *Hyla arborea*. Amongst the reptiles, on coasts of the Dnipro-Bugsky Estuary the following species are observed: *Emys orbicularis*; *Natrix natrix*; *Natrix tesselata*; *Lacerta viridis*; *Lacerta agilis*; *Eremias arguta*; *Hierophis caspius*; *Elaphe sauromates*.

Most amphibians and reptiles live nearby water objects and on slopes of the Dnipro-Bugsky Estuary, and they hardly approach the Project construction site. There is observed species of *Bufo viridis* and *Pelobates fuscus*. These species weakly depend on water, but in the afternoon *Bufo viridis* good hide in all kinds of shelter, and *Pelobates fuscus* buries into the ground. On the observed areas, the *Lacerta agilis* was observed *(class reptiles)*. The snakes in the field windbreaks was not found. Alongside the territory of the wind field, namely on the open areas of the Landscape Reseve «Oleksandrivskyi», the two species of snakes were found, namely:*Natrix natrix and Hierophis caspius*, Fig. 4.38, Fig. 4.39 respectively.

Fig. 4.37. *Pelobates fuscus*

Fig. 4.38. *Natrix natrix*

The *Natrix natrix* is typical and widespread specie in Ukraine. The *Hierophis caspius* is less numerous specie included to the Red Book of Ukraine, Fig. 4.39.

Inspected areas are also suitable for residence of *Vipera renardaii (The Red Book of Ukraine)* but during inspection of the territories this species did not observed.

During construction of the Project certain types of amphibians and reptiles (gray vermilion, lizard jelly, snakes) can fall into numerous traps (ditches, pits, etc.) and die under wheels of trucks and construction equipment.

Fig. 4.39. *Hierophis caspius*

Special studies of amphibians and reptiles at the construction site of «DB WPP» was not carried out. Due to absence of information about state of population from discussed group it is necessary to include study of background species of batrachogerpetofauna into the program of monitoring at the «DB WPP» construction site in all phases of the project implementation: from the preparatory to operation phases.

There is no data about number of amphibians and reptiles that can be killed during construction work and under wheels of trucks. This type of impact is temporary, only during construction period.

Conservation status and faunistic value of amphibians and reptiles presents in Table 4.13.

Table 4.13 – Conservation status and faunistic value of amphibians and reptiles

№	Species	IUCN Red List	European Red List	The Bern Convention	The Red Book of Ukraine	Vulnerability
1	*Bombina bombina*	+	+	+	+	V
2	*Bufo viridis*	+	-	+		LC
3	*Elaphe sauromates*	+	-	-	+	V
4	*Emys orbicularis*	+	-	+	-	NT
5	*Eremias arguta*	+	-	-	-	NT
6	*Hierophis caspius*	+	-	-	+	V
7	*Hyla arborea*	+	+	+	-	LC
8	*Lacerta agilis*	+	-	+	-	LC
9	*Lacerta viridis*	+	-	+	+	V
10	*Natrix natrix*	+	-	-	-	LC
11	*Natrix tesselata*	+	-	-	-	LC
12	*Pelobates fuscus*	+	+	+	-	LC
13	*Rana ridibunda*	+	-	-	-	LC

LC – Least concerns; NT – Near threatened; V – Vulnerable

Conclusion: probability of impact from «DB WPP» on amphibians and reptiles is absent because most amphibians and reptiles live nearby water bodies and on the slopes of estuary and don't gets on the territory of «DB WPP» construction.

4.4.3.2.4Mammals

In the vicinity of the Project territory the 22 species of mammals live. Two more species *Spermophilus odessanus* and *Lutra lutra* likely are considered extinct. Since 90s of the last century at the territory they are not observed. Fauna of small mammals is represented by 9 species, namely: *Sylvaemus sylvaticus*; *Sylvaemus uralensis*; *Microtus rossiaemeridionalis*; *Mus musculus*; *Mus spicilegus*; *Sorex minutus*; *Sisista subtilis*; *Cricetulus migratorius*; *Crocidura suaveolens*. Species that are common at the Project territory are: *Erinaceus europaeus*; *Lepus europaeus*; *Nyctereutes procyonoides*; *Canis lupus*; *Mustela erminea*; *Mustela nivalis*; *Vulpes vulpes*; *Mustela eversmanni*; *Meles meles*. Small mammals during the Project construction can get into numerous traps (ditches, pits, etc.) and die, like the rest of the species, under the wheels of trucks. Construction works may scare wild animal and cause their forced resettlement from traditional habitats. The mouses were sampled by standard technique with Geri traps installing 25 traps in line in each biotope. It should be noted, that major attention was paid to the valley of the Lake Solonets and its steppe gullies. In future, during the Project construction and operation this study shall continue provided the bat studies include the arable lands with different types of crop rotation and in the field windbreaks. Abundance and species diversity of mouse-like rodents can be used as integral indicator of environmental changes.

Small mammal deaths and injuries during the Project construction and their scaring from traditional habitats will be temporary. Noise impact from wind turbines at this group of animals is not sufficiently studied, so assessment of noise impact and related conclusion are possible only in the stage of «DB WPP» operation. Conservation status and faunistic value of mammals presents in Table 4.14.

Table 4.14 – Conservation status and faunistic value of the mammals

№	Species	IUCN Red List	European Red List	The Bern Convention	The Red Book of Ukraine	Vulnerability
1	*Sylvaemus sylvaticus*	-	-	-	-	
2	*Sylvaemus uralensis*	-	-	-	-	
3	*Microtus rossiaemeridionalis*	+	-	-	+	LC
4	*Mus musculus*	+	+	-	-	LC
5	*Mus spicilegus*	+	+	-	-	LC
6	*Sorex minutus*	+	+	-	+	R
7	*Sisista subtilis*	+	-	-	+	D
8	*Cricetulus migratorius*	+	+	-	+	LC
9	*Crocidura suaveolens*	+	+	+	+	LC
10	*Erinaceus europaeus*	+	+	-	-	LC
11	*Lepus europaeus*	+	+	-	+	R
12	*Nyctereutes procyonoides*	+	+	-	-	-LC
13	*Canis lupus*	+	+	+	-	LC
14	*Mustela erminea*	+	+	-	+	I
15	*Mustela nivalis*	+	+	-	-	LC
16	*Vulpes vulpes*	+	+	-	-	LC
17	*Mustela eversmanni*	+	-	+	-	D
18	*Meles meles*	+	+	-	-	-LC

4.4.3.2.5 Birds

Within the framework of this ESIA report, the ornithological field studies were carried out the «DB WPP» site (August 2016-June 2017) and the OHPL (September 2017 – August 2018). During the field studies (2016 and 2018) the site of the Project was inspected. For investigations of birds diversity, the conventional methods of routes counting, point counting, and trial plots were used. The observations were carried out in daylight from 8.00 to 16.00. The bird counting by routes were conducted at four specially selected individual areas with different types of natural complexes, Table 4.15, Fig. 4.40, Fig. 4.41.

Table 4.15 – Routes of birds counting in the vicinity of the Project site

Area	Coordinates of beginning and end of route	Total length of route	Notes
«DB WPP»			
№ 1	46°39'22.47" N.L 31°59'00.22" E.L. – 46°38'05.80" N.L. 32°00'38.15" E.L.	3 km 200 m	Shallow waters of the Bug Estuary and high slopes of coast with quaternary ravines.
№ 2	46°38'05.80" N.L. 32°00'38.15" E.L. – 46°37'21.90" N.L. 32° 02'13.60" E.L.	2 km 500 m	Shallow waters of the Bug Estuary with bushes of water vegetation (mostly reed bushes).
№ 3	46°36'57.43" N.L. 32°04'15.12" E.L. – 46°37'01.74" N.L. 32°05'19.09" E.L.	2 km 600 m	High slopes of coasts and quaternary ravines with wood-shrub vegetation.
№ 4	46°36´57.43" N.L. 32°04´15.12" E.L. – 46°37´01.74" N.L. 32°05´19.09" E.L.	1 km 700 m	Coast of the Dnipro-Bugsky Estuary with residuals of nests after waterfowl nesting under conventional name «Oleksandrivskyi Pod».
OHPL			
№ 1	46°40´03.96" N.L 32°05´30.75" E.L. – 46°41´04.34" N.L 32°06´21.44"E.	2 km	Plot in the upper reaches of the lake Solonets.
№ 2	46°44´17.97" N.L 32°10´36.15" E.L. – 46°45´22.82" N.L 32°12´03.42" E.L.	2 km 700 m	Agricultural landscapes.
№ 3	46°46´40.11" N.L 32°13´54.45" E.L. – 46°47´24.40" N.L 32°14´48.70" E.L.	1 km 700 m	Agricultural landscapes.

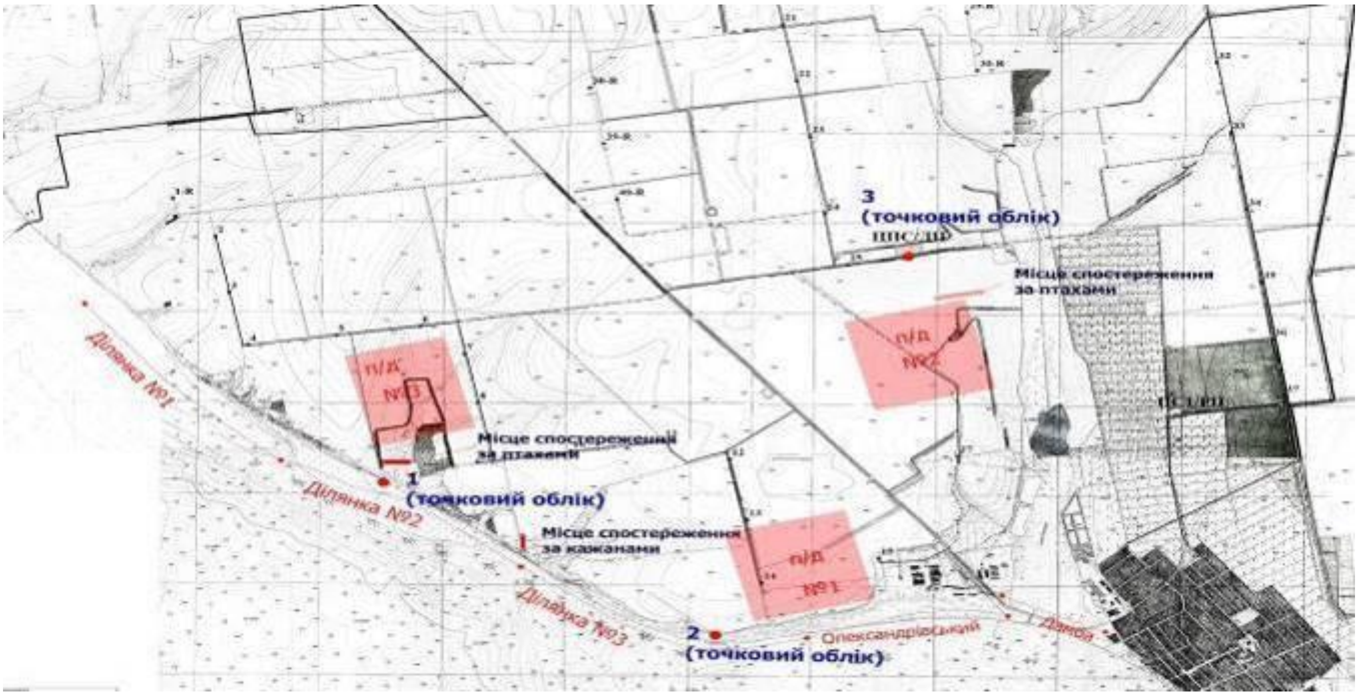


Fig. 4.40. Map of «DB WPP» and monitoring network

During field studies the researches of species composition, abundance, and distribution of migratory birds by biotopes, their behavior, dynamics, direction and movement height were carried out. The nature and intensity of anthropogenic impacts on birds and the corresponding reactions of birds to these impacts were also studied. The equipment used in the field studies consisted of binoculars (10-x) telescopes (25x60), navigation devices, digital cameras with variable optics, etc.

In addition, the territories of the Quaternary ravines slopes, located alongside the Bug Estuary (from village Oleksandrivka to the former water pumping plant) were inspected (common route counting). On this areas the two counting points were installed. Central coordinates of counting points for the «DB WPP»:

№ 1: 46°37´05.94" N.L. 32°04´13.31" E.L;

№ 2: 46°39´34.04" N.L. 32°05´13.24" E.L.

For investigations of birds diversity in area of the OHPL placement, the method of common route records were used. Investigations were carried out on areas of agricultural landscapes and in the upper reaches of the Lake Solonets, near the village Oleksandrivka. On these areas the two test sites were also laid.

Central coordinates of counting points for the OHPL:

№ 1: 46°39´56.63" N.L. 32°05´22.87" E.L.;

№ 2: 46°45´28.68" N.L. 32°12´24.04" E.L.

Point records of birds was held on two sites:

- in the upper reaches of the Lake Solonets, coordinates: 46°39´22.91" N.L. 32°05´00.48" E.L.
- agricultural landscapes, coordinates: 46°44´09.66" N.L. 32°10´46.74" E.L.

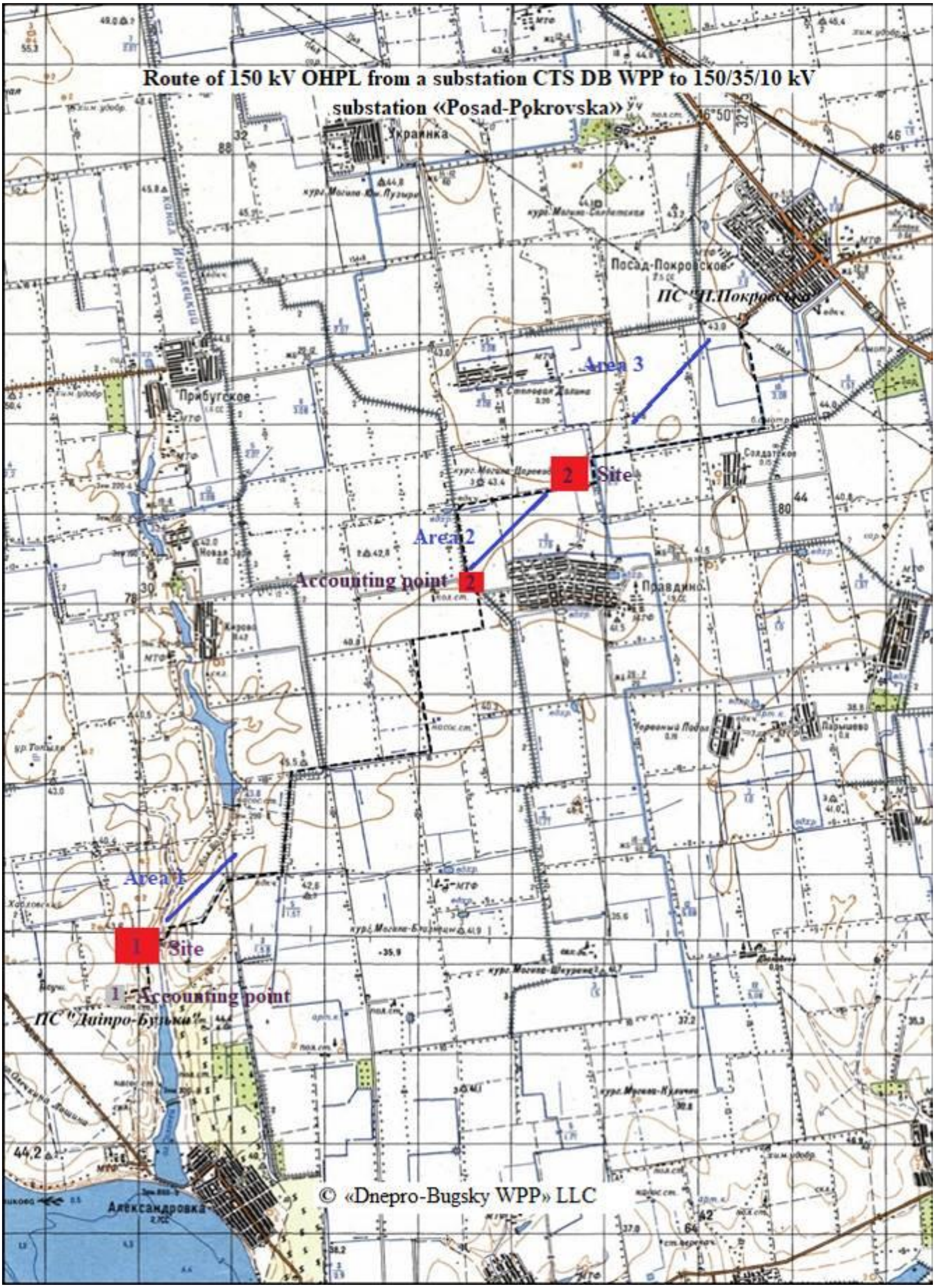


Fig. 4.41. Mapping the location of the research site the OHPL

By separate bird counting, the territories of agricultural landscapes (mainly places that can be used by birds in after-nesting and migration periods) were inspected (by automobile counting).

The point bird counting's were conducted:

- in the upper reach of the Lake Solonets, where main attention was paid to the places of waterfowl accumulation, and to the species of birds that inhabit a wood-shrub natural complexes;
- at the slopes of the dam near the former water pump plant;
- at the coastal slopes of Bug Estuary in the same territory.

Separately, the coastline plot of the Dnipro-Bugsky Estuary with typical for after-nesting accumulation of waterfowl, conventionally called «Oleksandrivskyi Pod» (Area № 3), was inspected). The point counting of birds was conducted in the upper Oleksandrivska Bay, where main attention was paid to the sites of waterfowl accumulation, and to the species of birds inhabiting woody-shrub natural complexes. As the second area for point counting the dam of the former water pump plant and coastal slopes of the Dnipro-Bugsky Estuary at the same territory were selected. The international experience provides significant amount of empirical data that confirm the danger of WTs for birds [37]. In Ukraine this issue is insufficiently studied, because ornitofauna studies were carried out mainly before WTs construction.

In connection with this, main threats for bird species diversity and abundance during «DB WPP» and power lines construction should take into account:

- need to avoid the territories used by birds for migrating routes or nesting, resting and feeding during the year;
- occurrence of anxiety agent and scaring of birds from traditional habitats, or places of stay, especially during «DB WPP» construction phase.

There are the critical areas where the placement of wind turbines can cause significant damage to migrating and wintering birds, namely, coastline of the Dnipro-Bugsky Estuary and gullies of it hydrological network, namely, valley of the Lake Solonets.

The heights of bird movement in the vicinity of the «DB WPP» wind field are insignificant. Approximately 95 % of bird species cross the territory of «DB WPP» wind field at the heights up to 150 meters (in the zone of WTs blade movement) that is an additional bird anxiety cause threatening their safety. Nocturnal migratory birds (above 50%) cross the territory of «DB WPP» wind field in significant numbers. The probability of their collision with WTs significantly increases, especially upon extreme meteorological conditions (fogs, strong winds). The majority of birds at the «DB WPP» territory (approximately 70% of all registered) forms the large flocks that increases the risk of their collision with WTs in their migratory routes. The assessment criteria of WPP impact on birds are:

- abundance of birds and number of species;
- number of nests and efficiency of bird's reproduction (including rare and protected species);
- number of dead and injured birds due to collision with WTs blades.

In results of monitoring in the area of the projected site of «Dnepro-Bugsky WPP» (conducted in 2016-2017), the data on the number of birds on routes, checkpoints and monitoring points were obtained. The results of the studies are presented in Table 4.16 – Table 4.18. Detailed results of ornitological researches for «DB WPP» site present in Annex L.

Table 4.16 – Species composition and frequency of bird encounters in the area of the of the «Dnepro-Bugsky WPP» location (in 2016-2017)

№	Species Ukrainian name	Species Latin name	Numb. of meetings	Status	Type of migrat.
1	Баклан великий	*Phalacrocorax carbo*	6	Р	N
2	Балабан	*Falco cherrug*	19	Н	N
3	Бджолоїдка звичайна	*Merops apiaster*	13	Ф-Р	D-N
4	Брижач	*Philomachus pugnax*	13	Ф-Р	D-N
5	Вивільга	*Oriolus oriolus*	17	Ф-Н	D
6	В'юрок	*Fringilla montifringilla*	5	Н	N
7	Вівсянка звичайна	*Emberiza citrinella*	13	З	D
8	Вівсянка очеретяна	*Emberiza schoeniclus*	21	Н	D
9	Вівсянка садова	*Emberiza hortulana*	21	Ф	D
10	Вівчарик весняний	*Phylloscopus trochilus*	14	Р	Z
11	Вівчарик-ковалик	*Phylloscopus collybita*	19	Н	D
12	Ворона сіра	*Corvus cornix*	19	Ф	D
13	Вільшанка	*Erithacus rubecula*	3	Н	Z
14	Волове очко	*Troglodytes troglodytes*	3	Н	Z
15	Ворона сіра	*Corvus cornix*	6	Н	Z
16	Гагара чорношия	*Gavia arctica*	7	З	N
17	Галагаз	*Tadorna tadorna*	28	З	N
18	Галка	*Corvus monedula*	11	Ф-Н	N
19	Горихвістка звичайна	*Phoenicurus phoenicurus*	20	Ф	N
20	Горлиця звичайна	*Streptopelia turtur*	3	Р	N
21	Горобець польовий	*Passer montanus*	15	Н	D
22	Горобець хатній	*Passer domesticus*	14	Ф-Н	D
23	Грак	*Corvus frugilegus*	5	Н	D
24	Гуска білолоба	*Anser albifrons*	4	Н	D
25	Гуска сіра	*Anser anser*	16	Н	D
26	Дрізд співочий	*Turdus philomelos*	8	Ф-Н	D
27	Дрізд чорний	*Turdus merula*	11	Р-Н	D
28	Дятел звичайний	*Dendrocopos major*	15	Р-Н	O
29	Дятел сирійський	*Dendrocopos syriacus*	21	Р-З	O
30	Жайворонок польовий	*Alauda arvensis*	7	З	N
31	Жайворонок степовий	*Melanocorypha calandra*	5	Н	Z
32	Журавель сірий	*Grus grus*	11	Ф	N
33	Зеленяк	*Chloris chloris*	11	Н	N

№	Species Ukrainian name	Species Latin name	Numb. of meetings	Status	Type of migrat.
34	Зозуля	*Cuculus canorus*	4	Р-Н	D
35	Золотомушка жовточуба	*Regulus regulus*	8	З	N
36	Зяблик	*Fringilla coelebs*	20	Ф	N
37	Кам'яна лиса	*Oenanthe pleschanka*	14	Р-Ф	N
38	Кам'янка звичайна	*Oenanthe oenanthe*	15	З	N
39	Кам'янка попеляста	*Oenanthe isabellina*	7	Н	N-D
40	Канюк звичайний	*Buteo buteo*	11	Н	N
41	Коловодник болотяний	Tringa glareola	15	Ф-Н	О-Н
42	Коловодник великий		3	Н	N
43	Коловодник лісовий	*Tringa ochropus*	15	Ф-Н	O-N
44	Коловодник чорний	*Tringa erythropus*	4	Р-Н	D
45	Коноплянка	*Acanthis cannabina*	20	Ф	O-N
46	Костогриз	*C.coccothraustes*	20	Ф	N-D
47	Крех середній	*Mergus serrator*	14	З	O-D
48	Крижень	*Anas platyrhynchos*	27	Ф	O
49	Кропив'янка сіра	*Sylvia communis*	12	Н-З	N-D
50	Крук	*Corvus corax*	28	З	N-D
51	Крутиголовка	*Jynx torquilla*	4	Р-Н	N
52	Крячок каспійський	*Hydroprogne caspia*	14	З	D
53	Крячок малий	*Sterna albifrons*	15	Н	D
54	Крячок річковий	*Sterna hirundo*	20	Ф	O
55	Крячок рябодзьобий	*Thalasseus sandvicensis*	19	З	D
56	Куріпка сіра	*Perdix perdix*	12	Н-З	O-D
57	Кульон великий	*Numenius arquata*	12	Ф	O
58	Ластівка берегова	*Riparia riparia*	15	Н	O
59	Ластівка міська	*Delichon urbica*	12	Н	O
60	Ластівка сільська	*Hirundo rustica*	27	З	O
61	Лебідь-шипун	*Cygnus olor*	17	Н	D
62	Лиска	*Fulica atra*	21	Н	D
63	Лунь лучний	*Circus pygargus*	13	Ф	O
64	Лунь очеретяний	*Circus aeruginosus*	11	Н	D
65	Лунь польовий	*Circus cyaneus*	2	Р	N
66	Мартин жовтоногий	*Larus cachinnans*	30	З	O
67	Мартин звичайний	*Larus ridibundus*	14	Н	O
68	Мартин каспійський	*Larus ichthyaetus*	22	Н	D
69	Мартин середземноморський	*Larus melanocephalus*	15	Ф	D
70	Мартин тонкодзьобий	*Larus genei*	8	З	D
71	Мартин сивий	*Larus canus*	12	Ф	D

№	Species Ukrainian name	Species Latin name	Numb. of meetings	Status	Type of migrat.
72	Мухоловка мала	*Ficedula parva*	18	Ф	O
73	Мухоловка сіра	*Muscicapa striata*	16	Н	O
74	Мухоловка строката	*Ficedula hypoleuca*	11	Ф	O
75	Набережник	*Actitis hypoleucos*	9	Н	O
76	Одуд	*Upupa epops*	17	З	N
77	Орлан-білохвіст	*Haliaeetus albicilla*	32	Ф	O
78	Очеретянка велика	*Acrocephalus arundinaceus*	23	Ф	O
79	Очеретянка ставкова	*Acrocephalus scirpaceus*	22	Ф	D
80	Пелікан рожевий	*Pelecanus onocrotalus*	6	Н	D
81	Підсоколик великий	*Falco subbuteo*	6	З	N
82	Пірникоза велика	*Podiceps cristatus*	28	Ф	O
83	Пірникоза мала	*Podiceps ruficollis*	23	Ф	O
84	Пірникоза сірощока	Podiceps grisegena	20	Ф	D
85	Пірникоза чорношия	*Podiceps nigricollis*	11	Н	D
86	Пісочник морський	*Charadrius alexandrinus*	17	З	N
87	Плавунець круглодзьобий	*Phalaropus lobatus*	15	З	N
88	Плиска біла	*Motacilla alba*	26	Ф	D
89	Побережник малий	Побережник малий	17	Н	D
90	Побережник чорногрудий	*Calidris alpina*	6	З	N
91	Попелюх	*Aythya ferina*	10	Р	N
92	Посмітюха	*Galerida cristata*	13	Н	N
93	Припутень	*Columba palumbus*	8	Н	N
94	Просянка	*Emberiza calandra*	14	Н	Z
95	Рибалочка	*Alcedo atthis*	8	Р	D
96	Сивка морська	*Pluvialis squatarol*	6	З	D
97	Сиворакша	*Coracias garrulus*	5	Н	D
98	Синиця блакитна	*Parus caeruleus*	8	Р	D
99	Синиця велика	*Parus major*	16	Р	D
100	Соловейко східний	*Luscinia luscinia*	4	Р	D
101	Синиця довгохвоста	*Aegithalos caudatus*	3	Н	D
102	Сова вухата	*Asio otus*	8	З	O
103	Сорока	*Pica pica*	25	Ф	O
104	Сорокопуд терновий	*Lanius collurio*	12	Ф	O
105	Сорокопуд чорнолобий	*Lanius minor*	10	Р	D
106	Трав'янка чорноголова	*Saxicola torquata*	26	З	D
107	Фазан	*Phasianus colchicus*	33	Ф	O
108	Чайка	*Vanellus vanellus*	32	Ф	O

№	Species Ukrainian name	Species Latin name	Numb. of meetings	Status	Type of migrat.
109	Чапля сіра	Ardea cinerea	25	З	O
110	Чепура велика	*Egretta alba*	28	Ф	D
111	Чепура мала	*Egretta garzetta*	16	З	D
112	Чернь білоока	Aythya nyroca	7	З	D
113	Чернь чубата	Aythya fuligula	16	Н	D
114	Чиж	*Spinus spinus*	15	З	D
115	Чикотень	*Turdus pilaris*	6	З	D
116	Чирянка велика	*Anas querquedula*	9	Ф	D
117	Шпак звичайний	*Sturnus vulgaris*	20	Ф	O
118	Щеврик лісовий	*Anthus trivialis*	18	Ф	O
119	Щиглик	*Carduelis carduelis*	12	Н	D
120	Яструб великий	*Accipiter gentilis*	7	З	D
121	Яструб малий	*Accipiter nisu*	5	Н	D
Total:			**1704**		

Symbols: F – background (met during 9-12 records), C – normal (met during 6-8 records), N – a few (met during 3-5 records); P – rare (met during 1-2 records), N – mostly a night migrant, D – mostly day migrant, Z – mixed type (day + night) type of migration, O – settled species.

Table 4.17 – The number of birds in the vicinity «DB WPP» site in 2016-2017 (route records)

№	Species		Number of Counting Individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**on 1 км^2 (lim)**
1	Баклан великий	*Phalacrocorax carbo*	11	0.06
2	Балабан	*Falco cherrug*	5	1.46
3	Бджолоїдка звичайна	*Merops apiaster*	179	8.68
4	Брижач	*Philomachus pugnax*	338	1.26
5	Вивільга	*Oriolus oriolus*	22	0.32
6	В’юрок	*Fringilla montifringilla*	80	0.93
7	Вівсянка звичайна	*Emberiza citrinella*	461	2.26
8	Вівсянка очеретяна	*Emberiza schoeniclus*	237	0.83
9	Вівсянка садова	*Emberiza hortulana*	80	0.50
10	Вівчарик весняний	*Phylloscopus trochilus*	38	0.24
11	Вівчарик-ковалик	*Phylloscopus collybita*	93	0.22
12	Вільшанка	*Corvus cornix*	298	3.12
13	Волове очко	*Erithacus rubecula*	470	4.98
14	Ворона сіра	*Troglodytes troglodytes*	87	0.38
15	Гагара чорношия	*Corvus cornix*	27	0.32
16	Галагаз	*Gavia arctica*	313	1.12
17	Галка	*Tadorna tadorna*	37	0.29
18	Горихвістка звичайна	*Corvus monedula*	400	1.48
19	Горлиця звичайна	*Phoenicurus phoenicurus*	48	0.18

№	Species		Number of Counting Individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**on 1 км^2 (lim)**
20	Горобець польовий	*Streptopelia turtur*	243	0.86
21	Горобець хатній	*Passer montanus*	6	0.06
22	Грак	*Passer domesticus*	13	0.01
23	Гуска білолоба	*Corvus frugilegus*	3	0.06
24	Гуска сіра	*Anser albifrons*	18	0.08
25	Дрізд співочий	*Anser anser*	3	0.04
26	Дрізд чорний	*Turdus philomelos*	5	0.14
27	Дятел звичайний	*Turdus merula*	84	0.26
28	Дятел сирійський	*Dendrocopos major*	71	0.46
29	Жайворонок польовий	*Dendrocopos syriacus*	84	0.02
30	Жайворонок степовий	*Alauda arvensis*	178	0.96
31	Журавель сірий	*Melanocorypha calandra*	786	8.03
32	Зеленяк	*Grus grus*	15	0.04
33	Зозуля	*Chloris chloris*	4	0.04
34	Золотомушка жовточуба	*Cuculus canorus*	28	0.31
35	Зяблик	*Regulus regulus*	67	0.34
36	Кам’яна лиса	*Fringilla coelebs*	1661	8.67
37	Кам’янка звичайна	*Oenanthe pleschanka*	48	0.38
38	Кам’янка попеляста	*Oenanthe oenanthe*	15	0.07
39	Канюк звичаний	*Oenanthe isabellina*	47	027
40	Коловодник болотяний	*Buteo buteo*	30	1.49
41	Коловодник великий	*Tringa glareola*	6	0.07
42	Коловодник лісовий	*Tringa ochropus*	298	4.01
43	Коловодник чорний	*Tringa ochropus*	805	0.05
44	Коноплянка	*Tringa erythropus*	65	0.87
45	Костогриз	*Acanthis cannabina*	215	1.71
46	Крех великий	*C.coccothraustes*	12	0.19
47	Крех середній	*Mergus serrator*	309	0.16
48	Крижень	*Anas platyrhynchos*	1090	3.76
49	Кропив’янка сіра	*Sylvia communis*	26	0.21
50	Крук	*Corvus corax*	1858	6.23
51	Крутиголовка	*Jynx torquilla*	9	0.15
52	Крячок каспійський	*Hydroprogne caspia*	52	0.26
53	Крячок малий	*Sterna albifrons*	96	1.63
54	Крячок річковий	*Sterna hirundo*	8530	41.92
55	Крячок рябодзьобий	*Thalasseus sandvicensis*	473	1.65
56	Куріпка сіра	*Perdix perdix*	11	0.09
57	Кульон великий	*Numenius arquata*	6509	33.22
58	Ластівка берегова	*Riparia riparia*	10	0.18
59	Ластівка міська	*Delichon urbica*	6	5.94

№	Species		Number of Counting Individuals	
	Ukrainian name	Latin name	абс. (lim)	on 1 км^2 (lim)
60	Ластівка сільська	*Hirundo rustica*	1100	2,89
61	Лебідь-шипун	*Cygnus olor*	682	2,20
62	Лиска	*Fulica atra*	439	1,53
63	Лунь лучний	*Circus pygargus*	20	0,26
64	Лунь польовий	*Circus aeruginosus*	14	0,19
65	Лунь очеретяний	*Circus cyaneus*	57	0,17
66	Мартин жовтоногий	*Larus cachinnans*	41	0,19
67	Мартин звичайний	*Larus ridibundus*	59	0,18
68	Мартин каспійський	*Larus ichthyaetus*	51	0,31
69	Мартин середземноморський	*Larus melanocephalus*	131	0,63
70	Мартин тонкодзьобий	*Larus genei*	6	0,09
71	Мартин сивий	*Larus canus*	1161	12,10
72	Мухоловка мала	*Ficedula parva*	27	0,11
73	Мухоловка сіра	*Muscicapa striata*	9	16,03
74	Мухоловка строката	*Ficedula hypoleuca*	270	3,06
75	Набережник	*Actitis hypoleucos*	3207	0,08
76	Одуд	*Upupa epops*	159	0,94
77	Орлан-білохвіст	*Haliaeetus albicilla*	3674	13,11
78	Очеретянка велика	*Acrocephalus arundinaceus*	282	0,30
79	Очеретянка ставкова	*Acrocephalus scirpaceus*	65	0,30
80	Пелікан рожевий	*Pelecanus onocrotalus*	14	0,05
81	Підсоколик великий	*Falco subbuteo*	4	0,06
82	Пірникоза велика	*Podiceps cristatus*	50	1,68
83	Пірникоза мала	*Podiceps ruficollis*	4814	24,27
84	Пірникоза сірощока	*Podiceps grisegena*	73	0,28
85	Пірникоза чорношия	*Podiceps nigricollis*	5	0,19
86	Пісочник морський	*Charadrius alexandrinus*	61	0,20
87	Плавунець круглодзьобий	*Phalaropus lobatus*	150	0,88
88	Плиска біла	*Motacilla alba*	57	0,20
89	Побережник малий	*Motacilla alba*	51	0,34
90	Побережник чорногрудий	*Calidris alpina*	4	0,06
91	Попелюх	*Aythya ferina*	5	0,05
92	Посмітюха	*Galerida cristata*	28	0,10
93	Припутень	*Columba palumbus*	7	0,05
94	Просянка	*Emberiza calandra*	38	0,22
95	Рибалочка	*Alcedo atthis*	58	0,26
96	Сиворакша	*Pluvialis squatarol*	5	0,39

№	Species		Number of Counting Individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**on 1 км^2 (lim)**
97	Сивка морська	*Coracias garrulus*	375	3.96
98	Синиця блакитна	*Parus caeruleus*	25	0.10
99	Синиця велика	*Parus major*	59	0.38
100	Синиця довгохвоста	*Luscinia luscinia*	38	0.48
101	Сова вухата	*Aegithalos caudatus*	35	0.44
102	Соловейко східний	*Asio otus*	42	0.10
103	Сорока	*Pica pica*	108	0.44
104	Сорокопуд терновий	*Lanius collurio*	15	0.55
105	Сорокопуд чорнолобий	*Lanius minor*	61	0.23
106	Трав'янка чорноголова	*Saxicola torquata*	130	17.69
107	Фазан	*Phasianus colchicus*	826	1.14
108	Чайка	*Vanellus vanellus*	616	2.15
109	Чапля сіра	*Ardea cinerea*	74	0.30
110	Чепура велика	*Egretta alba*	80	0.35
111	Чепура мала	*Egretta garzetta*	17	0.10
112	Чернь чубата	*Aythya nyroca*	71	0.39
113	Чернь білоока	*Aythya fuligula*	37	0.47
114	Чиж	*Spinus spinus*	82	0.27
115	Чикотень	*Turdus pilaris*	4	0.07
116	Чирянка велика	*Anas querquedula*	87	1.03
117	Шпак звичайний	*Sturnus vulgaris*	118	0.48
118	Щеврик лісовий	*Anthus trivialis*	484	24.54
119	Щиглик	*Carduelis carduelis*	88	0.42
120	Яструб великий	*Accipiter gentilis*	56	0.64
121	Яструб малий	*Accipiter nisu*	14	0.19
Total			**47 832**	**2.43 ос./ км^2**

Table 4.18 – Relative number of birds in the vicinity of «DB WPP» site 2016-2017 (at monitoring points)

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 км^2 (lim)**
1	Бджолоїдка звичайна	*Merops apiaster*	15	0.09
2	В’юрок	*Fringilla montifringilla*	57	0.69
3	Вивільга	*Oriolus oriolus*	6	0.05
4	Ворона сіра	*Troglodytes troglodytes*	18	0.12
5	Вівсянка очеретяна	*Emberiza schoeniclus*	312	1.66
6	Вівсянка садова	*Emberiza hortulana*	5	0.06
7	Вівчарик весняний	*Phylloscopus trochilus*	5	0.06
8	Ворона сіра	*Troglodytes troglodytes*	594	3.09
9	Галагаз	*Gavia arctica*	35	0.23

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 км^2 (lim)**
10	Галка	*Tadorna tadorna*	2	0.05
11	Горихвістка звичайна	*Corvus monedula*	2	0.02
12	Горлиця звичайна	*Phoenicurus phoenicurus*	3	0.03
13	Горобець польовий	*Streptopelia turtur*	8	0.05
14	Горобець хатній	*Passer montanus*	4	0.06
15	Грак	*Passer domesticus*	46	0.30
16	Гуска білолоба	*Corvus frugilegus*	235	2.45
17	Гуска сіра	*Anser albifrons*	23	0.14
18	Дрізд співочий	*Anser anser*	24	0.15
19	Дрізд чорний	*Turdus philomelos*	10	0.08
20	Дятел звичайний	*Turdus merula*	15	0.06
21	Дятел сирійський	*Dendrocopos major*	296	1.59
22	Жайворонок польовий	*Dendrocopos syriacus*	8	0.09
23	Жайворонок степовий	*Alauda arvensis*	1	0.02
24	Журавель сірий	*Melanocorypha calandra*	23	0.28
25	Зеленяк	*Grus grus*	908	3.09
26	Зяблик	*Regulus regulus*	2	0.05
27	Кам’янка лиса	*Fringilla coelebs*	601	2.08
28	Кам’янка звичайна	*Oenanthe pleschanka*	3	0.05
29	Кам’янка попеляста	*Oenanthe oenanthe*	4	0.06
30	Канюк звичаний	*Oenanthe isabellina*	73	0.41
31	Коловодник лісовий	*Tringa ochropus*	229	0.80
32	Коноплянка	*Tringa erythropus*	4	0.05
33	Костогриз	*Acanthis cannabina*	145	0.51
34	Крижень	*Anas platyrhynchos*	6	0.06
35	Кропив’янка сіра	*Sylvia communis*	48	0.19
36	Крук	*Corvus corax*	33	0.35
37	Крутиголовка	*Jynx torquilla*	22	0.10
38	Крутиголовка	*Крутиголовка*	3	0.03
39	Крячок річковий	*Sterna hirundo*	33	0.35
40	Ластівка берегова	*Riparia riparia*	12	0.14
41	Ластівка міська	*Delichon urbica*	2	0.04
42	Ластівка сільська	*Hirundo rustica*	6	0.05
43	Лебідь-шипун	*Cygnus olor*	1616	5.44
44	Лиска	*Fulica atra*	18	0.11
45	Лунь лучний	*Circus pygargus*	700	7.03
46	Лунь очеретяний	*Circus cyaneus*	17	0.10
47	Лунь польовий	*Circus aeruginosus*	1900	19.35
48	Мартин жовтоногий	*Larus cachinnans*	509	2.61
49	Мартин звичайний	*Larus ridibundus*	44	0.18
50	Мартин сивий	*Larus canus*	138	1.47

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 км^2 (lim)**
51	Мухоловка мала	*Ficedula parva*	1	0.02
52	Мухоловка сіра	*Muscicapa striata*	14	0.09
53	Одуд	*Upupa epops*	6	0.05
54	Орлан-білохвіст	*Haliaeetus albicilla*	36	0.14
55	Пірникоза велика	*Podiceps cristatus*	13	0.07
56	Пірникоза сірощока	*Podiceps grisegena*	71	0.78
57	Плиска біла	*Motacilla alba*	129	0.47
58	Посмітюха	*Galerida cristata*	17	0.36
59	Припутень	*Columba palumbus*	3	0.03
60	Просянка	*Emberiza calandra*	6	0.04
61	Рибалочка	*Alcedo atthis*	1	0.02
62	Сиворакша	*Pluvialis squatarol*	3	0.05
63	Синиця блакитна	*Parus caeruleus*	24	0.14
64	Синиця велика	*Parus major*	42	0.18
65	Соловейко східний	*Asio otus*	29	0.18
66	Сорока	*Pica pica*	65	0.24
67	Сорокопуд терновий	*Lanius collurio*	160	1.65
68	Сорокопуд чорнолобий	*Lanius minor*	4	0.06
69	Трав'янка чорноголова	*Saxicola torquata*	35	0.38
70	Фазан	*Phasianus colchicus*	71	0.38
71	Чапля сіра	*Ardea cinerea*	80	0.84
72	Чернь чубата	*Aythya nyroca*	2	0.05
73	Чиж	*Spinus spinus*	1	0.02
74	Чикотень	*Turdus pilaris*	45	0.49
75	Шпак звичайний	*Sturnus vulgaris*	73	0.28
76	Щеврик лісовий	*Anthus trivialis*	3	0.05
77	Щиглик	*Carduelis carduelis*	27	0.15
78	Яструб великий	*Accipiter gentilis*	7	0.08
79	Яструб малий	*Accipiter nisu*	4	0.05
Total			**9795**	**1,42 ос./ км^2**

The vast majority of registered birds (up to 70 %) were concentrated on «Oleksandrivskyi Pod» and coastal zones of the Bug Estuary.

In field windbreaks and agricultural lanscapes of the central part of WPP, the single predatory birds, transit flights of *Corvus corax*, representatives of species of the Order *Passeridae,* and single birds (*Perdix perdix and Phasianus colchicus*) were observed.

The feeding areas, that attracts the birds in those period were: reed beds on the coast of the Dnipro-Bugsky Estuary, lowland of the Solonets Lake, and lowland of large tertiary gullies (old water pump plant, and large coastal slopes of the Estuary), Fig. 4.42.

Fig. 4.42. The main corridors of movements of birds during the period of migrations in the zone of «DB WPP»
I, II – cluster of wetlands, 1 – cluster of wood-shrubbery birds in unfavorable weather conditions

It should also take into account the high periodically intensity birds movement in the dam area of Lake Solonets (mainly in the evening and in the morning time). In the season of premigration clusters of birds this area attracts waterbirds.

The end of spring migration at the site of the «Dnepro-Bugsky WPP» (on the basis of the monitoring data) is characterized by a rather low activity of the birds.

By result of the conducted research, it is defined that on site of planned «Dnepro-Bugsky WPP», there were no sites for large clusters of rare bird species in the nesting and premigration period. On site of planned «DB WPP», the mass migration of the Red Bird Species was not observed.

Counting of birds on the route of the planned OHPL (from SS «CTS «DB WPP» to the SS «Posad-Pokrovska») in migration period (October-November 2017) show presence of 50 species of birds with total number 2 thousand individuals. The migration season was characterized by insignificant activity of birds. Birds movement in area of construction of the planned OHPL was outlined mainly by field windbreaks and shrubs of the Lake Solonets.

All types of transit migrants (crane gray) were registered at altitudes 300-350 meters and above. In an unpredictable synoptic situation (fog, strong wind, etc.), the height of migrations of large species may change.

In the winter period (December - February 2017-2018), the number of birds in the area of the site is low. During the observation period, the 40 species of birds were registered, with a total population of about 2 thousand individuals. There was no active bird movement.

During the season of the spring migration-beginning of nesting perod (April-May 2018), the area of construction of the OHPL is represented by 62 species, a total of 1105 individuals in the period of counting. It is characterized by a poor composition, no breeding of red-breeding species has been noted, during research there have not been met here and large nesting colonies of birds. According to the results of the monitoring of the planned OHPL there is no serious threats in for birds in period of fowl poaching, and in nesting period.

The period of pre-migratory clusters and beginning of autumn migrations (August 2018), in the area of construction of the OHPL, was characterized by fairly low bird movements. During the registration period the 47 species of birds were registered, with a total population of 1972 individuals. Four types of rare birds from the Red Data Book of Ukraine (2009) are registered in the area of the OHPL construction. During the time of observation, the places with large groups (clasters) of birds in the pre-migration period were not found. The mass migration of the Red Bird species in the area of the planned OHPL was not observed The probability of a negative impact on rare species of birds listed in the Red Data Book of Ukraine (2009) is low due to their small size in the observed area.

Territory, on which the construction of the OHPL is projected, is located within the limits of mass winter migration of honeybee birds in the south of Ukraine, therefore, in the winter, the large clusters of these species were not observed. The conditions of the relief and prevailing wind direction create unfavorable conditions for wintering birds in this area, except for the coastal part of the Bugsky Estuary and the lower reaches of the Solonets Lake, but these territories do not intersect the projected the OHPL.

According to the established characteristics of the pre-migratory, autumn and winter ornithofauna and its territorial dynamics in the area of construction of the OHPL, it is possible to predict the low probability of a bird's collision with the OHPL on this territory.

Detailed results of ornitological researches for the OHPL site present in Annex M.

Conclusion: the impact of wind turbines on birds and bats in specified territory is predicted to be negligible in nesting and wintering period, and low in migration period, subject to the implementation of recommendations for impact reduction.

4.4.3.2.6Bats

One of the major guidelines that provide a framework for the Project bat studies is the guideline document published by the Secretariat of the Agreement on the Conservation of Populations of European Bats (EUROBATS), which came into force in 1994 under the auspices of the Convention on the Conservation of Migratory Species of Wild Animals «Guidelines for Consideration of Bats in Wind Farm Projects Revision 2014». According this guidelines, the most documented impacts of WPP on bat species are:

- Direct collision;
- Barotrauma (mortality due to damage to bats' lungs caused by sudden change in air pressure close to a turbine blade);
- Loss of foraging and commuting habitats (due to construction or avoidance);
- Barrier to commuting or seasonal movement, and severance of foraging habitats.

Ukrainian legislation stipulates that all legal and natural persons must comply with environmental norms, in particular regarding the environmental impact of construction and other types of commercial activity.

All bat species of Ukrainian fauna are protected under several international bat conservation agreements ratified by Ukraine, as well as by national legislation, in particular the Red Book of Ukraine and the Law of Ukraine «On Fauna» (Fauna of Ukraine, 2010).

Among mammals in Europe, all species of bats are recognized as very vulnerable species, and therefore listed on the lists of the Berne Convention, the Bonn Convention, the IUCN lists, the European Red List, etc. (as noted above). Review of all available data on previously identified bat species and acoustic surveys conducted in the wider area, distribution maps of the IUCN Red List of Threatened Species reveals the list of bat species potentially present at the Project License Area as presented in the Table 4.19.

Table 4.19 – Conservation status and faunistic value of bats

№	Species of bats	Status and conservation category				
		IUCN Red List	European Red List	The Bern Convention	Eurobats	The Red Book of Ukraine
1	*Eptesicus serotinus*	LC	–	2	2*	BP
2	*Myotis daubentonii*	LC	–	2	2*	BP
3	*Nyctalus noctula*	LC	–	2	2*	BP
4	*Plecotus auritus*	LC	–	2	2*	BP
5	*Pipistrellus kuhlii (Kuhl, 1819)*	LC	–	2	2*	BP

explanation to the table:

IUCN – global IUCN Red List of Threatened Species (assessment of species as of October 2009).

EL – status of species according to European red lists. For mammals – as in The Status and Distribution of European Mammals (2007), BE – Bern Convention («2» – Appendix II, «3» – Appendix III to the convention). BO – Bonn Convention («1» – Appendix I, «2» – Appendix II to the convention); species marked with asterisks are additionally protected by independent agreements: EUROBATS.

RU – Red Data Book of Ukraine (2009): «Ex» – extinct ; «ExN» – extinct in nature; «Eg» – endangered ; «Vu» – vulnerable ; «R» – rare; «USp» – unspecified ; «UKn» – unknown.

The review of literary sources was primarily focused on regional studies to analyze all available information on the features of regional distribution of bats and their conservation status, ecological niches, as well as some ecological characteristics of species that determine their distribution. As of today, 9 species are definitely located. During the fiel researched the 5 species of bats were registered. Other species included in the list according to old literary data (Selyunina, 2014; Voloh et al., 2014).

In particular, at the end of the 1960s the next species prevailed in the region: *Myotis mystacinus*, *Nyctalus noctula*, *Nyctalus leisleri*, *Pipistrellus pipistrellus*, *Pipistrellus Nathusii*. Since the 2000's on the coasts of the sea bays during migrations *Eptesicus serotinus*, *Pipistrellus kuchli*, and *Nyctalus noctula* are constantly recorded. *Eptesicus* *serotinus* and *Myotis mystacinus* are considered sedentary species in the region. The last species had not been detected during the field researches. *Vespertilio murinus* and *Pipistrellus* sp. have been recorded during winter over the last few years. Field studies were conducted in June 2018. There were 3 automobile routes (length of each route about 7-8 km) within the field of WTs. During the field work, 2 representative points were selected (where bats were trapped by the mist net).

The research covers the continental part of the Dnipro-Bugsky Estuary (Northern Black Sea Coast) in the western part of the Kherson Region in the vicinity of Oleksandrivska, Pravdinska, Posad-Pokrovska Village Councils of Bilozerskyi District, where the construction of the Project is planned. Points of observation and counting routes were concentrated in the main types of biotopes of the studied area, namely on the coast of the Dnipro Estuary, around the Solonets Lake, within the settlements (in particular Oleksandrivka village), along field windbreaks on agricultural land and along irrigation canals (areas along the OHPL).

During the analysis and the subsequent inspection of the territory, special attention was paid to ponds with an open or semi-open hill that are surrounded by woody vegetation or have its fragments on the banks (Lake Solonets, as well as the coastal strip of the estuary), valleys of rivers and streams, clay depression along the coast of the Dnipro Estuary's; fiel wind breaks; old quarries, mines. In the settlements (Oleksandrivka, Lymany) the existing green areas parks with hollow trees, areas along the shores of the reservoirs, quarters with old buildings (especially those with attics), wooden wall coverings, underground tiers, cellars, etc. were examined. The species composition of bats and their territorial distribution were determined by space scanning by an ultrasonic detector Magenta Bat MkIII Digital Quartz in different habitat types. Recording the sounds of bats performed using a special digital device ZOOM Handy Recorder H2, and the GARMIN e-trex 30 and GARMIN Legend HCx navigators, etc., which were used to determine the location, in predefined and subsequently refined transects. The procedure of experiment was as follows: moving on car with minimum speed on the relevant route, audio recording and counting the number of signals of bats, Fig. 4.43.

Thus obtained raw materials subjected to further processing using a computer program «Google Earth». The species were identified by comparing fixed sound signals with indicators of spectrograms constructed using the «BatSound 414» program and «The BatLib App» software. Detailed analysis of the literary sources, the use of various technologies, and optimal placement of observation points allows (in the shortest terms) to collect the maximum amount of output data for the analysis of the dominance degree of certain species in the regional fauna of Chiroptera and the spatial structure of the bat population. Further environmental monitoring of the implementation of the Project will allow to study this group of animals more thorough, and especially seasonal aspect of their a behavior and their migration features.

Fig. 4.43. Technical tools used in field research

For each bat species, certain ultrasound signals are characteristic. These signals (after their corresponding transformation by a special detector) allows to identify the species affiliation. But the frequency of some species living in a common territory may overlap - for example, Kuhl's pipistrelle (*Pipistrellus kuhlii* (Kuhl, 1817)) and the Whiskered bat (*Myotis mystacinus* (Kuhl, 1817)). This greatly complicates the identification of bats. In order to avoid this, experts have developed a signal duration (ms), which is now used with records of ultrasonic signals in slow mode.

This allows for more precise species identification, and then (during desktop studies) adjust the results using a computer program, for example, «Bat Sound».

Although there is still the difficulty in distinguishing between some close species. These include, for example, Brown long-eared bat (*Plecotus auritus* (Linnaeus, 1758)) and the Grey long-eared bat (*Plecotus austriacus* (Fischer, 1829)), which have similar frequency signal characteristics and also the wavelengths. Flight path of Ukrainian bat populations runs along the Dnipro to the Crimean Peninsula and across the Black Sea from the south-eastern edge of the Crimea to the Balkans, along the former northern coast of one of the ancient basins preceding the modern Black Sea (Selyunina, 2014).

In the surveyed area during the fieldwork, it was discovered five bat species: *Myotis daubentonii* (frequency range 37-55 kHz), *Eptesicus serotinus* (frequency range of 23-25 kHz), *Nyctalus noctula* (frequency range 17-20 kHz), *Pipistrellus kuhlii* (frequency range 40-42 kHz), *Plecotus auritus* (echolocation calls range from 25-50 kHz and peak at 35 kHz), Table 4.20.

Table 4.20 – Results of detector bats records conducted at selected points of the study area

Species/Biotopes	Myotis dasycneme		Myotis daubentonii		Nyctalus noctula		Pipistrellus kuhlii		Eptesicus serotinus		TOTAL	
	n	%	n	%	n	%	N	%	n	%	n	%
Coast of the Dnipro-Bug estuary			36	38.7	17	18.3	32	34.4	8	8.6	93	28.6
The LakeSolonets	2	4.3	14	29.8	26	55.3	5	10.6			47	14.5
Windbreaks of agricultural land					35	48.6	31	43.1	6	8.3	72	22.2
Settlement, green areas (Oleksandrivka village)					32	35.2	27	29.7	32	35.2	91	28.0
Individual trees along the irrigation canals (OHPL)					7	31.8	12	54.5	3	13.6	22	6.8
TOTAL	2	0.6	50	15.4	117	36.0	107	32.9	49	15.1	325	100

The distribution of bats within the studied area is clearly pronounced synanthropic (Fig. 4.44), although the guinea-vine leaves use all available biotopes for them, in particular: woody stands on the coast of the Dnipro-Bugsky Estuary – 28.6 %, wood-shrub plantations around the lake Solonets – 14.5 %, stationing of green zones of settlements (including Oleksandrivka village) – 28.0%, woodland windbreaks of agricultural land – 22.2 %, separate trees along irrigation canals (near the OHPL) – 6.8 %, Table 4.20.

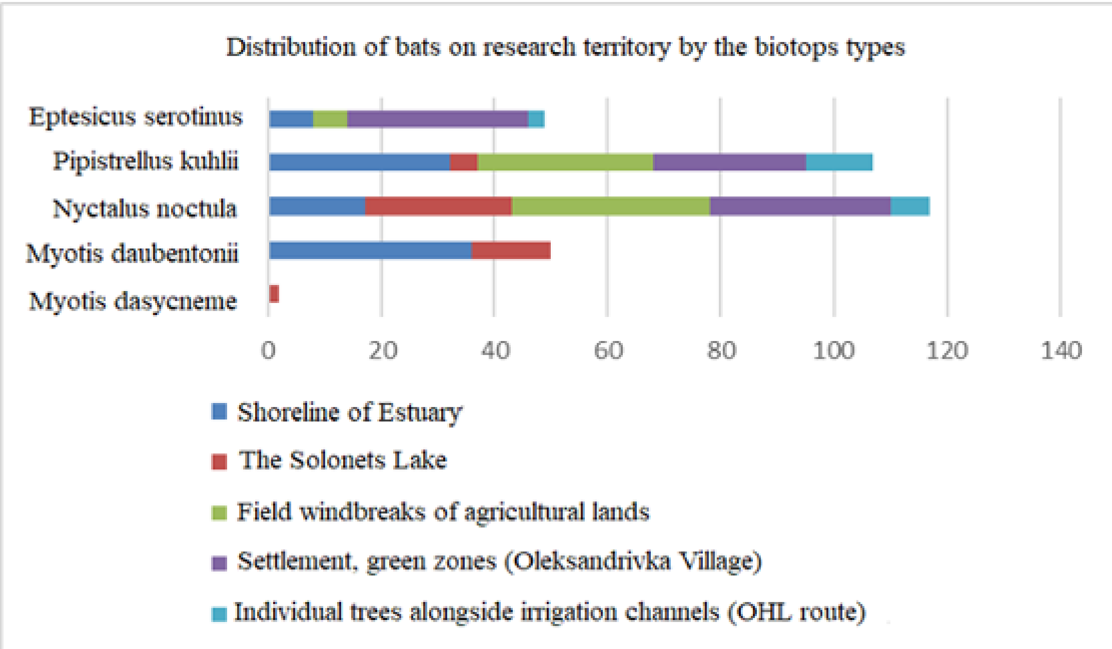


Fig. 4.44. Distribution of bats by major types of biotopes of the studied territory

Considering the nature of the activity and the degree of anthropogenic transformation of the first three types of habitats, all of them can be classified as synanthropic territories, and therefore the total share of bats within their limits, according to the results of the records, will be about 70 %. On the other hand, it is precisely for the coast of the estuary the highest number of bats (28.6 %), Table 4.20. This area is used by bats in the first place as forage area. Throughout the day, this area is well warmed up and there is a significant amount of insects that feed the bats. The main summer storage facilities for bats in the study area are anthropogenic repositories – buildings and other buildings in settlements, as well as, to a lesser extent, separate trees that grow within windbreaks and irrigation canals. The search of daytime repositories was carried out during route surveys of forest bands by recording the social sounds of bats in potential storage (duplex trees) and observing the possible evening bats departure of bats or their morning «swaddling» near the foundations. The route was surveyed in the evening hours (from 17 to 20 hours), during the high social activity of bats in the repositories.

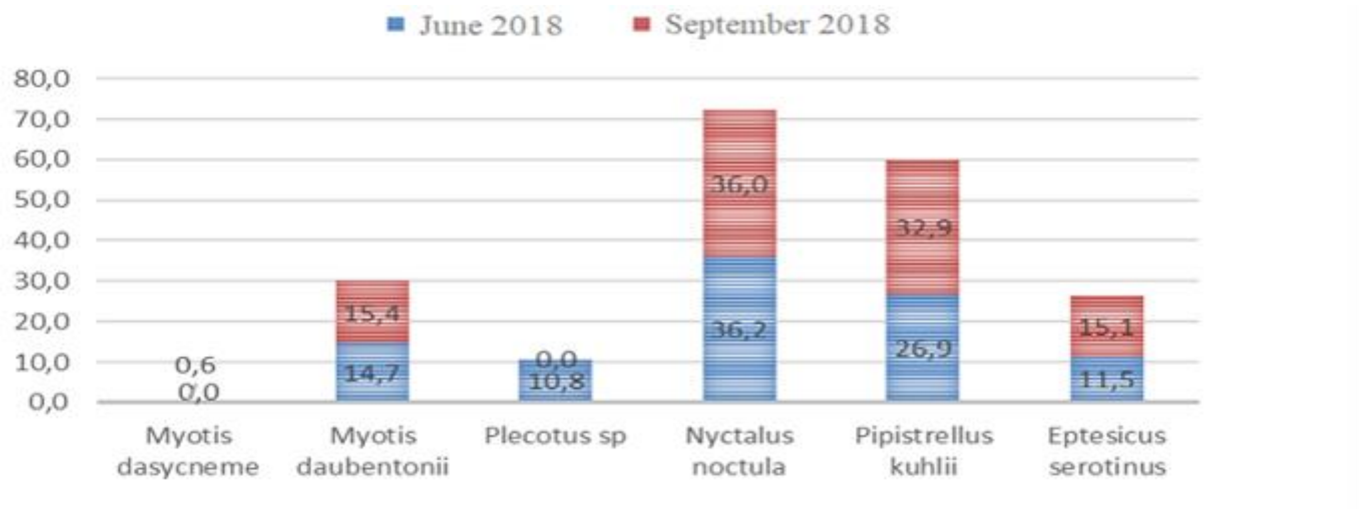


Fig. 4.45. Seasonal aspects of the number of bats in the studied area

In general, there is no significant difference between the records held in June and September 2018, which indicates that there are no significant bat migration corridors on this territory. It should be noted only that in the autumn two individuals were able to be registered *Myotis dasycneme* on hunting over the plaice of. Solonets, as well as failed to register representatives of the genus *Plecotus sp.*, whose share in the accounts for June was about 10%. Insignificant differences in the number of individual species are probably due to some differences in observation points. Totally, 275 bats from 5 species of bats on 2 observation points near the settlement Oleksandrivka, Bilozerskyi District, on place where the construction of the WPP is planned have been registered. There was also registered 127 individuals from 3 species of bats. There was conducted one trapping of bats on both checkpoints, which resulted in additional data on 2 bat species – the of the *Myotis daubentonii* and the *Eptesicus serotinus*:

- Point 1 is the border of the creek with agrocenoses (coordinates: 46°37'47.79" N.L. 32°1'35.92" E.L.): *Eptesicus serotinus* – 12 individuals caught;
- Point 2 is the right bank of the Lake Solonets (coordinates: 46°37'34.78" N.L. 32°5'20.06" E.L.): *Myotis daubentonii* – 4 individuals caught, *Eptesicus serotinus* – 6 individuals caught.

Among 5 identified species, the most numerous were the *Pipistrellus kuhlii* (27,3 % within the wind field) and *Nyctalus noctula* (36,7%). The quantity part of other 3 species: *Plecotus auritus, Eptesicus serotinus* and *Myotis daubentonii* which ranged from 11 to 21.3 %.

Bats are animals of twilight and night activity. The peak of their night activity on the study area falls on a time interval between 21 and 24 hours. More than 80% of bats were counted from 22 to 24 hours. After 24 hours the activity of bats decreased markedly and until the morning has not renewed practically. Morning activity of bats was insignificant. According to the literary data, the main sites of bats within the territory of the study are anthropogenic buildings of different types. Less often the bats hide in cracks which are formed during landslide from high clay banks, and occasionally settle in nest boxes and in hollows (Selyunina, 2014; Volokh et al., 2014). According to obtained data, the highest frequency of occurrence of bats (about 40%) was near the steppe areas with rich bush and herbaceous vegetation, for example, near Oleksandrivka village and near the field windbreaks adjacent to it (coordinates: 46° 37'47.79" N.L. 32°1'35.92" E.L.).

Less often bats occurred on the coast of the Dnipro-Bugsky Etuary and the Lake Solonets (coordinates: 46°37'34.78" N.L. 32° 5'20.06" E.L.), however, it is likely that bats will more often occur here during migration, which needs to be clarified in the future.

Myotis daubentonii (Kuhl, 1817) – Daubenton's bat.

The species was identified during detector survey on the 3 routes:

– route 1 (WTs 2-14 – 22 individuals per 8 km of the route);
– route 2 (WTs 16-25 – 9 individuals per 8 km of the route);
– route 3 (WTs 31-37 – 6 individuals per 7 km of the route).

Myotis daubentonii was trapped in mist net on 2 different count points (4 individuals totally). The overall quantity part of counted myotis daubentonii is 13 % of the total number of counted individuals.

Fig. 4.46. Daubenton's bat Myotis daubentonii (photo by M. Drebet)

Plecotus auritus (Linnaeus, 1758) – brown long-eared bat. The species was identified during detector survey on the 3 routes:

– route 1 (WTs 2-14 – 13 individuals per 8 km of the route);
– route 2 (WTs 16-25 – 9 individuals per 8 km of the route);
– route 3 (WTs 31-37 – 8 individuals per 7 km of the route).

Referring to literary sources, both species Plecotus auritus and Plecotus austriacus can be present in the region (Godlevska et al., 2011). The overall quantity part of counted plecotus auritus is 11 % of the total number of counted individuals. Most individuals of plecotus auritus are registered along linear structures (forest belts, forest roads) between places of they sites and hunting.

Eptesicus serotinus (Schreber, 1774) – serotine bat. The species was identified during detector survey on the 3-hours routes:

– route 1 (WTs 2-14 – 14 individuals per 8 km of the route);
– route 2 (WTs 16-25 – 5 individuals per 8 km of the route);
– route 3 (WTs 31-37 – 13 individuals per 7 km of the route).

Fig. 4.47. *Serotine bat Eptesicus serotinus (photo by M. Drebet)*

The overall quantity part of counted eptesicus serotinus is 12 % of the total number of counted individuals within the wind field and 27 % within the corridor of the OHPL. This species was caught in a mist net at the catch point 1 (coordinates: 46°37'47.79" N.L. 32°1'35.92" E.L.), the morphometric characteristics of the caught individuals are presented in Table 4.21.

Pipistrellus kuhlii (Kuhl, 1819) – Kuhl's pipistrelle. One of the most numerous species identified during the surveys. The species was identified during detector survey on the 3 routes:

– route 1 (WTs 2-14 – 33 individuals per 8 km of the route);
– route 2 (WTs 16-25 – 24 individuals per 8 km of the route);
– route 3 (WTs 31-37 – 18 individuals per 7 km of the route).

Table 4.21 – Morphometric characteristics of the caught individuals of bats

№	Species	Sex	Age	R (forearm)	5 finger	3 finger	Mass
1	Mdau	m	Ad	39.3	51.1	61.3	11.07
2	Mdau	m	Ad	38.6	48.2	61.7	6.00
3	Mdau	m	Ad	37.0	48.6	61.6	11.38
4	Mdau	f	Ad	37.9	48.1	61.5	11.10
5	Eser	f	Ad	51.6	61.7	81.7	24.10
6	Eser	m	Sad	51.6	62.7	77.1	26.32
7	Eser	f	Ad	52.9	63.7	90.1	27.00
8	Eser	m	Ad	51.2	61.4	90.0	21.30
9	Eser	m	Ad	50.8	61.7	86.3	21.05
10	Eser	m	Ad	53.1	62.9	94.3	30.48

Mdau – Myotis daubentonii (Kuhl, 1817); Eser – Eptesicus serotinus (Schreber, 1774).

The overall quantity part of counted *Pipistrellus kuhlii* is 27.3 % of the total number of counted individuals within the wind field and 36.2 % within the corridor of the power line.

Nyctalus noctula (Schreber, 1774) – common noctule. This is the most abundant species on the surveyed territory. It occurs in all surveyed types of habitats. The species was identified during detector survey on the 3 routes:

– route 1 (WTs 2-14 – 31 individuals per 8 km of the route);
– route 2 (WTs 16-25 – 33 individuals per 8 km of the route);
– route 3 (WTs 31-37 – 37 individuals per 7 km of the route).

The overall quantity part of counted nyctalus noctula is 36.7 % of the total number of counted individuals within the wind field. The total number of detected bats in comparison with other regions of Ukraine (such as Podillya, Transnistria, Crimean peninsulas) is negligible. A characteristic feature of the surveyed undergrounds used by bats is the low static air temperature, which does not contribute to the summer stay of the bats. In addition to what is extremely important for assessing the impact on bats, there are no species in the region that form large maternal colonies in underground caves in other regions of Ukraine. With regard to the low number of bats in the region during the winter period, this may be due to various reasons, among which the main ones are:

– temperature regime of the underground (temperature air temperature 12 °C and above), which is too high for normal hibernation;
– low density of troglophilic species of bats in the region as a whole;
– thrust factor characteristic of underground dwellings located near settlements.

Conclusion: taking into account the results of surveys, the development of wind power in the region in general will not interfere with the normal life of the sedentary species of bats, designed WT do not cross the migratory routes of migratory species. Placing wind turbines with small groups whose zone does not exceed their double diameter will allow bats to avoid danger zones without damage.

4.4.3.2.7Protected, rare and endangered species (populations)

According to the inventory at the territory of the landscape reserve «Oleksandrivskyi» and «DB WPP» territory the 12 species of terrestrial invertebrates from the Red Book of Ukraine are observed, Table 4.22.

Table 4.22 – The Red Book species of terrestrial invertebrates at the territory of the Landscape Reserve «Oleksandrivskyi» and «DB WPP» territory

Class of insects	Species of insects	Environmental protection status
Class *Myriapoda*, Order *Chilopoda*	*Scutigera coleoptrata* (Linnaeus, 1758)	rare
Class *Insecta*, Order *Odonata*	*Sympetrum pedemontanum* (Allioni, 1776)	vulnerable
Class *Insecta*, Order *Orthoptera*	*Saga pedo* (Pallas, 1771)	rare
Class *Insecta*, Order *Coleoptera*	*Dorcadion equestre* (Laxmann, 1770)	vulnerable
	Alosoma sycophanta (L., 1758)	vulnerable
Class *Insecta*, Order *Hymenoptera*	*Megascolia maculata* (Drury, 1773)	unvalued
	Melitturga clavicornis (Latreille, 1806)	vulnerable
	Xylocopa valga (Gerstaecker, 1852)	rare
	Bombus ruderatus (Fabricius, 1775)	rare
Class *Insecta*, Order *Lepidoptera*	*Papilio machaon* (L., 1758)	vulnerable
	Saturnia pyri (Denis & Schiffermuller, 1775)	vulnerable
	Zerynthia polyxena (Denis et Schiffermuller, 1775)	vulnerable

On the territory of the Landscape Reserve «Oleksandrivskyi» and on the territory «DB WPP» under the protection of the state are *Hierophis caspius, Elaphe sauromates* [128]. The protection lists of Berne Convention include *Natrix tessellata*. Among the mammal species included in the Red Book of Ukraine there are *Sisista subtilis*, *Cricetulus migratorius*, *Mustella ermine*, *Mustella eversmanni and three species of bats* living directly on the coast of the Dnipro-Bugsky Estuary and at the «DB WPP» territory. Another two species *Spermophilus odessanus and Lutra lutra* that are also protected by Bern Convention, and included in IUCN Red List [129] and European Red List [95], obviously are extinct since the end of the last century. In the vicinity of territory of projected construction of «DB WPP», during migration, the 13 species of birds from Red Book of Ukraine were revealed, Table 4.23.

Table 4.23 – Nationally protected species of birds in the vicinity of territory of planned construction of «DB WPP»

№	Species of birds	RBU*	ERL*	CITES*	BRC*
1	*Pelecanus onocrotalus*	+			+
2	*Aythya nyroca*	+			+
3	*Circus cyaneus*	+		+	+
4	*Haliaeetus albicilla*	+	+	+	+
5	*Falco cherrug*	+	+	+	+
6	*Falco peregrinus*	+	+	+	+
7	*Grus grus*	+		+	+
8	*Charadrius alexandrinus*	+			+
9	*Larus ichthyaetus*	+			+
10	*Hydroprogne caspia*	+			+
11	*Sterna albifrons*	+			+
12	*Coracius garrulus*	+	+		+
13	*Lanius excubitor*	+			+

Notes: RBU – Red Book of Ukraine; ERL* – European Red List; CITES* – The Convention on International Trade in Endangered Species of Wild Fauna and Flora; BRC* – Berne Convention.*

4.4.3.3 Priority biodiversity features and potential critical habitat triggers

Priority biodiversity features are defined as a subset of biodiversity that is particularly irreplaceable or vulnerable, but at a lower level than critical habitat (EBRD, 2014a). This includes:

- P(i) Threatened habitats;
- P(ii) Vulnerable species;
- P(iii) Significant biodiversity features identified by stakeholders or governments;
- P(iv) Ecological structure and functions needed to maintain the viability of features falling into the above criteria.

Features in the study area were identified as priority biodiversity features or potential critical habitat triggers if they were found to meet one or more of the following designations:

- habitats identified under the EU Habitats Directive Annex I;
- species listed as Vulnerable or above in the IUCN Red List;
- species listed as Vulnerable or above in the European Red List;
- species identified under the EU Habitats Directive Annex II or Annex IV;
- species identified under the EU Birds Directive Annex I.
- protected or internationally recognised areas (including Key Biodiversity Areas (KBA) and Important Bird and Biodiversity Areas (IBA); nationally and internationally important species or sites for conservation of biodiversity.

The Red Data Book of Ukraine was also consulted during this screening exercise. However, the criteria used in the Red Data Book of Ukraine do not align with IUCN Regional Red Listing guidelines. Designations in the IUCN Red List and regional Pan-European Red List were therefore referred to in the first instance to identify priority biodiversity features, with the national Red Data Book consulted where further information was required.

Species and habitats which meet criteria for priority biodiversity features are presented in Table 4.24.

The ESIA should be referred to for a full list of species and habitats recorded in the study area. Two habitat types and 50 species identified in the study area have the potential to be priority biodiversity features or above by meeting criteria P(i) and P(ii).

This consists of: one plant, eight reptile and amphibian, one terrestrial invertebrate, five bat and thirty-four bird species. No priority mammal species other than bats were recorded in the study area. The Landscape Reserve «Oleksandrivskyi» and Dnipro-Buzkyi Lyman Emerald Site (UA0000109) are considered priority conservation features under criterion P (iii). All other protected areas are beyond the zone of influence.

Table 4.24 – Summary of biodiversity features in the study area which meet criteria for priority biodiversity features (designations which potentially trigger critical habitat are highlighted in bold)

Biodiversity feature	**Habitat description/species common English name**	**Habitats Directive Annex I, II or IV[a]**	**Birds Directive Annex I [b]**	**IUCN Red List[c]**	**European Red List[d]**
Habitats, protected areas and flora					
1130 Estuaries	Habitat complexes of subtidal and intertidal habitats.	I	n/a	n/a	n/a
62C0 Ponto-Sarmatic steppes	Steppes of the plains, plateaus and hills of areas including those around the Black Sea.	I	n/a	n/a	n/a
Landscape Reserve “Oleksandrivskyi”	A landscape reserve of national importance, containing loess cliffs of the Dnipro Estuary, canyon-shaped ravines, steppe gulley, steppe upland, and the	n/a	n/a	n/a	n/a
Dnipro-Bugskyi Lyman Emerald Site	The site is a part of Dnipro River Ecological Corridor, supporting a high diversity of bird species, including	n/a	n/a	n/a	n/a

Biodiversity feature	Habitat description/species common English name	Habitats Directive Annex I, II or IV[a]	Birds Directive Annex I [b]	IUCN Red List[c]	European Red List[d]
Armeniaca vulgaris	Wild apricot - not naturally occurring in Ukraine, with the trees recorded being planted cultivars. Therefore, not considered a priority biodiversity feature and scoped out from further assessment	No	n/a	EN	n/a
Herpetofauna					
Bombina bombina	European fire-bellied toad	II; IV	n/a	LC	LC
Bufo viridis	European green toad	IV	n/a	LC	LC
Emys orbicularis	European pond turtle	II; IV	n/a	NT	NT
Hyla arborea	European tree frog	IV	n/a	LC	LC
Lacerta agilis	Sand lizard	IV	n/a	LC	LC
Lacerta viridis	European green lizard	IV	n/a	LC	LC
Natrix tessellate	Dice snake	IV	n/a	LC	LC
Pelobates fuscus	European Spadefoot Toad	IV	n/a	LC	LC
Vipera ursinii	Meadow viper	II; IV	n/a	LC	VU
Bats					
Myotis daubentonii	Daubenton's bat	IV	n/a	LC	LC
Eptesicus serotinus	Serotine bat	IV	n/a	LC	LC
Nyctalus noctula	Common noctule	IV	n/a	LC	LC
Pipistrellus kuhlii	Kuhl's pipistrelle	IV	n/a	LC	LC
Plecotus auritus	Brown long-eared	IV	n/a	LC	LC
Terrestrial invertebrates					
Bombus fragrans Pall	A bumblebee	No	n/a	n/a	EN
Birds					
Falco cherrug	Saker falcon	n/a	Yes	EN	VU
Philomachus pugnax	Ruff	n/a	Yes	LC	LC
Emberiza hortulana	Ortolan bunting	n/a	Yes	LC	LC
Gavia arctica	Black-throated loon	n/a	Yes	LC	LC
Streptopelia turtur	European turtle dove	n/a	No	VU	VU
Dendrocopos syriacus	Syrian woodpecker	n/a	Yes	LC	LC
Melanocorypha calandra	Calandra lark	n/a	Yes	LC	LC
Grus grus	Common crane	n/a	Yes	LC	LC
Oenanthe pleschanka	Pied wheatear	n/a	Yes	LC	LC
Tringa glareola	Wood sandpiper	n/a	Yes	LC	LC
Mergus serrator	Red-breasted merganser	n/a	Yes	LC	NT
Hydroprogne caspia	Caspian tern	n/a	Yes	LC	NT

Biodiversity feature	Habitat description/species common English name	Habitats Directive Annex I, II or IV[a]	Birds Directive Annex I [b]	IUCN Red List[c]	European Red List[d]
Sternula albifrons	Little tern	n/a	Yes	LC	LC
Sterna hirundo	Common tern	n/a	Yes	LC	LC
Numenius arquata	Common curlew	n/a	No	NT	VU
Circus pygargus	Montagu's harrier	n/a	Yes	LC	LC
Circus aeruginosus	Western marsh harrier	n/a	Yes	LC	LC
Circus cyaneus	Northern harrier	n/a	Yes	LC	NT
Larus melanocephalus	Mediterranean gull	n/a	Yes	LC	LC
Larus genei	Slender-billed gull	n/a	Yes	LC	LC
Ficedula parva	Red-breasted flycatcher	n/a	Yes	LC	LC
Haliaeetus albicilla	White tailed eagle	n/a	Yes	LC	LC
Pelecanus onocrotalus	Great white pelican	n/a	Yes	LC	LC
Phalaropus lobatus	Red-necked phalarope	n/a	Yes	LC	LC
Aythya ferina	Common pochard	n/a	No	VU	VU
Columba palumbus	Wood pigeon	n/a	Yes	LC	LC
Alcedo atthis	Kingfisher	n/a	Yes	LC	VU
Coracias garrulus	European roller	n/a	Yes	LC	LC
Lanius collurio	Red-backed shrike	n/a	Yes	LC	LC
Lanius minor	Lesser grey shrike	n/a	Yes	LC	LC
Vanellus vanellus	Northern lapwing	n/a	No	NT	VU
Ardea alba	Great egret	n/a	Yes	LC	LC
Egretta garzetta	Little egret	n/a	Yes	LC	LC
Aythya nyroca	Ferruginous duck	n/a	Yes	NT	NT

Source: (a) Directive 92/43/EEC: Annex I lists habitat types and Annex II species for which Special Areas of Conservation (SAC) are required (if criteria in Annex III are met) and Annex IV lists species in need of strict protection; (b) Directive 2009/147/EC: Annex I lists restricted-range and threatened bird species for which special habitat conservation measures are required; (c) IUCN, 2018; (d) IUCN, 2015: designations refer to the Pan-European Red List, which includes Ukraine.

4.4.4 Impact Assessment

4.4.4.1 Method

This section identifies and assesses the anticipated impacts from the Project activities on biodiversity. In line with European Commission guidance on EIA, a multi-criteria analysis has been used. This considers the conservation importance (sensitivity) of receptors and the magnitude of effect, defined as «the characteristics of the change... which would probably affect the target receptor as a result of the proposed Project» (European Union, 2017). The conservation importance of biodiversity features has been determined based on EBRD PR6. No critical habitat triggers were identified; therefore, this section assesses priority biodiversity features only. Species and habitats not qualifying as priority biodiversity features are not individually considered in this impact assessment, but are included in the ESIA. For all identified impacts, the magnitude of effects on each priority biodiversity feature are assessed to determine whether likely significance is: negligible, minor, moderate, or major. This considers the ecology of receptors and their presence in the study area relative to global or regional population size (Table 4.25).

In line with the aim of achieving No Net Loss of biodiversity, mitigation measures suggested in Section 4.4.6 are based on the outcomes of this impact assessment. Effects identified as major or moderate will be associated with targeted mitigation measures, specific to the species or species-group of relevance. Meanwhile, general best-practice measures to avoid adverse impacts from construction and operation of infrastructure development will be applied for all impacts and effects where relevant, including those identified as being of minor significance.

Table 4.25 – Criteria for determining magnitude of effect

Category	**Definition**
Major	Fundamental change to the biodiversity feature, resulting in long term or permanent change, typically widespread in nature a on significant proportion of species population or habitat extent (regional national and international); would require significant intervention to return to baseline.
Moderate	Detectable change to the biodiversity feature resulting in non-fundamental temporary or permanent change.
Minor	Detectable but minor change to the biodiversity feature.
Negligible	No perceptible change to the biodiversity feature.

4.4.4.2 Likely construction and operation impacts

The impacts assessed on each biodiversity category for the construction phase are:
- temporary and permanent habitat loss and degradation;
- hunting, poaching and collection of wildlife by construction staff;
- introduction or spread of non-native invasive species;
- injury or death of wildlife from road traffic and other project activities;
- disturbance and displacement of species (artificial lighting, noise and presence of people).

The impacts assessed on each biodiversity category for the operation phase are:
- disturbance and displacement of species;
- injury or death from collision with wind turbines and over-head lines;
- barrier to commuting or seasonal movements.

It is assumed that operational activities will require few staff on site, with no significant effects from potential associated impacts (e.g. injury and death from increase in road kills, hunting and poaching, human disturbance).

Table 4.26 assess these effects in relation to each priority biodiversity feature. The following sections provide further discussion on how conclusions were reached, separated into species groups. Significance of impacts in this section are assessed without mitigation measures in place; mitigation is presented in Chapter 4 with impact significance reassessed to identify if residual impacts may occur. All identified effects have been assessed as being of minor or negligible significance, with the exception of the effects from collision with the overhead line and have electric shock, which has been assessed as moderate for certain bird species.

Table 4.26 – Assessment of significance of impacts

	Construction Phase					Operation Phase		
	Temporary and permanent habitat loss and degradation	Hunting, poaching and collection of wildlife by construction staff	Introduction or spread of non-native invasive species	Injury or death of wildlife from road traffic and other project activities	Disturbance and displacement of species (artificial lighting, noise and presence of people)	Injury or death from collision with wind turbines	Injury or death from collision with overhead lines and have electric shock	Disturbance and displacement of species/barrier to movement
Habitats								
1130 Estuaries	Negligible	n/a	Negligible	n/a	n/a	n/a	n/a	n/a
62C0 Ponto-Sarmatic steppes	Negligible	n/a	Minor	n/a	n/a	n/a	n/a	n/a
Landscape Reserve «Oleksandrivskyi»	Negligible	n/a	Minor	n/a	n/a	n/a	n/a	n/a
Dnipro-Bugskyi Lyman Emerald Site	Negligible	n/a	Minor	n/a	n/a	n/a	n/a	n/a
Birds								
Falco cherrug	Minor	Minor	n/a	Negligible	Minor	Minor	Moderate	Minor
Philomachus pugnax	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Emberiza hortulana	Minor	Moderate	n/a	Minor	Minor	Minor	Minor	Minor
Gavia arctica	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Streptopelia turtur	Minor	Major	n/a	Minor	Minor	Minor	Minor	Minor
Dendrocopos syriacus	Minor	Negligible	n/a	Minor	Minor	Minor	Minor	Minor
Melanocorypha calandra	Minor	Minor	n/a	Minor	Minor	Minor	Minor	Minor
Grus grus	Negligible	Minor	n/a	Negligible	Minor	Minor	Moderate	Minor
Oenanthe pleschanka	Minor	Negligible	n/a	Minor	Minor	Minor	Minor	Minor
Tringa glareola	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Mergus serrator	Negligible	Minor	n/a	Negligible	Minor	Minor	Moderate	Minor
Hydroprogne caspia	Minor	Negligible	n/a	Minor	Minor	Minor	Minor	Minor
Sternula albifrons	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Sterna hirundo	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Numenius arquata	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Circus pygargus	Minor	Minor	n/a	Negligible	Minor	Minor	Moderate	Minor
Circus aeruginosus	Minor	Minor	n/a	Negligible	Minor	Minor	Moderate	Minor

Circus cyaneus	Minor	Minor	n/a	Negligible	Minor	Minor	Moderate	Minor
Larus melanocephalus	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Larus genei	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Ficedula parva	Minor	Negligible	n/a	Minor	Minor	Minor	Minor	Minor
Haliaeetus albicilla	Minor	Minor	n/a	Negligible	Minor	Minor	Moderate	Minor
Pelecanus onocrotalus	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Phalaropus lobatus	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Aythya ferina	Negligible	Moderate	n/a	Negligible	Minor	Minor	Moderate	Minor
Columba palumbus	Minor	Moderate	n/a	Minor	Minor	Minor	Minor	Minor
Alcedo atthis	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Coracias garrulus	Minor	Negligible	n/a	Minor	Minor	Minor	Minor	Minor
Lanius collurio	Minor	Negligible	n/a	Minor	Minor	Minor	Minor	Minor
Lanius minor	Minor	Negligible	n/a	Minor	Minor	Minor	Minor	Minor
Vanellus vanellus	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Ardea alba	Minor	Minor	n/a	Minor	Minor	Minor	Minor	Minor
Egretta garzetta	Negligible	Negligible	n/a	Negligible	Minor	Minor	Moderate	Minor
Aythya nyroca	Negligible	Moderate	n/a	Negligible	Minor	Minor	Moderate	Minor
Bats								
Myotis daubentonii	Minor	n/a	n/a	Negligible	Minor	Minor	Negligible	Negligible
Eptesicus serotinus	Minor	n/a	n/a	Negligible	Minor	Minor	Negligible	Negligible
Nyctalus noctula	Minor	n/a	n/a	Negligible	Minor	Minor	Negligible	Negligible
Pipistrellus kuhlii	Negligible	n/a	n/a	Negligible	Minor	Minor	Negligible	Negligible
Plecotus auritus	Negligible	n/a	n/a	Negligible	Minor	Minor	Negligible	Negligible
Herpetofauna								
Bombina bombina	Minor	n/a	n/a	Minor	Negligible	n/a	n/a	Negligible
Bufo viridis	Minor	n/a	n/a	Minor	Negligible	n/a	n/a	Negligible
Emys orbicularis	Minor	n/a	n/a	Minor	Negligible	n/a	n/a	Negligible
Hyla arborea	Minor	n/a	n/a	Minor	Negligible	n/a	n/a	Negligible
Lacerta agilis	Minor	n/a	n/a	Minor	Negligible	n/a	n/a	Negligible
Lacerta viridis	Minor	n/a	n/a	Minor	Negligible	n/a	n/a	Negligible
Natrix tessellate	Minor	n/a	n/a	Minor	Negligible	n/a	n/a	Negligible
Pelobates fuscus	Minor	n/a	n/a	Minor	Negligible	n/a	n/a	Negligible
Vipera ursinii	Minor	n/a	n/a	Minor	Negligible	n/a	n/a	Negligible
Terrestrial invertebrates								
Bombus fragrans Pall	Negligible	Minor	n/a	n/a	Negligible	Negligible	Negligible	Negligible

4.4.4.2.1 Habitats and Flora

Impacts on the terrestrial habitats, flora and fauna are largely associated with temporary and permanent habitat loss and degradation resulting from the construction of infrastructure. The developments will include: wind turbines, overhead lines, access roads, substation, temporary construction areas. An assessment of alternatives for the Project was undertaken (Chapter 3) and design outcomes will result in the minimization of habitat loss, especially of habitats of conservation importance, through: creating buffers around protected areas; reduction in number of turbines (37 to 25); shortest potential route for the OHPL (27.3 km rather than 36 km); use of metal pylons (fewer needed and less land take per pylon compared to concrete).

Habitat areas to be affected by the Project have been calculated and results are presented in Table 4.27, based on habitat mapping in Fig. 4.48. The study area is dominated by agricultural land, with areas of planted woodland. The permanent loss will be approximately 35.9 ha (of which 43% is agricultural or other cultivated land and 17% is planted broadleaved forest) and the temporary loss will be 7.1 ha (of which 43% is agricultural land). No habitat loss is anticipated within protected areas or of the priority habitat features, none of which overlap with the Project footprint. No priority flora species have been recorded in the study area.

Table 4.27 – Habitat loss quantification

Habitat types	**Total area of habitat in the study area (500m Buffer)**		**Total area of permanent land take**		**Total area of temporary land take**	
	Area (ha)	**Percentage**	**Area (ha)**	**Percentage**	**Area (ha)**	**Percentage**
Regularly or recently cultivated agricultural, horticultural and domestic habitats	4825.75	91.14	15.47	43.08	6.31	88.62
Anthropogenic herb stands, perennial calcareous grassland and basic steppes	182.25	3.44	5.59	15.56	0.51	7.14
Highly artificial broadleaved deciduous forestry plantations	148.19	2.80	6.11	17.02	0.10	1.46
Water	2.01	0.04	0.00	0.00	0.00	0.00
Residential areas	68.71	1.30	0.27	0.76	0.00	0.00
Transport network	68.16	1.29	8.47	23.58	0.20	2.78
Total	**5295.07**	**100.00**	**35.90**	**100.00**	**7.12**	**97.22**

The construction of the Project will also increase the potential for establishment of alien and invasive species of plants, with potential adverse effects on populations of native species. Several invasive species have been recorded in the study area (Section 4.4.3.1.3), with the potential magnitude of this impact without mitigation assessed as minor, as the study area is largely composed of highly modified habitats. Table 4.27 is based on the following assumptions:

- habitat mapping study area: 500 m buffer around all scheme elements: wind turbines, the OHPL pylons, substation, 35 kV Cable, Access roads;
- permanent land take area:
  - wind turbine circular buffer applied with a radius of 17.84 m (~0.1 ha land take);
  - the OHPL pylons circular buffer applied with a radius of 3.1 m (~30 m^2 land take)
  - substation building footprint used;
  - access roads buffered by 5 m;
  - 35 kV Cable buffered by 5 m.
- temporary land take area: the OHPL pylons circular buffer applied with a radius of 11.3 m (~400 m^2 land take);
- note: the permanent land take of the OHPL pylons was 'cut' out from the temporary land take layer in order not to double count it.

4.4.4.2.1Birds

Construction.

During construction, bird species in the study area may be affected by: loss/degradation of breeding and feeding habitat; disturbance and displacement; hunting and poaching by construction staff; and killing and injury of wildlife. Construction impacts will be confined to the project components and 500 m around them and will be temporary in nature, lasting the duration of construction activity.

The majority of waders and waterbirds were primarily recorded in areas outside of the Project footprint in the upper reaches of the Solonets Lake, in parts of the coastal zones of Dnipro-Bug Estuary and in the Oleksandrivskyi Pod. Direct loss of supporting habitat is therefore not anticipated. The magnitude of effects from habitat loss/degradation on species of waders and waterbirds is assessed as negligible.

Raptor species may be more affected by the impact of habitat loss as agricultural areas support some prey species and the plantation forests to be lost may provide perches or nesting habitat. In light of the number of individuals supported relative to population sizes, effects of habitat loss are considered minor on raptor species *(Falco cherrug, Circus pygargus, Circus aeruginosus, Circus cyaneus, Haliaeetus albicilla).*

Passerine and other bird species recorded in the study area may also be impacted by habitat loss as the plantation forest habitat and agricultural areas can provide suitable nesting and feeding habitats. The significance of this effect is considered to be minor. Additionally, clearance of woodland has the potential to result in direct damage or destruction of nests, with minor significance of effects from the impact of injury or death of wildlife from this activity. The significance of this impact on other bird groups is considered negligible.

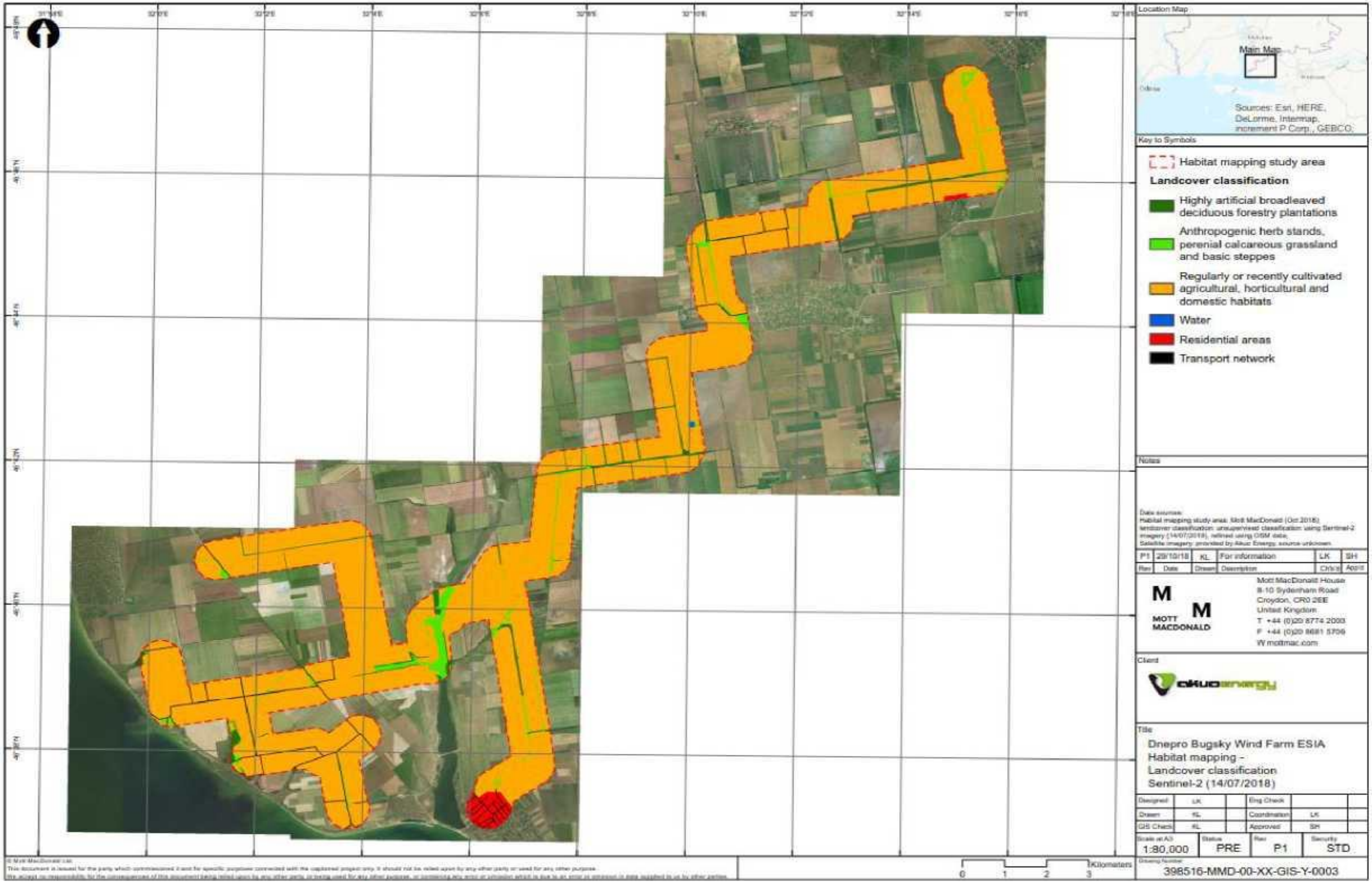


Fig. 4.48 Habitats present in study area

The effects of disturbance (noise and human presence) can lead to displacement of birds, thereby reducing the area of functional habitat availability. The effects of this impact decreases as distance from the source increases. While the distance from the stimuli at which birds show disturbance effects varies significantly, studies have found the maximum distances in which birds take flight from people approaching is 200 m (Cutts et al., 2009) and from noise disturbance is 300m (Cutts et al., 2013). The majority of works to be undertaken is beyond this distance from the main areas where wader and waterbird species have been recorded. Additionally, the attenuation of disturbance impacts over relatively small distances means that the areas to be impacted are relatively small relative to the species' ranges. The magnitude of effects from construction disturbance on all bird species is assessed as negligible.

The presence of construction staff in the Project area has the potential to create impacts from hunting of bird species or egg collection. The magnitude of hunting and poaching impacts on bird species is considered to be moderate or major on songbird, pigeon and dove species in the study area and minor or negligible on other bird species.

Operation.

During operation, bird species in the study area may be affected by: disturbance and displacement and collision with wind turbines and the overhead line.

Baseline surveys showed that raptor numbers were highest in the wintering period (Annex L), with *Buteo lagopus* being the most frequently recorded species. Raptor species are likely to hunt both on the adjacent wetland areas and in the agricultural fields within which the wind farm is proposed, creating a potential for collision impact. However, relative to the estimated global population of 300000-1000000 mature individuals of *Buteo lagopus*, the study area does not support a significant population of this species or of any of the other raptors recorded. Additionally, design elements of the Project, such as the use of horizontal axis turbines, have incorporated minimisation of this impact, with these turbines being less likely to result in collision tan vertical axis (Perrow, 2017). The significance of collision risk from the Project is assessed as minor.

Migratory and congregatory birds can also be vulnerable to collision risk impacts. No major bird migration routes have been found to cross the proposed wind farm area, with low numbers recorded in both spring and autumn surveys (Interim Report) and routes more likely to follow the coastal and estuarine habitats. Additionally, buffer zone around nearby protected areas has been established as part of Project design. The impact on migratory species is therefore considered of minor significance. The vulnerability of other bird species to the effects of displacement from wind turbines is lower. However, a greater proportion of individuals from these groups are supported by habitats surrounding the wind turbines, with magnitude of effects also considered minor.

The operation of overhead power lines as part of the Project has the potential to cause death or injury to birds through collision. Additionally, collision with the cable and pylons may occur; as with wind turbine collision, raptors and migrating birds are most vulnerable to this impact. A particular point for potential collision is presented by the location at which the transmission line crosses north of the Solonets Lake, where a significant proportion of the birds recorded were observed. Considering the Project location in relation to vulnerable species, this effect is considered moderate without mitigation on species of raptors, waders and waterfowl. However, effects on other bird species are considered minor.

Displacement has been identified as one of the key threats to birds from onshore wind farms (Hotker, 2017). Disturbance through displacement results in birds not using suitable habitat within or close to wind farms, creating an overall net loss of habitat. The most severely affected species groups have been found to be Anseriforms (swans, ducks and geese) and Charadriiform (shorebirds and gulls). The strength of disturbance impact decreases with distance from the wind farm and varies between species (Hotker, 2017). Considering the location of habitats supporting these species within the study area which is beyond this distance from the proposed turbine locations, the magnitude of effect on species of waders and waterbirds is considered minor.

4.4.4.2.2Bats

Construction.

During construction, bat species in the study area may be affected by: loss/degradation of foraging and commuting habitat and disturbance and displacement.

Field surveys undertaken show that the majority of bat species recorded are associated with habitats on the estuary coast. These areas do not overlap with the Project footprint, with the impacts of habitat loss therefore limited. Certain species *(Eptesicus serotinus, Nyctalus noctula, Pipistrellus kuhlii)* were more frequently recorded in the forest windbreaks, of which 6.21 ha is anticipated to be lost, potentially fragmenting commuting and foraging habitat. Considering the extent and quality of this area and the number of individuals recorded, the anticipated effect is low relative to the species' population and range with significance assessed as minor. The significance of habitat loss on other bat species *(Myotis daubentoniid, Plecotus auratus)* is negligible.

Habitat clearance also has the potential to cause injury or death of bats, should features supporting bat roosts be destroyed (e.g. trees). However, no such features were identified during baseline surveys and very little habitat with potential to support roosts is present in the area. The effects are therefore considered negligible on all bat species. Disturbance on bats could be caused by artificial lighting in the construction area, which can affect the feeding and commuting behaviour of bats and cause displacement (Bat Conservation Trust, 2018). Considering the relatively low number of bats observed in the study area compared to their populations and the fact that the majority were recorded in urban areas, the significance of effect is considered minor.

Operation.

During operation, bird species in the study area may be affected by: collision with wind turbines and barrier to movement. The most significant impact posed by operating wind turbines on bats is direct mortality due to collision and/or barotrauma (caused by rapid air-pressure reduction near moving turbine blades). Vulnerability to impacts varies between species and the highest levels of mortality tend to occur in areas of high bat activity, such as migration and commuting routes or in/near woodland habitats (Rodrigues et al., 2015). Certain bat species recorded in the study area *(Myotis daubentoniid, Eptesicus serotinus, Nyctalus noctula)* are more vulnerable to collision risks than the others (Eurobats, 2017). However, bat surveys undertaken indicate that the area is not an important migratory route and that levels of bat activity are relatively low and primarily concentrated in areas beyond the Project footprint (e.g. the Estuary shoreline and nearby habitats). As a result, the significance of effect is considered minor on all species.

The risk of bat collision with transmission lines is far lower and considered negligible in the context of this Project.

The presence of wind farms may create a barrier to the movement of bat species across the landscape, therefore causing population fragmentation. However, as the study area is not considered to support important commuting routes for bats, this impact is negligible.

4.4.4.2.3Herpetofauna

Construction.

Potential impacts from construction on herpetofauna are: habitat loss and degradation and killing and injuries.

The majority of reptile and amphibian species recorded in the study area were present on the coast of the Dnipro-Bug Estuary and in nearby waterbodies. These habitats do not overlap with the Project footprint with no reptile species recorded in the forest wind breaks. The significance of this effect is therefore considered minor on all species.

Direct mortality of herpetofauna could be caused through trapping in deep excavations, collision with vehicles and mortality due to vegetation clearing and ground preparation for construction. Records of herpetofauna were relatively low in the construction area with effects considered minor.

Operation.

Based on an assessment of reptile and amphibian data from baseline studies, no significant Impacts are anticipated from the operation of the Project.

4.4.4.2.4Terrestrial Invertebrates

Construction.

Potential construction impacts on terrestrial invertebrates are: habitat loss and degradation; collection of wildlife; and displacement due to artificial lighting. Only one priority invertebrate feature was recorded on site.

The invertebrate species recorded in the study area considered a priority feature *(Bombus fragrans)*, is primarily associated with grassland habitats and was observed in the steppe and forest-steppe areas. 6.1 ha of these habitats will be lost from the Project activities. This is considered not to be significant relative to the occurrence of these species, with the significance of effect considered to be negligible.

Bombus fragrans is a species which is subject to collection, with biological resource use identified as a major threat to the species (IUCN, 2018). Without mitigation, an increase in personnel in the area from the presence of construction staff has the potential to create a minor impact on the species' population.

The use of artificial lighting can result in the displacement of nocturnal invertebrate groups attracted to light (e.g. moths) and increased predation in these areas. Additionally, loss of functional habitat and disruption of invertebrate groups repulsed by light (e.g. earwigs, woodlice, earthworms) may occur (Bruce-White and Sharlow, 2011). *Bombus fragrans* is not considered sensitive to such impacts, with negligible significance of effects.

Operation.

Based on an assessment of terrestrial invertebrate data from baseline studies, no significant Impacts are anticipated from the operation of the Project.

4.4.5 Critical habitat assessment

Features with the potential to be critical habitat triggers were assessed in greater detail to determine if the Project is in critical habitat, defined as supporting the most sensitive biodiversity features (EBRD, 2014a). This comprises:

- C(i) Highly threatened or unique ecosystems;
- C(ii) Habitats of significant importance to endangered (EN) and critically endangered (CR) species;
- C(iii) Habitats of significant importance to endemic or geographically restricted species;
- C(iv) Habitats supporting globally significant migratory or congregator species;
- C(v) Areas associated with key evolutionary processes;
- C(vi) Ecological functions that are vital to maintaining the viability of biodiversity features described above.

Results of the screening exercise identified that features are present in the study area which have the potential to trigger critical habitat under criteria C(ii) and C(vi), should C(ii) be triggered (Table 4.24). Reasons for scoping out other criteria for critical habitat are outlined below.

It is considered that there is no evidence to show that the study area has the potential to support triggers of criteria C(i), C(iii), C(iv) or C(v). C(i) is not triggered as the study area does not support ecosystems that are: at risk of significantly decreasing in area or quality; have a small spatial extent; and/or contain concentrations of biome-restricted species. Criterion C(iii) is not triggered as no endemic or restricted range species are known or likely to occur in the area. It is considered that the study area does not support a significant proportion of the population of migratory or congregator species based on the results of field surveys and the fact that no KBAs or IBAs are within the zone of influence, with C(iv) not triggered. The study area is not associated with landscape features associated with particular evolutionary processes or distinct species associated with criterion C(v).

4.4.5.1 C(ii) Habitats of significant importance to EN and CR species

Areas supporting species at high risk of extinction are considered to trigger critical habitat under this criterion. This includes: CR or EN species on the IUCN Red List or equivalent national/regional systems; Alliance for Zero Extinction Sites; and species listed in the EU Habitats Directive Annex IV (EBRD, 2014b). Features recorded with the potential to trigger this criterion are: one plant species, nine reptile and amphibian species, five bat species, one terrestrial invertebrate species and one bird species. Further detail on these species and an assessment of whether they trigger critical habitat in the study area is presented in Table 4.28.

Table 4.28 – Potential critical habitat (CH) trigger species under criterion ii

Species	Status relevant to CH	Ecology and threats	CH trigger?
Bombina bombina European fire-bellied toad	Habitats Directive Annex IV	This species has a wide range across central and eastern Europe. Its preferred habitats are rivers and lakes, wetlands, woodland and forest and can also occur in grassland. Global populations are decreasing, with main threats being residential and commercial development, agriculture and pollution. However, populations in the Black Sea biogeographic zone are in favourable condition.	No. This species is abundant over its range, with the study area not considered to support a significant population.
Bufo viridis Green toad	Habitats Directive Annex IV	Distributed throughout Europe, living in a range of forest, forest steppe, scrubland, grassland and alpine habitats as well as modified areas. Populations decreasing globally with main threats being agriculture and aquaculture, transportation and service corridors and pollution.	No. This species is considered relatively abundant to common over its large range, with the study area not considered to support a significant population.
Emys orbicularis European pond turtle	Habitats Directive Annex IV	The European pond turtle is found in southern and central Europe, West Asia and North Africa. It generally inhabits wetlands surrounded by natural, wooded habitats. Decreasing globally and listed as IUCN NT, it is threatened by development of road networks and climate changes impacts.	No. This species has a wide geographic range, with the study area not considered to have sufficient suitable habitat to support significant populations.
Hyla arborea European tree frog	Habitats Directive Annex IV	A widespread Paleartic species generally associated with open forests, shrublands, meadows, gardens and lake shores. It is globally decreasing due to pressures from habitat loss and collection for the pet trade.	No. There is limited suitable habitat within the study area, which is not considered to support significant populations of this species.

Species	Status relevant to CH	Ecology and threats	CH trigger?
Lacerta agilis Sand lizard	Habitats Directive Annex IV	This species ranges across most of Europe and into Central and Eastern Asia and is found in a range of habitats including meadows, grassland and steppe. It is decreasing globally and in most parts of Europe due to habitat loss through urbanization and agriculture.	No. Species has a very wide range and is common in suitable habitat, with the study area not considered to support significant populations.
Lacerta viridis European green lizard	Habitats Directive Annex IV	This lizard is native to south-eastern Europe and is found in bushy vegetation at woodland fringe edges, open woodlands and similar habitats. There are no identified major threats to this species, and its EU conservation status in the Black Sea biogeographical region is considered favourable.	No. Wide ranging species, with study area considered to contain insufficient suitable habitat to support significant populations.
Natrix tessellata Dice snake	Habitats Directive Annex IV	Wide-ranging species, from central Europe to western China and northern Africa. Dice snakes are largely aquatic associated with rivers, coasts, lakes and surrounding terrestrial habitat. Not globally threatened but decreasing population due to loss and modification of wetland habitats and road mortality.	No. Study area not considered likely to support significant population of this species which is common in much of its wide range.
Pelobates fuscus European Spadefoot Toad	Habitats Directive Annex IV	A lowland species found throughout plains and hilly regions in Europe and into central Asia. It mostly inhabits open areas including steppes and meadows. Its global population is decreasing due to pollution and habitat loss.	No. Wide-ranging species and reported to be common in the European part of former Soviet Union, with study area not considered to support significant populations.
Vipera ursinii Meadow viper	Habitats Directive Annex IV	This species has a wide range from Central Europe to Central Asia but has very fragmented populations within this. It is primarily associated with open meadows and hillsides and is listed as VU on the European Red List, primarily due to treats from conversion to intensive agriculture.	No. This species was not actually recorded during field surveys and has not been seen in the study area in recent decades (from consultation with local ecologists).
Bats			
Myotis daubentonii Daubenton's bat	Habitats Directive Annex IV	This species is distributed throughout Europe, northern Asia and the Far East. It forages over waterbodies and is therefore reliant on water sources. Overall population is increasing, with no major threats known, though changes to water quality and loss or damage to roost sites can have negative impacts.	No. Large ranging and relatively abundant, with study area not considered to support significant population.

Species	Status relevant to CH	Ecology and threats	CH trigger?
Eptesicus serotinus Serotine bat	Habitats Directive Annex IV	Relatively large bats which occur throughout most of continental Europe, in a range of habitats. Relatively abundant species but with some threats from habitat loss and disturbance.	No. Widespread and abundant species with study area not considered to support significant population.
Nyctalus noctula Common noctule	Habitats Directive Annex IV	Very wide Palaearctic distribution, foraging over wetland, woodland and pasture. Relatively common throughout its range but has an unfavourable conservation status in most of Europe.	No. Widespread species with study area not considered to support significant population.
Pipistrellus kuhlii Kuhl's pipistrelle	Habitats Directive Annex IV	A small species of bat, widespread in Europe, Africa and Asia, it forages over a range of habitats including agricultural areas. It is a relatively abundant species with no major global threats.	No. Widespread and abundant species with study area not considered to support significant population.
Plecotus auritus Brown longeared	Habitats Directive Annex IV	This species is endemic to Europe and forages in the vicinity of its roosts in woodlands, hedgerows and isolated trees. It is common throughout central Europe, with habitat loss being the main threat.	No. Widespread across Europe with study area not considered to support significant population.
Invertebrates			
Bombus fragrans Pall A bumblebee	European Red List EN	The largest bumblebee in the west-Palearctic, this species has a wide range over central and eastern Europe, extending to Mongolia in the east. It is associated with grassland habitats and classified as EN on the European Red List due to its 50% decline over the past 10 years from threats due to agriculture, climate change and collection. It is listed as vulnerable in the Red Book of Ukraine.	No. This species has a large geographic range, with an area of occupancy of 944 km^2, with the study area not considered to support significant populations due to the habitat types present (primarily agricultural).
Birds			
Falco cherrug Saker Falcon	IUCN EN	Occurs in a wide range from eastern Europe to western China and hunts on open grassy landscapes such as steppes and arid montane areas and uses copses or cliffs for nest sites. It is listed as IUCN EN and European VU having suffered mainly from the loss and degradation of steppes and dry grasslands. Its estimated global population is c.12,200-29,800 mature individuals and European population is 710-990 mature individuals.	No. Bird surveys undertaken in the study area recorded a maximum of five individuals of *Falco cherrug*, which is <1% of the estimated European population. Due to these results and the relative size of the study area compared to the species distribution, it is considered that critical habitat is not

Sources: IUCN, 2018; European Environment Agency, 2018; Encyclopedia of Life, 2018

4.4.5.2 C(vi) Ecological functions that are vital to maintaining the viability of biodiversity features described above

Critical habitat may be triggered under this criterion if ecological functions are supported without which critical biodiversity features could not persist (e.g. dispersal or migration corridors, hydrological regimes, etc.). As this assessment has identified that the Project study area is not in critical habitat, this criterion is not triggered.

4.4.6 Mitigation and monitoring

Measures have been identified to insure the implementation of the mitigation hierarchy (avoid, reduce (minimise), remedy (restore) and offset) in line with EBRD Performance Requirements and standard international best practice. These practical measures are presented in this chapter and are incorporated into the framework environmental and social management and monitoring plan (ESMMP) to minimise any additional pressures on habitats, flora and fauna from construction and land clearance activities. Targeted mitigation measures, specific to the species or species-group of relevance are provided for impacts assessed as moderate, and some impacts of minor significance. Meanwhile, general best-practice measures to avoid adverse impacts from construction and operation of infrastructure development are required for all impacts and effects where relevant. Considering the baseline biodiversity in the study area, size and scale of the Project, and proposed mitigation measures, it is considered that no significant residual impacts will result on biodiversity from the Project, with all effects assessed as negligible or minor. Table 4.29 outlines mitigation and enhancement measures for impacts identified in Chapter 4.4.4. They are discussed in more detail in the Biodiversity Management Plan in Chapter 4.4.7, which will be used to inform construction and operation activity to achieve no net loss to biodiversity.

In order to increase the safety of the section of the OHPL at the intersection of the Wovchka Beam, namely 3 (three) spans between 4 (four) pylons No. 178-181, engineering solutions will be introduced by using preventive means and installing special technical devices on the electrical grid structures: means and devices, which make the design of the power grid more visible, and therefore activate vigilance of birds, enable them to timely estimate the distance to the obstacle and fly it.

To increase the vigilance of birds, the installation of signal ball markers is foreseen. These devices provide visual aberration, avoidance of collision with the air lines and prevent possible loss of birds. Such devices are made on the basis of plastic, resistant to atmospheric precipitation and ultraviolet radiation. The diameter of the ball is 600 mm, the mass 6.9 kg. They are intended for installation on a wire of a wide range of diameters using special clamps. Bullet-markers have a bright red, orange-colored color, which is adjusted so that the balls create a strong contrast against the background of the sky and the surrounding landscape during the daylight hours, Fig. 4.49. Birds will avoid planting in places that will save their lives.

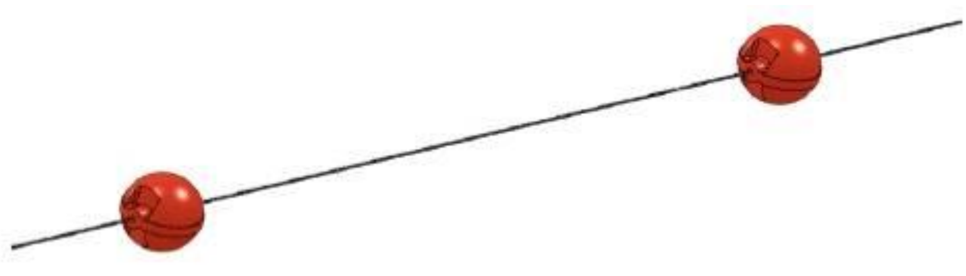


Fig. 4.49. Bird protection device bullet-ball marker

It is recommended to place colored bullets, such as orange-white-orange-white, etc. to increase visibility in different seasons (against the backdrop of snow, against the background of green grass, against the background of water obstacles). An example of installing bullets-ball marker is provided on Fig. 4.50.

Fig. 4.50. Example of bullet-ball marker mounting on air-conductor wires

Table 4.29 – Mitigation and enhancement measures for impacts on biodiversity receptors

Impacts to mitigate and significance before mitigation	Mitigation or Monitoring Measure	Mitigation Hierarchy	Detail	Residual Impacts
Construction Phase				
Hunting, poaching and collection of wildlife: – Birds: negligible – minor; – Terrestrial invertebrates: minor.	Ban on hunting, poaching and collecting	Avoid	A ban on hunting and poaching by construction and operation staff will be implemented to reduce pressure on threatened and protected species in the Project areas and surroundings. All construction and operation at the Project site will be required to follow company rules and code of conduct.	– Birds: negligible; – Terrestrial invertebrates: negligible
Introduction or spread of non-native invasive species of plants: – Habitats: minor	Prevent the introduction of non-native and invasive species	Avoid	During construction, the contractor will monitor the non-native and invasive plant species identified (ESIA Section 4.4.1.1.2) and will report on new invasive species establishing in the Project areas. If necessary, a alien species local botanist will be employed to undertake the monitoring or will be contacted to confirm the identification of invasive species. IFC PS6 advice on invasive species is aligned to EBRD PR6 and includes the following best practice measures with regard to Alien Invasive Species (AIS): –Must not intentionally introduce alien species unless this is in accordance with existing regulatory framework; –Must not deliberately introduce AIS irrespective of regulatory framework; –Introduction of alien species (e.g. in planting) must be subject to a risk assessment; –Implement measures to avoid accidental introduction or spreading of alien species.	– Habitat: negligible

Injury or death of wildlife from road traffic: – Herpetofauna: minor	Raise awareness through staff inductions and implement speed restrictions on site	Reduce (minimise)	All staff operating motor vehicles must undergo an environmental induction training course that includes instruction on the need to comply with speed limits, to respect all forms of wildlife (especially reptiles and amphibians) and, wherever possible, prevent accidental road kills of fauna. Snakes should only be handled after inductions have taken place due to the risks of envenomation.	– Herpetofauna: negligible
Injury or death of wildlife from road traffic: – Herpetofauna: minor	Monitoring biodiversity in the Project site	Reduce (minimise)	Road mortalities should be monitored with trends evaluated and subject to review as part of monthly reporting. Monitoring should occur via a logbook system where staff takes note of the date, time and location of the sighting/incident. This will allow determination of the locations where the greatest likelihood exists of causing a road mortality and allow mitigation against it (e.g. seasonal speed reductions). Mitigation should be adaptable to the onsite situation.	– Herpetofauna: negligible
Injury or death of wildlife: – Herpetofauna: minor	Limit open excavated trenches	Reduce (minimise)	Excavated trenches will be left open for as short a time as possible to avoid acting as dispersal barriers. All open excavated trenches must have at least one of the slopes with an angle of less than 45° to allow for trapped fauna to crawl out.	– Herpetofauna: negligible
Injury or death of wildlife Temporary and permanent habitat loss (construction): – Birds: negligible - minor	Undertake vegetation clearance outside of the main bird breeding period	Reduce (minimise)	To minimise the potential impact to breeding bird species which may be present in the forest wind breaks, vegetation clearance will be undertaken outside of the main bird breeding period if possible (likely period March to August; to be confirmed with local ecologists). Where this is not possible, the areas to be cleared will be checked for breeding birds prior to clearance and if nesting birds are found, appropriate mitigation measures will be implemented. This may involve avoiding construction within 50 m of the active nest until the chicks have fledged.	– Birds: negligible

Injury or death of wildlife Temporary and permanent habitat loss (construction): – Bats: negligible	Survey for bat roosts before clearance of habitat	Reduce (minimise)	No bat roosts were identified during baseline field surveys and the majority of habitat to be cleared does not provide suitable roosting habitat. However, if any trees providing potential roosting habitat are identified, it should be ensured that they are subject to a roost survey before clearance, following best practice guidelines (e.g. Hundt, 2012). If a roost is identified, appropriate mitigation will be required to prevent injury or death to bats.	– Bats: negligible
Disturbance and displacement of species: – Birds: minor – Bats: minor	Minimise noise disturbance	Reduce (minimise)	Equipment with low noise emissions will be procured and piling or other noise intensive activities restricted to daylight hours (best practice measures to be followed, with further details incorporated in Environmental and Social Management Plan).	– Birds: negligible – Bats: negligible
Disturbance and displacement of species: – Birds: minor – Bats: minor – Terrestrial mammals – Terrestrial invertebrates	Minimise light disturbance	Reduce (minimise)	Exterior lighting will be reduced to minimum levels necessary for safe operational activities, and strategies implemented to reduce spill light. Use non-UV lights where possible, as light emitted at one wavelength has a low level of attraction to insects. This will reduce the likelihood of attracting insects and their predators, including bats.	– Birds: negligible – Bats: negligible
Temporary habitat loss and degradation: – Habitats and flora: negligible – Birds: minor - negligible – Bats: minor - negligible – Herpetofauna: minor – Terrestrial invertebrates: negligible	Habitat rehabilitation and restoration	Restore	At the end of construction, temporary structures will be removed and temporary sites will be restored to their initial status where possible (7.12 ha).	– Habitats and flora: negligible – Birds: minor - negligible – Bats: minor - negligible – Herpetofauna: minor – Terrestrial invertebrates: negligible

Operational Phase				
Injury or death from collision with wind turbines: – Birds: minor; – Bats: minor.	Habitat and site management and maintenance	Reduce (minimise)	Habitats within the Project site will be maintained during operation to reduce the risk of attracting collision-prone birds, e.g. avoiding establishing ponds or waste sites within the development. Additionally, good wind plant maintenance practices will be followed, such as filling of holes in nacelles so that nesting and perching is not possible. To provide potential benefits to saker falcons and other raptors present, the erection of artificial nesting platforms outside of the wind farm site will be undertaken. Exact locations should be determined in consultation with local ecologists or other relevant stakeholders (e.g. in north eastern extent of the OHPL).	– Birds: minor; – Bats: minor.
Injury or death from collision with overhead power lines: – Birds: minor - moderate	Appropriate design of transmission lines	Reduce (minimise)	Transmission lines should be designed to minimise the potential for bird collision; this is particularly relevant to raptor species known to occur in the study area, particularly the IUCN EN saker falcon. Measures to minimise collision risk include: – Install bird deflectors in potential high impact areas (e.g. section of OHL directly north of Solonets Lake); – Design lines in a horizontal plane to reduce collision risk; – Provide safe perching areas.	– Birds: negligible - minor
Disturbance and displacement of species Barrier to commuting or seasonal movements: – Birds: minor – Bats: negligible	Monitor displacement and barrier effects	Reduce (minimise)	Post-construction monitoring of bird and bat populations should be undertaken to measure displacement and barrier effects and test the efficacy of mitigation measures. This will be part of an adaptive management framework to allow for alterations in mitigation measures if necessary.	– Birds: minor – Bats: negligible

Injury or death from collision with wind turbines and over-head lines: – Birds: minor – Bats: negligible	Monitor mortality rates	Reduce (minimise)	Mortality effects on bird and bat populations should be monitored, so that potential long-term impacts can be identified, and any necessary adaptive management implemented. This will involve carcass searching for bats and birds as follows.	– Birds: minor – Bats: negligible

4.4.7 Biodiversity management plan

4.4.7.1 Overview

This Section presents the Biodiversity Management Plan (BMP) for the «Dnepro-Bugsky Wind Farm Project». In line with EBRD PR6 (EBRD, 2014a), the objective is to achieve no net loss for biodiversity from Project activities where feasible. To enable this, the BMP provides detail on the measures outlined in Chapter 4, to mitigate adverse impacts on biodiversity features. The plan includes: expected timelines, responsible parties, and measures for success. Measures are split into: targeted mitigation measures for impacts and effects of moderate significance or with the potential to affect multiple priority biodiversity features; and general mitigation measures which reflect general good practice to reduce impacts during construction and operation.

Monitoring actions are also included. This is intended to be a dynamic plan, with adaptive management applied in response to results from project monitoring and evaluation of mitigation measures.

4.4.7.2 Further studies required

Table 4.30 – Further studies potentially required

Impact to be addressed	Study	Location/Activity	Responsibility	KPI
Temporary and permanent loss under Project footprint	Ground-truthing of habitat classification map	The habitat classification map produced for this report should be reviewed by local ecologists to ensure that calculations are accurate	Developer	Confirmation of habitats mapped through remote sensing

4.4.7.3 Mitigation requirements

Mitigation measures outlined in Table 4.31 of this BMP will be incorporated and developed within a construction environmental management and monitoring plans (CEMMP) by the ECP contractor.

In addition to these mitigation measures, the CEMMP will include the following:

- details of the environmental staff to be hired by the contractor and their responsibilities with regard to the implementation of mitigation measures and the biodiversity monitoring during construction;
- details of the local organisation and the specialists that will undertake some of the activities that require specialist and local knowledge;
- description of the biodiversity monitoring methods and sites to be used during construction;
- measures to prevent the introduction and spread of non-native invasive species during construction;

- on-site habitat restoration;
- details of how the other biodiversity mitigation measures presented will be implemented;
- all workers engaged in the Project will be made aware of the environmental and ecological sensitivities (priority biodiversity features and threatened and protected species) of the Project site and their own actions. Staff will be provided with relevant information through staff induction, toolbox talks, leaflets and office posters;
- control measures for soil and water pollution.

4.4.7.4 Monitoring requirements

Table 4.32 outlines biodiversity monitoring required during the construction phase and ongoing monitoring to be undertaken as part of an adaptive management approach during operation of the Project. Data collected will be reviewed to assess project impacts on biodiversity and the effectiveness of the mitigation measures undertaken, with thresholds set for each of the parameters monitored. Should it be found that any of the thresholds defined in Table 4.31 are exceeded, an adaptive management response will be triggered, as follows:

Investigate cause of adverse impact:

- if project activity cannot be excluded as cause, convene meeting of relevant ecological consultants and stakeholders to discuss event and determine what mitigation measures or further inquiry is needed;
- undertake a site visit by biodiversity and impact assessment specialists if deemed necessary;
- update EMP and any other relevant site management plans to include additional mitigation and monitoring required.

Table 4.31 – Mitigation measures

Impact to be addressed	Management/ mitigation/ enhancement action	Timing	Location	Target/threshold
Targeted measures				
Injury or death from collision with overhead lines	Transmission lines should be designed to minimise the potential for bird collision; this is particularly relevant to raptor species known to occur in the study area, particularly the IUCN EN saker falcon. Recommendations to minimise collision risk include: – Install bird deflectors in potential high impact areas (e.g. section of the OHPL directly north of Solonets Lake); – Design lines in a horizontal plane to reduce collision risk; – Provide safe perching areas; – Minimising collision risk should be project-specific, with guidelines available in the Migratory Soaring Bird (MSB) Project's Power Line Guidelines (2018).	Incorporated in design and construction	OHPL route	No reported collision of priority bird species with transmission lines
Temporary habitat loss under Project footprint	– Habitat rehabilitation and restoration on the sites affected temporarily by construction - 7.12 ha, of which 0.1 ha is broadleaved forest and 0.51 ha is perennial calcareous grassland and basic steppes; – The nature and areas of habitats to be restored on these sites will be determined following consultation with local ecologists and other relevant stakeholders.	End of construction	Temporary construction areas	Successful completion of rehabilitation/ restoration of areas affected temporarily by construction
Permanent habitat loss under Project footprint	– Compensation of habitats to be lost under the project footprint, to achieve no net loss; – 35.9 ha of which 6.1 ha is broadleaved forest and 5.6 ha is perennial calcareous grassland and basic steppes and should be compensated (other habitats re modified and do not provide supporting habitat for priority bidiveristy features).	End of construction	Within study area (exact locations to be identified in consultation with local ecologists)	Successful establishment of areas created for compensation

General measures				
Temporary and permanent habitat loss and degradation	– Work within defined construction working areas, prohibiting off-road driving, reduce dust levels (e.g. by using water sprays/misting); – Minimise construction working areas by ensuring clearings associated with construction occur in as small a footprint as possible and avoid priority habitats (estuaries, Ponto-Sarmatic steppes and protected areas).	Implemented throughout construction	Project study area	No significant increase (>10%) in the project footprint compared to habitat loss assessed in the ESIA.
Disturbance and displacement of species because of artificial lighting, noise and presence of people	– Minimise noise disturbance and light pollution: – Equipment with low noise emissions will be used and activities with high-intensity noise impacts limited to daylight hours. – Exterior lighting will be reduced to minimum levels necessary for safe operation, and operational strategies implemented to reduce spill light. Use non-UV lights where possible, as light emitted at one wavelength has a low level of attraction to insects. This will reduce the likelihood of attracting insects and their predators. – Keep the workforce within defined boundaries and agreed access routes where possible to minimise disturbance on wildlife. – A mandatory environmental induction for all staff members to raise awareness on disturbance avoidance.	Implemented throughout construction	All working areas	No significant change in the baseline noise and light levels during construction
Injury or death from collision with wind turbines Injury or death from collision with overhead lines	– Habitats within the Project site will be maintained during operation to reduce the risk of attracting collision-prone birds: – Avoid establishing ponds or waste sites within the development; – Follow good wind farm maintenance practices, such as filling of holes in nacelles so that nesting and perching is not possible.	Throughout operation	Project study area	No reported collision of priority bird species with transmission lines.

Table 4.32 – Monitoring requirements for biodiversity

Monitoring activity	Parameters	Location	Responsibility	Timing/Frequency and Deliverables	Potential response in event of exceedance
Monitor the spread of invasive plant species known on site (recorded during baseline surveys; ESIA Section 4.4.3.1.3) and any new invasive species recorded onsite.	During construction, the contractor will monitor the non-native and invasive plant species identified and will report on new invasive species establishing in the Project areas. Other species known to be invasive in Ukraine and globally (refer to Lowe et al., 2000) will be also monitored if recorded on the construction sites. A local botanist will be employed to undertake the monitoring or will be contacted to confirm the identification of invasive species.	Within the construction areas and known locations of invasive species	Suitably qualified contractor(s) with field surveying experience and knowledge of local plant species and invasive species to be appointed by developer.	Every three months during construction. Brief technical report to be produced after each survey, listing location and abundance of invasive species recorded. Data to be assessed annually to identify trends.	Implement control and eradication measures for the invasive species. Implement better site hygiene preventative measures. Potential increase in the frequency of monitoring invasive species.
Visual assessment of road kill and trenches to monitor wildlife mortalities in project site.	Report all killings/injuries and highlight priority biodiversity features	All roads and trenches/excavations on Project site.	All staff to keep logbook up to date. Suitably qualified environmental and social officer to undertake weekly checks.	Weekly checks by the environmental and social officer (EPC contractor) during construction. On-going logbook system of road mortalities with review as part of monthly reporting	Enforce lower speed limits on construction sites. Ensure all trenches and excavations are covered at the end of every shift. If any trapped or injured wildlife is found on the construction sites, advice should be sought from an ecologist or the animals should be taken to a rescue centre if appropriate and possible.

Implement anonymous reporting system for any known hunting/collection of wildlife and monitor data.	Any incidents of reported poaching/hunting undertaken by project staff should be reported, with any incidents involving species of conservation importance highlighted	Project site.	All staff to report incidents.	On-going during construction, with review of reported incidents as part of monthly reporting.	Ensure knowledge of ban on hunting/poaching with all staff. Enforcement of penalties if required.
Habitat monitoring of restoration areas to ensure they are correctly established	Vegetation structure and composition and condition to compare with baseline data	Restored habitats on construction site	Suitably qualified contractor(s) with field surveying experience and knowledge of local plant species and habitats to be appointed by developer.	Once per year (during summer) for the first two years after construction	Identify causes of failure (e.g. pests, unsuitable substrate, lack of water, diseases) and implement appropriate control/ remediation measure
Carcass search under wind turbines and the OHPL to ensure mitigation for collision is sufficient.	Report any bird and bat casualties and highlight those of conservation concern (particularly *Saker falcon*). Methodology detailed in ESIA Annex N and Annex O.	50 m either side of the new transmission line at key points (e.g. north of Solonets Lake).	Suitably qualified contractor(s) with knowledge of local bird and bat species to be appointed	Once per month during first two years of operation. For the wind turbines, frequency will be increased to every 14 days during key periods (spring and autumn migration; summer breeding). This may need to be extended depending on results from the first year.	If there are significant casualties, monitoring should be extended for another year. Revise and adapt mitigation by design measures such as diverters.
Monitoring bird populations to identify if the Project is impacting populations through displacement.	Presence and abundance of bird species, following methods outlined in ESIA Annex N to provide results comparable to baseline surveys.	Points within Project site to be defined by ecologist surveying.	Suitably qualified contractor(s) with knowledge of local bird species and monitoring methods	Monthly monitoring during operation (ESIA Annex N).	If populations are significantly affected adaptation and mitigation measures will be reviewed in consultation with relevant stakeholders, such as species experts.

4.5 Critical ecosystems

4.5.1 Baseline conditions

The proposed Project site does not overlap with any nationally or internationally recognised protected areas (see Fig. 4.52-Fig. 4.56).

However, the study area is adjacent to the nationally protected Oleksandrivskyi Landscape Reserve and Dnipro-Busky Lyman Emerald Site (UA0000109). Oleksandrivskyi Landscape Reserve is designated as part of the Ukraine’s Natural Reserve Fund and has an area of 996 ha. Dnipro-Bugsky Lyman Emerald Site is part of the Emerald Network of nature conservation areas across Europe, launched by the Council of Europe and officially adopted by Ukraine in December 2017. This site is 712.6 km^2 (Fig. 4.51), adjacent to the study area and is designated for supporting a high diversity of bird species and represents an important area for significant numbers of migratory birds, being part of Dnipro River Ecological Corridor (Natura 2000, 2017).

Fig. 4.51 Boundary of Dnipro-Bugsky Lyman Emerald Site

All other protected areas are beyond the zone of influence of the Project and are not further considered in this assessment. This includes: Kinburns'kyj peninsula IBA (> 10km from Project); Dnipro delta IBA (>15 km from Project); and Dnipro River Delta Ramsar site (>15 km from Project).

Critical ecosystems of the Dnipro-Bugsky Estuary are:

- Valuable Steppe areas, where rare and endangered formations of *Stipa lessingiana, Stipa capillata, Stipa ucrainica, Stipa pulcherrima and Stipa asperella grow*;
- Woody-shrubbery formations with relict and endemic species, namely *Gymnospermium odetianum, Galanthus elwesii in small gullies*.

In Fig. 4.52 presents the protected areas, which are situated near Project territory. The territory of the Project is located outside the objects of the Emerald Network (according to the data of European Environmental Agency, http://emerald.eea.europa.eu/), Fig. 4.53.

According to BirdLife International, the Project site is not within range Important Bird and Biodiversity Area (http://datazone.birdlife.org/country/ukraine/ibas), Fig. 4.54.

According Ramsar Convention the Project site is not within range Ramsar Sites of Ukraine (https://www.ramsar.org/wetland/ukraine), Fig. 4.55.

Main migration corridors within «DB WPP» wind field are shoreline zone of the Dnipro-Bugsky Estuary and gullies of its hydrological network. The valley of the Lake Solonets and the Landscape Reserve «Oleksandrivskyi» are most important gullies of hydrological network of the Dnipro-Bugsky Estuary, Fig. 4.56.

To prevent the destruction of critical ecosystems at the territories adjacent to Project, namely, the regional Landscape Reserve «Oleksandrivsky», requires to put «DB WPP» wind turbines at the distances no less than 500 m from the Dnipro-Bugsky Estuary shoreline, 500 m from the Lake Solonets and no less than 100 m from the border of the Landscape Reserve «Oleksandrivskyi» (virgin Steppe areas, woody-shrubbery grouping etc.).

4.5.2 Impact mitigation and management

Absence of critical ecosystems at the territory of the Project allow not consider probability of a significant impact and not plan the preventive and mitigation measures.

Conclusion: location of the Project at the safe for regional Landscape Reserve «Oleksandrivskyi» distance excludes impact of Project on vegetation cover.

Fig. 4.52. Location of the Project relative to objects of protected areas

Fig. 4.53. Location of the Project territory relative to objects of Emerald Network

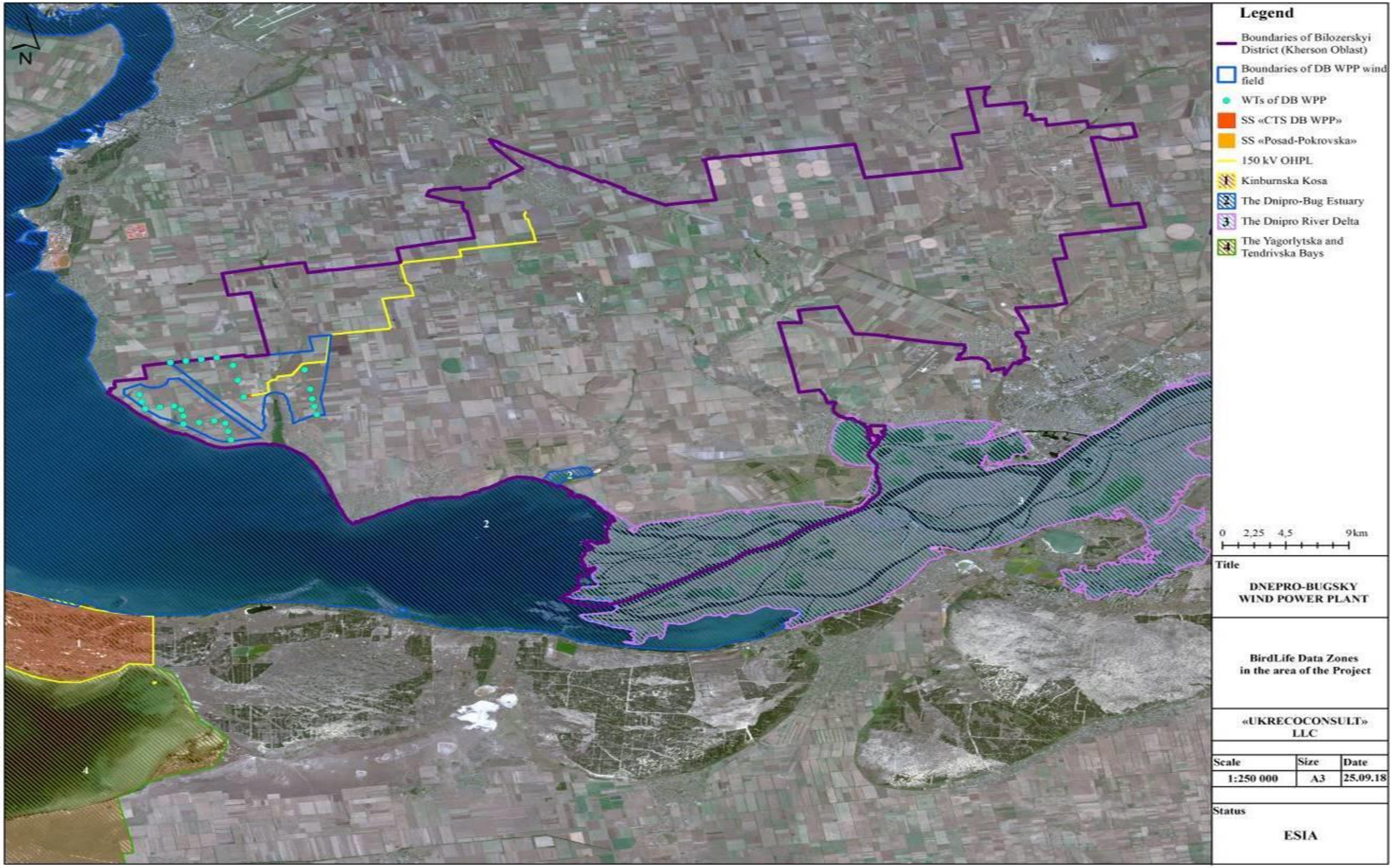


Fig. 4.54. Boundaries of Important Bird and Biodiversity Area

Fig. 4.55. Boundaries of Ramsar Sites near «DB WPP»

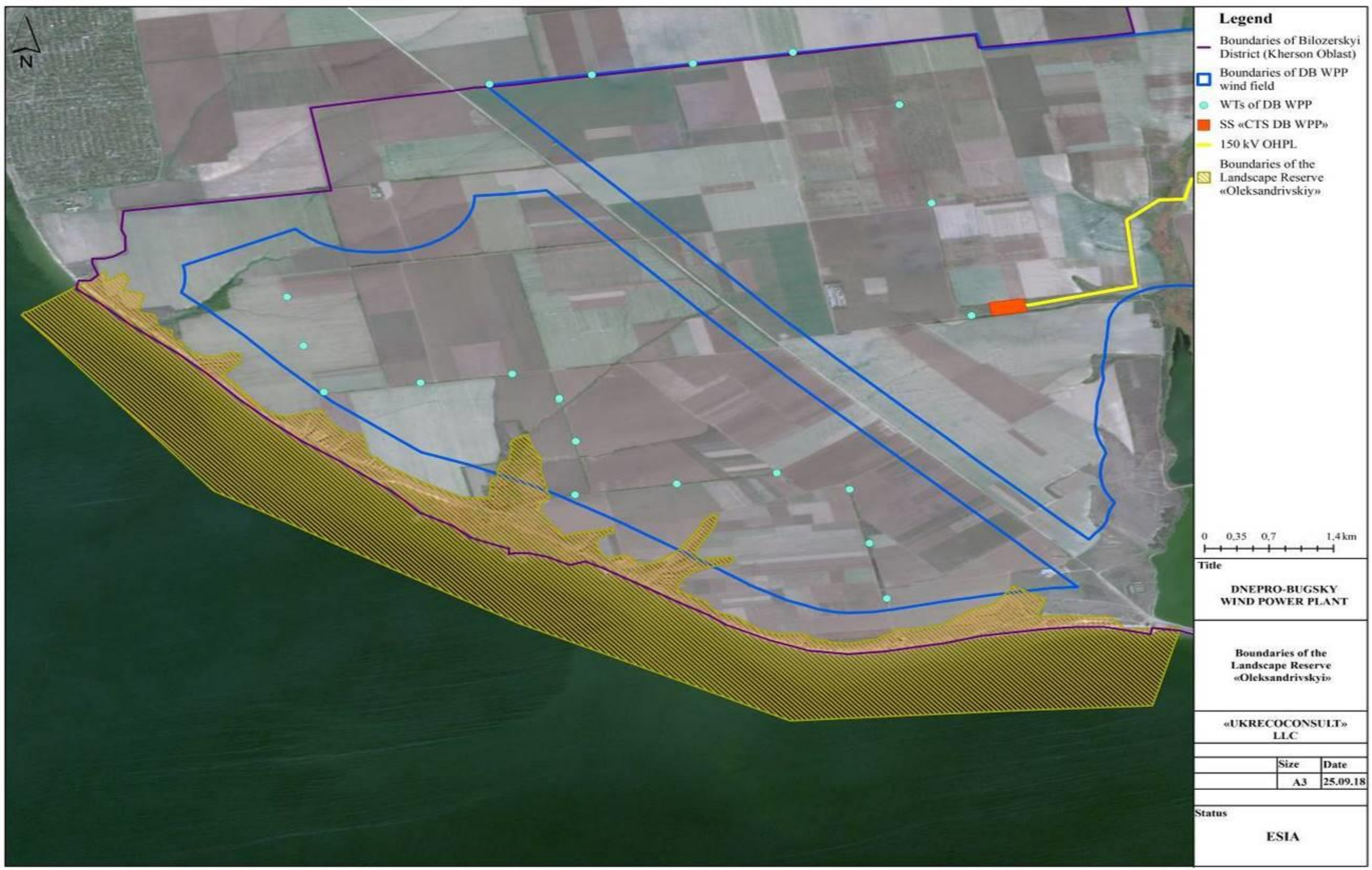


Fig. 4.56. Boundaries of the Landscape Reserve «Oleksandrivskyi»

4.6 Ecosystems issues

4.6.1 Baseline conditions

Ecosystems at Project territory are agriculturally modified, differing from natural ecosystems by significantly simplified structure and functioning, fewer flora and fauna species with some dominant monocultures, instability and total dependency of existence from human activities. The relatively undisturbed ecosystems exist only at the territories of the regional Landscape Reserve «Oleksandrivskyi» adjacent to «DB WPP» objects places.

The Landscape Reserve of national value «Oleksandrivskyi» is one of the objects of the Natural Reserve Fund of the Kherson Object. Total area of the Landscape Reserve «Oleksandrivskyi» 996 hectares. It was created in 2002 in accordance with the Decree of the President of Ukraine dated on February 21, 2002 No. 167/2002.

There are various ecosystems on the territory of the Reserve. Among them, the main value has the loess cliff of the Dnipro Estuary, loess canyon-shaped ravines, steppe gulley, adjacent areas of the steppe upland, the coastal strip of the Dnipro Estuary.

Throughout the whole cliff, ravines and gulley, there are vertical loess «rocks» up to two dozen meters high. The exposed anthropogenic (quaternary) rocks become uncovered here. The vast majority of them are represented by loess, which forms layers with thickness of 1 to 16 meters. The loess layers alternate with less powerful layers of clay and buried soils. The profile ends with a low-power (up to 50 cm) layer of modern dark chestnut soils. The loess cliff, ravines and gulley are occupied by semi-desert and steppe vegetation, which contains a significant number of rare plants, animals and mushrooms included in the Red Book of Ukraine. On the coast of the Dnipro Estuary, they are occupied by wetland vegetation, (Fig. 4.57).

Fig. 4.57. Steppe gulley on the territory of the Landscape Reserve «Oleksandrivskyi»

The flora of vascular plants of the Landscape Reserve «Oleksandrivskyi» is represented by 246 species of vascular families. The leading flora families are: *Asteraceae; Fabaceae; Poaceae; Brassicaceae; Caryophyllaceae; Lamiaceae; Rosaceae; Apiaceae; Chenopodiaceae*.

Among them, the 4 species of soophytes are plants included to the Red Book of Ukraine, namely: *Astragalus borysthenicus* K.; *Stipa capillata* L.; *Crambe maritima* L.; *Tulipa gesneriana* L., and 5 species of soophytes included to the Red List of Kherson Region: *Prangos odontalgica*; *Ephedra distachya* L.; *Vinca herbacea*; *Ferula caspica*; *Limonium platyphyllum*.

Also there is observed species of *Stipetea capillatea*, included to the Green Book of Ukraine. The *Stipa capillata* is a species-edificator of grouping, included to the Red Book of Ukraine.

4.6.2 Impact mitigation and management

Absence of pristine or slightly altered ecosystems and availability of dominating man-made agricultural ecosystems allow do not consider probability of a significant impact of «DB WPP» and do not introduce the preventive and mitigation measures relevant for undisturbed ecosystems.

Conclusion: Impacts of Project on ecosystems is absend due to absence of well-preserved natural ecosystems on the territory of the Project location.

4.7 Landscapes and visual perception

4.7.1 Baseline conditions

4.7.1.1 Landscapes

According to physical-geographical zoning of Ukraine [110], the territory of Project belongs to Bilozerskyi i region of the Dnister-Bug lowlands of the Black Sea Middle-Steppe Edge. The landscapes are formed by loess plains with southern chernozems (black soil), dark chestnut and alkaline soils covered in the past by fescue-feather and saline (solonchak) vegetation. In the paragenetic landscape structure (by the geosystems features) toward watershed, the following specific land strips are presented:

1) aqua-coastal land strip with active cliffs of heavily dismembered by ravines loess coasts and brackish water area with rocky and sandy-silty bottom. There are well-preserved natural complexes used for recreation at this territory.

The installation of WTs in such areas is not planned. Visual perception of horizons and landscapes will slightly worsen, but the Project benefits will compensate this insignificant impact (Fig. 4.58-Fig. 4.60).

Fig. 4.58. Landscape of «DB WPP» site (from estuary)

Fig. 4.59. Landscape of «DB WPP» site (southern view)

Fig. 4.60 Landscape of «DB WPP» site (northern view)

Fig. 4.61 Marshes of the Lake Solonets adjacent to «DB WPP» site

2) Ravine-gully area with southern low-humus black soils - it will not be used for the «DB WPP» construction, however abandoned and operating warehouses already surrounded this area (Fig. 4.62);

Fig. 4.62. Agrotechnical buildings (warehouses) at «DB WPP» territory

3) The land strip of anthropogenic alluvial (IV and V) fluvial terraces covered by loess-like rocks and southern low humus black soils (chernozems). The land strip is fully transformed into agricultural lands, so change of view of agricultural landscapes at the territory of construction of «DB WPP» objects will be minor. Insignificant loss of aesthetic attractiveness of landscapes will be compensated by Project benefits.

According to the physico-geographical zoning of Ukraine [4, 49], the territory of the inclination of the OHPL belongs to the Bilozerskiy District of the Dniester-Bug low-lying region of the Black Sea Region of the Middle Step province. Landscapes are represented by forest lowlands with chernozems in southern, dark chestnut and saline soils, in the past under fescue-keuvial and saline flora.

Fig. 4.63. Landscape in one of the districts of the route of the OHPL

The placement of the OHPL in such areas is not planned. On the whole, the visual perception of the horizons and the landscape after the construction will not deteriorate due to the sufficient distance of the OHPL from the settlements.

Impact assessment was mainly focused on the operation phase, as the wind turbines will be the main visible components of the Project.

The operational life of the Project will be a minimum of 25 years, which could potentially be extended to cover the License Duration with proper maintenance and advancements that could be made in line with future technological developments. Sensitivity criteria to be considered in the assessment has been developed based on the Guidelines for Landscape and Visual Impact Assessment 3rd edition (Landscape Institute, IEMA, 2013) and provided in Table 4.33.

Table 4.33 – Sensitivity Criteria for Visual Receptors

Impact Subject	High	Medium	Low
Visual	– Residents at home; – People, whether residents or visitors, who are engaged in outdoor recreation; – Visitors of heritage assets or to other attractions; – Communities where views contribute to the landscape setting enjoyed by residents; – Travellers on road, where travel involves recognised scenic routes awareness of views is likely to be particularly high.	– Residents at public places; – Travellers on road, rail or other transport routes.	– People at their place of work whose attention may be focused on their work or activity, not on their surroundings; – People engaged in outdoor sport or recreation, which does not involve or depend upon appreciation of views of the landscape.

During the operation phase, 25 wind turbines and 196 OHPL pylons will be operational within the Projects area. The visual impact assessment of «DB WPP» was carried out according to the operational phase visibility of the «DB WPP» in the view shed from the viewpoints identified as major principle visual receptors. As detailed in the following sections, the following studies were conducted as part of the VIA:

- Zone of Theoretical Visibility (ZTV) diagrams were produced;
- Photomontages were prepared;
- Effects on representative viewpoints were assessed.

The term «Zone of Theoretical Visibility» (ZTV) is used to describe the area over which a development can theoretically be seen and is based on a Digital Terrain Model (DTM) and overlaid on a map base. This is also known as a Zone of Visual Influence (ZVI), Visual Envelope Map (VEM). However, the term ZTV is preferred for its emphasis of two key factors that are often misunderstood:

- Visibility maps represent where, in theory, a development may be seen, it may not actually be visible in reality, for example due to localized screening which is not represented by the DTM; and

- The maps indicate potential visibility only, that is the areas within which there may be a line of sight. They do not convey the nature or magnitude of visual impacts, for example whether visibility will result in positive or negative effects and whether these will be significant or not.

ZTV diagrams for the Project have been generated using Geographic Information System (GIS) software, to demonstrate the number of turbines that may theoretically be seen from any point in the study area (8 viewpoints (VP), 5 viewpoints of «DB WPP» and 3 viewpoints of the OHPL). The map produced as a result of the ZVI model is provided in Fig. 4.64.

Photomontages are illustrations that aim to represent an observer's view of a proposed development. For the purposes of this assessment, photomontages have been compiled to analyses the potential visual impact of the wind turbines from a selection of representative viewpoints. The methodology used for the visualization production is based on the Guidelines for Landscape and Visual Impact Assessment 3rd edition *(Landscape Institute, IEMA, 2013*) and the Visual Representation of Wind Farms, (*Scottish Natural Heritage, December 2014*). Eight of the sixteen photographed viewpoints have been selected for the preparation of photomontages. The selection was based on the viewpoints which represent a range of viewer types (e.g. residents living in the surroundings, travelers along designated routes) and potential cumulative impacts due to other operational WPPs identified in the study area.

The photomontages were generated using digital photographs taken by Canon EOS 3200 photograph machine with 55-200 mm lens, ESRI ArcGIS software, 3D modelling software (Autodesk 3ds Max) to generate the wireline diagrams or «wireframes» and Adobe Photoshop.

To ensure the photomontages consistently present a view which is representative of the human eye, photographs were taken at average human viewing height (approximately 1,60 m). Although the parameters of human vision when stationary are often quoted as falling between the 45-60°, humans generally move their eyes, heads and bodies as necessary to experience a view. Therefore, a wider field of view has been used for the photomontages to represent panorama view of «DB WPP» and the OHPL, Fig. 4.73 - Fig. 4.74.

A receptor audience is a group of people that have the potential to view the Project from outside the Project boundaries. A variety of views that can be obtained by individual receptors were intended to be represented in this assessment. Each of these viewpoints was carefully selected to represent areas where either the most sensitive receptors are permanently located or where the highest number of receptors are likely to pass by. The following visual receptors were identified to be likely viewers who would experience views of the «DB WPP»:

- residents at home and public places in the surrounding neighborhoods (Oleksandrivka, Luparevo, Posad-Pokrovske, Pravdino village councils);
- visitors of heritage assets;
- travelers on road.

Fig. 4.64. Locations of Representative Viewpoints (Photomontage Model Output) for «DB WPP»

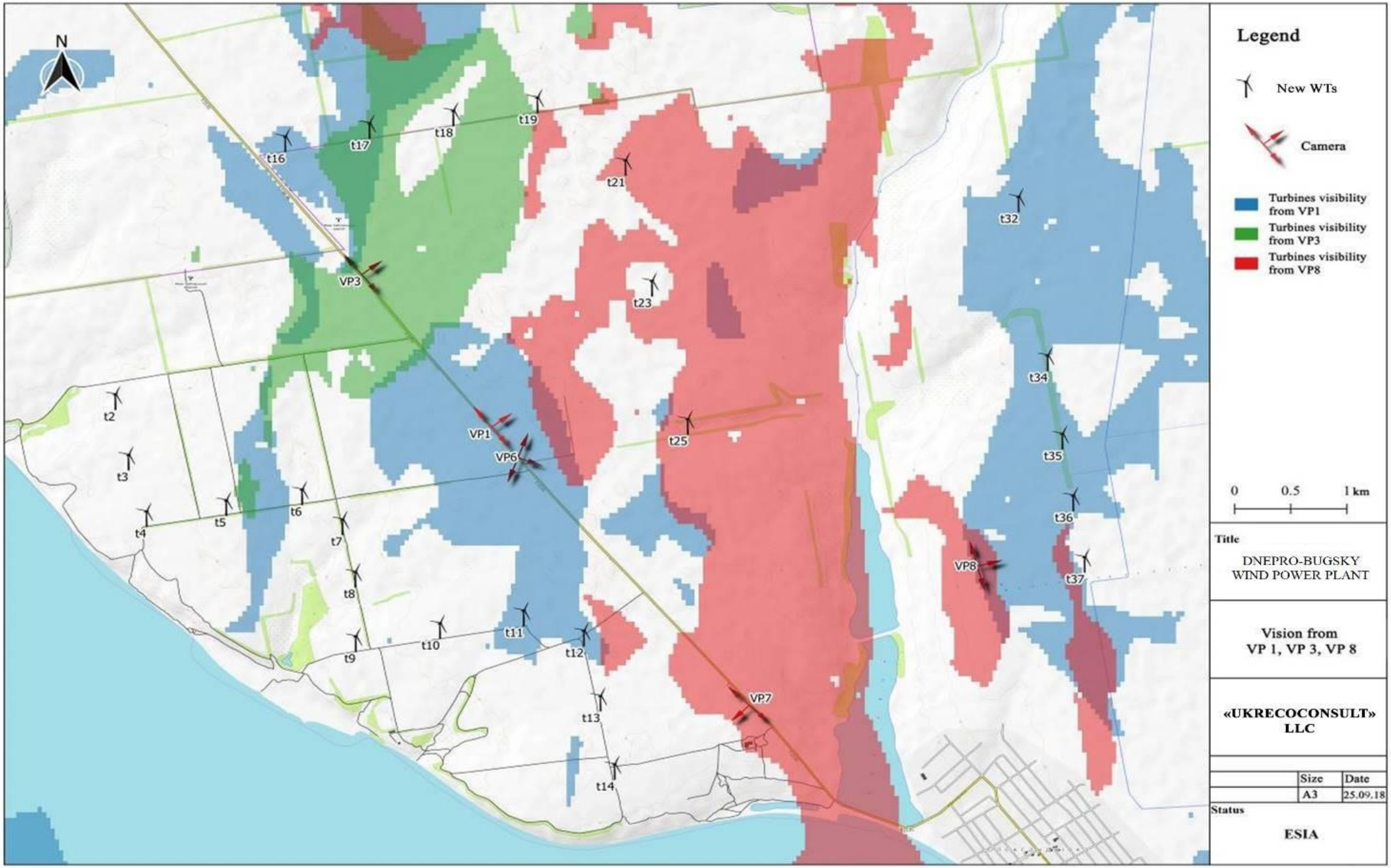


Fig. 4.65. Vision from VP 1, VP 3, VP 8

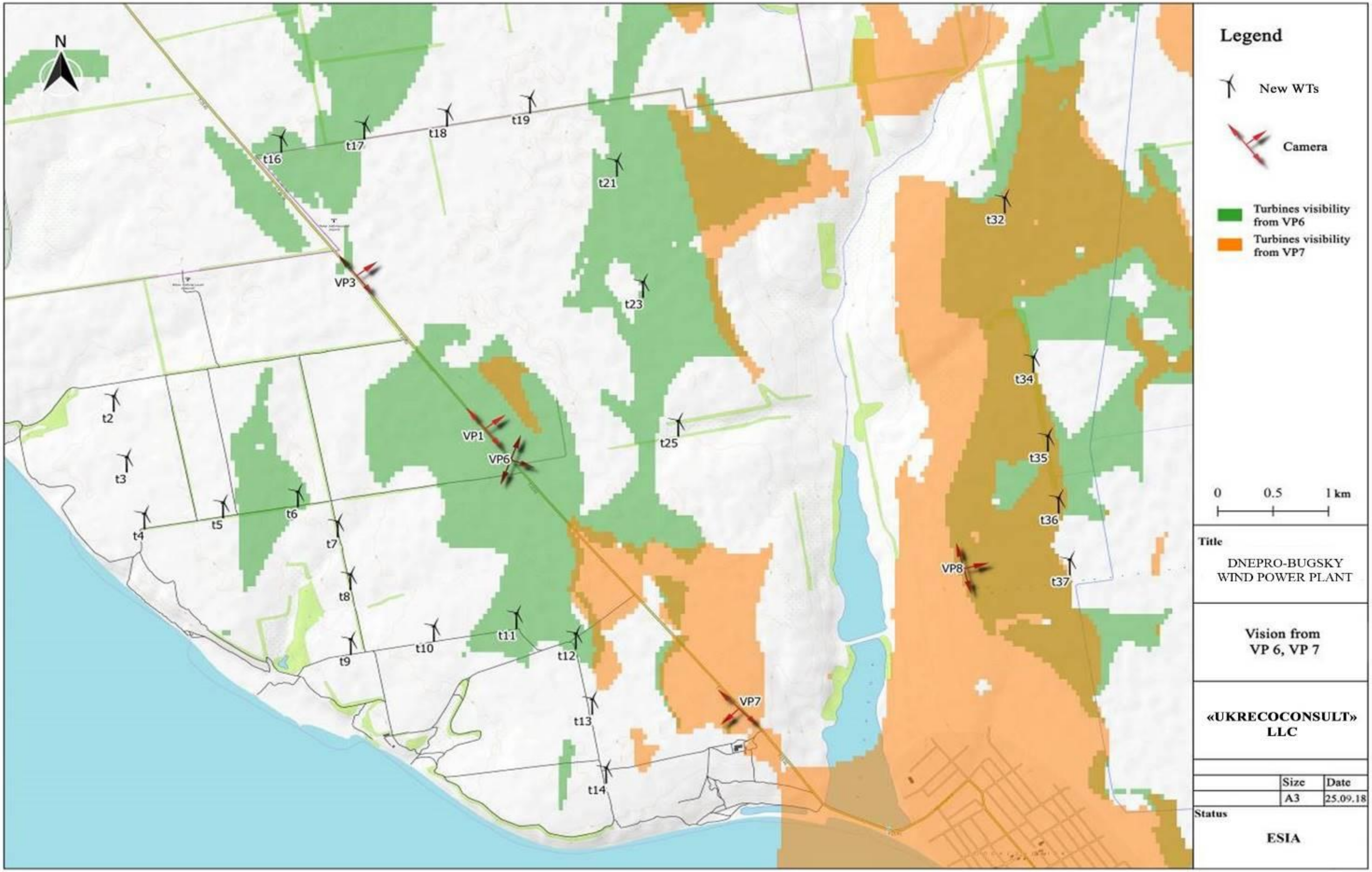


Fig. 4.66.Vision from VP 6, VP 7

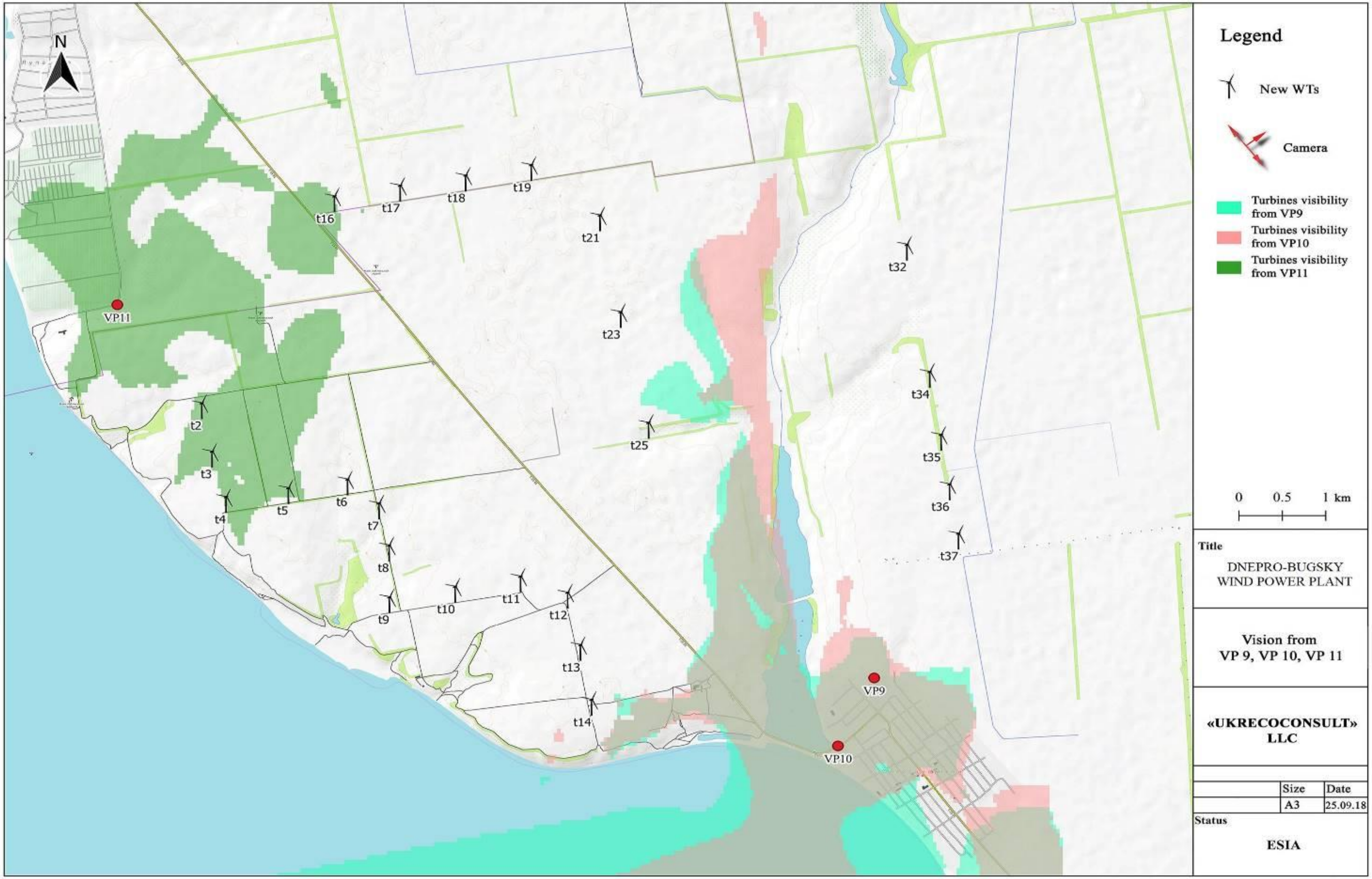


Fig. 4.67. Vision from VP 9, VP 10, VP 11

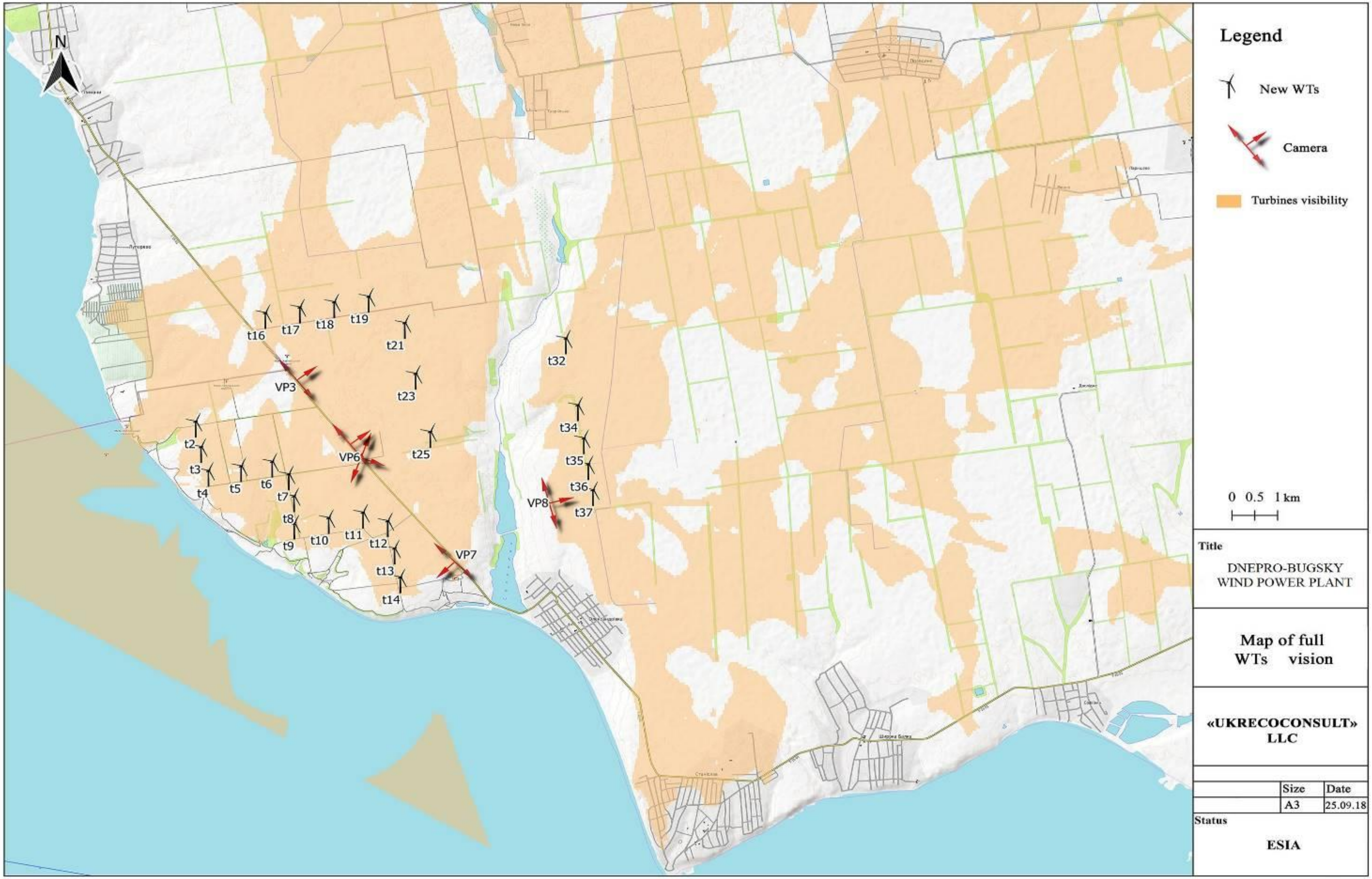


Fig. 4.68. Map of full WTs vision

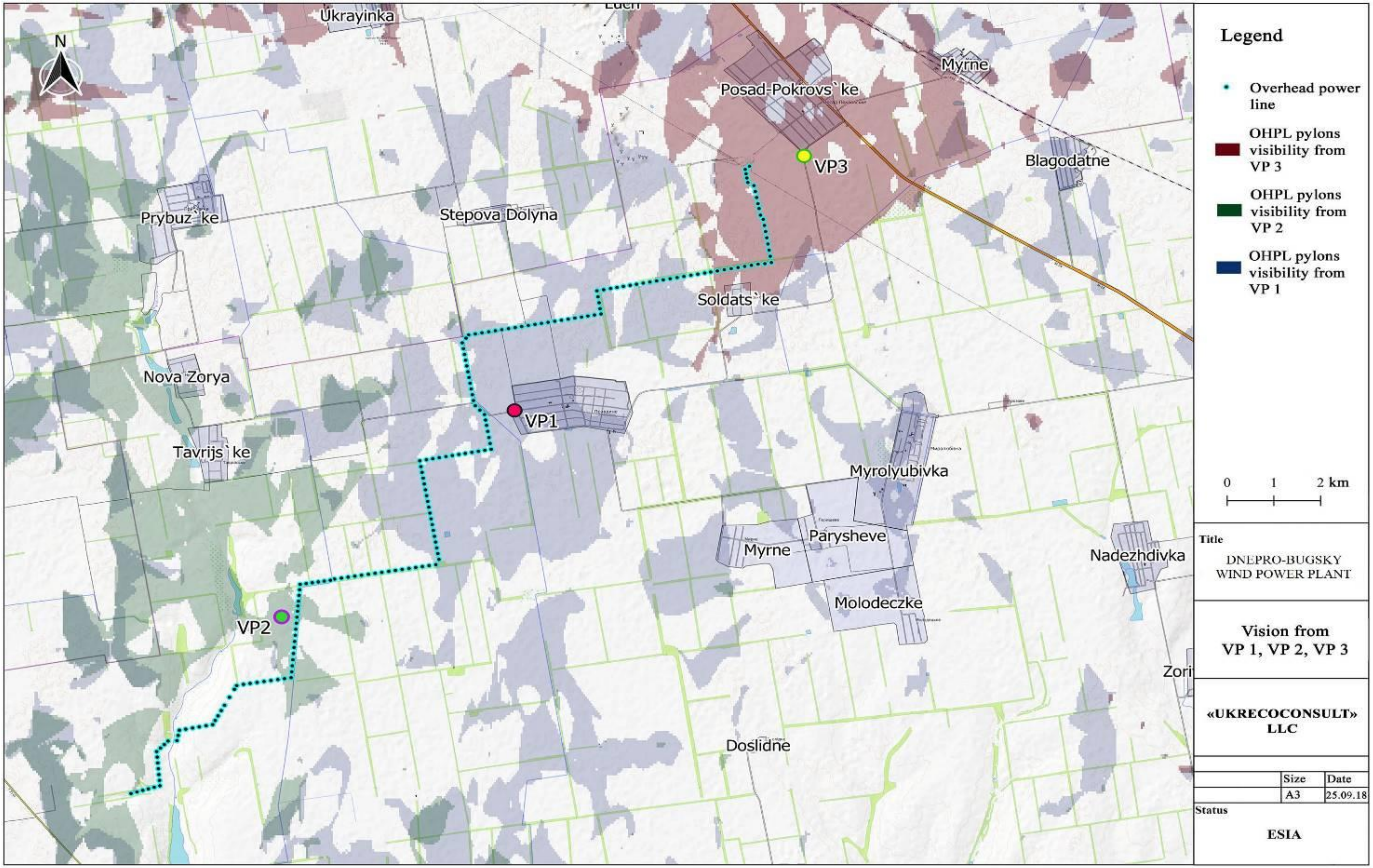


Fig. 4.69. Vision of the OHPL from all VPs

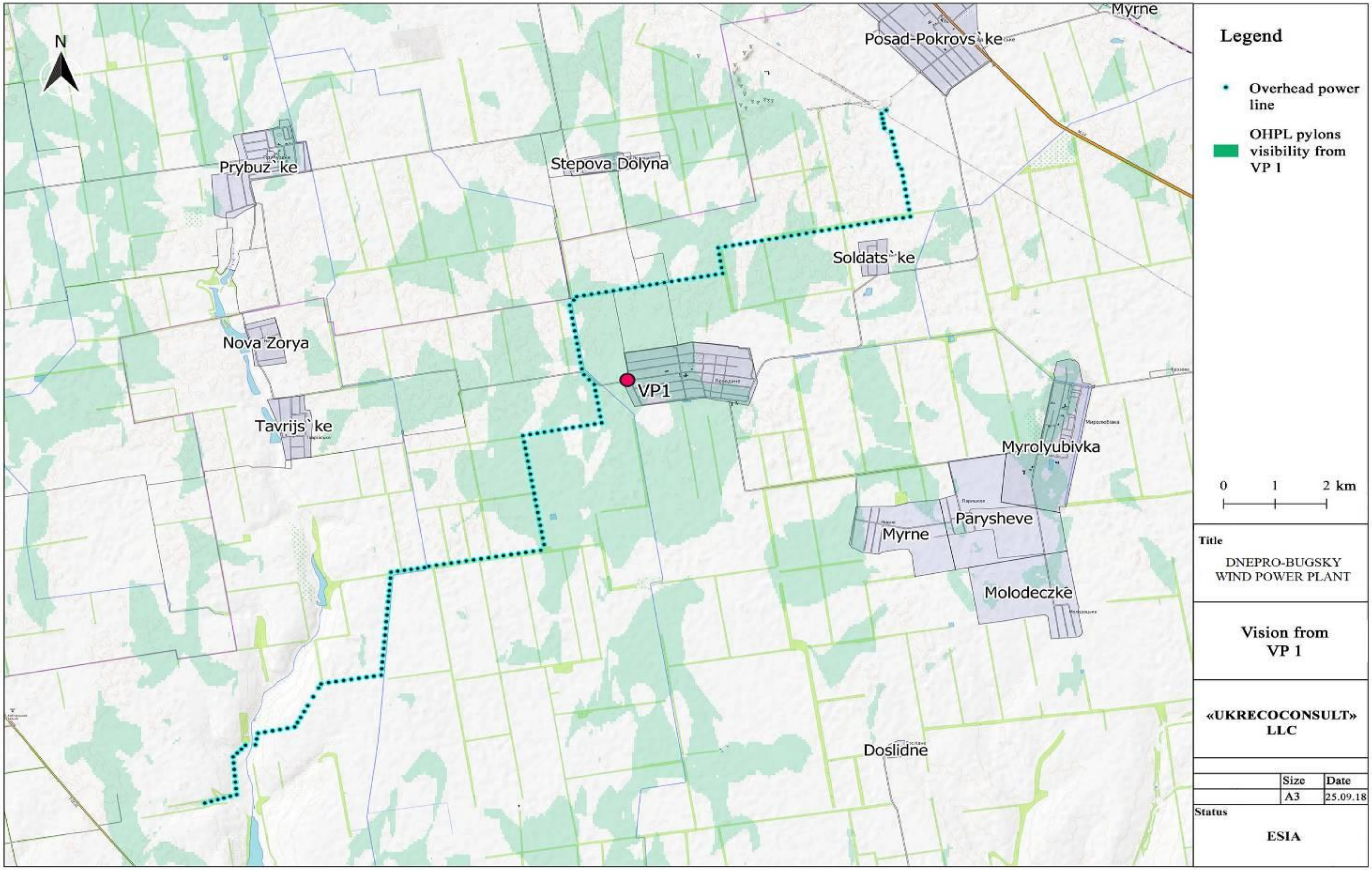


Fig. 4.70. Vision of the OHPL from VP1

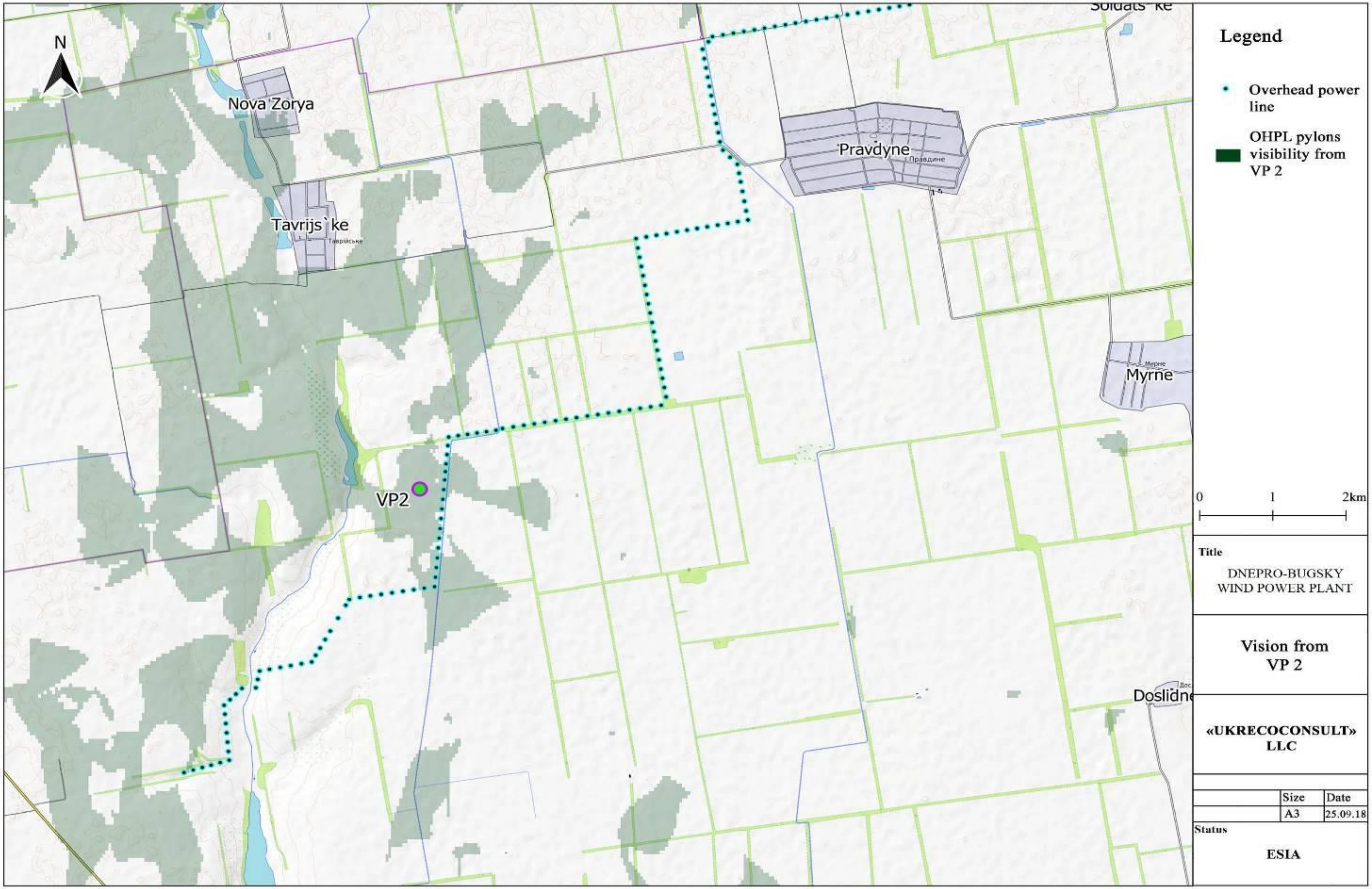


Fig. 4.71. Vision of the OHPL from VP2

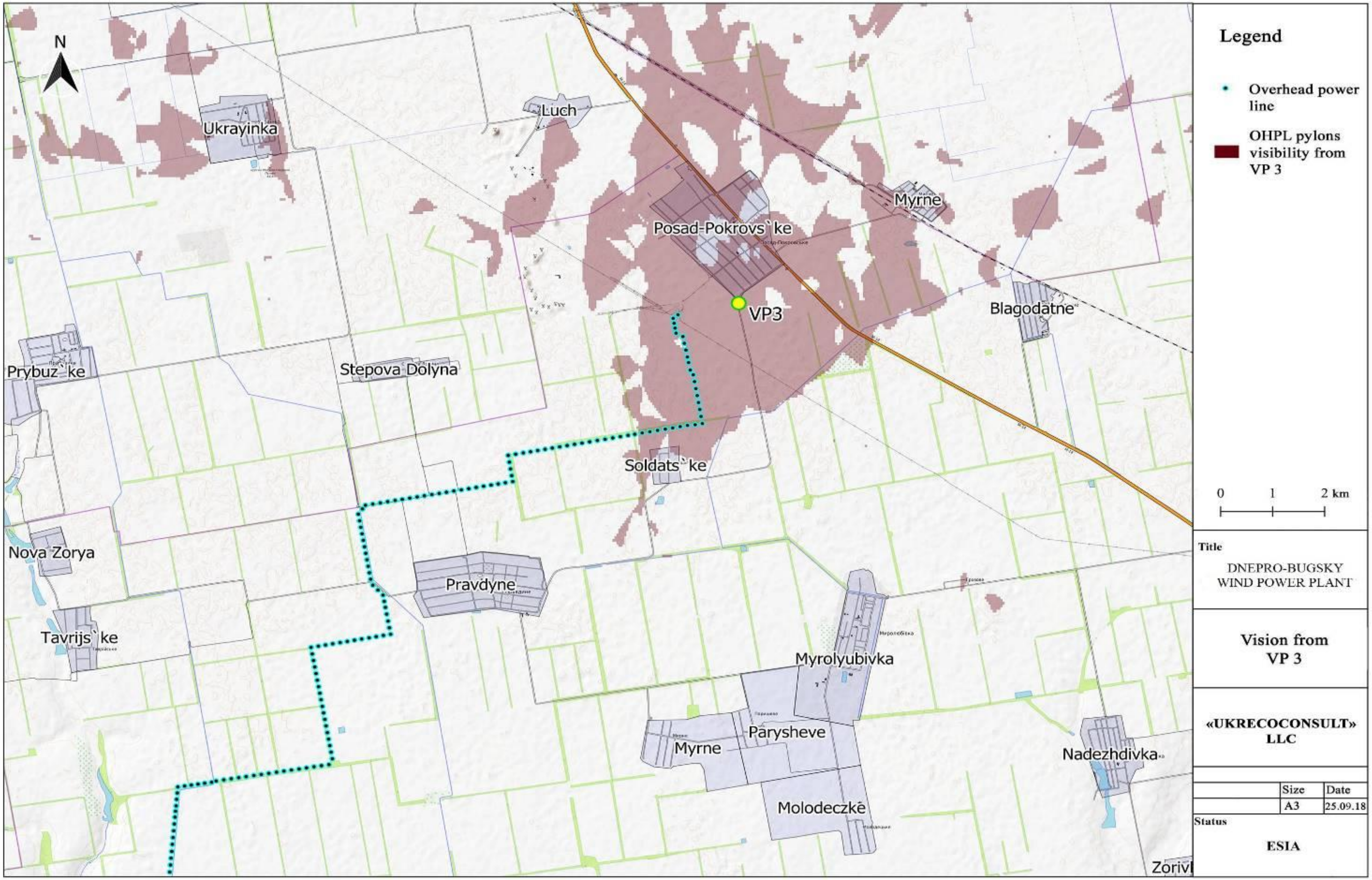


Fig. 4.72. Vision of the OHPL from VP3

Viewpoint Location Information

X (Easting)	Y (Northing)	Z(from sea level)	Z (Offset)	Center of panorama View Direction	Field of View (deg)	WTGs within field of view	Visible WTGs at tip height	Visible WTGs at hub height	Closest WTG (m)	Furthest WTG (m)
5885555	3567557	39	+1.5	52	180x18	12	12	12	1737	5536

Fig. 4.73. Viewpoint 1 of «DB WPP»

Viewpoint Location Information

X (Easting)	Y (Northing)	Z(from sea level)	Z (Offset)	Center of panorama View Direction	Field of View (deg)	WTGs within field of view	Visible WTGs at tip height	Visible WTGs at hub height	Closest WTG (m)	Furthest WTG (m)
5887826	3565858	37	+1.5	52	180x24	12	12	12	1365	7168

Fig. 4.74. Viewpoint 2 of «DB WPP»

Viewpoint Location Information

X (Easting)	Y (Northing)	Z(from sea level)	Z (Offset)	Center of panorama View Direction	Field of View (deg)	WTGs within field of view	Visible WTGs at tip height	Visible WTGs at hub height	Closest WTG (m)	Furthest WTG (m)
5885109	3567899	40	+1.5	138	180x18	11	11	11	1518	5221

Fig. 4.75. Viewpoint 6 of «DB WPP»

Viewpoint Location Information

X (Easting)	Y (Northing)	Z(from sea level)	Z (Offset)	Center of panorama View Direction	Field of View (deg)	WTGs within field of view	Visible WTGs at tip height	Visible WTGs at hub height	Closest WTG (m)	Furthest WTG (m)
5881420	3570941	38	+1.5	227	180x22	13	13	13	1362	6456

Fig. 4.76. Viewpoint 7 of «DB WPP»

Viewpoint Location Information

X (Easting)	Y (Northing)	Z(from sea level)	Z (Offset)	Center of panorama View Direction	Field of View (deg)	WTGs within field of view	Visible WTGs at tip height	Visible WTGs at hub height	Closest WTG (m)	Furthest WTG (m)
5883491	3573893	35	+1.5	87	180x32	5	5	5	976	3640

Fig. 4.77. Viewpoint 8 of «DB WPP»

Viewpoint Location Information

X (Easting)	Y (Northing)	Z(from sea level)	Z (Offset)	Center of panorama View Direction	Field of View (deg)	OHL pylons within field of view	Visible OHL pylons at tip height	Visible OHL pylons at hub height	Closest OHL pylon (m)	Furthest OHL pylon (m)
5908069	3591946	36	+1.5	196	70x15	143	36	36	1392	20979

Fig. 4.78. Viewpoint 1 of the OHPL

Viewpoint Location Information

X (Easting)	Y (Northing)	Z(from sea level)	Z (Offset)	Center of panorama View Direction	Field of View (deg)	OHL pylons within field of view	Visible OHL pylons at tip height	Visible OHL pylons at hub height	Closest OHL pylon (m)	Furthest OHL pylon (m)
5908069	3591946	36	+1.5	267	70x15	50	7	7	1187	9200

Fig. 4.79. Viewpoint 3 of the OHPL

4.7.1.2 Shadow flicker and stroboscopic effect

This chapter reports on the assessment of the potential for shadow flicker to occur at residential properties in the vicinity of the Project. It quantifies the geographical area over which shadow flicker could potentially occur, sets out an assessment of the duration and timing of these impacts, and identifies potential mitigation measures.

Description of factor of impact. As any typical construction WTs, including their moving parts, in sunny daytime cast a shadow on the ground and other objects. If surface of a blade turned to sun is shiny, it reflects the solar rays. For those who live nearby wind turbine, shadow flicker effect and/or glittering can harm life and activities.

Shadow flicker can occur when the sun passes directly behind the rotors of a wind turbine, casting a shadow over neighboring properties. As the blades rotate the shadow can flick on and off but only occurs inside buildings where the flicker appears through a narrow window opening.

The nature and likelihood of occurrence of shadow flicker will vary under different situations, depending on the:

- direction of the residence relative to the turbine(s);
- distance from the turbine(s);
- turbine hub height and rotor diameter;
- time of year;
- proportion of daylight hours in which the turbines operate;
- frequency of bright sunshine and cloudless skies (particularly at low elevations above the horizon);
- prevailing wind direction.

Ukraine has no requirements for assessing the stroboscopic effect, therefore, British legislation is based. In Britain, the potential shadow flicker area is limited to within 130 degrees either side of north for each turbine (*ODPM, 2004*). In addition, shadow flicker has been proven to only occur within ten times the rotor diameter of a turbine (*ODPM, 2004*).

The distance between a wind turbine and a potential shadow flicker receptor affects the intensity of the shadows cast by the blades, and therefore the intensity of flickering. Shadows cast close to a turbine will be more intense, distinct and ‘focused’. Effects will decrease towards the edge of the potential shadow flicker zone.

As described above, shadow flicker has been proven to occur only within 10 times the rotor diameter from the nearest turbine. Any properties located at a greater distance will not experience impacts. It is anticipated that the Project turbines a rotor diameter of up to 149.1 m and therefore any properties located further than 1491 m from a proposed turbine have not been assessed, Fig. 4.80.

There are no existing sources of shadow flicker in the area at present. The distance from the nearest turbines to the settlements: Villages Oleksandrivka and Luparevo is presented in Table 4.34.

Table 4.34 – The distance from the nearest turbines to the settlements

WT Number	Settlement	Approximate distance from WT, km	Within Potential Shadow Flicker Zone?
37	v. Oleksandrivka	2.47	No
14	v. Oleksandrivka	3.76	No
2	v. Luparevo	8.0	No
16	v. Luparevo	4.7	No

The potential for shadow flicker impacts was considered during the scheme design process. Turbine No. 15 was removed due to the close location of the wind turbine to the farm's security home, located near the turbine (less than 1410 m). As none of the properties located within 1410 m of a turbine are within the potential shadow flicker zone, no impacts are predicted during the operational phase.

Cumulative shadow flicker impacts could arise if properties are at risk from potential shadow flicker impacts as a result of more than one wind farm. In this instance, there are no properties that will be affected by the «DB WPP» along with any other wind farms in the vicinity of the site. Therefore, no cumulative shadow flicker impacts are predicted. A summary of impacts before and after proposed mitigation measures is provided in Table 4.35.

Table 4.35 – Summary of Impacts

Potential Impacts	Significance	Proposed Mitigation/ Enhancement	Residual Impact
Impacts on residential amenity as a result of shadow flicker during operation	No impact	No mitigation is necessary	No impact
Cumulative operational impacts	No impact	N/A	No impact

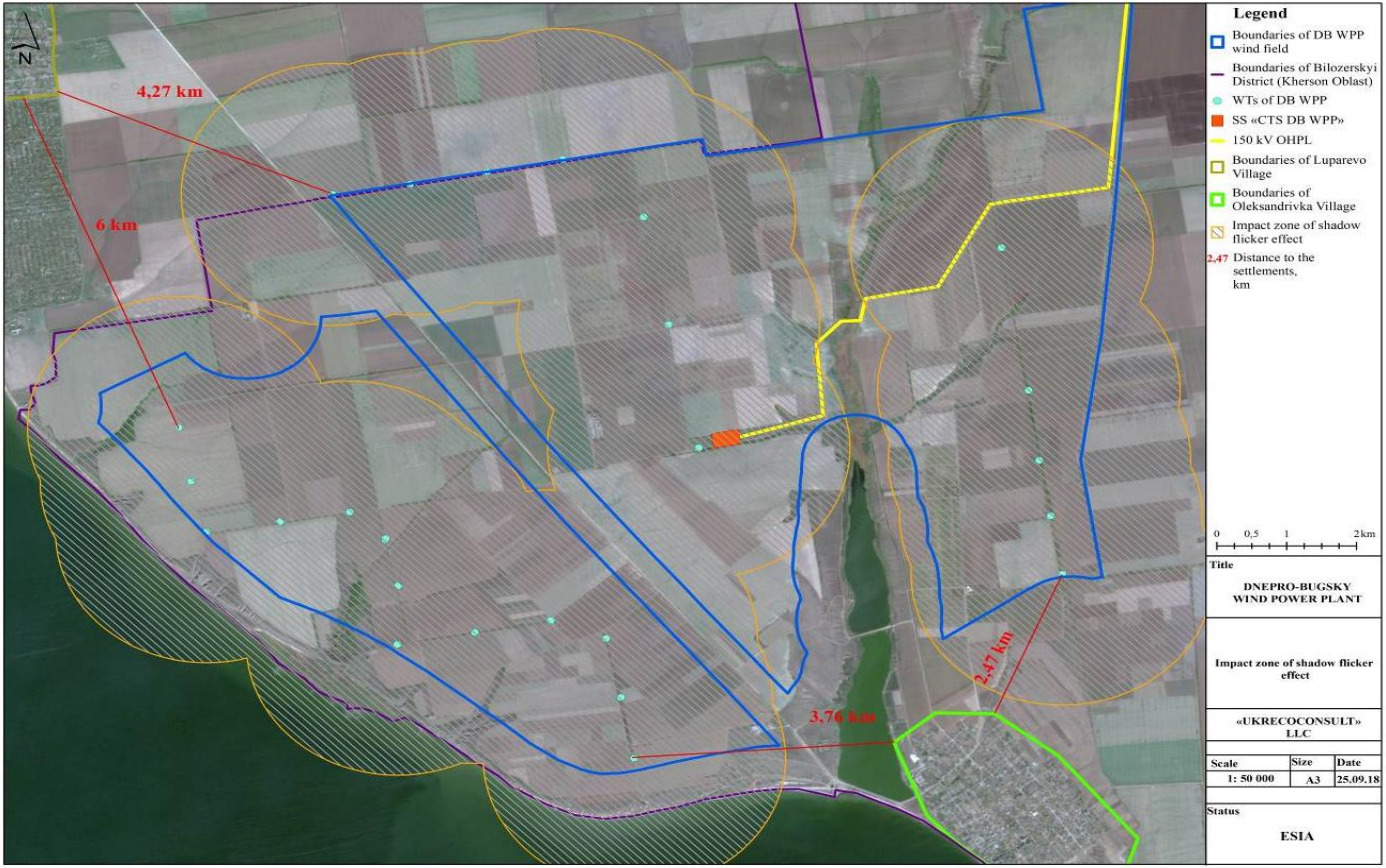


Fig. 4.80. Map of theWTs closest to the village Oleksandrivka

4.7.2 Impact mitigation and management

The Project was initially planned with 28-40 turbines (as mentioned in the national EIA Report) but the number of turbines was reduced to 25 based on feasibility studies conducted following the national EIA process.

This revision in the Project layout inherently resulted in the avoidance of visual impacts caused by the 3 additional turbines. Particularly, three turbines that were located on the north of Oleksandrivka Village, the nearest settlement to the Project components, were eliminated ensuring minimization of the visual impacts on this receptor.

The design of contemporary wind turbines allows downgrade impact of «DB WPP» on the landscape view by use of rural landscape friendly shape and color of wind turbines. Therefore, «DB WPP» will not change view of agricultural landscape significantly; at the same time, the benefits of the project will adequately compensate the insignificant loss of aesthetic attractiveness of the landscape view.

As blades of wind turbines, chosen for «DB WPP», are not shiny and their rotation speed is low, the stroboscopic effect over long distances will not be perceptible.

Conclusion: at the territory of Oleksandrivka Village and facilities of the State Hydrographic Service such phenomena as shadow flickers and stroboscopic effect will not be observed.

4.8 Air quality and existed emissions

4.8.1 Baseline conditions

4.8.1.1 Construction of the «DB WPP»

There are no enterprises that pollute air at the territory of Oleksandrivka Village Council. Analysis of technologies and equipment used by a wind power plant for energy production shows absence of pollutant emissions released equipment; therefore, in the exploitation phase air pollution is not expected. Commissioning of «DB WPP» is probable by stages in the four start complexes. During construction, phase main sources of pollution are vehicles, welding works, and dust generating construction works. Emissions during construction works are released by vehicles and construction equipment (mobile pollution sources). Operating engines release nitrogen dioxide, nitrogen oxide, black carbon (soot), sulfur dioxide, carbon monoxide, hydrocarbons (kerosene) into atmosphere. Detailed specification of necessary construction equipment is listed in construction work plan taking into account the availability of equipment in construction company. Combustion of organic fuel in vehicles and construction equipment results in release of pollutants into atmosphere.

During construction works, maximal total specific emission corresponds to summarize simultaneous emissions of every machine and mechanism and is calculated by summarizing specific fuel consumption of individual equipment. Expected emissions from vehicles and construction equipment for I, II, III and IV start complexes of «DB WPP» construction are presented in Table 4.36 – Table 4.39.

Table 4.36 – Emissions of atmosphere pollutants from vehicles and construction equipment for I start complex of «DB WPP» construction

Pollutants	Emission rate, g/s	Gross emissions, t
Nitrogen dioxide	0.140301	0.647368
Nitrogen oxide	0.025333	0.105199
Carbon (Soot)	0.014567	0.049225
Sulfur dioxide	0.022451	0.105367
Carbon monoxide	0.938532	3.595558
Petrol	0.033495	0.14282
Hydrocarbons (kerosene)	0.124861	0.462746

Table 4.37 – Emissions of atmosphere pollutants from vehicles and construction equipment for II-nd start complex of «DB WPP» construction

Pollutants	Emission rate, g/s	Gross emissions, t
Nitrogen dioxide	0.109123	0.503509
Nitrogen oxide	0.017733	0.081822
Carbon (Soot)	0.010197	0.038286
Sulfur dioxide	0.015716	0.081952
Carbon monoxide	0.656972	2.796545
Petrol	0.023446	0.111082
Hydrocarbons (kerosene)	0.087403	0.359914

Table 4.38 – Emissions of atmosphere pollutants from vehicles and construction equipment for III-rd start complex of «DB WPP» construction

Pollutants	Emission rate, g/s	Gross emissions, t
Nitrogen dioxide	0.109123	0.503509
Nitrogen oxide	0.017733	0.081822
Carbon (Soot)	0.010197	0.038286
Sulfur dioxide	0.015716	0.081952
Carbon monoxide	0.656972	2.796545
Petrol	0.023446	0.111082
Hydrocarbons (kerosene)	0.087403	0.359914

Table 4.39 – Emissions of atmosphere pollutants from vehicles and construction equipment for IV- th start complex of «DB WPP» construction

Pollutants	Emission rate, g/s	Gross emissions, t
Nitrogen dioxide	0.077945	0.359649
Nitrogen oxide	0.012667	0.058444
Carbon (Soot)	0.007284	0.027347
Sulfur dioxide	0.011225	0.058537
Carbon monoxide	0.469266	1.997532
Petrol	0.016747	0.079345
Hydrocarbons (kerosene)	0.062431	0.257081

Total emissions of atmosphere pollutants from vehicles and construction equipment for I-IV start complex of «DB WPP» construction are presented in Table 4.40.

Table 4.40 – Total emissions of atmosphere pollutants from vehicles and construction equipment for I-IV start complex of «DB WPP» construction

Pollutants	**Emission rate, g/s**	**Gross emissions, t**
Nitrogen dioxide	0.436490812	2.014034
Nitrogen oxide	0.073466139	0.327287
Carbon (Soot)	0.042244581	0.153145
Sulfur dioxide	0.065107636	0.327808
Carbon monoxide	2.7217428	11.18618
Petrol	0.097135324	0.44433
Hydrocarbons (kerosene)	0.362097252	1.439655
TOTAL	3.798284545	15.89244

Amount of harmful substances released into atmosphere from electric welding posts is calculated according to guidelines «Emissions (specific emissions) of pollutants by different industries into the atmosphere».

Expected emissions of harmful substances from electric welding posts during «DB WPP» construction are presented in Table 4.41.

Table 4.41 – Emissions of harmful substances from electric welding posts during «DB WPP» construction

Type of equipment	**Pollutant**	**Emissions rate, g/s**	**Annual emissions, t/year**
I start complex			
Welding posts	Iron oxide Manganese oxide Hydrogen Fluoride	0.00275 0.00025 0.00023	0.01455 0.00164 0.00148
II start complex			
Welding posts	Iron oxide Manganese oxide Hydrogen Fluoride	0.00159 0.00018 0.00016	0.01018 0.00115 0.00104
III start complex			
Welding posts	Iron oxide Manganese oxide Hydrogen Fluoride	0.00159 0.00018 0.00016	0.01018 0.00115 0.00104
IV start complex			
Welding posts	Iron oxide Manganese oxide Hydrogen Fluoride	0.00113 0.00013 0,00012	0.00727 0.00082 0.00074
TOTAL		0.007979	0.051233

4.8.1.2 Construction of the OHPL

It is assumed that the construction of the OHPL will last for 8 months. The construction site will use automotive equipment, namely: special automobiles working on diesel fuel and diesel and petrol trucks. Accordingly, the budget for this period will be spent 136 382.474 liters of diesel fuel and 25 556.487 liters of gasoline. The results of calculations of atmospheric air pollution levels as a result of the construction transportation and its impact on the environment, Table 4.42.

Table 4.42 – Gross emissions of pollutants and greenhouse gases during all construction work, t

Code	Name	Emissions for the entire construction period, t
$\frac{6000}{337}$	Carbon monoxide	12654.015
$\frac{11000}{-}$	Non-Methane Volatile Organic Compounds (NMVOC)	1484.935
$\frac{12000}{410}$	Methane	62.360
$\frac{4001}{301}$	Nitrogen oxides (oxide and nitrogen dioxide) in terms of nitrogen dioxide	3825.691
$\frac{03000}{2902}$	Substances in the form of suspended solid particles undifferentiated by composition (Soot)	803.361
4002	Nitrogen (1) oxide [N_2O]	14.573
$\frac{6001}{303}$	Ammonia	0.076
7000	Carbon dioxide	$4.23 \cdot 10^5$
$\frac{5001}{330}$	Sulfur dioxide (dioxide and trioxide) in terms of sulfur dioxide	517.390
$\frac{1009}{184}$	Lead and its compounds in terms of lead	0.246
$\frac{13101}{703}$	Benz (a) pyrene	3.478
TOTAL:		$\boldsymbol{4.43 \cdot 10^5}$

It is supposed that at the construction site for all time of construction works (8 months), electrodes of type E-42 in the amount of 0.10078 tons of ANO-6 electrodes of diameter 4 mm will be used at work for 200 hours a year, as well as 0.0876 tons of electrodes of the UNIA -13/45 with a diameter of 5 mm when working 168 hours per year.

Table 4.43 – Gross emissions of pollutants from welding works at the construction stage

Code	Name	Emissions	
		g/s	t (for the whole period of construction)
01003 123	Iron and its compounds (in terms of iron)	0.003557	0.002383
01104 143	Mangan and its compounds (in terms of manganese dioxide)	0.000347	0.000241
	Silicon dioxide	0.000203	0.000123
16000 344	Fluorides are poorly soluble	0.000637	0.000385
16000 343	Fluorides are well soluble	0.000319	0.000193
16001 342	Fluoride hydrogen	0.000145	0.000088
TOTAL:			***0.003412***

The following materials are planned to be used in the technological process of dyeing during the construction of the OHPL: enamel anticorrosive gray PF 115 (0.0096 t), filler MCH 0054 in quantity (0.20853 t); as well as solvents: P-4 solvent (0,002979 t), white spirit (0,0364 t). Painting method PF 115 – pneumatic sawing; method of applying putty MCH 0054 – spatula application, Table 4.44.

Table 4.44 – Gross emissions of pollutants from dyeing works at the construction stage

Code	Name	Estimated	
		g/sec	t/year
11030 616	Xylene	0.015263	0.011335
11000 2752	Non-metallic volatile organic compounds of NMVOC (White spirit)	0.003571	0.00216
11000 1078	Non-metallic volatile organic compounds of NMVOC (Ethylene glycol)	0.002923	0.002294
11000 -	Non-metallic volatile organic compounds of NMVOC (Etilkarbitol)	0.002923	0.002294
03000 2902	Substances in the form of suspended solid particles undifferentiated by composition	0.002619	0.001584
11007 1401	Acetone	0.002781	0.000841
11009 1210	Butyl acetate	0.001496	0.000452
11041 621	Toluene	0.007675	0.002321
11000 1061	Non-metallic volatile organic compounds of NMVOC (ethyl alcohol)	0.000313	$9.48 \cdot 10^{-5}$

Code	Name	Estimated	
11020 1246	Ethylcelosolve	0.000251	$7.58 \cdot 10^{-5}$
11000 1042	Non-metallic volatile organic compounds of NMVOCs (n-butyl alcohol)	0.012162	0.009318
TOTAL:		***0.3580***	

4.8.2 Impact mitigation and management

This section describes the actions and strategies suggested to avoid or minimize the potential impacts of Project on air quality. During the land preparation and construction phase of the Project, the potential impacts will be associated with carbon monoxide emissions and exhaust gas emissions from diesel fueled construction machinery and equipment.

During the land preparation and construction phase the following measures for the reduction and control of air emissions will be implemented (in accordance with relevant Ukrainian regulations and international standards and best practices), namely:

- loading and unloading of material will be carried out without scattering;
- during their transportation, excavated materials will be covered with nylon canvas;
- access roads and internal roads will be stabilized roads;
- speed limitations will be applied for vehicles;
- construction vehicles will not be permitted to keep engines running while waiting to enter to the site or waiting on-site;
- drop height of materials that have potential to generate dust will be kept as minimum as possible;
- well and adequate maintained vehicles will be used and regular maintenance of these vehicles will be ensured.

Beekeeping activities and agricultural activities are other receptors where air quality impacts are considered. Significance of residual impacts on beekeeping activities and agricultural activities is estimated to be negligible.

Conclusion: expected maximal emission rate of pollutants releasing during «DB WPP» and the OHPL construction will be insignificant and will not cause significant impact on atmosphere in the area of the Project construction. Excavation works will be carried out in the forest soils, therefore, at normal for area of the Project construction soil humidity the probability of significant dusting is excluded.

4.9 Noise

4.9.1 Baseline conditions

The noise limits given in the Annex № 16 «Permissible sound levels at the territory of residential development» and international GIIP documents (i.e. IFC General EHS Guidelines) have been assessed to establish the Project noise limits for the construction and operation phases. Hygienic assessment of cumulative impact of the noise from Project in settlements was based on laboratory research data for noise impact on separate elements of environment as well calculations of design and planning documentation in accordance with hygienic norms and regulatory procedures – for maximum permissible levels (MPL) [124], planning and building regulations and sanitary regulations [125].

The sound levels (L_A) and sound pressure levels in octave frequency bands are used for description of industrial and municipal sources with constant acoustic characteristics (8.37 [83]). Adequate measures for compliance with hygienic norms of noise and vibration in residential areas, in premises of residential and public buildings, at the territories of resort and in recreation zones must be provisioned in design and construction of settlements, industrial, municipal, and transport objects. (p. 8.38 and Annexes № 16-19) [83].According to Annex № 16 «Permissible sound levels at the territory of residential development», permissible sound levels at territory adjacent to residential buildings, polyclinics, outpatient clinics, rest homes, boarding houses, boarding schools, preschool institutions, schools and other educational institutions, libraries are in daytime, (LA_{eq} day = 55 dB(A)) and in night time LA_{eq} night = 45 dB(A)). The noise limits set by the above-mentioned standards are given in Table 4.45.

Table 4.45 – Noise standards for residential receptors

Norms of sound levels for time of day, dBA	Noise Limits for Residential			
	IFC EHS Guidelines		Ukrainian legislation	
	Construction, LA_{eq}	Operation, LA_{eq}	Construction, LA_{eq}	Operation. LA_{eq}
Day	55 dB(A)	70 dB(A)	70 dB(A)	55 dB(A)
Evening	-	-	-	-
Night	45 dB(A)	45 dB(A)	-	45 dB(A)

The territory of planned Project is situated outside villages. A distance of 470-1700 m is foreseen between each WTs of «DB WPP». The area of land plot for installation of one WT is 0.1 ha. Background environmental noise levels at the settlement located in the vicinity of the Project components, were determined based on the site modelling. Two of the closest receptors, selected as noise sensitive are shown on the map provided in Table 4.46.

Table 4.46 – Noise Receptors (NR) selected for baseline noise modelling

Receptor Code	**Settlement**	**Nearest Wind Turbine/Pylons**	**Distance to the Nearest Turbine/Pylons, m**
NR-1	v.Oleksandrivka	Wind Turbine 37	2470
NR-2	v. Luparevo	Wind Turbine 16	4270
NR-3	v. Pravdino	Pylon № 85	460
NR-4	v. Soldatske	Pylon № 26	680

The receptors of the noise impact will be human. Specific sensitivity criteria considered in the assessment of noise impact on human receptors was determined in Table 4.47.

Table 4.47 – Criteria for the sensitivity of noise receptors

Impact Subject	High	Medium	Low	Negligible
Noise	Noise sensitive areas where educational, cultural and health facilities are predominantly located together with summer houses and camp sites.	Mixed use areas where commercial buildings and noise sensitive areas are collocated with a predominance of residential buildings.	Mixed use areas where commercial buildings and noise sensitive areas are collocated with a predominance of workplaces; users of agricultural lands.	Industrial areas.

Criteria to be considered in determining magnitude of change are provided in Table 4.48.

Table 4.48 – Criteria for magnitude of change

Impact Subject	High	Medium	Low	Negligible
Noise	More than 3 dBA increase in background noise level in case of exceedance of regulatory limits.	1-3 dBA increase in background noise level in case of exceedance of regulatory limits.	0-1 dBA increase in background noise level in case of exceedance of regulatory limits.	Compliance with regulatory limits.

4.9.1.1 Construction phase

Construction machinery and equipment to be used for the construction of access roads and crane pads, preparation of WT, pylons foundations and other civil works, will result in noise generation during the construction phase of the Project, which may impact the noise sensitive receptors.

Noise characteristics of the pilling equipment are given in Table 4.49.

Table 4.49 – Equivalent noise level from machinery/equipment

The name of the equipment	Noise level at a distance of 7.5 m, dB(A)
Diesel hammer	110
Pneumatic or steam hammer	105
Triphammer	100
Hydraulic hammer	95
Vibrators	95

For construction equipment, the following levels of maximum sound are characteristic, Table 4.50:

Table 4.50 – List of Construction Machinery/Equipment

Machine	Lw (dB)*
Truck motor transport	85 ... 96 dB(A)
Scraper:	83 ... 84 dB(A)
– when the soil is set	80 dB(A)
– at unloading	82 ... 83 dB(A)
Bulldozer	90 dB(A)
Motor grader	92/85 dB(A)
Excavator with a bucket capacity of 2 m^3	95/92 dB(A)
Excavator with bucket capacity of 1 m^3	90/88 dB(A)
Excavator with capacity of a bucket 0,5 m^3	87/85 dB(A)
Compressor with internal combustion engine	101/87 dB(A)
Compressor with electric drive	93/80 dB(A)
Car with a carrying capacity of > 10 t	85/90 dB(A)

The measured noise level at the workplace of the welder [47], generated by manual argon arc welding, in the range of nominal values of the welding current LA_{eq} = 59,6 dB(A). The maximum value of the equivalent sound level at the receptor point, if the work is done in a palette:

$$LA_{eq} = 110 - 48,5 = 61,5 \text{ dB(A)}$$

In the absence of piling works:

$$LA_{eq} = 30 \text{ dB(A)}$$

For transportation work:

$$LA_{eq} = 39 \text{ dB(A)}$$

Noise pollution zones during the construction of the «DB WPP» and the OHPL are given on Fig. 4.81. For settlements: Pravdino and Soldatske noise impacts from the construction of transmission lines will be less than 45 dBA in the most negative scenario, which is the accepted noise level for settlements in accordance with Annex No. 16 «Permissible sound levels at the territory of residential development» (Ukrainian requirement and norms) and international GIIP documents.

Table 4.51 – Comparing of total sound levels LA_{eq}, for different contribution of wind turbines, depending on the distance to the control point, dB(A)

№ WT	Distance, m									
	200.0	400.0	600.0	800.0	1000.0	1500.0	2000.0	**2470.0**	3000.0	**4270.0**
16	51.1	44.4	40.5	37.8	35.3	32.7	30.2	**27.6**	25.0	22.5
37	51.3	44.9	41.2	38.5	35.9	33.4	30.8	28.2	25.7	**23.1**

Table 4.52 – Comparing of total sound levels LA_{eq}, for different contribution of wind turbines, depending on the distance to the control point, dB(A)

№ pylons	Distance, m								
	25.0	50.0	100.0	200.0	400.0	**460.0**	600.0	**680.0**	1000.0
26	53.9	51.6	50.3	48.6	45.3	44.9	43.1	**42.8**	39.7
85	53.7	52.8	51.4	49.3	46.4	**44.7**	43.0	42.5	38.9

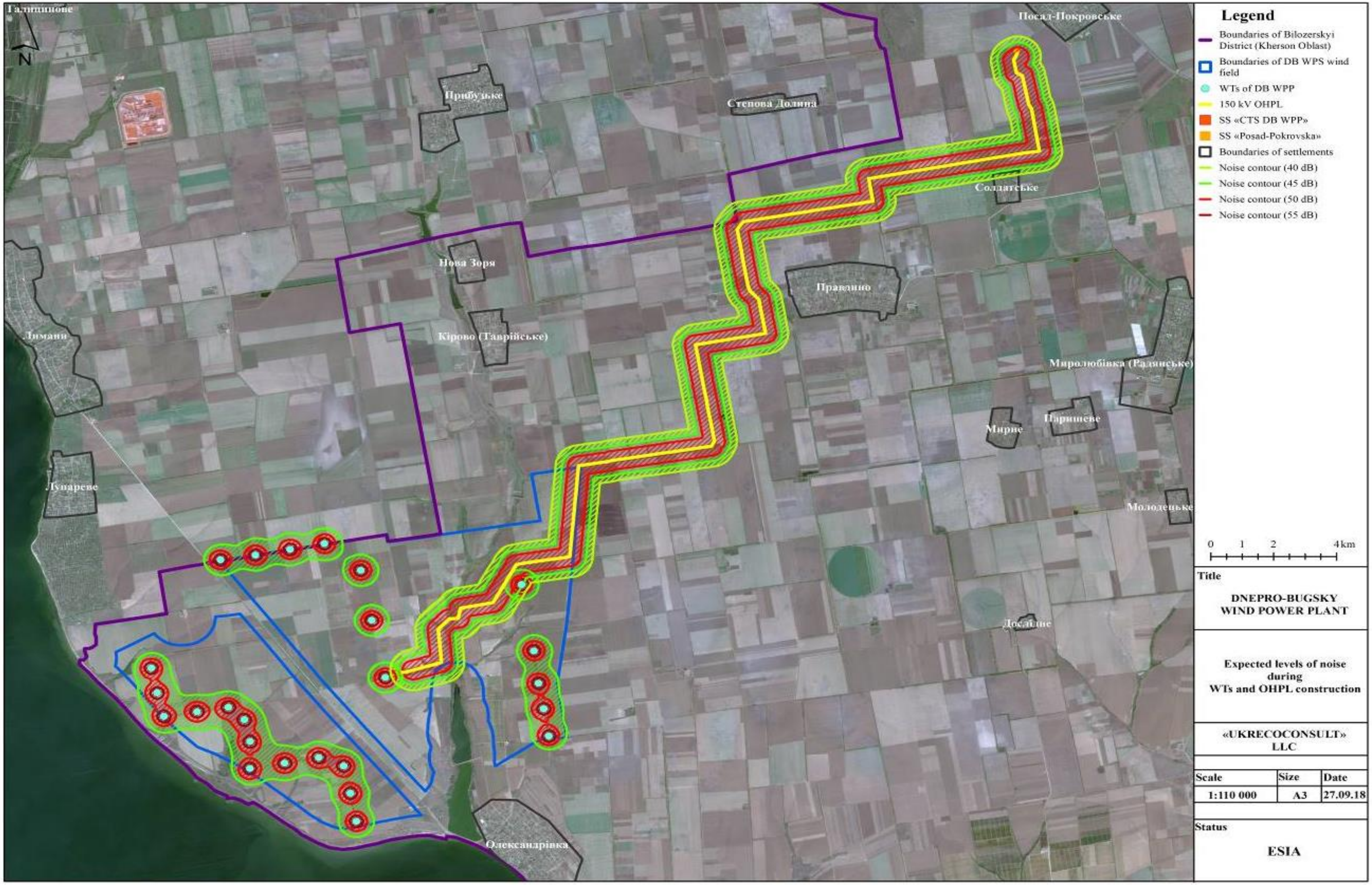


Fig. 4.81. Noise pollution zones during the construction of the Project

4.9.1.2 Operation phase

The aerodynamic noise (noise of aerodynamic flows around the profiles of blades, noise of gearbox rotation and noise of blades rotation) makes a significant noise impact in sound frequency band, Fig. 4.82.

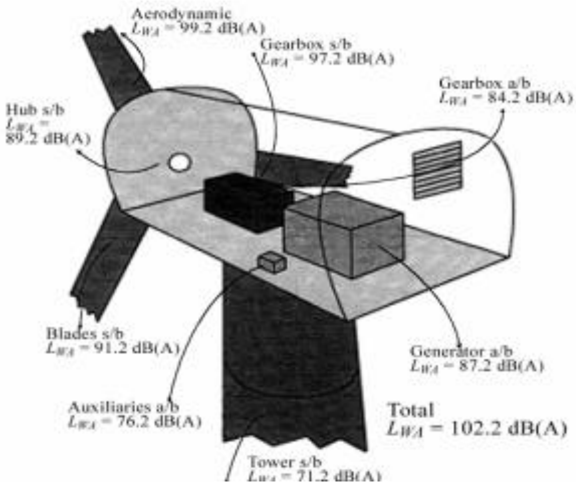


Fig. 4.82. Main sources of noise on WTs

The wind turbines often generate pulsating noise, which is a source of numerous complaints due to difficulties of adaptation or ignoring such noise. Such sound pulsation is also called «amplitude modulation». Scheme of amplitude modulation formation by wind turbine is presented in Fig. 4.83. It exceeds significantly the perceptible difference of sound volume that usually equals 3-5 dB.

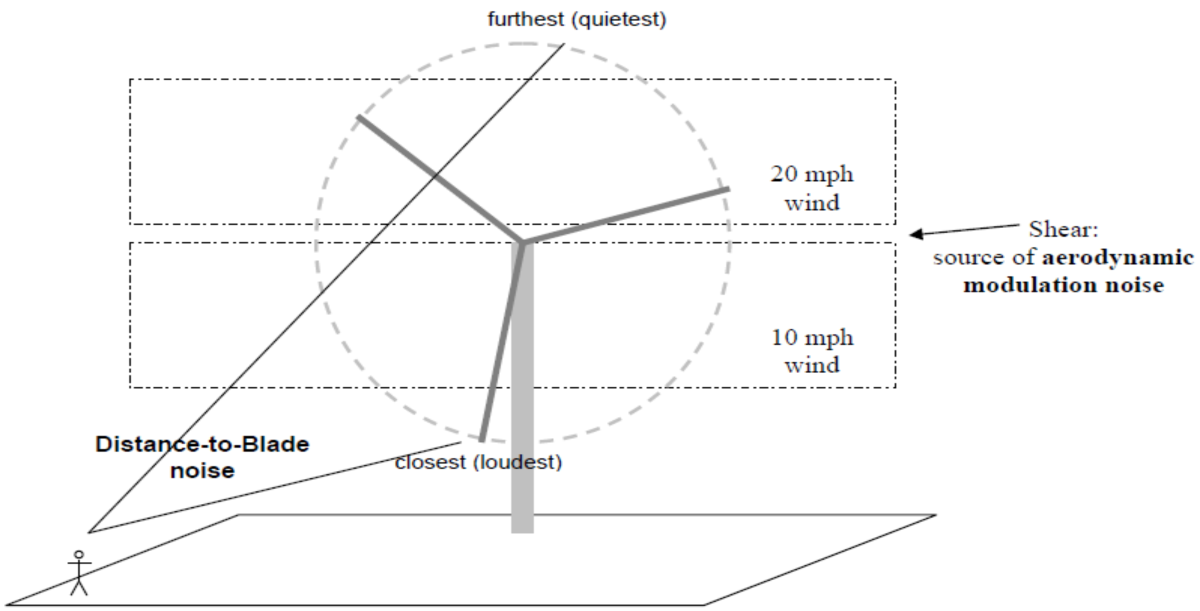


Fig. 4.83. Scheme of amplitude modulation formed by wind turbine

Results of calculation of noise characteristics (according to MEK 61400-11) for WT Nordex N 149/4.0-4.5 (Germany) are presented in Table 4.53, Table 4.54.

Table 4.53 – Sound levels of WT (dB (A)) depending on wind speed

Wind speed, m/s	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
N149/4.0-4.5	98	98.5	103	106.8	107.3	107.4	107.5	107.2	107.2

Table 4.54 – Spectral levels of sound power according to the results of certification exams, height of rotor location and rotor diameter

WT	**Octave frequency bands, Hz**								
	31,5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
N 149/4.0-4.5	90.0	95.0	99.0	99.0	96.0	97.0	92.0	79.0	80

By requirements of sanitary rules [125] the regulatory norms of constant noise are sound pressure levels L, dB, in octave bands of average-geometrical frequencies 31.5; 63; 125; 250; 500; 1000; 2000; 4000; 8000 Hz as well as maximal and equivalent sound levels.

For calculation of sound levels in individual point (control point) depending on distance to noise source, the special model is used. This model considers the effects of sound waves spreading in the environment and characteristics of noise source (requirements to the individual effects of sound waves spreading in the atmosphere is defined by standards), namely:

- characteristics of the noise source, including direction and spectral characteristics of radiation, and height of noise source above the surface;
- distance from source of sound (noise) to control point;
- sound absorption in atmosphere (it depends on frequency and parameters of atmospheric conditions);
- impact of the earth (namely reflection and absorption of sound energy by land surface that depends on frequency and parameters of land surface, height of noise source, etc.);
- shielding of sound waves by obstacles on the way of waves distribution;
- weather effects (namely, wind speed, changes of wind speed and air temperature depending on the height (it defines conditions of sound waves refraction);
- forms of underlying surface which can increase (focus sound waves) and decrease intensity of sound waves.

The modern calculating models should provide definition of sound pressure levels and sound levels with further drawing of noise contours on map.

The software «NoBel», developed in National Aviation University, corresponds to these requirements. The software is developed according to the requirements of individual standards that consider individual effects of sound waves spreading.

Sound absorption in the air is determined for atmosphere condition by the MCA requirements: temperature 15 °C, pressure 101.325 kPa, relative air humidity 70%. The coefficients of sound absorption near the tertiary-octave spectrum bands for humidity 70% and 100% at temperature 15 °C and pressure 760 mm are presented in Table 4.55.

Table 4.55 – Comparison of sound absorption coefficients in the atmosphere for humidity 70% and 100% (temperature 15°C, pressure 760 mm)

Frequency, Hz	50	63	80	100	125	160	200	250
α_{70}, dB/m	0.00024	0.00030	0.00038	0.00047	0.00059	0.00075	0.00094	0.00118
α_{100}, dB/m	0.00024	0.00030	0.00038	0.00047	0.00059	0.00075	0.00094	0.00118
Frequency, Hz	315	400	500	630	800	1000	1250	1600
α_{70}, dB/m	0.00149	0.00190	0.00238	0.00301	0.00384	0.00482	0.00607	0.00785
α_{100}, dB/m	0.00149	0.00190	0.00238	0.00301	0.00384	0.00482	0.00607	0.00785
Frequency, Hz	2000	2500	3150	4000	5000	6300	8000	10000
α_{70}, dB/m	0.01000	0.01320	0.01793	0.02506	0.02984	0.04198	0.06099	0.09002
α_{100}, dB/m	0.00992	0.01257	0.01612	0.02105	0.02444	0.03278	0.04534	0.06511

Impact of wind and air temperature on spreading of sound waves happens due to so called «sound refraction effect». It happens as a result of height changes, and as a result of changes of wind speed and temperature that is characterized by values of their gradients.

4.9.1.3 Cumulative impact of noise from Project

To assess cumulative impact of noise from wind powerplant it is necessary to determine contribution of each WT in the total acoustic field of wind power plant. For this purpose a principle of energy sum (L_Σ) of sound levels (Li) [67], generated by each WT in a control point is applied and reflected in the formula:

$$L_\Sigma = 10\lg\left(\sum_i 10^{0,1L_{ii}}\right)$$

Comparing to sound level from one WT, the cumulative impact of noise from wind power plant differs at 0.8 up to 200 m from nearest WT – 3,5 dB (A) (up to 2470 m from nearest WT №). Even noise level contours 45 dB (A) from cumulative impact of «DB WPP», are at significant distance from borders of Oleksandrivka village (Fig. 4.84) (for calculations as permissible level was used 50 dB (A) corresponding to night permissible values of noise according to the requirements of the rules [125].

Total acoustical field of «DB WPP» is calculated by software «NoiseWPP». For WT Nordex N 149/4.0-4.5 the spectral characteristics of noise emission power, defined by international standard IEC 61400-11, 2nd ed was received. These spectral characteristics allow to calculate dependencies between sound level noise generated by WT and distance to the control point.

The dependencies described above was used for calculation of total acoustical field of «DB WPP».

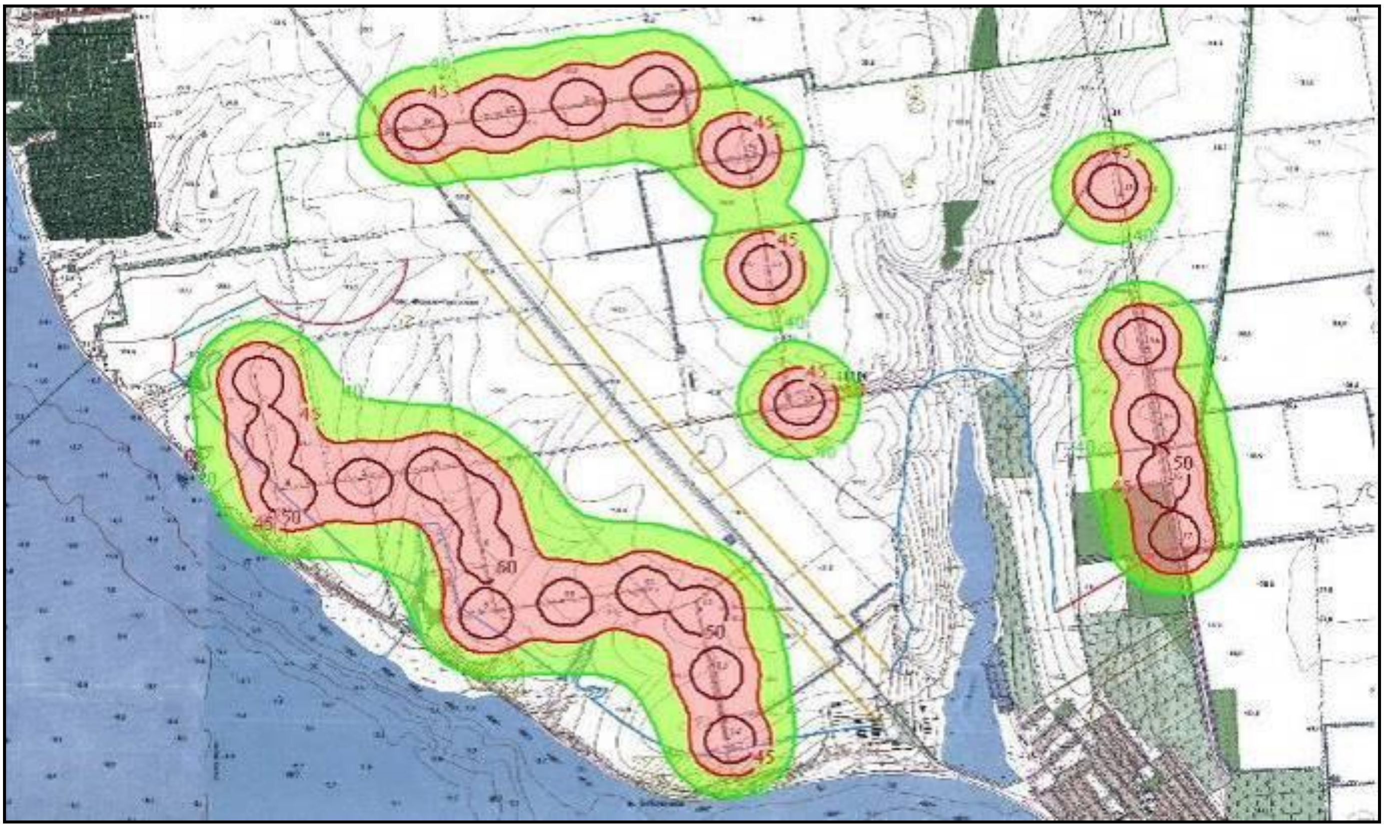


Fig. 4.84. Zone of noise for the WTs placement (Nordex 149/4.0-4.5)

Taking into account the cumulative impact of noise from wind power plant, the total levels of sound do not exceed the sound levels of the nearest wind turbines. Calculated level of noise does not exceed permissible noise level even in nighttime LA_{eq} = 45 dB (A) even at a distance 300 meters from the nearest source of noise.

If in certain conditions, WTs are considered as non-stationary source of noise, then normative value of noise by «State sanitary rules of planning and urban development» [83] is equal to 45 dB(A); it is not exceeded at distance 400 meters from a single WT. This distance is lower that the distance recommended by SI «O.M. Marzeiev Institute for Public Health» of NAMSU – 700 meters, but distance in 400 meters is fully coincides with recommendations concerning placement of WT due to noise conditions.

It should be noted that the calculated levels of sound in the absence of piling works do not even violate the normative values for sound levels at night. If pilotage works are performed during the foundation of the basement under the turbine tower – these types of work should be done only during the day.

During exploitation the OHPL may give a low «buzzing» sound, but this sound will be heard under the line and, possibly, a few meters outside the line width. This «buzzing» sound will not be heard in the surrounding settlements due to significant distance between planned the OHPL and nearest settlements, namely: Village Soldatske – 0.46 km (nearest pylon № 26, coordinates: 46°46'1,188"N.L 32°14'47,909"E.L); Village Pravdino – 0.68 km (nearest pylon № 85 coordinates: 46°44'8,116" N.L 32°10'39,556" E.L).

Other settlements located at significance distance from planned the OHPL: village Oleksandrivka – 3.65 km; village Stepova Dolyna– 2.27 km; village Posad-Pokrovske – 1.06 km. Such placement correspond to the requirements of sanitary and hygienic norms of Ukraine.

Conclusions: Noise contours for sound levels 45 and 50 dB(A) calculated for WT of model N 149/4.0-4.5, and presented in Fig. 4.83, Fig. 4.84 respectively, shown that residential buildings of the nearest settlement (v. Oleksandrivka) are located far beyond the boundaries of sanitary-protective zone of «DB WPP» zones with above permissible values of noise. In this case additional measures for mitigation of noise impact and its management are not required.

4.9.1.4 Infrasound

Impact factor description: The infrasound in environment generates by multiple source, namely, ventilation systems, waves on the seacoast, remote explosions, traffic, aviation flights, a variety of machinery, etc**.** The infrasound spreads on bigger distances than high frequency sounds. Such «prevalence» of infrasound is caused by low levels of losses on distribution way. Differentiation of wind turbines by type of a rotor (windward rotor or leeward rotor) is important for study of infrasound from WTs. Some earlier models of WTs with leeward rotor generated significant levels of infrasound. Rotors emit noise in a broad range of sound frequencies that include low frequency sound and infrasound.

«Whistle» sound is amplitude modulation of sound at the frequency of blades rotation (main harmonica = rotation frequency × number of blades). It occurs mainly due to interaction of wind blade tips with turbulent «attacking» wind flow. Measurements of dependencies between infrasound and distance *R* shows that infrasound levels decrease, approximately by the law of geometric distribution but not so fast as noise levels. Scheme of conducted measurements is presented in Fig. 4.85.

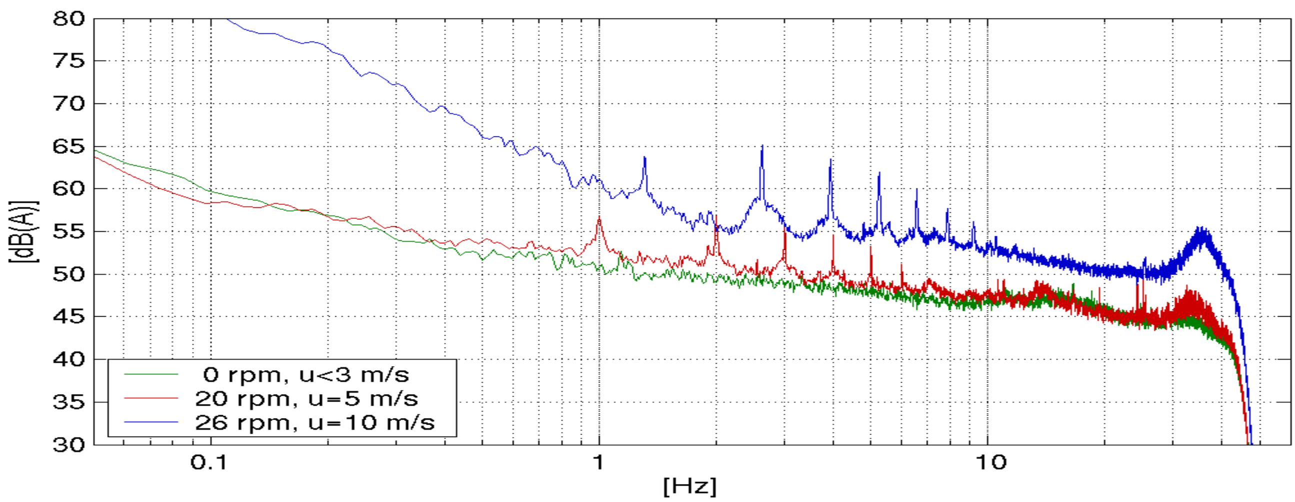


Fig. 4.85. Dependencies of spectral infrasound level from the wind speed: green – up to 3 m/s; red – 5 m/s; blue – 10 m/s

In addition, the dependency between infrasound level and wind speed was defined, Fig. 4.86.

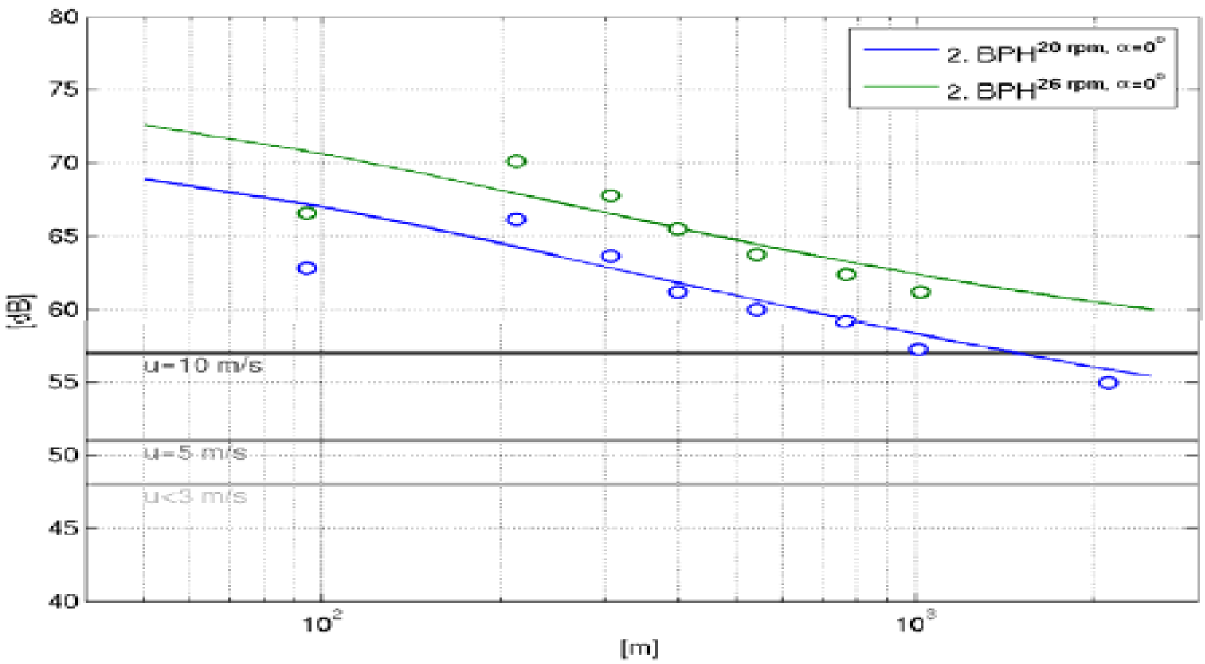


Fig. 4.86. Comparison of calculated values (lines) and measured values (circles) for two modes of wind turbine rotor rotation: green – 20 rotations per minute; blue – 26 rotations per minute

The direction of infrasound emission from WT, according to the model, is almost independent from the angle of emission, that confirmed by the results of measurements, Fig. 4.87. The dependency between infrasound sound pressure level and speed of rotor rotation is defined as *SPL* ~ rotations per minute.

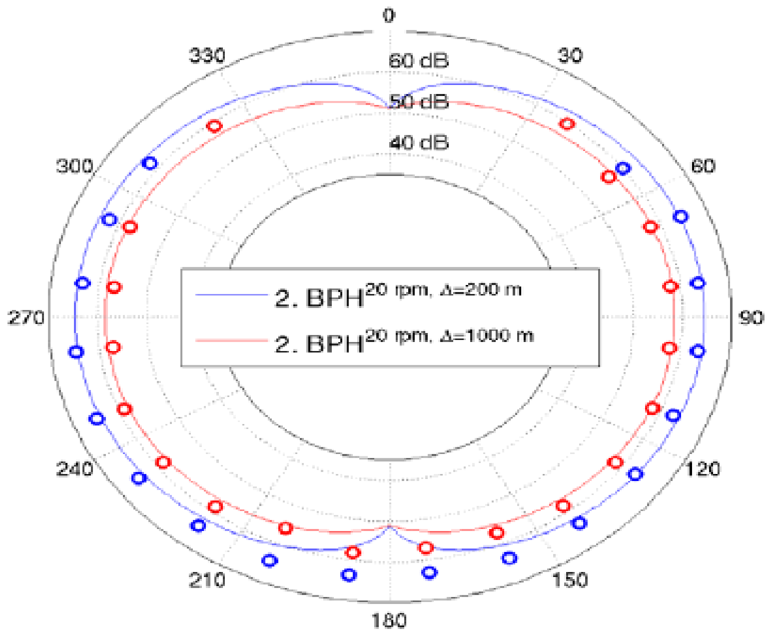


Fig. 4.87. Direction of infrasound emission of WT for two modes of rotor rotation: green – 20 rotations per minute; blue – 26 rotations per minute

Impact on human. Infrasound and low frequency sound have some impact on perception by humans (Fig. 4.88), namely:

– low frequency sounds and infrasound (2-100 Hz) are felt by humans as mixture of auditory and tactile reactions;
– lower frequencies should be of a higher level (dB), for identical perceptions, for example hearing threshold at frequency 10 Hz is 100 dB in comparison with 80 dB at frequency 20 Hz;
– tonal sound cannot be felt (perceive) below 18 Hz;

The long length of the sound wave makes impossible to find out from which specific location infrasound comes. Impact on humans depend on magnitude of infrasound power (Table 4.56).

Table 4.56 – Impact of infrasound on human body in dependency from sound level of sound

90 dB and below	reliable scientific data about negative physiological or psychological effects are absent;
115 dB	traumas, apathy, hypertension are probable;
120 dB	pain level approximately at frequency 10 Hz;
120 – 130 dB and above	exposure during 24 hours cause physiological traumas

Assessment criteria. The regulatory infrasound levels (at working places) are levels of sound pressure in octave frequency band with average geometric frequencies 2; 4; 8; 16 Hz in decibels [124]. Permissible levels of sound pressures (in dB) in octave frequency band with given average-geometrical frequencies are 105 dB. Permissible summary level of sound pressure is 110 dB.

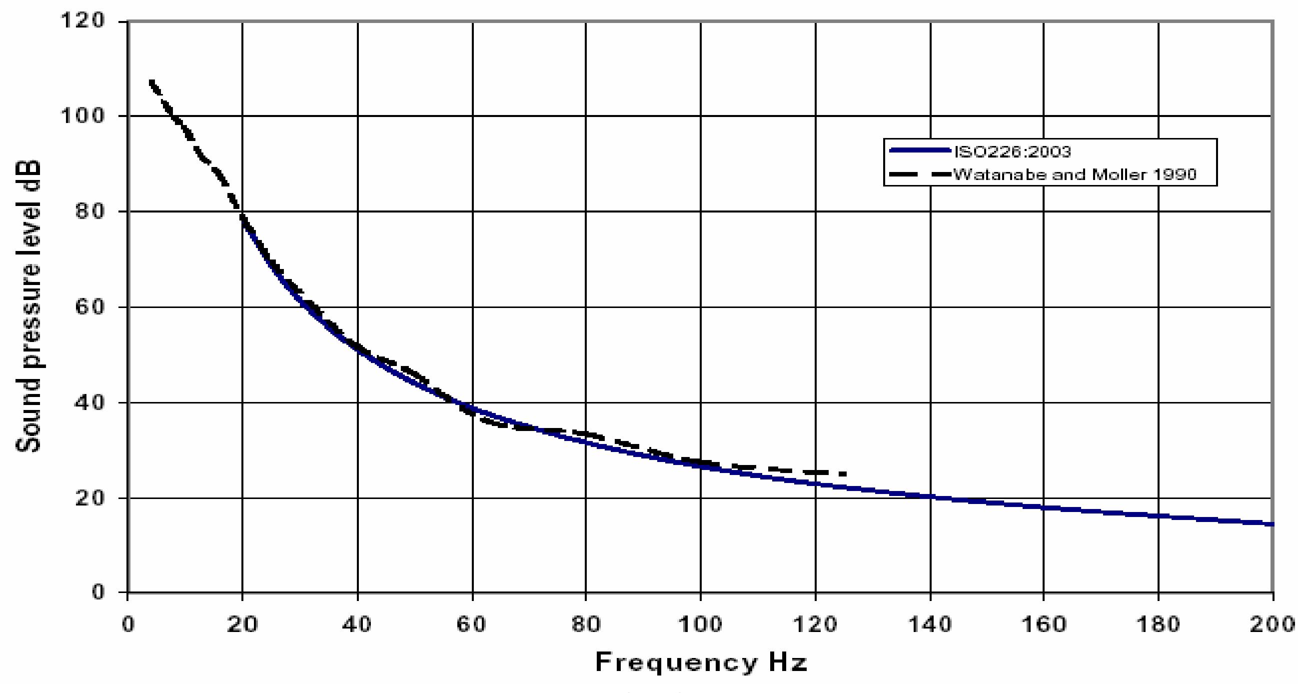


Fig. 4.88. Threshold levels of infrasound perception by human

Explanations to threshold levels of perception (TLP) of infrasound and low frequency sound by humans - Table 4.57.

Table 4.57 –Threshold levels of perception of infrasound and low frequency sound by human

Hz	4	10	20	30	40	60	80	100
dB	107	97	80	60	56	39	37	23

Standard deviation of threshold level of perception are ~ 6 dB [48]. Thus, it is expected that only small number of people have sensitivity to 12 dB or more. Most people do not feel higher sound level of infrasound.

At a distance of 100 the levels of infrasound from wind power plant are below the thresholds levels of perception, Table 4.58.

Table 4.58 – Infrasound levels from WT at distance 100 meters

Nordex N 149/4.0-4.5 (4.4 MW)	L_{max} = 81 dB

Conclusion: Significant impact of infrasound formed in WPP operation phase will not be observed because at distances above 100 meters from source noise levels will not exceed threshold levels of perception by humans.

4.9.2 Impact mitigation and management

The noise counters for sound levels 45 and 50 dB (A), calculated for placement of WTs Nordex N 149/4.0-4.5, shows that the nearest settlement v. Oleksandrivka is far outside of the buffer zone of «DB WPP» – zones beyond which noise levels do not require measures for noise mitigation and management.

In order to prevent, reduce and ensure the safe levels of noise, the following measures are necessary to undertake:

- establish the boundaries of «DB WPP» within wind fields in compliance with sanitary and technical requirements of noise;
- ensure the installation of individual wind turbines, sources of noise at the approved distance of 700 m of the buffer zone (sanitary-protection zone) (for safety of WT noise, as recommended by State Institution «O.M. Marzeiev Institute for Public Health» NAMSU) from settlements taking into account territories of their future development.

4.10 Vibration

4.10.1Baseline conditions

Vibration is a motion of point or mechanical system with increase or decrease of least one coordinate of point or mechanical system in time.

Vibration is characterized by oscillation intensity, their spectral composition, impact duration and direction. Intensity indicators are mean square or amplitude values of vibration acceleration *a*, m; vibration velocity *V*, m/s; vibration shifting *x*, m/s^2. In addition, the vibration is characterized by such parameter as frequency, *f*, Hz.

Parameters *x*, *V*, *a* – are interrelated and every parameter of sinusoidal vibrations could be calculated by another from the ratio:

$$a = V(2\pi f) = x(2\pi f)^2,$$

where $2\pi f$ – is circular frequency of vibration, s^{-1}.

For practical purposes, in vibroacoustic research the relative values of vibration velocity L_V and vibration acceleration L_a, are used. Vibration velocity L_V and vibration acceleration L_a are measured in decibels defined as:

$$L_V = 20 \cdot \lg (V/V0); \; L_a = 20 \cdot \lg (a/a_0),$$

where V, a – are respectively the root mean square of vibration velocity m/s and vibration acceleration in measured point m/s^2; $V_0 = 5 \cdot 10^{-8}$ m/s, $a_0 = 3 \cdot 10^{-4}$ m/s^2 – limit (threshold) values of vibration velocity and vibration acceleration.

A human being percepts a threshold vibration velocity of 10^{-4} m/s, and more than 1 m/s he or she feels the pain. Humans are able to percept the vibration only when a peak value of the corrected vibration acceleration exceeds 0.015 m/s^2 (83,5 dB). The frequencies up to 63 Hz are the most dangerous as they coincide with the natural oscillations of different body parts. Vibration in nature does not harm people that much but threatens buildings and constructions. Methods of vibration mitigation are well studied. From transport movement, for example city trams or trains, the vibration is transmitted through rails to their supporting elements and then through the ground to surrounding constructions. Vibration can be as an independent source of impact as a source generating sound.

The vibration could damage constructions, reduce structure stability or cause their insignificant damage when repair is needed. If there are grounds to assume dangerous vibration for the buildings, then instrumental research shall be carried out. Nowadays in Ukraine, the methods of calculation of vibration impact on buildings, constructions and residential and public premises from vehicles, trams or wind turbines are not officially adopted. The vibration from wind turbine is absent if aerodynamic profile for blades of a chosen wind turbine is well balanced, the generator works normally and its maintenance is regular and timely. General vibration for premises of residential and public buildings is regulated in Ukraine. The vibration impact along roadsides and in populated area is not regulated. Hygienic assessment of vibration occupational impact at work place is carried out by the following methods: frequency (spectral) analysis of vibration parameters; integral assessment by spectral frequency parameters, which are that are regulated. vibration exposures (doses). Vibration effect on human organism can be total and local. According to the main regulatory document («System of safety standards. Vibration. General Requirements») and («Limits of total and local industrial vibration») regulatory parameters are the vibration velocity (V) and vibration acceleration (a) in dB or their logarithms L_v, L_a in the octave bands with mean geometric frequencies for each vibration direction and vibration type:

- for local vibration: 8.0; 16.0; 31.5; 63.0; 125.0; 250.0; 500.0; 1000.0 Hz;
- for total vibration: 1.0; 2.0; 4.0; 8.0; 16.0; 31.5; 63.0 Hz,
- or in the 1/3 octave bands 0.8; 1.0; 1.25; 1.6; 2.0; 2.5; 3.15; 4.0; 5.0; 6.3; 8.0; 10.0; 12.5; 16.0; 20.0; 25.0; 31.5; 40.0; 50.0; 63.0; 80.0 Hz.

Standard DSTU ISO 2631-1:2004 «Vibration and Shock mechanical. Impact assessment of total vibration on humans» regulates total vibration and is not applied to dangerous vibration impacts transmitted directly to extremities (for example, by power tools). This standard determines methods for measurement of periodic, random and transient vibration. It indicates the principal parameters that shall be considered to define the acceptable vibration impact. The appendices of the Standard contain common practices and provide guidelines for assessment of possible vibration impacts on health, comfort, perception and motion sickness. The considered frequency ranges are: for health – between 0.5 Hz and 80 Hz, comfort and perception; for motion sickness – and 0.1 Hz 0.5 Hz.

The Standard DSTU ISO 2631-1:2004 «Vibration and Shock mechanical. Impact assessment of total vibration on humans» does not establish the boundaries of vibration impact. However, assessment methods allow use of methodology as basis for establishing individually elaborated limitations. The presented in this Standard method allows assessing random high peak vibrations (which have high peak factor).

Standards DSTU 12. 1. 012-2008 «System of safety standards. Vibration. General Requirements» and «Limits of total and local industrial vibration» regulate actual parameters of vibration velocity, m/s, and vibration acceleration, m/s^2, and their levels (dB) respectively. The only parameter used for assessment is the mean squared vibration acceleration or vibration velocity or their logarithms (RMS). If expressed as the vibration velocities of typical levels it corresponds: 132 dB – $20\cdot10^{-2}$ m/s; 108 dB – $1.3\cdot10^{-2}$ m/s. The standardization of vibration can be vividly demonstrated graphically (Fig .4.89).

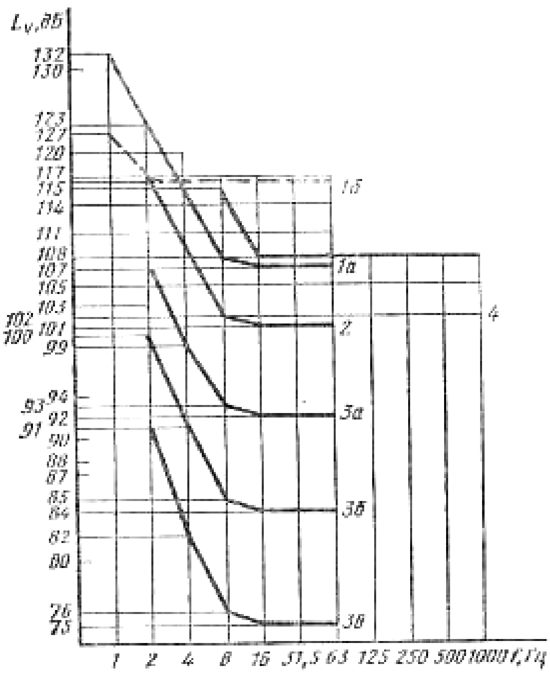


Fig .4.89. Hygienic standardization of vibration:
1a – transport vertical vibration; 1б – vertical and horizontal);
3a – technological vibration (vertical and horizontal) in manufacture premises with vibration sources; 3б – the same in manufacture premises without vibration sources;
3в – the same in premises for mental work and governmental premises; 4 – local vibration

Vibration levels should not exceed permissible levels, established by «State sanitary norms of industrial total and local vibration») in work hours for the industrial premises, Table 4.59.

Table 4.59 –Maximum permissible levels of vibration at working place, dB

Standardized parameter	Average-geometric frequencies of octave bands, Hz						Corrected and equivalent corrected levels in dB
	2	4	8	16	31,5	63	
Vibration velocity	79	73	67	67	67	67	72
Vibration acceleration	25	25	25	31	37	43	30

Standard values of vibration are set in «State sanitary norms of industrial total and local vibration» for work time 480 minutes (8 h).

Studies of vibration impact on structure constructions performs if exist reasonable grounds to assume their damage upon vibration impact. Such study is a multi-stage process, that starts at design phase of new construction if there are existing vibration sources or planned new structures that have vibration sources themselves and can significantly affect already built constructions. For different phases of project design, the calculation models shall be developed and refined. These models includes dynamic properties of vibration sources, vibration direction and specific features of the constructions.

The model output are responses of a construction in its different points. Vibration measurements, set in by this Standard, can be used to validate reliability of developed calculation model.

Nowadays, there are no sufficient data of interrelation between the rigidity of object upon vibration and damage caused by vibration.

Indicative values for vibration are present in a number of national standards and other regulations of foreign countries. These indicative values do not cover the diversity of structures and types of vibration influences; therefore, they shall be used only after a preliminary analysis of every individual situation. Nowadays the approaches for assessment methodologies and numerous criteria of hazard for technogenic vibration for buildings are different in different countries. Among the international regulations of vibration measurements there are:

- National Standard of Germany DIN 4150-3:1999 «Structural vibration – Part 3: Effects of vibration on structures»;
- National Standard of Great Britain BS 7835-2:1993 «Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground borne vibration»;
- National Standard of Norway NS 8141:2001 «Vibration and shock – Measurement of vibration velocity and calculation of guideline limit values to avoid damage of constructions.

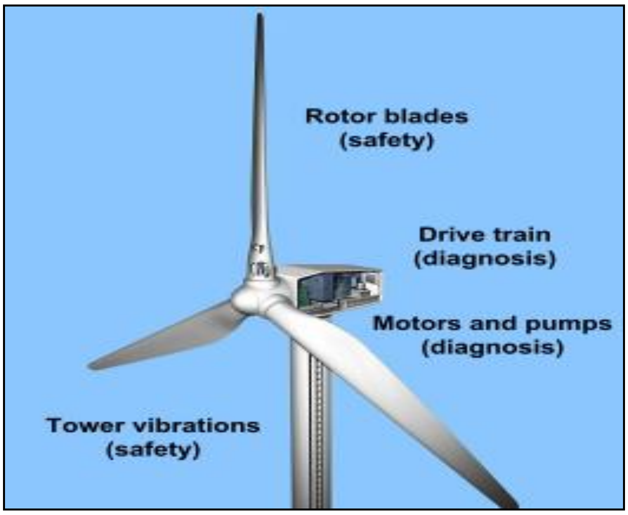
National Standard of Ukraine is «Vibration and Mechanical shock. Assessment of impact of total vibration on humans. Part 2. Vibration in buildings (from 1 Hz to 80 Hz)».

The National Standard of Ukraine regulates the total vibration and shock impact on comfort and annoyance for humans. It contains a method to assess, evaluate, and detect the direction and place of vibration. The Standard determines frequency weighting used in the frequency band from 1 Hz to 80 Hz. In these conditions, the position (pose) of person is not considered. The Standard does not offer guidance for considering possibility of structure damage as ISO 4866 does. Additionally, the Standard is not used for assessment of vibration impact on human health. Acceptable vibration levels are not set up in this standard. Nowadays no guidance on the acceptable vibration values can be offered until more information is collected for this standard.

Wind turbines create a new challenge for reliability for technical equipment ,since individual components of WTs must be in constant rotational movement – rotors, gearboxes, generators, and other important elements of WTS. During WPP operation, the vibration source is, first, movable parts of WTs, namely, blades of rotor. For example, the 3.5 MW modern WT has rotor with diameter up to 120 m – bigger than Boeing - 747 aircraft.

In reality, speed of blades rotation is relatively low. In the first models of WTs the rotor speed was between 45 and 70 rotations per minute, and gearbox ratio – in range between 1:25 and 1:40. Nevertheless, because of big diameter of rotor blades in more powerful WTs (> 1 MW), number of rotations was reduced in order to maintain speed of blade tips within the subsonic range. In modern wind turbines, speed of rotation is up to 12 rotations per minute, that requires maintaining ratio of rotation frequencies up to 1:150.

Therefore, modern gearboxes increases frequency of rotor shaft rotation to the frequency of drive shaft generator rotation – 1500 rotations per minute. Many manufactures of wind turbines use planetary reduction gears and often multi-stage planetary gear reducer. These are very sophisticated gearboxes as shown in Fig. 4.90.



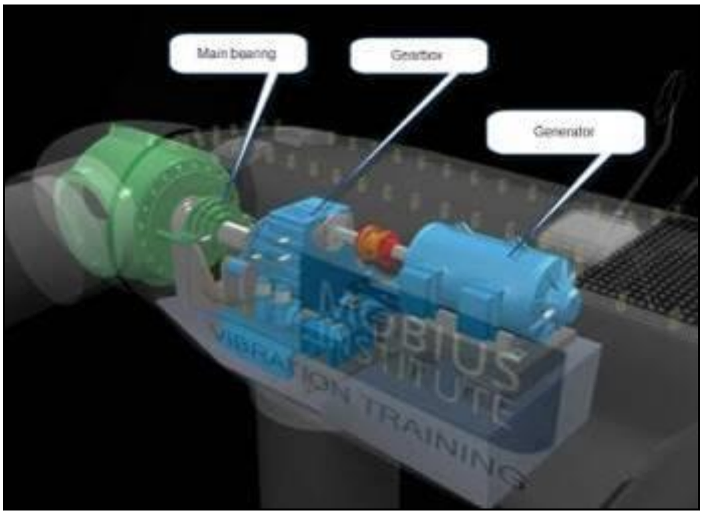
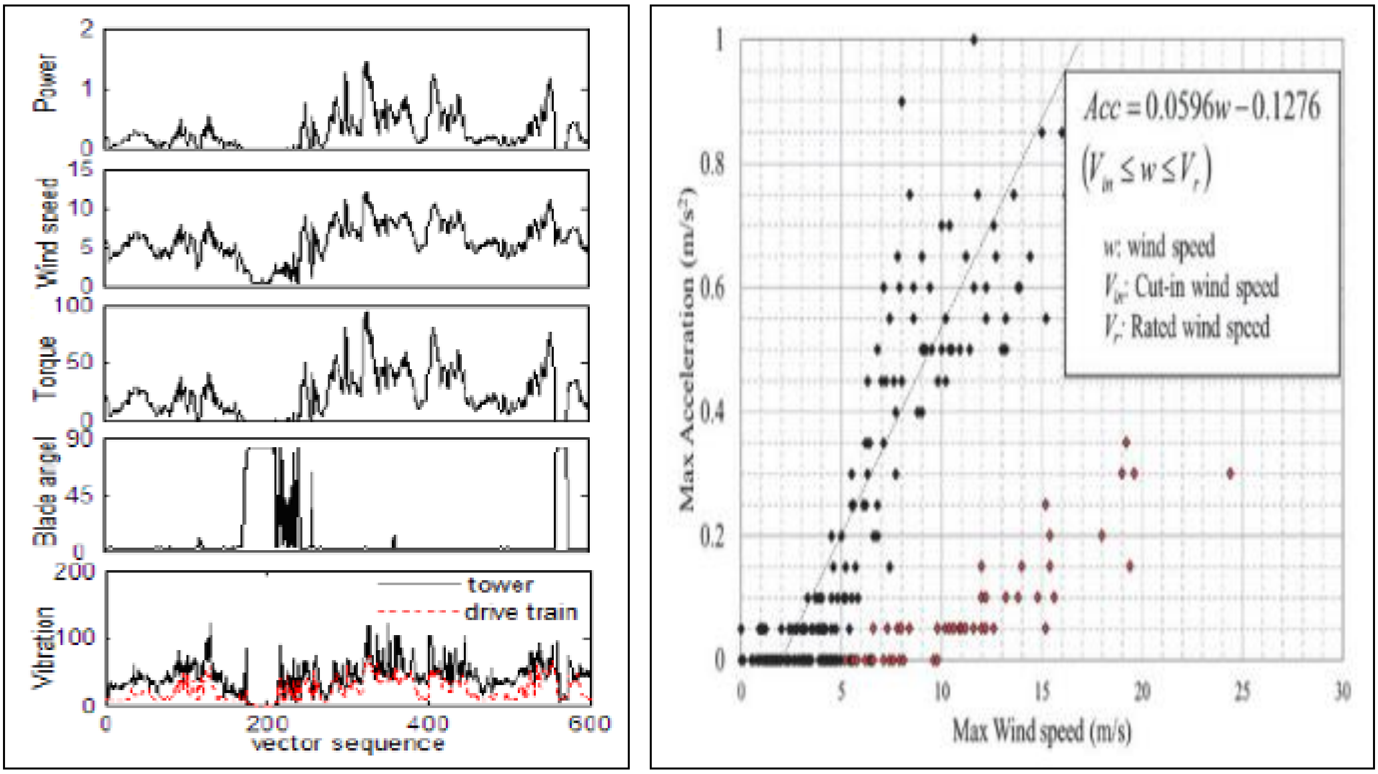


Fig. 4.90. The most important rotational elements of wind turbine:
shaft of rotor with supports, gearbox, and generator

Unbalanced thrust of rotor damages the support structure of tower, causes vibration of tower and its deviation from normal operational conditions (Fig. 4.91 – results of measurements of wind field «Zhangjiakou» to the north from Beijing). However, the dependency of vibration of WT construction from wind speed (Fig. 4.91 a) is obvious.



(a) (b)

Fig. 4.91. Dependence of tower vibration and related variables upon wind velocity below nominal 1.5 MW): a) power; wind velocity (m/s); twisting moment (%); blade (angle degree); vibration (mm/s^2); b) Maximal vibration acceleration depending from wind speed

4.10.2Impact mitigation and management

Vibration protection measures are technical, organizational, therapeutic, and prophylactic. In addition, they can be divided into group and individual measures. Technical measures include:

– vibration reduction in the source of origin – selection of such kinematic and technological schemes that exclude processes caused by shock and sharp accelerations (substitute of cam and crank mechanisms by hydraulic gears, punching by pressing, etc.);
– vibration dampering – transformation of vibration mechanical energy into thermal energy. This can be achieved by application of materials with high internal friction (plastics, rubber), coating of vibrating surfaces by viscoelastic materials (mastics, styrofoam, plastic, etc.);
– vibration suppression: suppression of dynamic oscillations is achieved by installation of vibrating equipment and mechanisms on individual massive solid foundations. Mass of the foundation is selected in such way that amplitude of foundation base oscillation does not exceed 0.1….0.2 mm and 0.005 mm for high precision equipment;
– vibration isolation – reduction of oscillation transmission from source of vibration to an object of protection by use of elastic elements into the vibrating system (vibration isolators, shock absorbers, elastic carriages, etc.).

Suppression of dynamic oscillations is achieved by installation of vibrating equipment and mechanisms on individual massive solid foundations. Mass of the foundation is selected in such way that amplitude of foundation base oscillation does not exceed 0.1….0.2 mm.

Specific vibration protection measures include:

1) elimination of vibration source by equilibration, balancing or centering of equipment;
2) replacement of technological process, substitution of unbalanced machines by balanced ones or their translocation to the location distant from sensitive to vibration objects;
3) traditional constructive ways for decreasing of foundation oscillation levels that includes base strengthening, rebuilding of foundation changing of machine installation on the foundation and changing of machine foundation installation in the plan;
4) use as active and passive vibration isolation of different types as dynamic vibration dampers.

Widely recognized ways to enhance foundation strength is to increase area of foundation base that could be achieved by reinforced concrete bandage (beckets) at the level of foundation base around the perimeter of foundation or by connection of reinforced concrete slabs from one or two sides at the level of foundation base (in the direction of disturbing force effect), Fig. 4.92.

Fig. 4.92. The foundation of modern wind turbine generator

Increase of foundation mass reduces significantly the amplitude of foundation oscillations if mass increase comprises 50-80 % of foundation mass. Increase of the foundation mass (without changing area of its base) is less effective for low frequency equipment as its own oscillations decrease, approaching frequency of forced oscillations and causing danger of resonance. Increase of the foundation mass of high frequency equipment (without changing of base area) can be expedient for decrease of foundation vibration by restoration of their oscillations frequency from the operating frequency of rotate WTs.

Strengthening of foundation can be made by increasing of area of cross-sectional of its elements, introduction of additional longitudinal and transverse bonds, and change of construction design, etc. Most widespread method is application of rigid jackets such as bandage, stiffening belts that encircle the foundation or some of its parts. This allows increase cross-sectional area of foundation and load transmission to its new parts, as well as consolidation of the deformed parts of foundation (if any exists).

The rigid jackets can be made of reinforced concrete or metal. Metal rigid holders are usually used when increased vibration causes visible cracks in foundation perpendicular to the direction of dynamic force.

Transition coefficient expressing the effectiveness of vibration isolation and vibration dampering is calculated by the formula:

$$TC = \frac{F_m}{F} < 1,$$

where F_m – force, acting on base in presence of elastic connection; F – force acting on base in presence of rigid connection. The transition coefficient is calculated as:

$$TC = 1/((f/f_0)^2 - 1),$$

where f and f_0 – corresponding frequency of forced and own oscillations of system.

Usually f/f_0 is equal 3…4, corresponding to required (in many cases) value of TC = 1/8…1/15 (vibration isolation and vibration dampering are good); the lower is a value of TC the higher is vibration isolation or vibration dampering.

The important element in management by vibration of wind turbine is implementation of Condition Monitoring Systems (CMS) during WT operation. Vibration is the one of indicators of wind turbine conditions. Condition Monitoring Systems of WT is presented in Fig. 4.93.

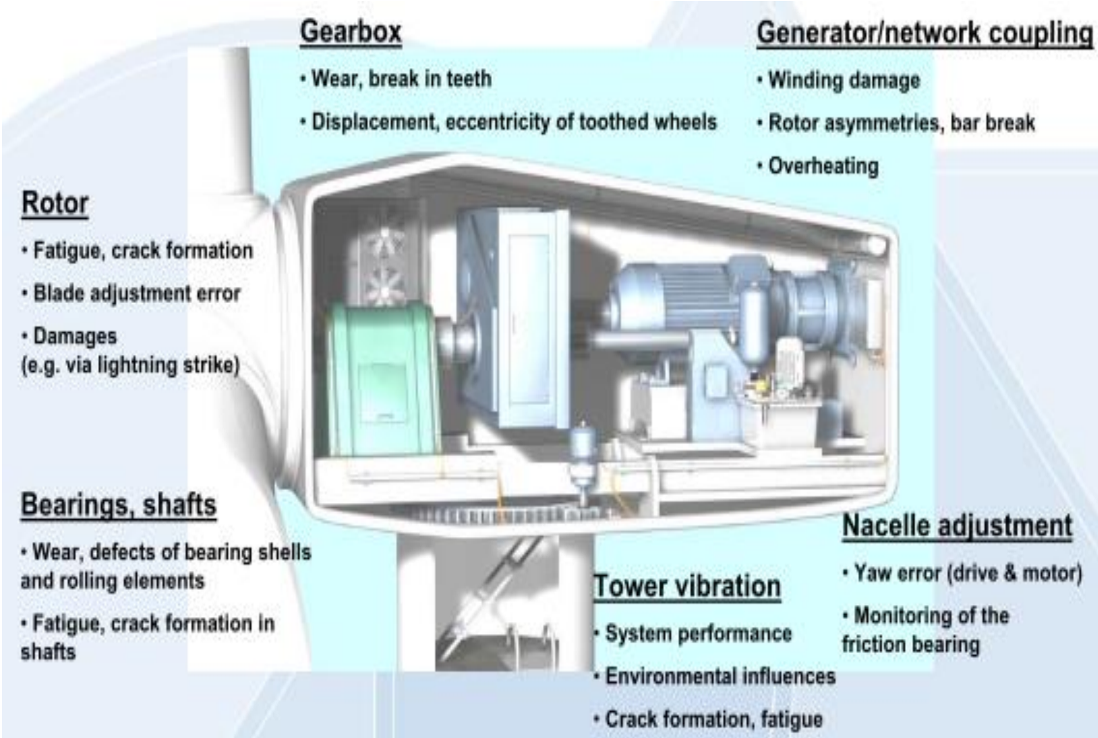


Fig. 4.93. Condition Monitoring System of WT state

The most important elements of wind turbines triggering vibration are controlled by CMS. CMS of WT state in part «Economy» includes observation by key rotating elements of WT: generator + gearbox + bearing support of the rotor shaft (Fig. 4.94).

Digital signals of alarm system switch on as soon as observed parameters exceed technological norms (Fig. 4.95), vibration of WT rotating elements is one of them.

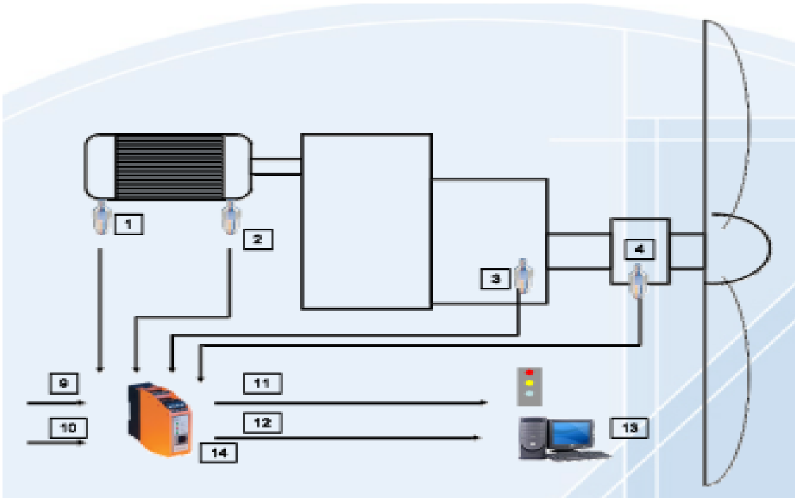
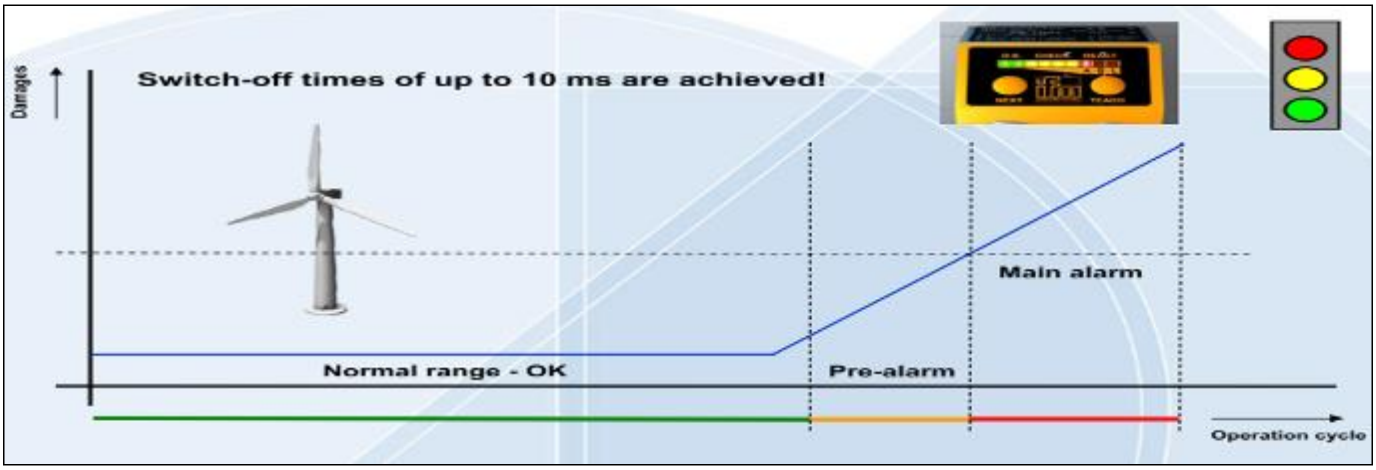
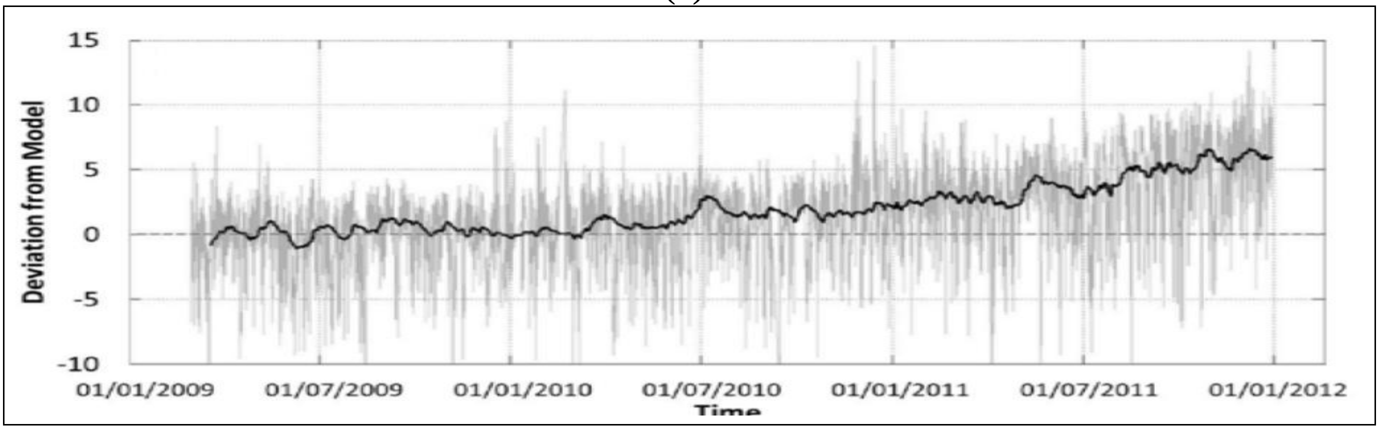


Fig. 4.94. Main elements of WT Condition Monitoring System
1) convertor bearing control; 2) bearing gearbox control;
3) rotor shaft bearing control, (end of gearbox);
4) gearbox bearing monitoring; 9) input signal of rotational frequency (pulse-shaped signal, 4-20 mA); 10) input signal of loading (pulse-shaped signal, 4-20 mA);
11) alarm signal (between 2 and 10 alarm outputs); 12 data transmission interface TCP / IP; 13) PC for processing or data storage;
14) diagnostic by Valley Service Electronic (VSE electronics)



(a)



(b)

Fig. 4.95. Alarm from CMS during beyond of parameters within the limits of installed technical norms

The following conclusions results from the carried out study:

1. According to empirical theory of D.D. Barkan, total vibration of a construction is absent if mass of fixed part of construction in 16 times higher than mass of its movable parts (due to vibration suppression by the mass of the whole construction). Mass of WT movable parts (selected for «DB WPP») varies between 55 and 80 tons. Mass of WT fixed part of varies between 2800 and 4400 tons, respectively. Thus, mass of WT fixed part exceeds mass of their movable parts by 50 – 55 times.
2. Following mitigating measures to avoid vibration will be introduced:
   – selection of relevant aerodynamic profile of WT blades;
   – well balancing the rotating elements of wind turbines at manufacturing stage use of vibration dampers with weight not less than 5 tons.
3. The WT CMS will be installed at the construction site of «DB WPP» in full compliance with regulatory technical requirements. In case if vibration exceeds normative values the maintenance or repair of correspondent element of wind turbines for reduction of vibration to normative values will be carried out.

Conclusion: vibration caused by rotation of separate elements of wind turbines will fully disappear at the levels of load bearing elements and foundations of wind turbines and will not have impact on the environment of the adjacent territories.

4.11 Electromagnetic radiation of wind turbines and the OHPL

The distributed sources of electromagnetic field (cable lines 35 kV and WTs) are probable sources of unfavorable impact on environment and population.

Operation of the wind turbines as work of any electric appliances, even the household ones, creates electromagnetic fields (EMF). Electromagnetic field created by an industrial wind turbines (of capacity over 1 MW) is strong enough, but this type of wind turbine is never installed in the immediate vicinity to the residential area. The measurement of the EMF can vary within the Project territory, depending on equipment location – wind turbines, substations and internal electrical cables. Evaluation of electrical levels and magnetic components of electromagnetic fields of industrial frequency 50 Hz was carried out through modeling of their spatial distribution, according to current official methodology for determination of electromagnetic fields levels of cable and the OHPL.

The hazard levels of the electromagnetic fields were determined in accordance with national sanitary norms. The values from the Annex of European directive on electromagnetic safety was used as maximal permissible levels of magnetic field (due to absence of regulation for industrial frequencies of magnetic fields of overhead power lines.

4.11.1Baseline conditions

4.11.1.1 Electromagnetic interference

Studies have shown that glass and carbon fiber plastics, used for manufacturing wind turbine blades, do not absorb electromagnetic signals, and do not change them. The potential impact of wind turbines on flight safety and the operation of radio engineering equipment of civil and military aircrafts should also be taken into account. All necessary permissions were obtained during the designing phase of the Project.

Conclusion: Impact of wind turbines into the work of regional air navigation systems at and in the vicinity of the DP WPP location is absent.

4.11.1.2 The impact of electromagnetic fields on humans and standardization

The investigation of the specifics of influence of physical factors in the energy and mining sectors of Ukraine, carried out in 2005-2006, has shown that besides of intense noise and vibration at workplaces of electric workshops of power plants the electromagnetic field of industrial frequency (50 Hz) is also a quite common factor affecting on employee health. The obtained data substantiate the necessity to revise the hygienic norms for the magnetic component of the electromagnetic field of industrial frequency as well as infrasound, which has not been reviewed in last 25 years. Fundamentally important is the understanding of the electromagnetic conditions in the environment as a whole, because powerful electricity consumers generate hygienically significant leakage currents in this situation.

Even now, this happens at the territories of modern high-rise buildings, especially when the recently developed State Building Norms of Ukraine allow use the attached and embedded transformer substations with dry transformers. «Dry» transformers are used to replace highly fire hazardous (ignition) transformer oils, prohibited for use in residential buildings. It is also necessary to take into account the negative impact of electromagnetic fields on communication infrastructure (computer and telephone cables, radio modems, etc.).

Electromagnetic fields (EMF) and radiation (EMR) are ones of the most powerful physical factors of negative impact on human health.

Recent studies have proven the risk of various changes in EMF and EMR exposed human body, e.g. dysfunction of the cardiovascular system, mental disorders. Electromagnetic fields increase risks of malignant tumors, birth defects of individual development, fetus development during pregnancy, neurasthenic syndrome. It should be noted that the data on the bioinfluence of this physical factor is somewhat controversial (especially for establishing maximum permissible levels). Therefore, the World Health Organization (WHO) extended the principles of ALARA (As Low As Reasonable – as low as reasonably achievable) [16]: to electromagnetic fields: there are no hazardous levels of EMF and EMR of anthropogenic origin, but there is a limit of technical and economic capacity to ensure their safety). Thus, the population protection from EMR impact acquires an increasingly important medical and socio-economic significance, and in light of this special attention should be given to [109]:

a) state counting and sanitary and epidemiological surveillance of their sources, the number of which is rapidly increasing every year;
b) substantiation of establishing of the calculated sanitary protection zones (SPZ) and limitation zones of urban development (LZUD);
c) radio technical object sanitary passports (RTOs) and other related issues within the competence of the Ministry of Health of Ukraine and its subordinate institutions.

The system of sanitary and hygienic regulation of the EMF maximum permissible levels for the population of Ukraine is based on the principle of restrictions imposition on specific radiation cases. Depending on the location of the source of EMF, a person may be exposed to electric or magnetic component of the electromagnetic field, or their combination, and in the case of being in the wave zone to the effects of the formed electromagnetic wave. Each safety exposure control criterion is selected based on EMF component. The state standards and State Sanitary Rules and Norms require to control of levels of the electric field (EF) by the voltage of the EF – E, W/m. Control of magnetic fields (MF) is carried out in voltage of the MF – H, A/м, or in magnetic induction – B, T. In the zone of the formed wave, control is carried out in density of the energy flux, W/m^2. Currently Ukrainian state sanitary rules for operating electromagnetic fields sources [81, 82, 84, 116-119] are rather advanced and hygienically justified. These rules are very convenient for practical use and more stringent in most provisions than corresponding international documents. The guidance on limitation of the impact of alternating electric, magnetic and electromagnetic fields (up to 300 GHz) developed by the International Commission for Non-ionizing Radiation Protection (ICNIRP) [23] that is the basis of the sanitary requirements of the relevant European Directive [10].

Interim guidelines on limits of exposure to 50/60 Hz electric and magnetic fields. Radiation health [30] establish exposure norms for the population and production for both electric and magnetic fields. However, some of the requirements of this document are obsolete. For example, it establishes the limits of the intensity of an electric field of 30 MHz range at the level of 28 V/meter, while the sanitary norms [10] suggest 3 V/meter (Fig .4.89). The permissible level of the alternating magnetic field of the industrial frequency of 50 Hz for the population is 100 μT, while national standards [81] suggest 1.5 μT. As of the whole low frequency range, there are a number of discrepancies because in the ICNIRP norms the maximum allowable (controlled) levels change continuously in accordance with frequency, and in norms [85] – they are fixed at frequency intervals (Fig. 4.96).

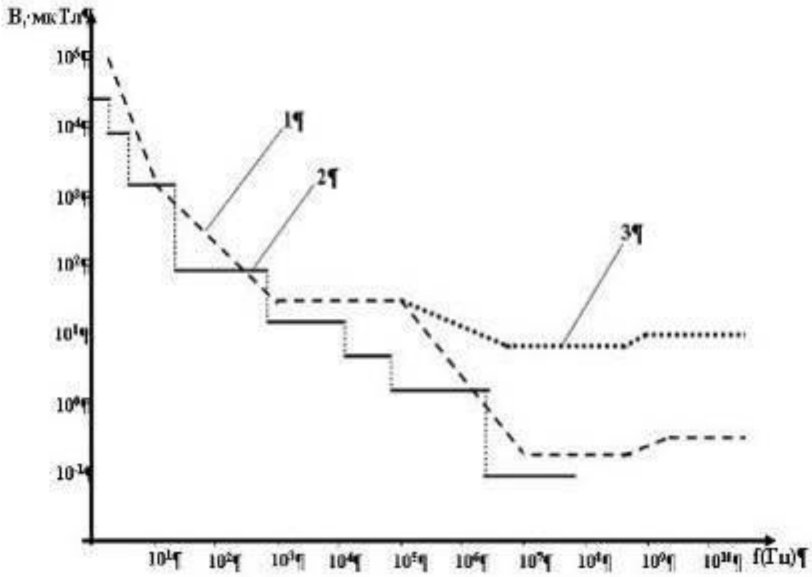


Fig. 4.96. Controlled levels of electromagnetic fields under production conditions
1 – boundary levels according to ICNIRP; 2 – boundary amplitude levels according to the national standard of Ukraine; 3 – amplitude levels according to ICNIRP

However, national regulations of Ukraine on electromagnetic safety have some drawbacks. Sanitary norms [89] recommend protection against the EMF fields with screens made of aluminum, copper, their alloys, steel screens and «permaloy» type of alloys in the form of sheets and wire meshes, in addition to protection by time and distance. The drawbacks of the national regulations are in the lack of guidance on the field parameters that are screened by one or another material. In case of radiation (fields of the wave zone), it is desirable to indicate the step of gridline spacing (or mesh size), depending on electromagnetic wave length. In addition, it is necessary to supplement the list of materials with modern magnetically amorphous alloys, the protective properties of which are even higher than that of heat-treated alloys. Sanitary norms [81] in its part related to impact of industrial frequency fields, defines the term «population» as «people temporarily living or working in the zone of influence of this physical factor, while not having a professional attitude to its source».

Thus, there is no clear distinction between occupational and living conditions that in practice leads to misunderstandings and misinterpretation of electromagnetic safety. The aforementioned norms are the only ones from the current sanitary norms, which contain a list of equipment for monitoring of intensity of electromagnetic fields and radiation. However, this list refers to devices of purely foreign production with large measurement errors (1-4 dB), and that is not quite acceptable for controlling electromagnetic fields and radiation of low levels, which are the main component of negative impact on people.

The most significant drawback of the normative acts, which are in force in Ukraine, are some features of a formal nature, which lead to interpretational discrepancies in practical work. Thus, sanitary norms «State sanitary norms and rules of protection of the population from the influence of electromagnetic radiation» [81] establish the radiation limit at the level 2.5 mW/cm^2 for the 11th range meteorological radar station, operating no more than 12 hours per day with single-order intensity, while in the state sanitary rules [84] this norm is equal to 10 mW/cm^2.

4.11.1.3 Electromagnetic fields of wind turbines and the OHPL

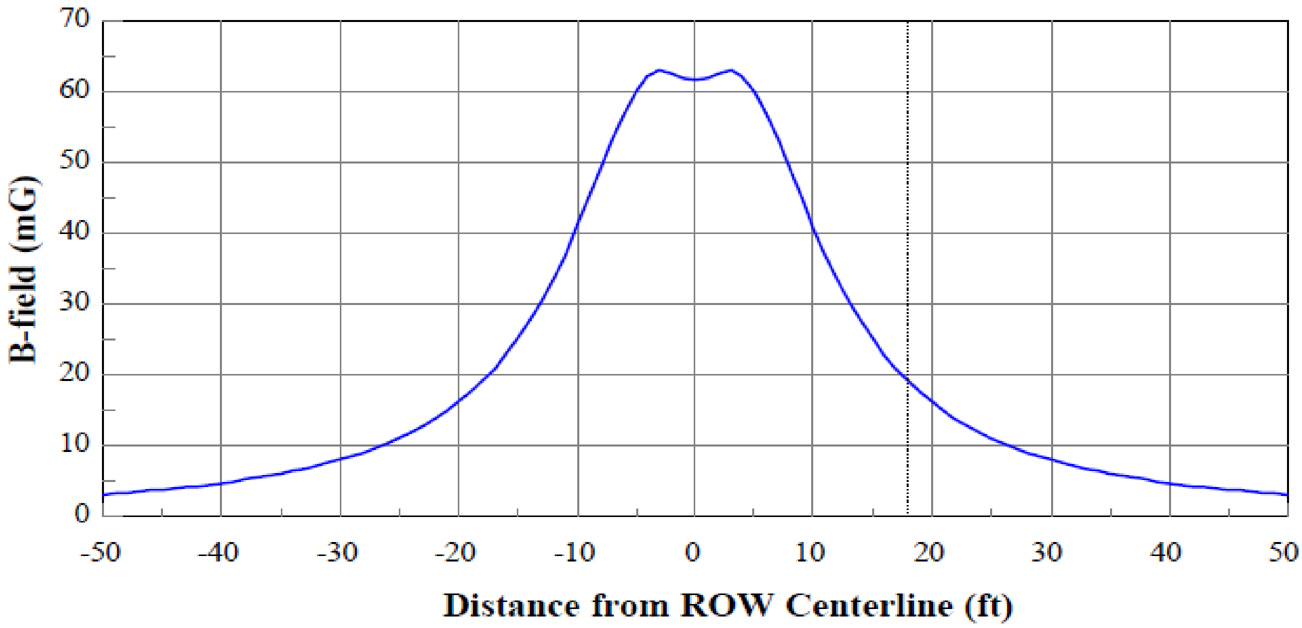
Most of WT electric equipment is mounted at the foundation of the tower (inside), or placed at the altitude about 120 m above the earth's surface. Protection against the radiation sources by distance and screens reduces the impact of radiation of electromagnetic fields.

The highest EMF levels are measured nearby substations. A typical strategy to reduce the influence of electromagnetic fields is to increase the distance from the EMF source. Other strategies also include hiding the cables inside the soil; and placing them together reduces area of impact of EMF fields. The magnetic fields resulted from generation and transmission of electricity from the wind turbines do not pose a threat to human health. In front of the steel doors of the tower of the wind turbine, the measured magnetic field is 0.4 mG (milliGauss) (Fig. 4.97).

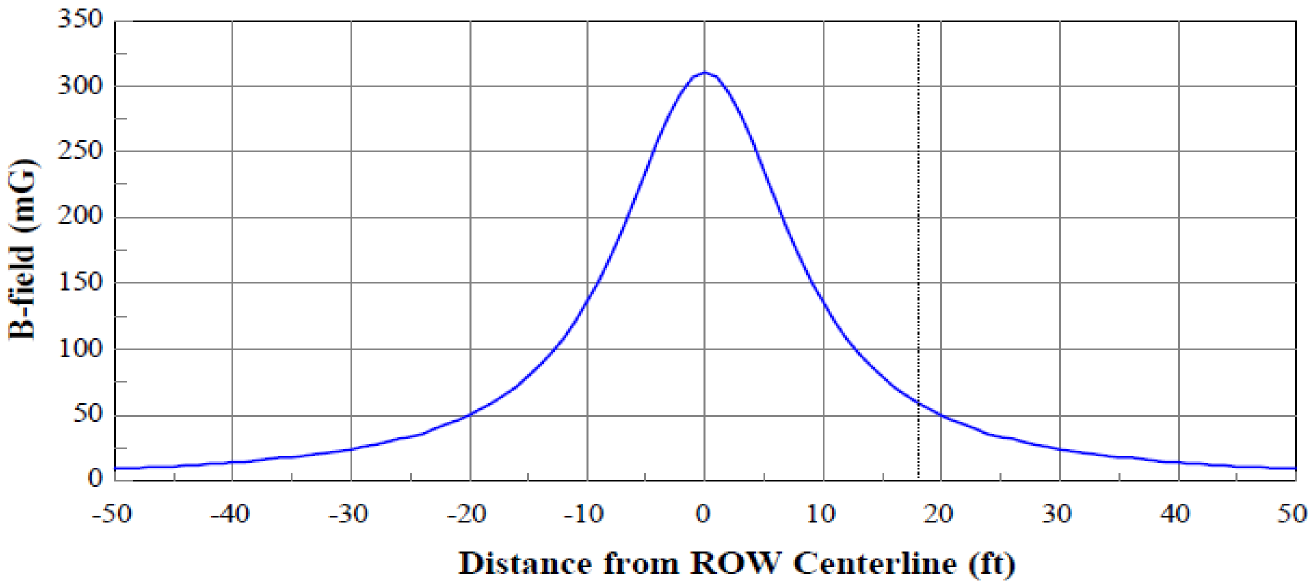
Measured values of the magnetic field in front of the WT door is 0.4 mG, the typical value around the wind turbine is 0.04 mG, and the permissible value is 833 mG.

Fig. 4.97. The magnetic field measured in front of the steel door of the turbine tower with the magnitude of 0,4 mG

Thus, Fig. 4.98 illustrates an example of relationship of the distance and the cables hidden in the soil with the magnetic radiation components of the electrical grids [51]. The test results for the CNE wind turbine (~ 2 MW) show that the magnetic field at a distance of 10 feet (3 m) from the wind turbines and the transformers becomes smaller than the magnetic field of the usual hairdryer. At the distance of 25 ft. (7-8 m) from the wind turbine any magnetic field (measured) is not expected.



(a)



(b)

Fig. 4.98. Characteristics of the magnetic field of the cable, hidden inside the soil (a) and on the soil surface (b) depending on the distance (in feet)

For the simulation of spatial distributions of electromagnetic fields of cable transmission lines, an official method for calculating the electric and magnetic fields of transmission lines was selected. Software «Microsoft Visual Studio» is selected as the software environment, the interface is implemented in the programming language C#, the algorithm is implemented in the «MATLAB» programming language.

The voltage of the electric field of the cable line (CL) is calculated for single-conductor cables with unshielded sections of cable's conductors in relation to the ground.

The current values of voltage of the CL electric field are calculated for planes, which are normally conducted to the direction of the CL through points with unshielded sections of the cable's conductors (Fig. 4.99) under the following conditions:

- unshielded sections of the cable – metal balls with an equivalent radius *re* equal to the double radius of the conductor cable core remoted from the surface of the ground at a distance determined by the Project design, but not less than that specified in 2.3 ПУЕ-2009 [4];
- engineering communications, buildings and structures, vehicles, people do not effect on the distribution of the electric field of the CL in space;
- the relative permittivity of the soil ε_r is equal to six.

The complex operating voltage of the CL electric field at the intercrossing point on the plane is calculated as the sum of the complex operating voltage of the electric field formed by each of the *k* unshielded network of the cable $\dot{E}_k^{н.}$ and their mirrored images $\dot{E}_k^{н.д.}$ at this point (Fig. 4.99), using the formula:

$$\dot{E} = \sum_k \dot{E}_k^{н.} + \sum_k \dot{E}_k^{н.д.}$$

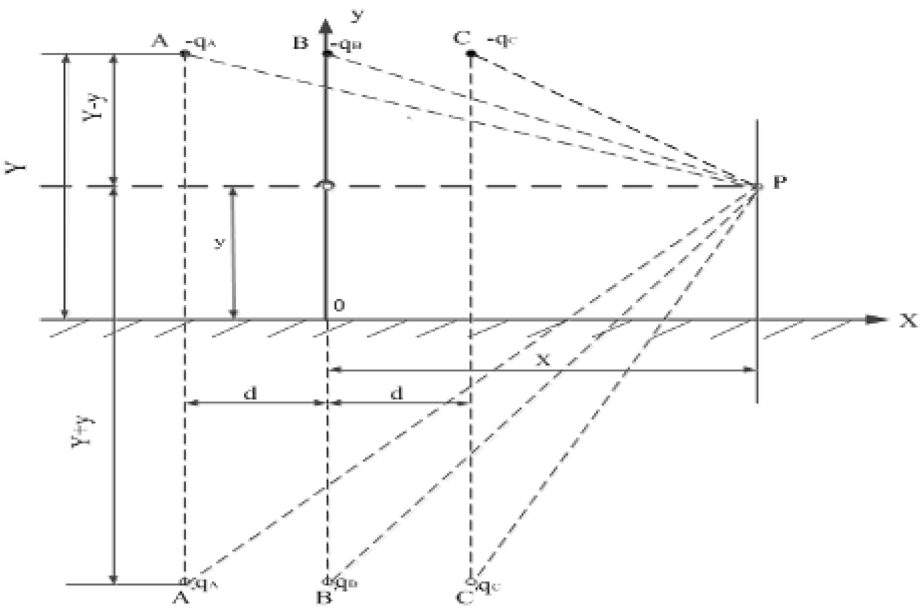


Fig. 4.99. The layout of the cables of the CL (first case)

The complex operating voltage of the CL electric field for each of *k* unshielded section of the cable $\dot{E}_k^{н.}$ at the point with coordinates *x* and *y* on the plane of the intercrossing is calculated by the formula:

$$\dot{E}_k^{н.}(x, y) = \frac{C * \dot{U}_k}{2 * \pi * \varepsilon_0 * \varepsilon_r * \sqrt{\left(x - X_k^{н.}\right)^2 + \left(y - Y_k^{н.}\right)^2}} * \exp\left(j * \psi_k\right),$$

where C – is the electrical capacity of the k-th unshielded part of the cable, Ф; $\dot{U}_k$ – complex active value of phase voltage of the k-th cable, B; $X_k^{н.}$, $Y_k^{н.}$ coordinates of k-th unshielded part of the cable on the plane of the section in intercrossing, according to Fig. 4.99, м; $\varepsilon_0 = 8{,}854 * 10^{-12}$ – electric constant value, Ф/м; ε_r – relative dielectric permittivity of the environment,

$$\psi_k = \arg\left[\left(x - X_k^{н.}\right) + j * \left(y - Y_k^{н.}\right)\right]$$ - the angle, radian.

Complex operating of phase voltages are calculated by the following formulas:

$$\dot{U}_A = \frac{U}{\sqrt{3}} * e^{j*0}; \quad \dot{U}_B = \frac{U}{\sqrt{3}} * e^{-j*\frac{2*\pi}{3}}; \quad \dot{U}_C = \frac{U}{\sqrt{3}} * e^{j*\frac{2*\pi}{3}}.$$

The data of formula have been simplified:

$$\dot{U}_A = \frac{U}{\sqrt{3}}; \quad \dot{U}_B = \frac{U}{\sqrt{3}} * \left(-\sqrt[3]{-1}\right); \quad \dot{U}_C = \frac{U}{\sqrt{3}} * (-1)^{\frac{2}{3}};$$

The complex operators of the electric field voltage of the mirrorred images for each of the *k* unshielded sections of the cable $\dot{E}_k^{н.д.}$ at the point with the coordinates x and y on the plane of the intercrossing are calculated by the formula:

$$\dot{E}_k^{н.д.}(x, y) = \frac{-C * \dot{U}_k}{2 * \pi * \varepsilon_0 * \varepsilon_r * \sqrt{\left(x - X_k^{н.д.}\right)^2 + \left(y - Y_k^{н.д.}\right)^2}} * \exp\left(j * \varphi_k\right)$$

where $X_k^{н.д.}$, $Y_k^{н.д.}$ – the mirrored image coordinates of the *k*-ї unshielded section of the cable on the plane of the intercrossing in accordance with Fig. 4.99, m;

$$\varphi_k = \arg\left[\left(x - X_k^{н.д.}\right) + j * \left(y - Y_k^{н.д.}\right)\right]$$ – the angle, radian.

Capacity of the cable section that are unshielded relative to the ground area is calculated by the formula:

$$C = 8 * \pi * \varepsilon_0 * \varepsilon_r * r,$$

where r – the radius of conductor cable core, meters.

Calculating the functional values of CL magnetic induction is performed for a plane, which lines up normally to the direction of the CL route through the point of the least cavity of the cables under the following conditions:

- CL cables – is a system of infinitely long parallel wires of infinitely small diameter with currents that are remote from the surface of the ground to the depth determined by the Project decisions;
- engineering networks, buildings and structures, vehicles, people do no affect on the distribution of the electric field of the CL in space;
- the relative magnetic permittivity of the soil μ_r is equal to one.

The complex active magnetic inductions of the CL electromagnetic field in the point on the intercrossing plane are calculated as the sum of the complex active magnetic inductions $B_к^{пр}$, generated from the *k*-currents of the CL at this point (Fig. 4.100) by the formula:

$$\dot{B} = \sum_k \dot{B}_k ,$$

In case of current absence in the shields of single-core cables, the complex active magnetic inductions of the electromagnetic field of each of the *k*- currents for the CL at the point with the coordinates *x* and *y* on the plane of the intercrossing are calculated by the formula:

$$\dot{B}_k(x, y) = \frac{\mu_0 * \mu_r}{\pi} * \frac{\dot{I}_k}{\sqrt{(x - X_k)^2 + (y - Y_k)^2}} * \exp\left[j * \left(\psi_k - \frac{\pi}{2} \right) \right],$$

where $\dot{I}_k$ – complex operating current cable, A;

X_k, Y_k – coordinates of the trace of the geometric axis of *k*-th on the plane of intersection according to Fig. 4.100, m;

$$\psi_k = \arg\left[(x - X_k) + j * (y - Y_k) \right] -$$ angle, radian

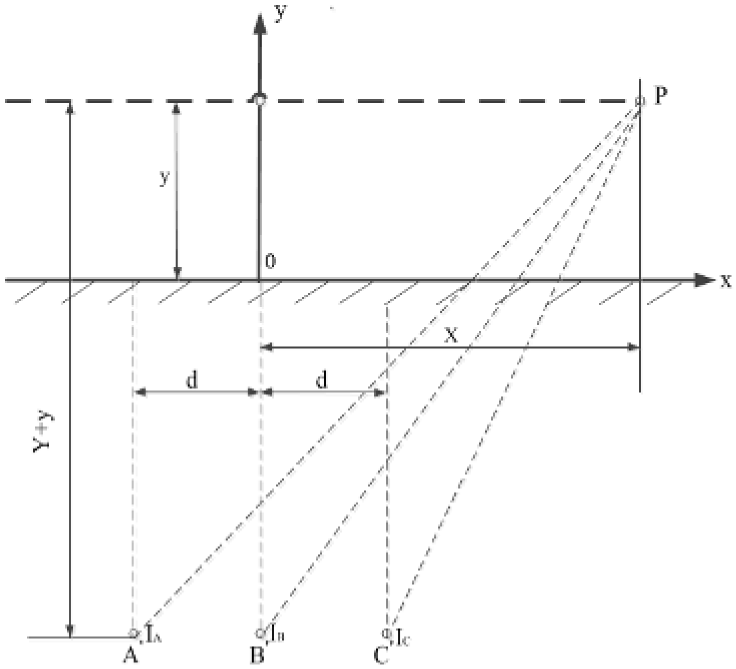


Fig. 4.100. Scheme of cable location (second case)

For case when single-conductor cables in the screens which currents flow (the screens are grounded on both sides) for calculation of complex active magnetic induction of each electromagnetic field is used, the each of the k-currents of the cable line $\dot{B}_k$ at the point with the coordinates x and y on the intersection plane the following formula is used:

$$\dot{B}_k(x, y) = \frac{\mu_0 * \mu_r}{\pi} * \frac{\dot{I}_k * m}{\sqrt{(x - X_k)^2 + (y - Y_k)^2}} * \exp\left[j * \left(\varphi_k - \frac{\pi}{2} \right) \right]$$

where the correction coefficient *m* for the cable’s cross section 300 mm^2 is equal to 0,15.

Outputs are the data that characterize a cable transmission line, namely:

– voltage of cable transmission line;

– the distance between the cables' axes;
– cable core's radius;
– depth of cable laying;
– the most functional value of current strength.

Measurements are carried out at an altitude of 0.5 m. The results of calculations of the electric field voltage of cable lines 35 kV are presented in Fig. 4.101.

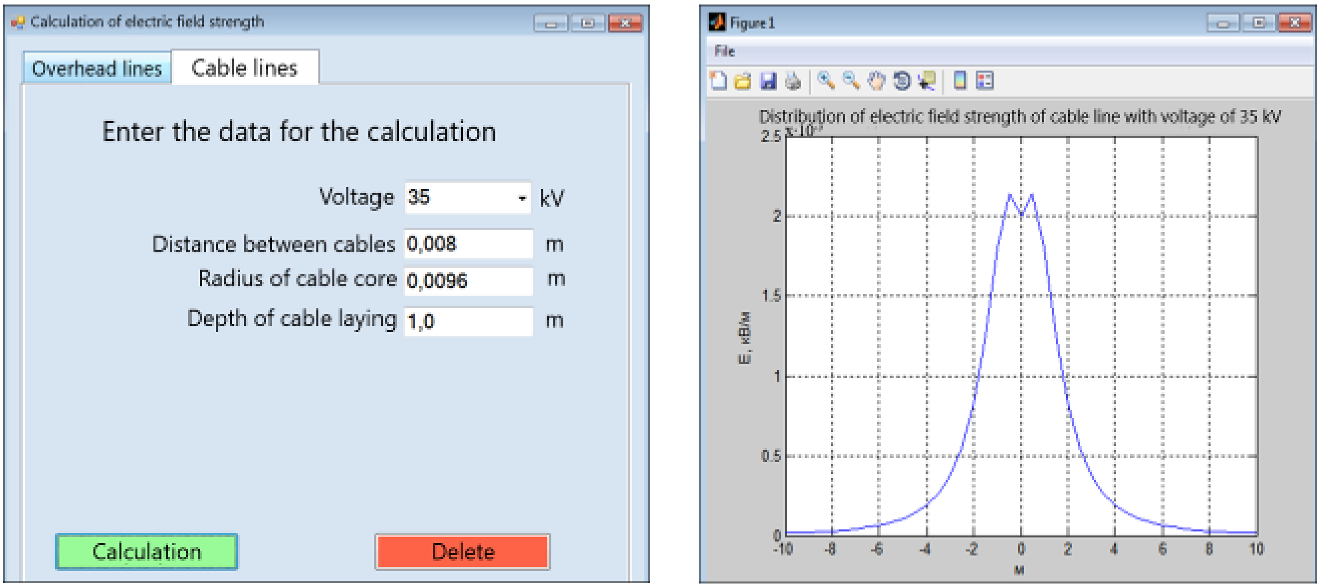


Fig. 4.101. Tension of electric field of the cable line 35 kV

According to [2] the maximum permissible level of the electric field strength of industrial frequency within the residential zone is 1 kV/m, and in the residential area outside the residential zone, it is 5 kV/m.

Consequently, the tension of electric field of the cable lines with loads laid down in Projects design cannot pose a danger to the population and the environment.The results of calculations of the induction of a magnetic field of cable line 35 kV are presented in Fig. 4.102.

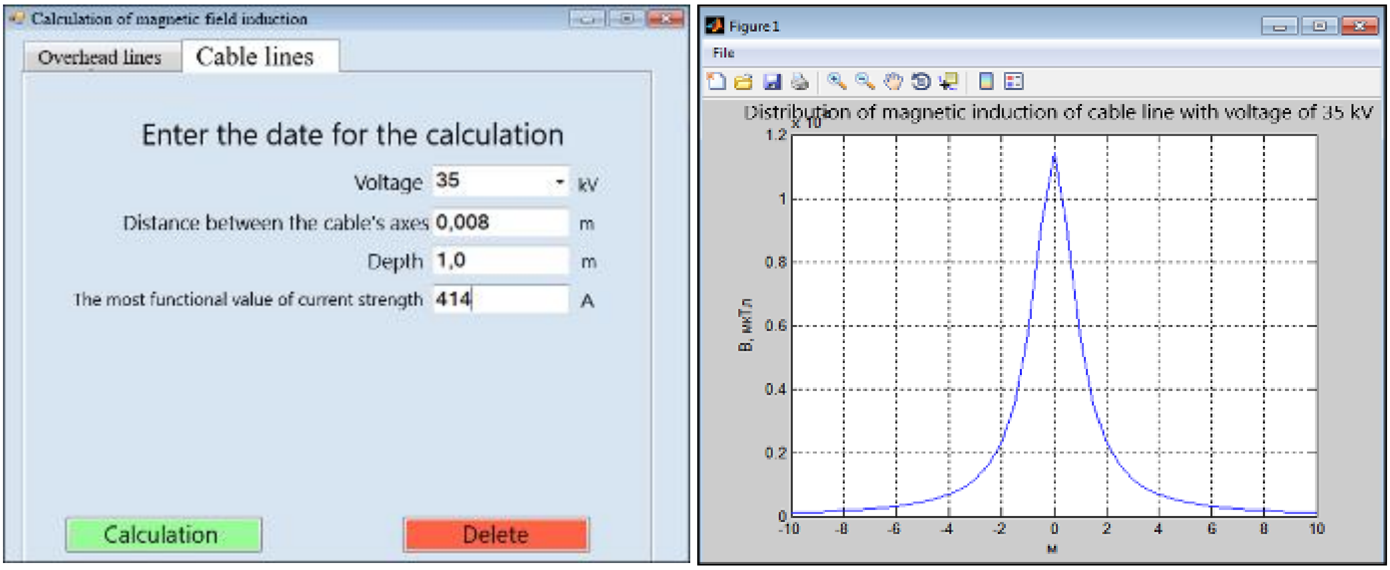


Fig. 4.102. Magnetic induction of cable line 35 kV

According to [1] induction of magnetic field on height 0.5 meters above the ground surface should not exceed 0.5 µT. Results of calculations shows that exceeding of this value is observed only within the boundaries of the object, directly above the cable line.

The field strength from the electric cables depends on the electrical voltage, the distance from the source of radiation, the relative phasing of the electrical circuit and the location of conductors. Measurements of magnitudes of both magnetic and electric fields are given below [2]:

– Measurements of the magnetic field beneath the 220 kV high-voltage transmission line showed the highest values of 7.8 microtesla (µT or 78 mG). Typical values of the magnetic field nearby the 330 kV high-voltage transmission line varies between 5 and 50 mG on the distance of 30 m from the center of the auxiliary structure. The data of these measurements are within the expected values for the usual EMF sources, Table 4.60;
– Measurement of the electric field from the 220 kV high-voltage transmission line showed a maximum value of 3.2 kV/m, while from the 115 kV line – 0.07 kV/m and 0.01 kV/m, measured on the distance of 30 m and 60 m respectively.

Table 4.60 – Magnetic component of typical EMR sources

Source	Typical measurements, mG	Range of measurements, mG
TV	1	0.2 - 2
Refrigerator	2	2 - 5
Electric kettle	3	2 - 10
PC	5	2 - 20
Electric blanket	20	5 - 30
Hairdryer	25	10 - 70
Power line (beneath the line)	20	10 - 200

The main sources of possible adverse effects on the population and the environment as a whole are dispersed sources of electromagnetic field of the OHPL with voltage of 150 kV. Estimation of the levels of electrical and magnetic components of electromagnetic fields at an industrial frequency of 50 Hz was carried out by the method of modeling their spatial distributions in accordance with the current official methodology of levels of electromagnetic fields of cable and the OHPL [73].

The hazard levels of the fields were determined in accordance with national sanitary norms [20]. Taking into account that the levels of the magnetic fields of the industrial frequency of transmission lines are not normalized, the values laid down in the annex (mandatory) to the European directive on electromagnetic safety were adopted at the maximum permissible levels [82]. Simulation of the electric field intensity and the magnetic field induction is performed with calculations in a complex form based on the basic method [73].

Outputs are data that characterize the transmission line, namely:

– voltage of the OHPL of transmission;

– height of suspension of the cable on the riser;
– dimension of the OHPL;
– height from the surface of the earth inside the run;
– distance between phase axes;
– number of wires in the phase;
– radius of wire;
– step of splitting;
– maximum power transmitted over the OHPL.

The results of calculations of the electric field strength of the OHPL are given below (Fig. 4.103). Consequently, the tension of the electric field of the OHPL with loads placed in the design documentation cannot pose a danger to the population and the environment. The results of calculations of induction of a magnetic field of the OHPL are given below (Fig. 4.104).

The levels of the magnetic field of the industrial frequency of the OHPL in accordance with the national standard [20] are not standardized. The maximum permissible level according to the international standard [82] is the induction of a magnetic field of an industrial frequency of 100 μT.

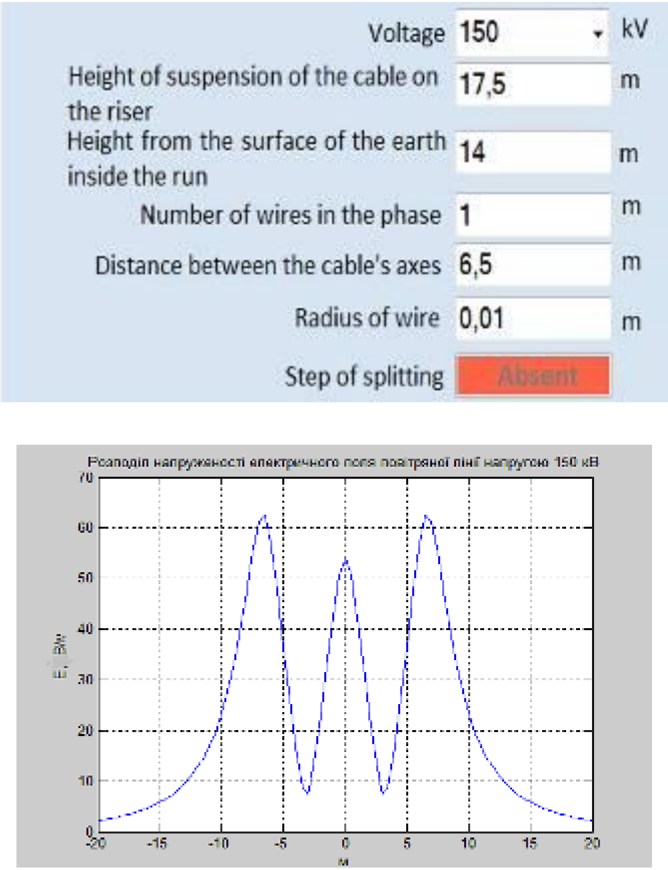


Fig. 4.103. Voltage of the electric field of the 150 kV OHPL

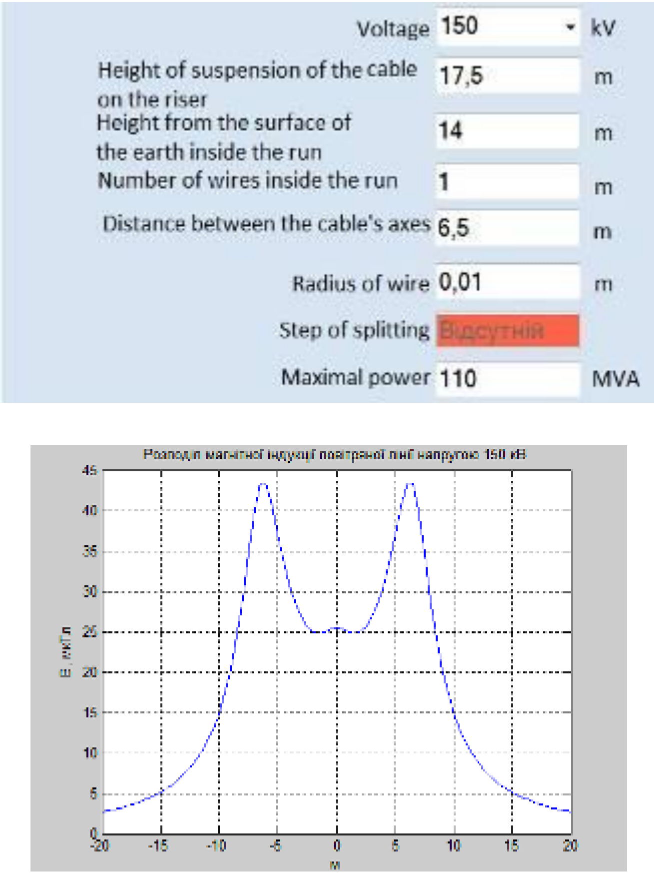


Fig. 4.104. Induction of the magnetic field of the 150 kV OHPL

Due to operation of the substation and its elements, the highest magnetic field alterations from 1 mG to 66 mG were recorded (measured beneath the safety fence around the substation). Conclusions on electromagnetic radiation:

1. Operation of the wind turbines, as work of any electric appliances, even the household ones, creates electromagnetic fields. In an industrial wind turbine (with power over 1 MW), the electromagnetic field is quite strong. The results of the EMF measurement can vary within wind power plant area, depending on equipment location – wind turbines, substations and internal electrical cables. Measurement results of magnitudes of both magnetic and electric fields are given below [2]: The measurement of the magnetic field near 220 kV high-voltage transmission line showed maximum value of 7.8 microtesla (μT or 78 mG). Typical values of the magnetic field levels near the 330 kV high-voltage transmission line are from 5 to 50 mG at a distance of 30 m from the center of the auxiliary structure.
   2.2. The measurement of the electric field from the 220 kV high-voltage transmission line showed a maximum value of 3.2 kV/m, while from the 115 kV line – 0.07 kV/m and 0.01 kV/m, measured at a distance of 30 m and 60 m respectively.
   2.3. During the operation of the substation and its elements, the highest magnetic field alterations from 1 mG to 66 mG were recorded (measured near the security fence around the substation).
   2.4. Measured values of the magnetic field: in front of the door 0.4 mG (miliGauss), the typical value around the wind turbines is 0.04 mG, the permissible value is 833 mG [2, 30].

4.11.2 Impact mitigation and management

The main planned measures for avoidance of the negative impact of electromagnetic effects on personnel are:

- installation of warning signs on the places of possible electromagnetic influence;
- informing personnel and on magnitude of the electromagnetic field on the site of Project;
- determination of the time interval for works near WTs and the OHPL;
- periodic measurement of the electromagnetic field near WTs and the OHPL.

Conclusion: the electromagnetic fields emitted by wind turbines and electric power transmission cable lines do not pose a threat to human health and the environment.

5 SOCIO-ECONOMIC

5.1 Baseline conditions

5.1.1 Population

As of 01.01.2017, the total population of Bilozerskyi District was 66 462 persons [114], of which 2270 persons live in the village Oleksandrivska, 2170 persons in Pravdinska Village Council, 2314 persons in Posad-Pokrovska Village Council. in the immediate vicinity to Project. The number of population in villages presents in Fig. 5.1 - Fig. 5.3.

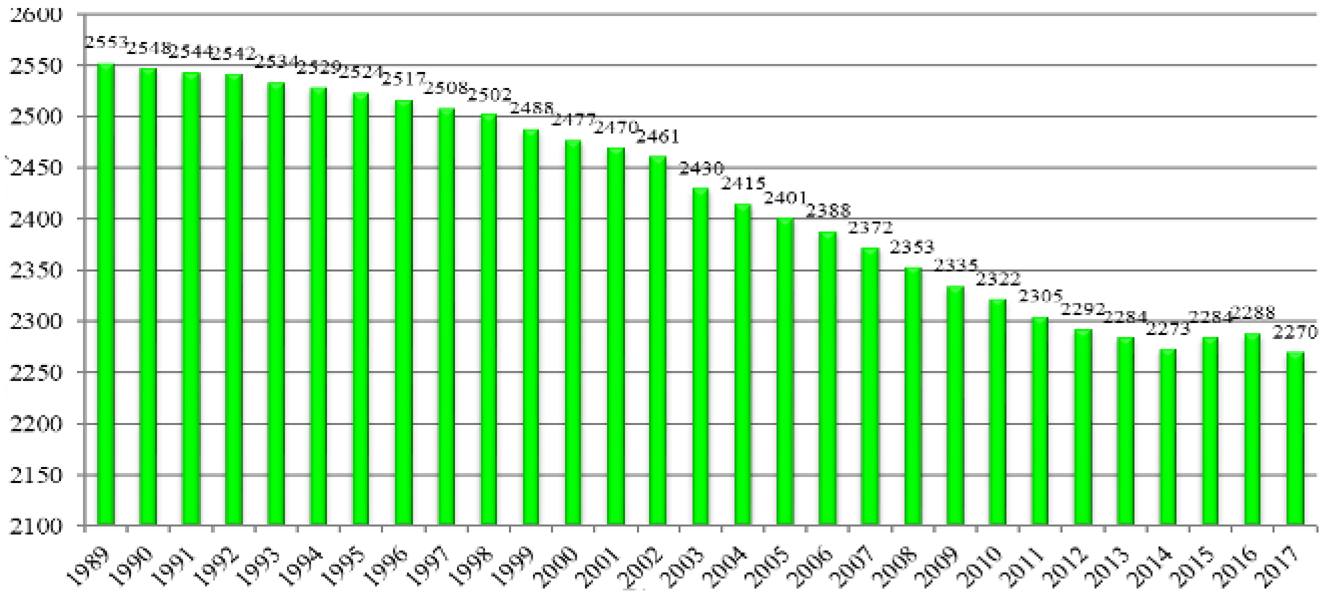


Fig. 5.1. The dynamics of population change in the Oleksandrivska Village Council

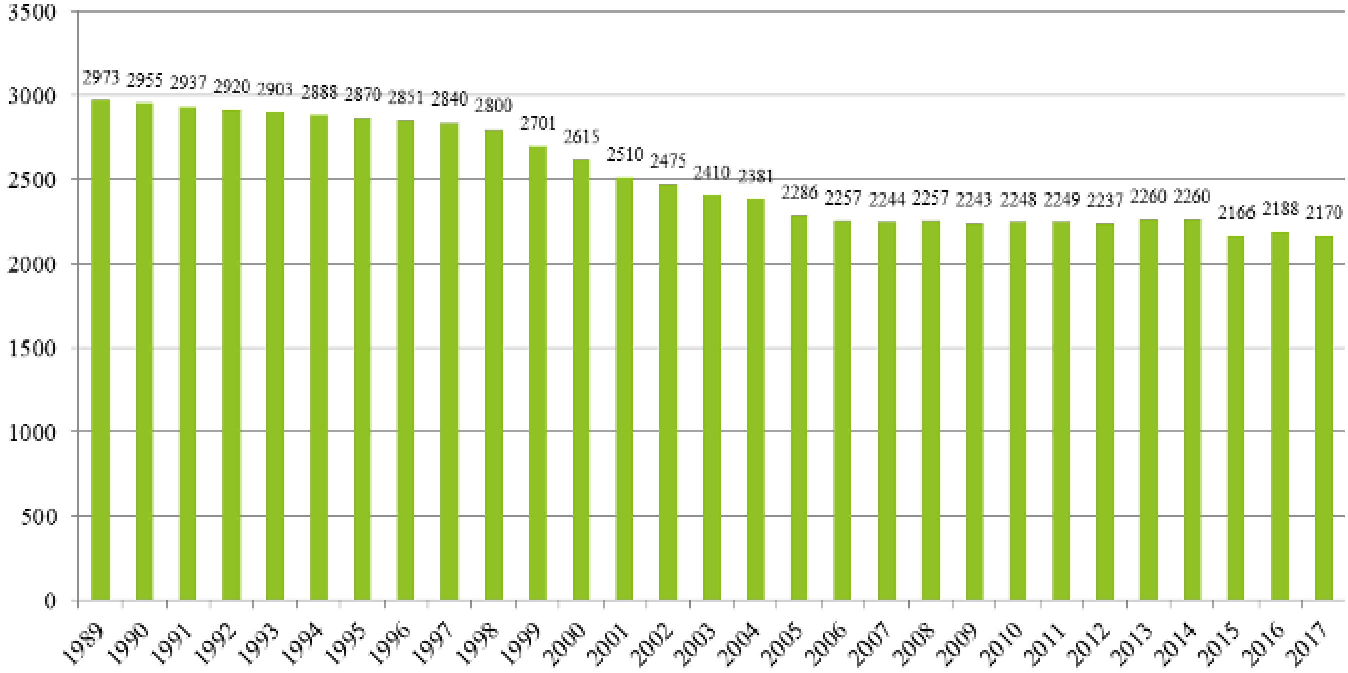


Fig. 5.2. The dynamics of population change in Pravdinska Village Council

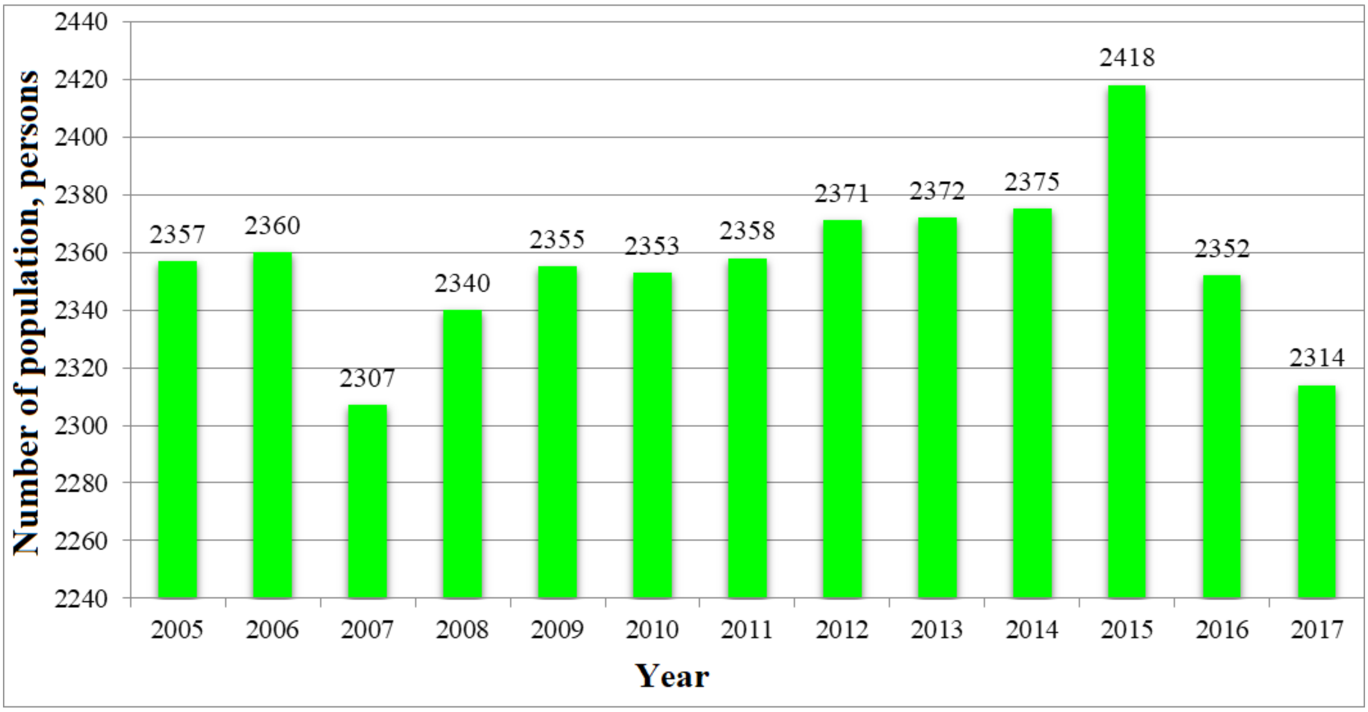


Fig. 5.3. The dynamics of population change in the Posad-Pokrovska Village Council

The demography of population of Oleksandrivka Village Council has negative trend until 2015. Coefficient of natural increase of population in 2015 was -2.0. However, recently, the decreasing trend of population slowed down comparing to the previous years due to the state financial support of newborns, Table 5.1.

Table 5.1 – Birth and mortality trends of the population of the of the Oleksandrivka village council

Year	Number of people		
	Birth	Mortality	Total number
1993	32	46	2534
1994	30	34	2529
1995	27	38	2524
1996	34	40	2517
1997	32	26	2508
1998	19	30	2502
1999	22	36	2488
2000	34	42	2477
2001	24	30	2470
2002	18	47	2461
2003	12	44	2430
2004	21	33	2415
2005	26	45	2401
2006	25	47	2388
2007	29	47	2372
2008	23	54	2353
2009	16	34	2335

Year	Number of people		
	Birth	Mortality	Total number
2010	25	37	2322
2011	28	39	2305
2012	26	37	2292
2013	22	42	2284
2014	18	22	2273
2015	22	30	2284
2016	17	47	2288
2017	6	43	2270

A similar tendency is observed on the territory of Pravdinska Village Council. Indicators of the birth rate and mortality of the Posad-Pokrovsky Village Council are given in Table 5.2.

Table 5.2 – Birth and mortality trends of the population of the Posad-Pokrovska village council

Year	Number of people		
	Birth	Mortality	Total number
2005	16	48	2357
2006	18	44	2360
2007	28	49	2307
2008	30	41	2340
2009	31	42	2355
2010	26	32	2353
2011	28	37	2358
2012	27	32	2371
2013	32	35	2372
2014	24	39	2375
2015	24	43	2418
2016	22	28	2352
2017	15	41	2314

The coefficient of migration growth in 2015 was 0.1 %. Better job opportunities, possibility for career and higher salaries for people with higher education explain the observed tendency in outflow of young people of 18-28 old to the large cities Kherson, Mykolaiv, Odessa. Most of village population (men) look for a job outside the region and abroad.

The young men mainly are employees at nearby enterprises in cities Kherson, Mykolaiv, and Odessa because of absence of work places in the Oleksandrivka Village Council. Other reasons of work migration to above-mentioned cities are higher salaries, bigger variety of job opportunities and higher social benefits.

Characteristic of population in Oleksandrivka, Pravdinska, Posad-Pokrovska Village Councils present in Table 5.3.

Table 5.3 – Characteristic of population in Oleksandrivka, Pravdinska, Posad-Pokrovsky Village Councils

Settlement	male	female	young peoples under 18 years old	lonely citizens	able-bodied population	unemployed	temporarily moved beyond the boundaries of the settlement
Oleksandrivka	1046	1224	284	11	1272	438	131
Pravdinska	1044	1126	353	14	1456	235	150
Posad-Pokrovsky	1296	1018	268	16	1543	560	279
Total:	6754		905	41	4271	1233	560

Conclusion: Coefficient of natural increase of population in 2015 was -2,0. However, recently, the decreasing trend of population slowed down comparing to the previous years due to the state financial support of newborns.

5.1.2 Social composition (nationalities, clans/tribes, minorities)

The population of Bilozerky District and Oleksandrivska, Pravdinske Village, Posad-Pokrovka Village Councils are multinational, Fig. 5.4.

Ukrainians, Russians, Belarusians, Moldovans, Armenians and other nationalities constitute the ethnic composition of Bilozerskyi District [112]. Armenian and Moldavian are the most notable national minorities in the District. Their basic type of employment is trade. The clan/tribal structure is absent.

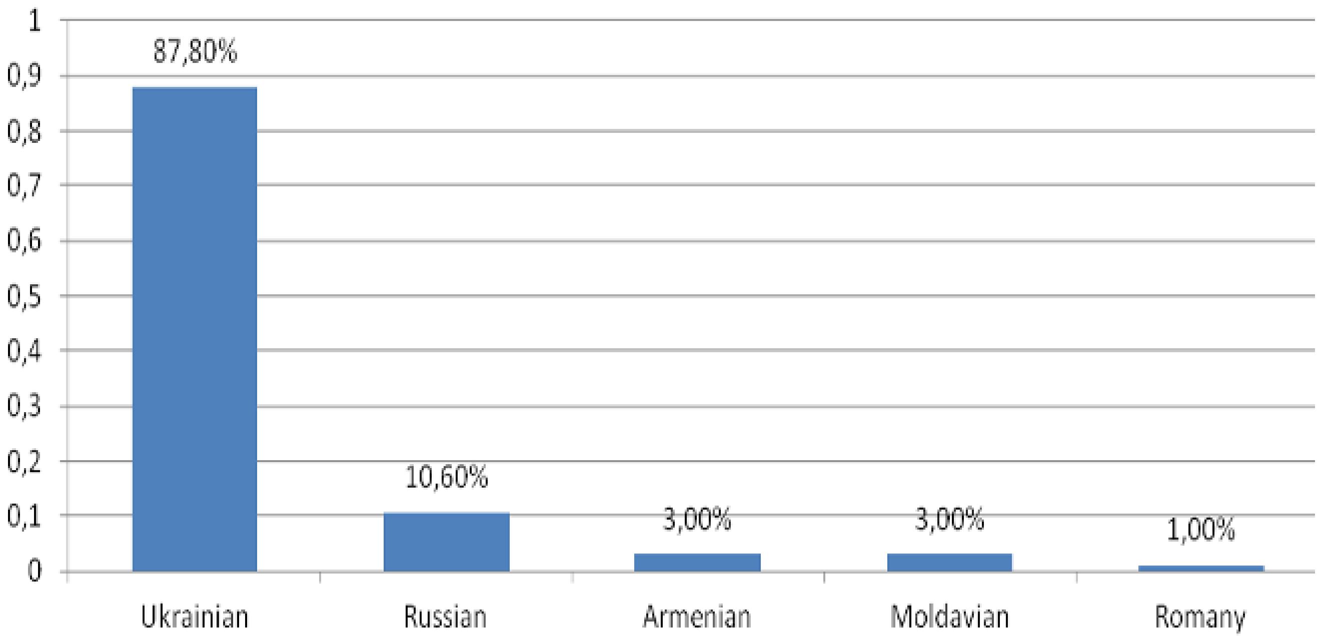


Fig. 5.4. The native language of population of the Kherson region (as of 2015)

Conclusion: construction and operation of the Project will not cause significant changes of already existing multinational social composition of communities in Bilozerskyi District.

5.1.3 Conflicts and social tension

Against the backdrop of a rather disproportionate development of farms in the communities of the Oleksandrivska, Pravdinska and Posad-Pokrovska Village Councils, the main features of their social situation remain the orientation for servicing the regional center and suburban households.

Contradictions and conflicts between different social groups, as well as contradictions and conflicts on the national, linguistic and religious grounds within the Oleksandrivska, Pravdinska and Posad-Pokrovska Village Councils, are not observed or evident.

Conclusion: Construction and operation of the Project will increase the level of employment and material wellbeing, decrease outflow of the able-bodied part of the villagers that will promote improvement of social status of citizens.

5.1.4 Sources of income

The main sources of income within all neighbourhoods are: agriculture, retirement pension and wage labor. Due to the suitable features of the land and climate, grape cultivation and wheat/sunflower plantations are the most common agricultural activities in the neighbourhoods. In addition, gardening products such as potatoes and tomatoes are also suitable for certain areas. Apart from agricultural activities, local communities also are engaged in beekeeping and livestock activities. Primary, secondary and tertiary income sources in the settlements are given in Table 5.4.

According to the information obtained from neighbourhood headmen, the predominant source of income is wheat or sunflower plantations within the Project impact area. Retirement pension and grape cultivation are also important income sources.

Table 5.4 – Income source of settlements

Settlement	Primary Income Source	Secondary Income Source	Tertiary income sources
Oleksandrivka	Wheat/sunflower plantations	Grape cultivation	Wage labor
Pravdinska	Wheat/sunflower plantations	Wage labor	Retirement pension
Posad-Pokrovska	Retirement pension	Wheat/sunflower plantations	Grape cultivation

Wheat/sunflower plantations. The growing of sunflowers and wheat is one of the leading branches of the Kherson region. This type of activity is also prevails on territory of the Bilozerskiy District. On territory of the District located large plantations of sunflower and wheat, that belong to local farmers. Growned products, usually, processed (production of flour, oil, seeds). Despite of the number of measures implemented by local farmers to increase yields, there are threats of rapid decline in harvest. Such threats are caused both by natural causes (absence of precipitation, rising air temperature), and economic (water cost, lack of funds for the restoration of existing irrigation systems).

Grape cultivation. Due to temperate continental climate with mild small snow-covered winter and hot, dry summers, the territory of the Bilozerskiy District is suitable for growing berries, fruits, vegetables and grapes. Growing of grapes is one of the most widespread activity in the area of the location of the «DB WPP». The main growers of grapes are local agribusinesses. The part of the produced products is usually processed in purees, juices and raw materials for the production of alcoholic beverages. Part of the processed products is purchased by the companies «Sandora», «Jaffa» and the «Odesa Children's Food Factory».

Retirement Pension. People, who are living in the neighbourhoods are mostly retired and their retirement pension depends on agricultural business. Retirement pension is the main income source for residents of villages Oleksandrivka, Pravdino and Posad-Pokrovske.

Wage Labor. People who are at working age within the neighbourhoods are mostly working in the factories located around the region. Most of these factories produce agricultural products and employees are supplied from the region as well as raw material needs.

The dynamics of filling the budget of the Oleksandrivka village council per capita over the last five years is given in Table 5.5.

Table 5.5 – The size of the budget of the Oleksandrivka village council

Year	In total, thousand UAH	Per capita, thousand UAH	Including			
			Own receipts	Per capita	Grants Investments	Per capita
2013	1507.4	0.7	374.0	0.2	1133.4	0.5
2014	1866.2	0.8	555.3	0.2	1310.9	0.6
2015	2184.7	1.0	868.0	0.4	1316.7	0.6
2016	4069.1	1.8	1425.7	0.6	2634.4	1.2
2017	3889.3	1.7	1887.1	0.8	2002.2	0.9

The budget of Pravdinska village council for 2018 is 1560.0 thousand UAH. The size of the village council budget per capita is 718.0 UAH.The budget of the Posad-Pokrovka village council for 2018 is 5459.8 thousand UAH. The size of the budget of the village council per capita – 2359.0 UAH.

Conclusion: There is expected creation of new working places and involvement of the local firms and companies in material supply and services during construction and operation of the Project. This will contribute to decreased outflow of local population and to improvement of demographic situation in villages: Oleksandrivka, Pravdinske, Posad-Pokrovka and Bilozerskyi i District in a whole.

5.1.5 Labor force, unemployment and poverty

The main indicators of the labor market in 2000-2017 in Kherson region and Indicators of labor efficiency are showed in Table 5.6, Table 5.7.

Table 5.6 – The main indicators of the labor market in 2000-2017 in Kherson region

Year	Economically active population				including							
	at the age of 15-70 years		able-bodied age		busy population				unemployed population			
					at the age of 15-70 years		able-bodied age		at the age of 15-70 years		able-bodied age	
	on average, thousand people	In % of the population of the corresponding age group	on average, thousand people	In % of the population of the corresponding age group	on average, thousand people	In % of the population of the corresponding age group	on average, thousand people	In % of the population of the corresponding age group	on average, thousand people	In % to the economically active population of the corresponding age group	on average, thousand people	In % to the economically active population of the corresponding age group
2000	556.4	62.8	526.2	74.0	479.3	54.1	450.0	63.3	77.1	13.9	76.2	14.5
2001	537.1	61.0	509.8	71.9	466.6	53.0	439.8	62.0	70.5	13.1	70.0	13.7
2002	530.6	60.6	497.2	70.3	462.1	52.8	429.7	60.8	68.5	12.9	67.5	13.6
2003	517.4	59.2	495.9	70.1	456.4	52.2	435.0	61.5	61.0	11.8	60.9	12.3
2004	535.1	61.4	494.2	69.9	477.6	54.8	437.1	61.9	57.5	10.7	57.1	11.6
2005	548.9	63.1	509.5	72.6	499.9	57.5	460.5	65.6	49.0	8.9	49.0	9.6
2006	553.0	63.9	509.4	72.8	504.6	58.3	461.0	65.9	48.4	8.8	48.4	9.5
2007	551.3	64.0	507.6	73.0	505.7	58.7	462.0	66.5	45.6	8.3	45.6	9.0
2008	553.6	64.9	506.2	73.5	507.5	59.5	460.1	66.8	46.1	8.3	46.1	9.1
2009	538.0	64.0	497.0	73.0	486.9	57.9	445.9	65.5	51.1	9.5	51.1	10.3
2010	534.9	64.4	492.7	73.3	488.8	58.9	446.6	66.4	46.1	8.6	46.1	9.4
2011	528.5	64.3	488.3	73.4	480.7	58.5	440.5	66.2	47.8	9.0	47.8	9.8
2012	523.4	64.3	488.4	73.3	477.7	58.7	442.7	66.4	45.7	8.7	45.7	9.4
2013	524.6	65.2	490.3	73.6	480.2	59.6	445.9	66.9	44.4	8.5	44.4	9.1
2014	499.8	62.6	484.0	72.8	450.2	56.4	434.4	65.3	49.6	9.9	49.6	10.2
2015	496.6	62.5	487.2	73.4	445.8	56.1	436.4	65.7	50.8	10,2	50.8	10.4
2016	496.9	62.8	488.0	73.6	441.0	55.8	432.1	65.1	55.9	11.2	55.9	11.5
2017	497.2	63.1	488.1	74.8	442.2	56.2	433.1	66.3	55.0	11.1	55.0	11.3

Table 5.7 – Indicators of labor efficie

Year	The average number of full-time employees thousand people	Coefficient of turnover of labor		The average monthly salary		
		by admission	on release	nominal		Real in % to the previous year
		In % to the average number of full-time employees		UAH	In % to the subsistence minimum for able-bodied persons	
2000	329.4	21.4	31.2	173	60.1	…
2010	201.9	28.1	31.1	1733	187.9	107.9
2011	194.6	31.6	33.0	1970	196.2	104.3
2012	192.9	28.6	33.3	2269	200.1	115.3
2013	184.5	30.6	34.8	2464	202.3	109.4
2014	181.8	26.5	32.5	2617	214.9	94.5
2015	172.9	26.3	34.6	3123	226.6	78.3
2016	164.8	28.3	31.2	4046	252.8	112.7
2017	161.3	33.7	35.2	5842	331.6	123.3

Registered unemployment and the number of vacancies in 2017 (according to the State Employment Service) in Kherson region, Table 5.8.

Table 5.8 – Unemployment and the number of vacancies in 2017 in Kherson region

Month	The number of registered unemployed		The average amount of assistance per month, UAH	Number of vacancies, units	Load per vacancy, persons
	persons	In % of the working age population			
January	12442	1.9	1794	652	19
February	12891	2.0	1676	1087	12
March	11942	1.8	1752	1422	8
April	10295	1.6	1628	1233	8
May	8558	1.3	1683	1408	6
June	7148	1.1	1670	1332	5
July	6658	1.0	1840	1094	6
August	6443	1.0	1871	1248	5
September	6722	1.0	1847	1075	6
October	7242	1.1	1906	1164	6
November	8908	1.4	1967	719	12
December	11223	1.7	2079	476	24

The employment of the population in the economic sectors and the percentage of inhabitants who work in them by 2018 are given in Table 5.9.

Table 5.9 – Employment of the population

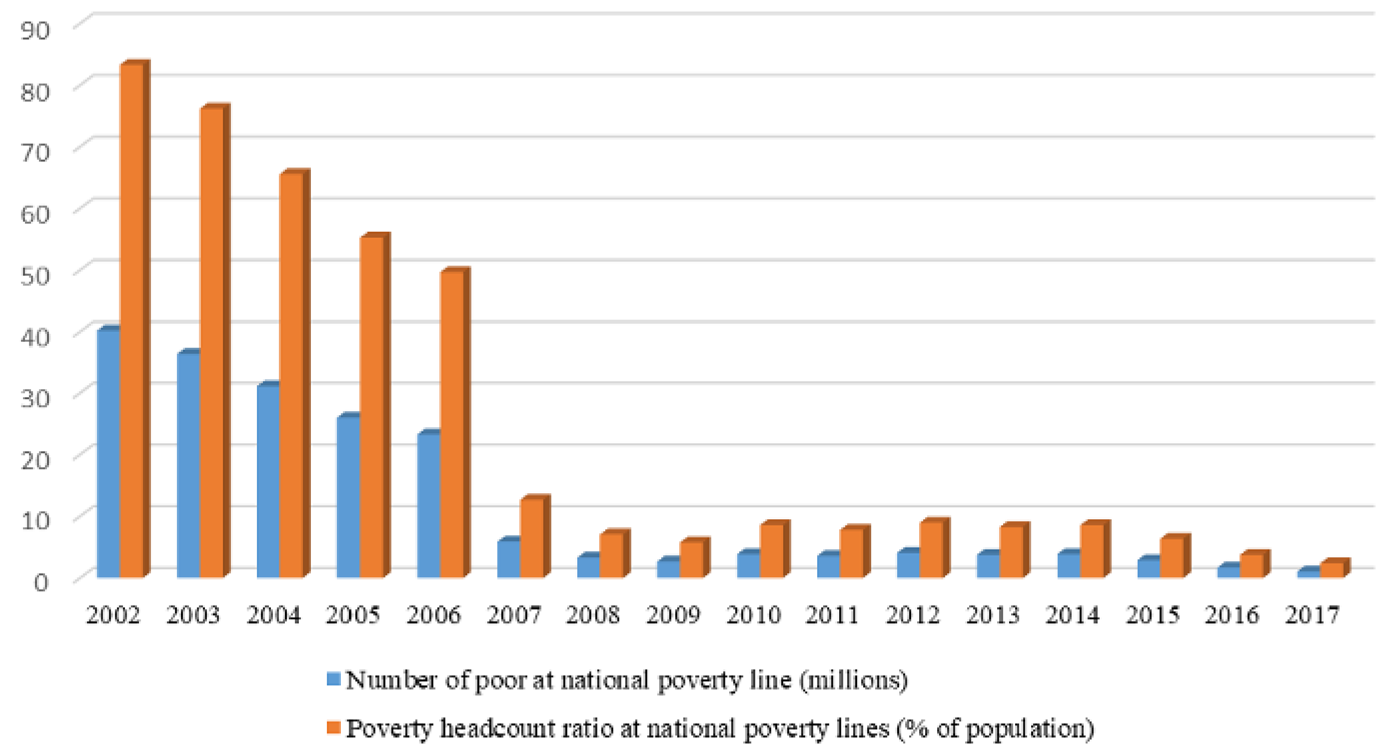
Economic sectors	**Number of working people population, persons**	**Percentage of able-bodied population,%**
Oleksandrivka Village Council		
Agriculture	47	3,8
Budget Organizations	142	11,4
Outside the village	315	25,5
Total	504	40,7
Pravdinska Village Council		
Social sphere	140	15
Agriculture	789	84
Total	929	99
Posad-Pokrovska Village Council		
Agriculture	358	26,6
Budget Organizations	316	23.4
Outside the village	674	50,0
Total	1348	100

According to the Data of the World Bank (http://povertydata.worldbank.org/poverty/country/ukr) in Ukraine, moderate poverty has started to decline, reaching an estimated 6.4% in 2016. This follows a doubling of the poverty incidence from 3.5% in 2014 to 7.8% in 2015 due to sharp recession and high inflation in 2014-2015. This recent decline in poverty was driven by a rebound in the real sector including real wage growth though poverty levels remain high compared to historical trends.

According to a non-official national poverty measure calculated by the National Statistical Service, poverty declined further from 51.1% in 2016 to 34.9% in 2017. Such a national poverty measure is constant in terms of purchasing power, and thus suitable for monitoring trends over time, unlike the official national poverty measure.

Due to the contraction of the economy, Ukraine has performed poorly in terms of shared prosperity over the period 2011-2016, Fig. 5.5. The consumption of the bottom 40% contracted (0,9 %) and this decrease was greater than that of the total population by 0.2%.

Those in the bottom 40 % have worse labor market outcomes than he rests of the population, are less equipped to find a job, more likely to have constrains such as childcare when looking for jobs, and more likely to live in rural areas, where employment opportunities are more limited.



**National poverty headcount ratio is the percentage of the population living below the national poverty lines. National estimates are based on population-weighted subgroup estimates from household surveys.*

Fig. 5.5. Poverty rate in Ukraine

The distribution of poverty measures across regions of Ukraine is showen in Fig. 5.6. From this figure the share ot the at-risk poor is 44 % in Kherson Region.

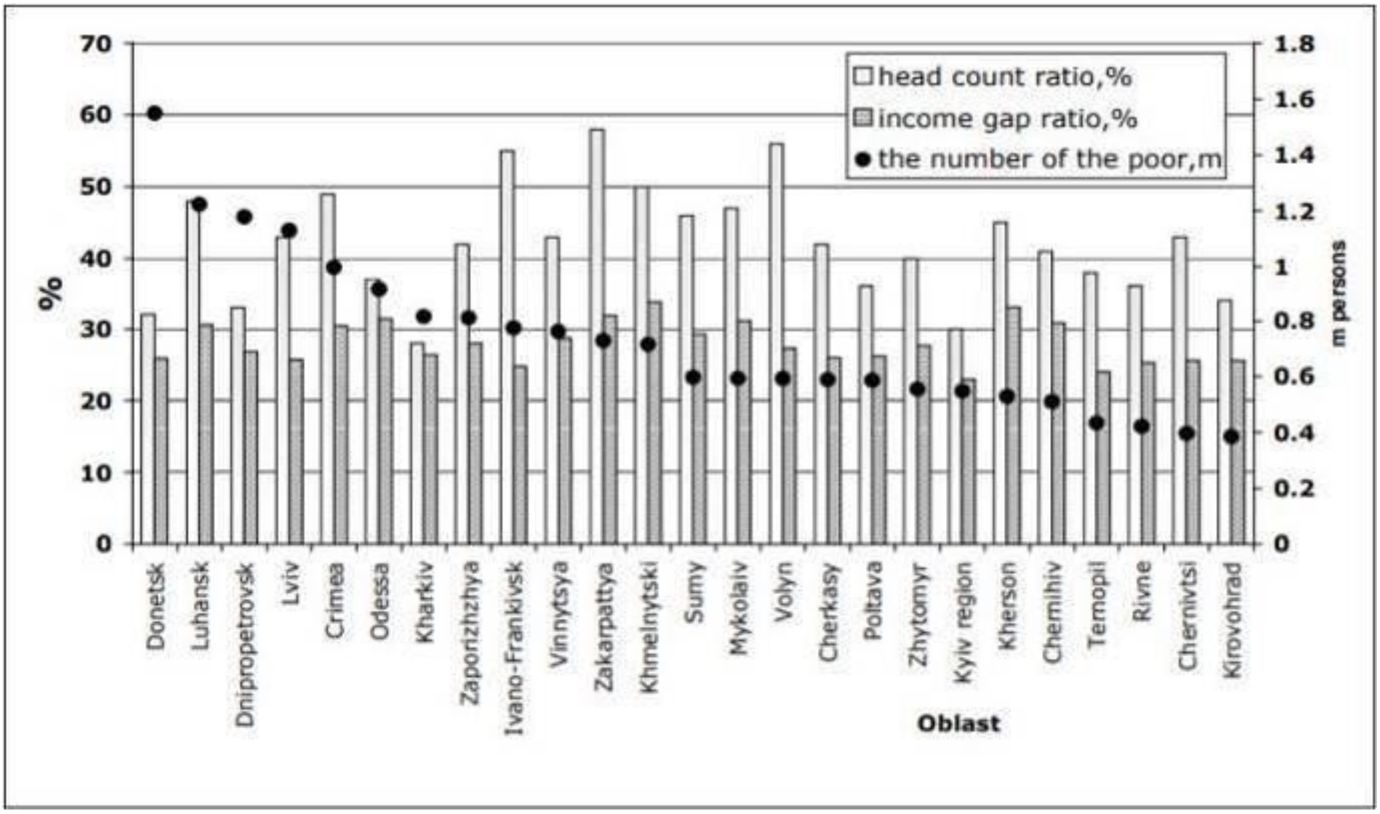


Fig. 5.6. The distribution of poverty in Regions of Ukraine

5.1.6 Land owners and land ownership

Altogether, within the limits of the Oleksandrivka Village Council, the area of land is 6733.8 hectares, including within the village Oleksandrivka – 6500.5 hectares; the area of the lands of the Pravdino Village Council is 7522,7 hectares. The area of the lands of the Posad-Pokrovska Village Council is 6322.6 hectares.

Information about landowners within the territory of the Oleksandrivka Village Council is given in in Table 5.10.

Table 5.10 – A list of the main landowners of the Oleksandrivka Village Council

Landowners	Number of owners, persons	Area, ha
Owners of land shares	1095 shares	4178
Communal property	-	1.3
State property	-	1315.5

According to the data of the socio-economic evauation, the expected consequences of the construction and operation of the Project's main facilities will be insignificant and will have a negligible impact on the livelihood of the affected persons. The households living in the Project area are not having a good quality of life. Due to the lack of active business activity in the area of development of the Project many families or some family members moved to the nearest cities (Kherson or Mykolaiv) or abroad in search of work. For example, Oleksandrivka and Pravdino Village Councils are geographically located in the steppe zone of southern Ukraine with no industrial enterprises and transport infrastructure which negatively affects the employment and income of local population. At the same time, if we compare the level of employment and income of the population of these village councils with Posad-Pokrovske Village Council, the standard of living of the local population of the latter is somewhat higher, since the M-14 Odessa-Melitopol-Novoazovsk international road passes through its territory. The average income of the person of working age is UAH 4,500.

The planned Project will benefit the local population, as it will increase local employment during the construction of the project as well as its maintenance/operation, it will also benefit the revenue of local budgets, which will improve medical and social services in these villages.

5.1.7 Land use and types of settlements

On the territory of the Oleksandrivka village council of Bilozerskyi District of the Kherson Region, the settlement is located – Oleksandrivka village, which has 926 courtyards and 2270 inhabitants. The area of this settlement is 464.5 hectares, including 178.0 hectares for building.

Pravdinska Village Council unites:

- v. Pravdino – 540 yards;
- v. Tavricheskaya – 160 yards;
- v. Nova zorya – 50 yards.

The Posad-Pokrovsky Village Council unites:

- v. Posad-Pokrovske – 939 yards;
- v. Kopani – 29 yards;
- v. Soldatske – 60 yards.

The distribution of land within the Oleksandrivka, Pravdinska and Posad-Pokrovska Village Councils is given in Table 5.11.

Table 5.11 – Categories of land

Categories	**Area, ha**
Oleksandrivka Village Council	
Total land	6733.8
Incl. agricultural land	6150.3
Forests and other forest areas	139.8
Constructed land	149.2
Wetlands	18.3
Lands without plant cover or with insignificant cover	50.5
Water	225.7
Pravdinska Village Council	
Agricultural land	7033.89
Forests and forest cover	127.3
Constructed land including residential building	132,71 27.8
Lands of industry	2.1
Wetlands	11.4
Water	215.6
Posad-Pokrovska Village Council	
Total land	6322.6
Incl. agricultural land	5617.4949
Forests and forest cover	73.5
Constructed land	475.0861
Wetlands	13.2
Lands without plant cover or with insignificant cover	17.5190
Water	125.8

The distribution of agricultural land and its constituent parts and non-agricultural land are given in Table 5.12.

Table 5.12 – Agricultural lands and their constituents

Types of land	**Area of ha**
Oleksandrivka Village Council	
Total agricultural lands, including	5912.2
- arable	5451.1
- perennial plantations	76.6
- pastures	384.5

Types of land	Area of ha
Total non-agricultural land, including	238.0
- Economic yards	121.5
- economic ways	116.6
Pravdinska Village Council	
Total agricultural lands, including	6842.23
- arable	6367.73
- perennial plantations	18.88
- pastures	59.6
Total agricultural lands, including	396.0
Total non-agricultural land, including	238.0
- Economic yards	121.69
- economic ways	69.97
- contaminated agricultural land that is not used	1.2
Posad-Pokrovska Village Council	
Total agricultural lands, including	5478.3054
- arable	5192.1944
- perennial plantations	98.4
- hayfields	10.6
- pastures	177.111
Total non-agricultural land, including	139.1895
- land under economic buildings and courtyards	90.9114
- paths and runs	48.2781

5.1.8 Economic activity (formal and informal sectors)

Existing industrial-economic objects by branches of economic activity in the production and non-production sphere are given in Table 5.13.

Table 5.13 – Existing industrial and economic objects on the territory of Oleksandrivka, Pravdinska, Posad-Pokrovska village councils

№	Objects	Owners
1.	Agricultural facilities: stock, storage, weight	ТОВ «Еко-Ленд»
2.	Agricultural facilities: stock, storage, weight	ТОВ «Весна»
3.	Agricultural buildings: warehouses, workshops	ФГ Виноградар «Херсонщини»
4.	Buildings for fish breeding: ponds, dams	П.П. Некрасов С.О.
5.	Vegetable Fruit Storage	ФО Мамедов
6.	Storage compartments for grain	ФГ «Ольвія»
7.	The composition of civil defense	Херсонська ОДА
8.	Shops for food and household goods	ПП Кравець Ю.В. ПП Учик М. І. ПП Макаренко В.В. ПП Воробьев ВВ

9.	Cultivation of agricultural crops	ТОВ «Вікол-Експо» ТОВ «Таврія-Правдине» 12 фермерських господарств
10.	Enterprise for the processing of agricultural products	МЧП «Янтарь»

On the territory of the Oleksandrivka Village Council the objects of production infrastructure are absent. On the territory of Pravdinska Village Council there are:

1. Road transport enterprises: road service in the Kherson region – 30.0 ha.
2. Communications companies – 0.2049 ha:
   - post offices – 0.2 ha;
   - CJSC «Київстар Дж; Єс; Єм» – 0.0043 ha;
   - PrAT «ВФ Україна» – 0.0043 ha.
3. Power generation and distribution companies – 1.1 ha.

On the territory of the Posad-Pokrovska Village Council there are: mobile telecommunication towers Kyivstar, Vodafon of Ukraine, and Telesystems of Ukraine. Within the limits of Oleksandrivka village council new infrastructure objects are planned:

- installation of solar panels within. Oleksandrivka on an area of 47 ha;
- construction of the port of «Nibulon» LTD within the limits of v.Oleksandrivka on the area of 29 ha;
- outpatient clinic.

Conclusion: the Project will contribute to development of the social infrastructure of region during its construction and operation. Also, in the construction period (2-3 years) and in entire period of the Project operation (25 years) the additional workplaces will be created.

5.1.9 Education

A comprehensive school of I-III levels (232 students) and a kindergarten (150 children) function at the territory of Oleksandrivka Village Council, Table 5.14-Table 5.16.

Table 5.14 – Educational institutions at the territory of Oleksandrivka Village Council as of 01.01.2017

Educational institutions	**01.01.2017**				
	Numbers	Calculated number of places	among them		Form of ownership
			Teachers, educators	Teachers, pupils	
Higher educational institutions	-	-	-	-	-
Schools	1	624	26	232	municipal
Including comprehensive schools of:I-III level	1	624	26	232	-

Educational institutions	01.01.2017				
	Numbers	Calculated number of places	among them		Form of ownership
			Teachers, educators	Teachers, pupils	
Secondary school of I-II level	-	-	-	-	-
Secondary school of I level	-	-	-	-	-
Boarding schools	-	-	-	-	-
Gymnasia (collegiums)	-	-	-	-	-
Active preschool establishments	1	118	11/7	150	municipal

Table 5.15 – Educational institutions at the territory of Pravdinska Village Council as of 01.01.2017

Educational institutions	01.01.2017				
	Numbers	Calculated number of places	among them		Form of ownership
			Teachers, educators	Teachers, pupils	
Higher educational institutions	-	-	-	-	-
Schools	2	713	10	190	municipal
Including comprehensive schools of:I-III lev.	2	713	10	190	municipal
Secondary school of I-II lev.	-	-	-	-	-
Secondary school of I lev.	-	-	-	-	-
Boarding schools	-	-	-	-	-
Gymnasia (collegiums)	-	-	-	-	-
Active preschool establishments	2	130	10/7	137	municipal

Table 5.16 – Educational institutions at the territory of Posad-Pokrovska Village Council as of 01.01.2017

Educational institutions	01.01.2017				
	Numbers	Calculated number of places	among them		Form of ownership
			Teachers, educators	Teachers, pupils	
Higher educational institutions	-	-	-	-	-
Schools	1	297	8	160	municipal
Including comprehensive schools of:I-III lev.	1	297	8	160	-

Educational institutions	01.01.2017				
	Numbers	Calculated number of places	among them		Form of ownership
			Teachers, educators	Teachers, pupils	
Secondary school of I-II lev.	-	-	-	-	-
Secondary school of I level	-	-	-	-	-
Boarding schools	-	-	-	-	-
Gymnasia (collegiums)	-	-	-	-	-
Active preschool establishments	1	150	8/3	150	municipal

Conclusion: operation of the Project will provide additional payments in the form of taxes and rental payments for land use to the central and local budgets. Additional payments will facilitate the development of educational and cultural institutions financed from these budgets.

5.1.10Medical facilities in Bilozerskyi District

In the Belozerskyi District population health is in satisfactory condition. Sanitary and epidemiological situation is stable. There are following medical facilities in Bilozerskyi District: 3 hospitals (Bilozerska Central District Hospital, Dariivska and Stanislavska state hospitals), 22 paramedical-obstetric points, 9 rural ambulatories and 10 pharmacies.

Bilozerka Central District Hospital has 215 beds, Dariivska state hospital – 35 beds, Stanislavska state hospital – 25 beds, 1 policlinic at the hospital and dental department at hospital. At the territory of Oleksandrivska, Pravdinskoy, Posad-Pokrovsky Village Council there is 3 paramedic – obstetric point where 12 people work, and a pharmacy, where 5 people work.

Conclusion: Operation of the Project will provide additional payments in the form of taxes and rental payments for land use to the central and local budgets. Project realization will contribute to further improvement of health care institutions financed from the central and local budgets.

5.1.11Water

Overall, 98.2 % of the population in Ukraine use an improved source of drinking water – 98.6 % in urban areas and 97.1 % in rural areas. 40.6 % of household’s members do not use any water treatment methods, (32.2 % in urban areas, and 62.5 % in rural areas). Boiling water is used by 39% of household members, (43.9 % in cities and towns, and 26.1 % in rural communities). Almost one-third of household members – predominantly urban – tend to use water filters to treat water. Quite a popular method is to let water stand and settle – it is used by 13.8% of household members.

An improved sanitation facility is defined as the one that hygienically separates human excreta from human contact. Improved sanitation facilities for excreta disposal include flush or pour flush to a piped sewer system, septic tank, or pit latrine; ventilated improved pit latrine, pit latrine with slab, and use of a composting toilet.

Almost the entire population of Ukraine (98.9 %) lives in households that have improved sanitation facilities.

Overall, 95.9 % of the household population of Ukraine use improved sources of drinking water and improved sanitation facilities. Accessibility of improved water sources and sanitation for rural residents (93.5 %) is lower than that for urban households (96.9 %). As for the regional availability of these conditions of comfort living, it is lower in the Centre (92.7 %) and in the South (93.5 %)[2]. The data presented in Table 5.17: pertains to national statistics, regarding drinking water provision and sanitation facilities.

Table 5.17 – National drinking water/sanitation data[3]

Data	**%**
Use of improved drinking water sources, 2011, total	98.0
Use of improved drinking water sources, 2011, urban	98.1
Use of improved drinking water sources, 2011, rural	97.7
Use of improved sanitation facilities, 2011, total	94.3
Use of improved sanitation facilities, 2011, urban	96.5
Use of improved sanitation facilities, 2011, rural	89.4

On the territory of the Oleksandrivka Village Council, the Oleksandrivka Municipal Enterprise is operates (on a self-supporting basis). The length of the water supply network in the village is 28 km. The water main is in an emergency, constantly in need of ongoing repairs. Annually over the past 3 years, a partial overhaul of the water network was carried out. Water in the village is supplied from three artillery bore holes. More than 100 estates have their own artesian wells. The village is provided with 100% of drinking water and water for irrigation of private plots.

On the territory of Pravdinska Village Council there are two communal enterprises:

- Communal enterprise «Obriy» – v.Pravdinske of Pravdinska Village Council;
- Communal enterprise «Aquarius» – v.Tauride of Pravdinska Village Council.

The above mentioned enterprises work on servicing the water network and providing the population with drinking water. On the territory of the Posad-Pokrovska Village Council, the communal enterprise performs the provision of drinking water to the population.

5.1.12 Gender issues

The majority of male rural population are prone to work migration outside the region and abroad. A large proportion of the female population of village is engaged in housekeeping and household activities. Selling vegetables and milk products is a

[2] https://www.unicef.org/ukraine/children_25107.html
[3] https://www.unicef.org/infobycountry/ukraine_statistics.html#117

substantial support to their families in rural areas A small part of female population works in the private agricultural enterprises (former state and collective farms). Among the population of retirement age, women prevail. Traditionally occupations are divided into male and female works. Most of men have professions connected with machines (tractor operator, driver, combine operators and others). Women mostly work in farming, gardening, education, culture and health.

Conclusion: the Project future need in human resources, the number of able-bodied men and women of village Oleksandrivka and nearby settlements in the region could be employed during construction and operation works of the Project that will reduce labor migration and balance gender situation in the region.

5.1.13Vulnerable groups

Construction and operation of the Project will not lead to negative impacts on environmental, social, economic, cultural and other living conditions of population. The following groups may be groups may be considered as vulnerable:

– personnel working in «DB WPP» including highly dangerous works (for example, at significant heights, with movable mechanisms, with high voltage, etc.). Their works will be carried out in full compliance with labor safety legislation and occupational safety rules of Ukraine;
– all owners and users of land plots, used for placement of the Project objects experiencing financial losses and inconveniences (will be compensated for temporary lands loss during the construction phase and reclamation of disturbed lands after completion of construction works);
– persons / unorganized tourists that might be affected upon emergency situations (restriction of access of population to wind turbines, compensations in case of accident, warning of population about the prohibition of visiting of wind field in extreme weather conditions, etc.).

5.2 Impact mitigation and management

The Project will not have harmful impacts on social life and economic activity of Oleksandrivka Village Council but quite opposite. It will promote its socio-economic development.

6 CULTURAL HERITAGE

6.1 Baseline conditions

6.1.1 Historical description of the site

In 1754, Zaporozhian Cossacks have founded the village Oleksandrivka (old names are Nyzhni Solontsi, Bublikovy, Milradovicha, Shtychova). There were Cossak wintering huts (called Zymivnyk), fishing grounds (Sapetni), where Cossacks fished and mined the salt in Prognoi. The village belonged to Pereviska Palanca.

In the vicinity of Oleksandrivka there is a number of cultural heritage sites located on the lands of Oleksandrivka Village Council:

- antique settlement Oleksandrivka – I is located on the ancient shore of the Dnipro Estuary, in 1 km to the South from the Oleksandrivka and has been dug up and studied by V. Hoshkevych (1909), M. Ambikulova (1977), M. Olenkovsky (1977, 2000 and 2002), I. Ratner (1978), O. Shkorb (1996). Olvia expedition of the Institute of Archaeology of the Academy of Sciences of Ukraine repeatedly surveyed and studied this monument (1947-1948, 1976, 1987).

Area of settlement was up to 4.5 ha at the time of first study. Today, no more than one third of area of the settlement has been preserved. The cultural layer is 0.3-0.7 m thick.

The monument is multilayer with a few ancient settlements: the second half of VI – beginning of V century. BC; III-V century AD (Chernyakhiv archeological culture).

- antique settlement «Bublikova Balka» is located in 3.5 km to the west from the Oleksandrivka, on the edge formed by the left side of Bublikova Gully and estuary coast. The settlement was discovered in 1947 by Olvia expedition of the Institute of Archaeology of the National Academy of Sciences of Ukraine. It was studied by S. Buiskyh in 1976 and 1987, and by M. Olenkovsky in 1998 and 2000. The settlement has two cultural layers of VI and III centuries BC according to S. Buiskyh. The archeological site is heavily damaged by natural factors. An undamaged part of the settlement is no more than few thousand km^2. The cultural layer is no more than 0.6 m thick.
- antique settlement «Skel`ka 1» has the status of a monument of archeology of the national importance. It is located 8 km to the North-West from the Oleksandrivka, on the shore of Bug Estuary, in the tract «Skel`ka». V. Hoshkevych has discovered it in 1895 and surveyed in 1909. It was excavated in 1947-1948. The local unit of Olvia expedition of Institute of archeology of Academy of Sciences of Ukraine carried out stationary excavation in 1978-1979.

It is located on the high shore, limited by deep old gullies in the East and West, divided into two parts by the gully. Presence of ash pit shows that the gully existed in the time of settlement existence.

The monument has two cultural layers. Main cultural layers are dated by the end V – III centuries BC. and I centuries BC – III century AD. Remains of monuments are spread over 25-30 thousand m^2. Thickness of the cultural layer is 1.2 m.

The upper cultural layer of fortified part of settlement is a hillfort. The bottom layer belongs to the unfortified part of settlement. According to the data of S. Buiyskih, the hillfort was a part of fortified system of Olvia state after Getae period. Excavations at the archeological site revealed the fortification complex of ditches, ramparts, fortified stonewalls, towers. Numerous and diverse archaeological materials have contributed new data to the study of the ancient history of Ukraine.

6.1.2 Archeological monuments

The Project location has an important and cultural value. There are nine state recorded archeological monuments: antique settlement Oleksandrivka – I; antique settlement Bublikova Balka; antique settlement «Skel'ka»; Kurgan «MOHYLA TERPYLOVA», burial Kurgan (barrow group), and 4 nameless barrows.

Scientific archeological surveys were performed at the land plots of planned «DB WPP» location (subject to the additional areas required during construction) of total area 50.08 ha. It was performed to confirm the presence (absence) of archaeological cultural layer, to determine the area of its distribution, its culture-chronological affiliation. During the survey, the archaeological sites on the state account and the new monuments (barrow group of two burial places, and two burial barrows) were investigated.

The scientific report «NDTS LUKOMORE» (the State Enterprise NDC «Archaeological conservation service of Ukraine of the Institute of Archeology of the National Academy of Sciences of Ukraine») of Institute of Archeology of NAS of Ukraine confirmed presence of the numerous archeological monuments at the territory of «DB WPP» site for which boundaries of protection zones are established.

Proceeding from historical archival data and conducted archaeological examination, it is defined that land plots within the territories of the Oleksandrivska, Pravdinska and Posad-Pokrovska Village Councils of the Bilozerskyi District of Kherson Region (total area of 162.0 hectares) do not belong to the lands of historical and cultural purpose in connection with the absence archaeological objects and historical cultural laye .

The exception is the burial mound (in the coordinate area 46°40'19,84 N.L 32°6'15,83"° E.L) with an area of 0.2 hectares and its unified protection zone 25 m from the polar burial mound (end of the burial site) [49].

Observance of the boundaries of the protection zone excludes any influence of construction and operation of the OHPL on architecture, cultural and historical monuments.

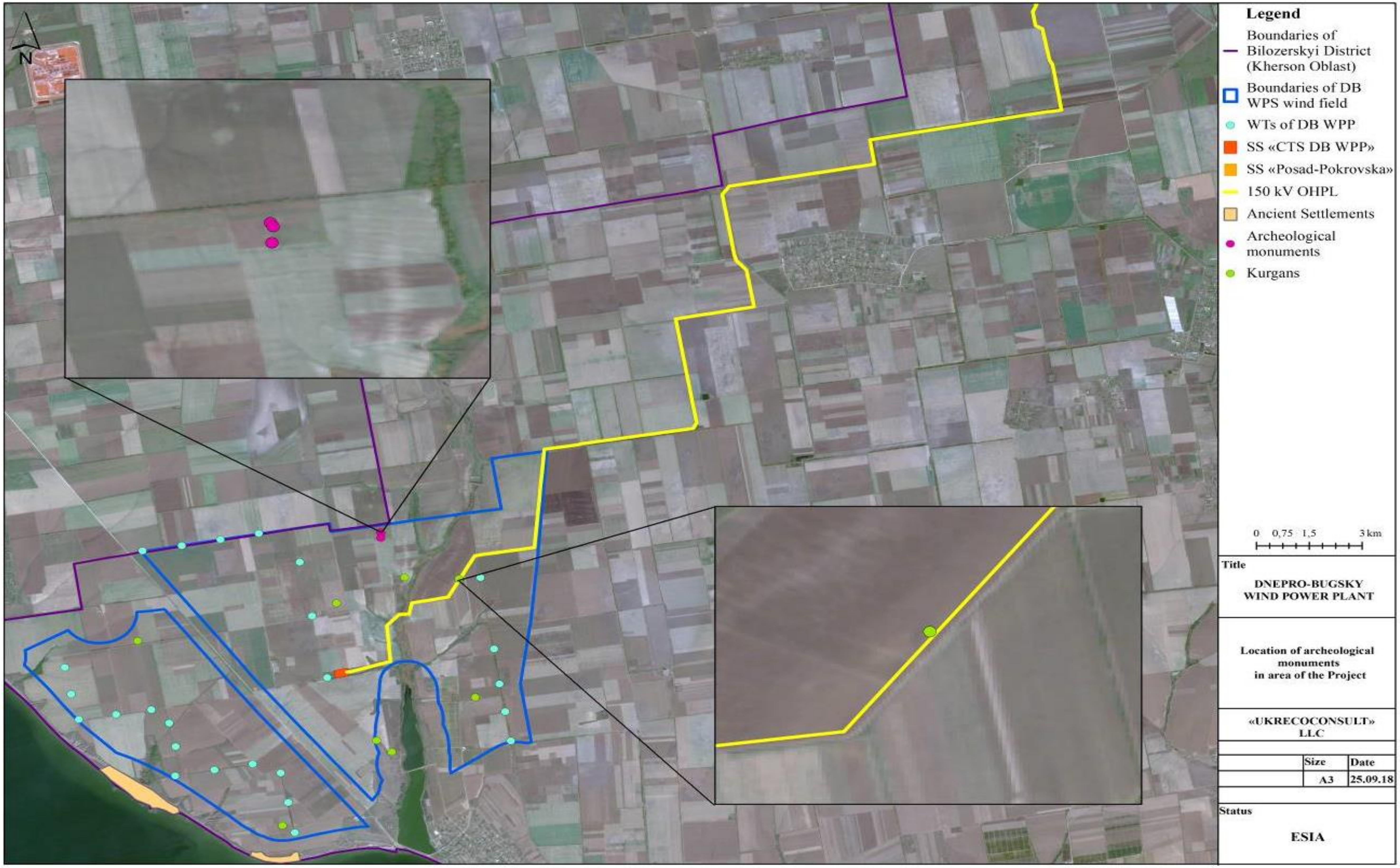


Fig. 6.1. Location of archeological monuments

6.1.3 Historical monuments

There is Cossack Konoshka's grave of 1782 on the territory of village Oleksandrivka (on the outskirts of the village). The stone cross was on the grave until 20s of 20 centuries. There was an inscription «Бившаго Війська Запорозькаго козак куреня Платнирівського. Зде опочиває раб Божий Василь Конюшко блаженно памяти 1782 року місяці генваря 10 дня» («Cossack of Former Zaporizhian Host of Platnyrivskyi Kuren. Servant of God Vasyl Konushko Blissful reposes here in the memory of 1782, the month of January, 10-th day»). For today, the fragments of the cross are located in Mykolaiv region Museum of Regional Ethnography [112].

6.2 Impact mitigation and management

During construction of operation of the Project, the main impacts on objects of cultural heritage may happens at construction stage, namely during earthworks and excavation activities, which may cause potential impacts on physical state of cultural heritage objects.

For avoidance and mitigation of probable impact of the Project construction process on objects of cultural heritage, the special measures will be implemented:

- informing of personnel about presence of cultural heritage objects on construction site of the Project, with presentation of their detailed coordinates, and distances to the nearest wind turbines;
- fencing of zone, where objects of cultural heritage are placed;
- limitation of additional transport access on areas where object of cultural heritage placed.

Conclusion: construction and operation of the Project will not affect the cultural and historic heritage of the territory of the Project.

7 LABOR AND WORKING CONDITIONS

7.1 Baseline conditions

7.1.1 Occupational health and safety in Ukraine

Works in engineering projects stages should be performed in full compliance with the requirements of the following regulations in labor protection and safety engineering:

- Law of Ukraine «On Labor Safety»;
- «Rules of operation of electrical installations of consumers»;
- «Safety rules for the operation of electrical installations of consumers»;
- «Instruction for Safe Operation in Protected Zones of Active Communications»;
- «Safety Requirements by Type of Work».

The labor protection and occupational hygiene requirements include:

- compliance to the requirements to illumination of premises, type of materials and equipment;
- favorable sanitary and hygienic work conditions;
- use of protective grounding for planned metal constructions, pylons.

In Ukraine during the last 10 years there is a steady tendency on reducing the level of occupational injuries. The total number of injured in production annually decrease in average by 13 %, and the number of deaths – by 7 %. The level of occupational injury per 100 thousand employees in 2 years decreased by 19 %, and the level of death injury – by 40 %. Over the past five years, the average level of fatal injuries in Ukraine is 6.2 cases per 100 thousand employees (www.rada.gov.ua).

At the same time, according to the International Labor Organization, the level of fatal injuries in Ukraine remains one of the highest compared to European countries and the USA: on the basis of 100 thousand workers in comparison with Germany is higher than 2.5 times, in comparison with the USA in 2 times, in comparison with Italy – in 1.3 times, but lower than in Russia in 1.5 times. According to the International Labor Organization, in countries with a market economy, the average rate of accidents with fatal consequences is one case per year on 23,5 thousand workers, whereas in Ukraine it is an average of one case per year, almost on 16 thousand employees. Almost 80 % of injuries and more than 40 % of cases of deaths are happens in enterprises of the coal industry, machine building, agro-industrial complex, socio-cultural sphere. As a result of the decrease of industrial production in the country in 2008-2009, in almost all branches of the economy, the total number of accidents at work decreased.

Despite some positive improvements, the situation in the field of labor protection in Ukraine remains tense. A harmful and dangerous working conditions and high production risks, which increases the risk of an increase in the number of accidents and occupational diseases is typical feature of Ukraine's modern production. Decreasing of the total number of cases of industrial injuries in the country at sustainable growth of the economy, reducing of industrial risks and occupational injuries to the level of developed countries of the world – the main task for today.

As of today (as in 2009), the most traumatic industries are coal industry, agro-industrial complex, social-cultural sphere, construction and transport. On eneterprises of these industries injured 68 % of people (from total number of injured) and 71 % of people are died (from total number of died). Almost 70 % of accidents on the production occurred because of organizational reasons, 19 % because of technical reasons, 11 % because of psychophysiological reasons.

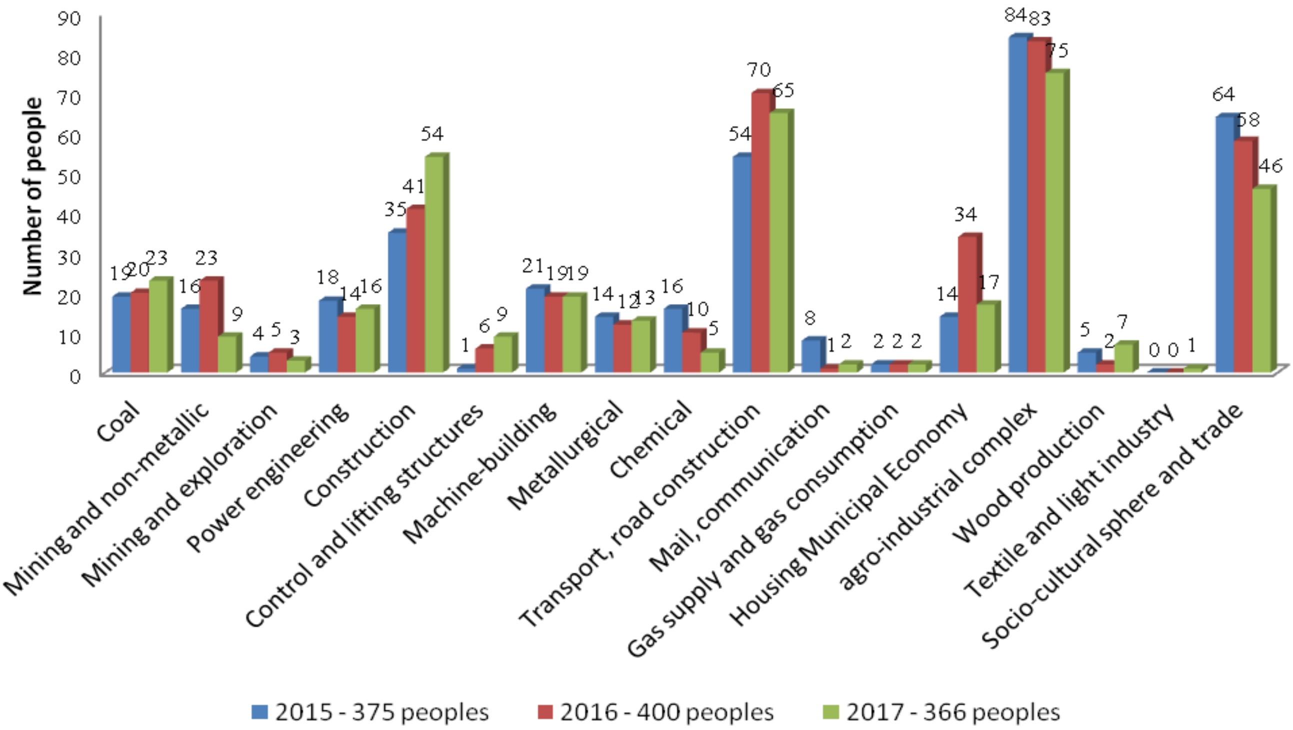


Fig. 7.1. The state of occupational injuries with fatal consequences in the branches of supervision in 2015-2017

7.1.2 Summary of wind turbine accidents

The statistics of accidents of wind turbines is carried out since 1996. The copyrights on collection of statistic data belong to the *Caithness Windfarms Information Forum* (CWIF). CWIF collects information on turbine related incidents and accidents that occur in the world, mainly through press releases and published official reports (*CWIF website – http://www.caithnesswindfarms.co.uk/index.htm, 2017*).

In Table 7.1 presents recorded accidents of wind turbines that could be found and confirmed by press releases or official information released before September 30, 2009.

Occupational health and safety (OHS) statistics in wind energy sector is generally sparse and lacks comprehensive data, the reason for this is generally attributed to the fact that the sector is relatively new with the turbine designs constantly progressing. However, the number of accidents occurring in the sector showed an increasing trend, especially in the past few years, proportional to the increase in new installations each year.

Table 7.1 – Chronological distribution of accidents

Quantity	**Years**	**70i**	**80i**	**90-94**	**95**	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**
General		1	8	17	5	9	16	8	33	29	12	63	51	52	54	54	83	111	68
Fatalities		1	8	8		2	4		1	3		1	3	4	3	5	4	8	4
Injuries				2		1		1	1	4	1	2	2	1	2	4	3	8	5
Blades destruction				3	3	3	6	2	18	4	5	15	12	14	9	12	17	18	17
Fires				1	1		1	1	2	3	1	24	17	15	14	12	20	16	5
Structural failures				1				3	6	9	2	8	4	3	7	6	11	9	6
Human hitting by ice fragments						3	3		3			2	1	4	3	2		3	3
Transport												4		2	4	3	14	8	7
Environmental damage				1							1	1	7	1	5	3	8	20	9
Others				1	1		2	1	2	6	2	6	5	8	7	7	6	21	12

The instructions on labor protection and safety for the employees of «Dnepro-Bugsky WPP» should be developed taking into account local conditions, approved by the head of a company and agreed with the local trade union representatives. The instructions establish the rules for the work performance in the amount required from the employees of such profession (position) and on issues of works according to the «Regulations on the instructions development for the labor precaution», approved by the order of the State Committee for Observation and Protection of Labor on January 29, 1998 № 9.

Fire extinguishers and automatic fire extinguishing systems are envisaged on CTS and CP, and at each wind turbine. Primary fire extinguishing at the CTS and CP is also supposed to be carried out by primary means – fire motor pumps of type MP-1600. At necessity, fire extinguishing is carried out by mobile means of fire teams, which are the closest to the object of incineration.

7.1.3 Third party risk

It is necessary to consider and evaluate all existed and all possible situations with consideration of all dangerous factors in probable critical conditions that could be a reason of injury or even death of a person.

Main quantitative indicators of accident risk are:

- ***Individual risk*** – a possibility of person`s death (for a person staying in the area of risk) from possible sources of hazard of dangerous objects during a year (taking into account the probability of his/her location in the affected zone);
- ***Territorial risk*** – a possibility of person’s death during a year from possible sources of danger (high-risk objects). The type of risk applies for person located in a specific place of territory;
- ***Social risk*** – a possibility of people’s death more that the certain number (or expected number of deaths) taking into account the probability of their presence in the affected area.
- ***Acceptable risk*** – a risk that does not exceed the maximum permissible concentration on the territory of high risk object’ and beyond its borders. For high risk object, the acceptable risk is established with consideration of the scale of danger created by it and by placement of other enterprises in area that have high risk objects provided that total risk of adverse effects does not exceed permissible level.

Acceptable non-voluntary individual risks is equal 10^{-6} per year. Risk assessment provides main input data in risk management program. Tasks of risk management means to:

1) determine the most dangerous unfavorable factor (that society is ready to perceive);
2) review availability of management (regulation) options;
3) introduce appropriate measures for reducing (or completely liquidate) the unacceptable risks (program performance);
4) assess consequences.

However, in practice, the third party risk management around potentially dangerous objects requires the establishment of a zone of civil safety (ZCS). This zone is an analogue of Sanitary Protection Zone (SPZ). For example, in a sphere of civil aviation, the SPZ established around airports (airdromes or runways) with boarders along contours of individual risk standard. Total number of events in wind power industry concerning people`s death and serious damages is quite low, but their percentage is high in comparison to other type of industries. The risks of diseases because of dangerous exposures are minimal. Nevertheless, the wind power has unique industrial risks for personnel working in dangerous conditions:

1) detachments of blades from the rotor shaft;
2) destruction of the wind turbine;
3) destruction (collapse) of wind turbine tower;
4) overheating and fire of elements of the wind turbine;
5) extreme weather conditions;
6) large heights (100 m or higher for 2,5 MW wind turbines or more);
7) rotating equipment;
8) lifting and holding of heavy equipment;
9) high electric voltage;
10) vehicle access;
11) exposure to hazardous soluble chemicals during manufacture of rotors;
12) oil spills;
13) icing.

There are a following examples of incidents happened at individual WTs on the territory of EU countries according to National Wind Watch 46 fires (friction or lightning can cause fire), destruction of WTs during storm (fall on moving and stationary objects), heavy ice layering on wind turbines rotors, its cracks and fall down, short circuit.

Wind turbines should withstand significant amount of massive loadings (tension) – for example, during storms. The limbs of rotors blades should withstand wind speeds up to 320 km/h. Regular inspections affirm presence of cracks on limbs of rotors blades (Fig. 7.2).

Fig. 7.2. Inspection of limbs on WT blades

Each blade has special lightning rods. They are built-in on both sides of blade closely to its limbs. Flexible steel wire built into the blades provides electric conductivity from rod to rotor hub that, in turn, is used as a gear for main shaft.

Wind turbines with higher towers, and bigger diameters of rotors, require the regular technical service more than normal wind turbines (Fig. 7.3). The statistics of insurance companies shows that problems with wind turbines appear quite frequently despite their operation guaranteed by manufacturers without problems over 20-25 years. The service and inspection of wind turbine is performed «on march» (when workers work on altitude ~100 meters above land) (Fig. 7.4).

Fig. 7.3. Regular technical service

Fig. 7.4. Inspection of wind turbines «on march»

Due to significant height of wind turbine, the service and inspection of its main elements are difficult and expensive. Machinery equipment inside the wind turbine is not complicated, but it should withstand numerous manifestations of round-the-clock loading (tension). The gearboxes require most frequent special services and inspections (Fig. 7.5).

Fig. 7.5. Special service of gearbox

Many problems occur due to destruction of wind turbines that can be quite dangerous. For example, the case that happened near the German motorway was fatal for a car having moved by that motorway.

In specific meteorological conditions ice formation on the surface of WT rotor is possible (Fig. 7.6).

Fig. 7.6. Ice layering at the rotor of WT

The preliminary results of development of risk assessment methodology allow assumption that 200-250 m from any wind turbine as the safe distance beyond which there is no significant risk for humans to be hit by ice fragments. Monte Carlo analysis simulating the scattering of 10,000 ice fragments from the WT rotor was applied to identify the safe distance to wind turbines. The radial and azimuthal position of rotor, speed and direction of wind matched the probability distributions assumed in advance according to wind rose (Fig. 7.7).

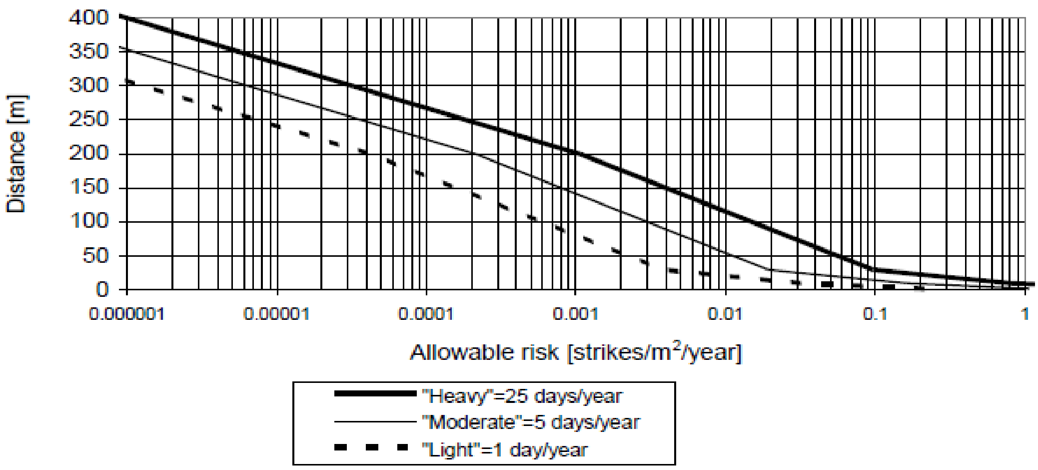


Fig. 7.7. Safe distances from WT for different conditions of the ice layer formation on the surface of wind turbine's rotor (diameter 50 m)

The obtained results presented as function of the distance from the wind turbine are the probability of a single ice fragment landing on a land plot of one square meter of the earth's surface. It is evident that risk per square meter per year depends on probability of scattering and number of ice fragments scattered during the year (Fig. 7.8). For example, the risk of ice fragment hitting a person is defined as 0.00000077 that corresponds to 1 hit per 13,75 million years. This probability (less than 10^{-6} per year [107]) is comparable to the probability of a lightning striking the certain part of earth's surface.

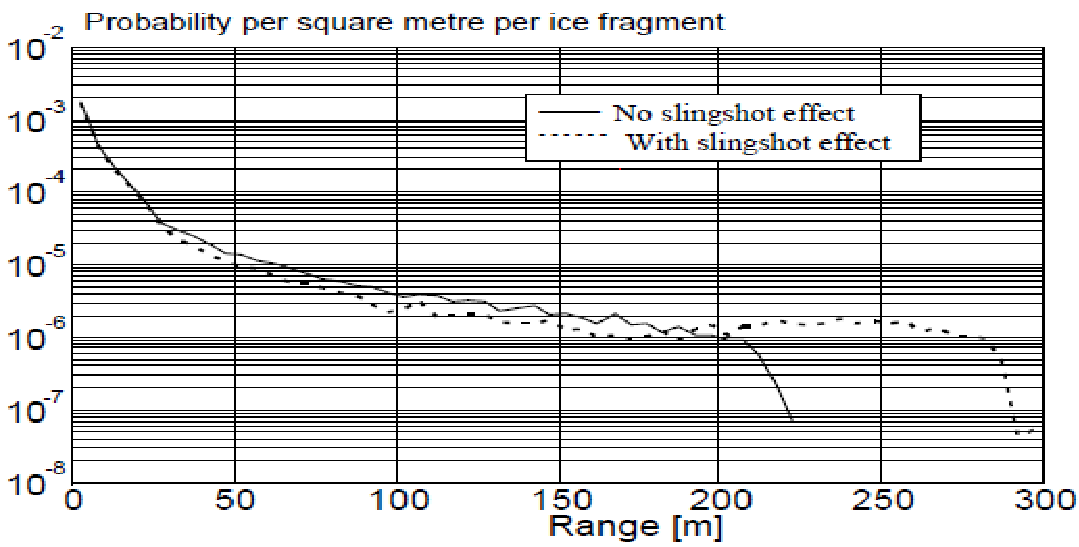


Fig. 7.8. The probability of landing of a single ice fragment on a land plot of one square meter of the earth's surface as a function of the distance from the wind turbine

In practice, analysis of ice scattering has shown that distance of scattering depends on wind direction and can reach ~ 100 m from the tower of wind turbine, (Fig. 7.9). The allowed safe distance between wind turbines and human settlements differs in different countries (Table 7.2). In the states of Wisconsin and Michigan (USA), licenses were issued for the construction of wind turbines at the distance not closer than 1,000 feet (~ 330 m) from human settlements. The European countries sometimes require the distance not closer than 1 mile (1,6 kilometers) from human settlements.

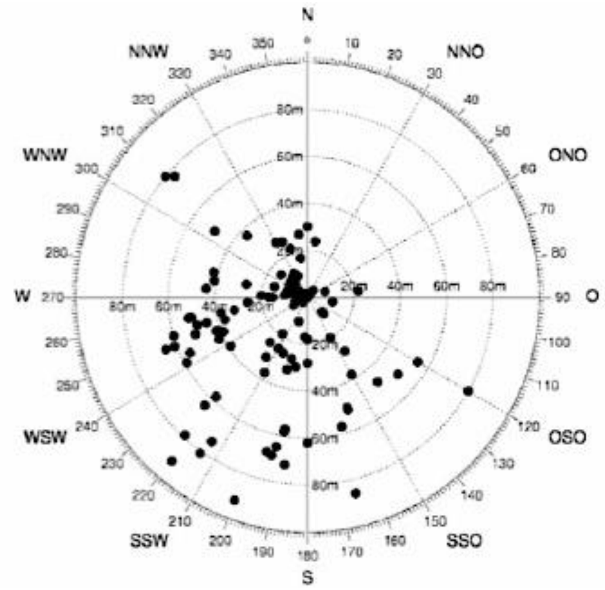


Fig. 7.9. Results of the international study of ice frequency scattering
(Case of Swiss Alps)

Table 7.2 – Allowed distance between industrial wind turbines and human settlements

Source of information	Allowed distance, km
Recommendations of Manufacturer's	0.4
Protection from the scattering of ice and blades	0.53
National Research Council, USA	0.76
Germany	1.61
France	1.61
Michigan, USA	0.3
Wisconsin, USA	0.3
Academy of the Sciences of France	1.45

Destruction or failure of wind turbine (or it separate element) can occur upon the significant wind loads on constructions/mechanisms of wind turbine (usually when damage is higher than structural limit of WT). The failures can stop not only the operation of the wind turbine, but also lead to the third party risk. Based on contemporary meteorological knowledge in most cases to predict a maximum wind speed of storm is not realistic.

In extreme winds the destruction of the WT tower (collapse) can occur. In this case, a zone of the third party risk depends on the size of wind turbines, Fig. 7.10.

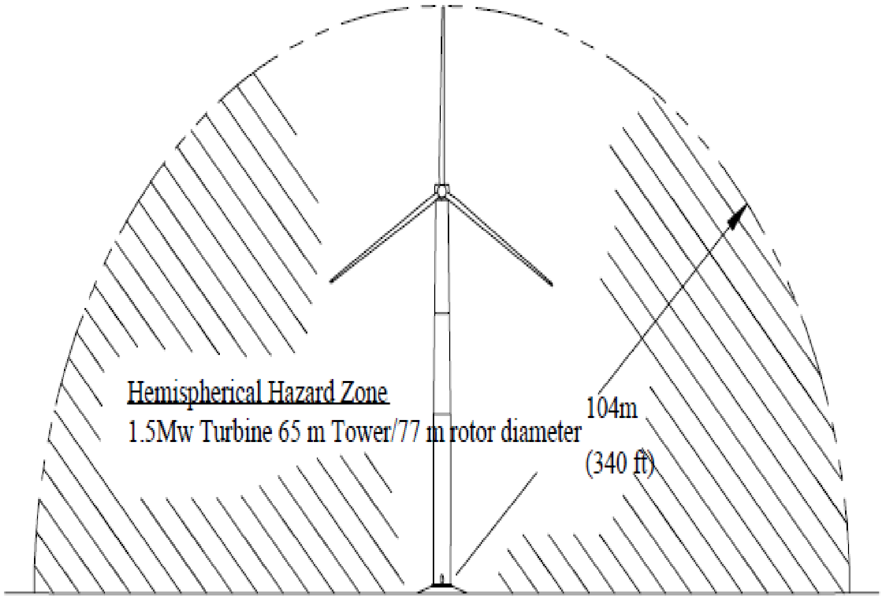


Fig. 7.10. The collapse risk zone of the WT tower

The calculations also show that distance of scattering of fragments of destructed blades for wind turbine with a rotor diameter of 70-80 m and a maximum rotation of 20-22 rotations per minute shall not exceed 150 m, (Fig. 7.11).

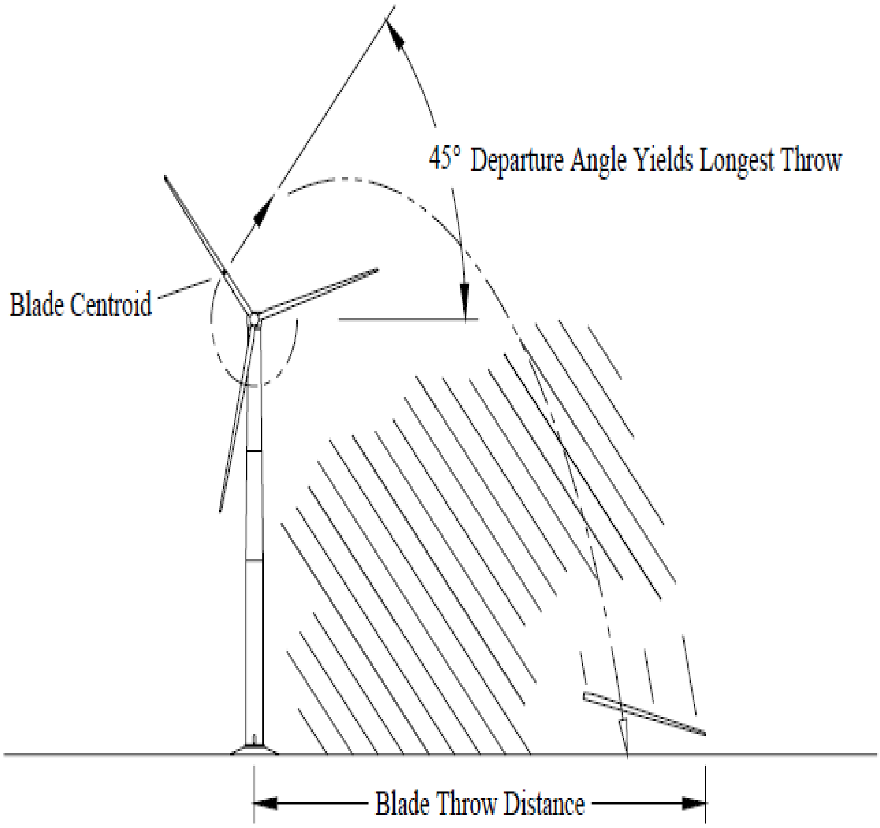


Fig. 7.11. The dangerous zone upon scattering of WT fragments of destructed blades

Potential destruction of human settlements upon the wind speed distribution are presented in Table 7.3.

Table 7.3 – Dependence of potential destruction of human settlements from the wind speed distribution

Wind speed, m/sec	Potential damage
17.9-36.7	Some damage to chimneys and TV antennas; fragments of tree branches, fallen trees with surface roots.
32.1-49.5	Ruined roofs; broken windows; scattered or overturned small trailer houses; fallen or broken trees; cars scattered from the road.
50.0-69.6	Smashed roofs of buildings and structures (only vertical walls remain); destroyed constructions in rural areas; completely smashed trailer houses; large trees broken or uprooted; derailed train wagons; scattered along roadsides cars.
70.6-92.09	Roofs and some walls demolished from the foundations; completely destroyed some rural constructions; derailed trains; lifted above earth cars; massively broken, uprooted or fallen on the earth trees in forests.

In 1981 in Denmark the two special experiments on susceptibility of wind turbines to the strong winds were carried out. The wind turbines were subjected to strong winds with the speeds of 35 m/s during 10 minutes. The results of experiments have shown significant damages and failures of 250 WTs. The main causes of failure are presented in Table 7.4.

Table 7.4 – Main causes of failures of 250 wind turbines upon 10-minute exposure to the wind speed of 35 m/sec

Reasons of failures	Percent of failures, %
Dynamic loading (fatigue)	21
Static load	28
Incorrectly designed mechanical/aerodynamic brakes	11
Insufficient power regulation	21
Unidentified causes	19
Total	100

The reliability of separate components of wind turbines, indicators of their failure are presented in Table 7.5.

Table 7.5 – Reliability (number of failures) of separate components of wind turbines

Component of the wind turbine	**Indicator of failure, *hour*$^{-1}$**
Brakes of the blades limbs	$1.000 \cdot 10^{-4}$
Yaw brakes	$1.150 \cdot 10^{-5}$
Blades	$1.116 \cdot 10^{-5}$
Bolted joints	$1.116 \cdot 10^{-5}$
Sleeves	$1.116 \cdot 10^{-5}$
Generator	$0.769 \cdot 10^{-6}$
Rotor brakes	$2.160 \cdot 10^{-6}$

Potential types of wind turbine destruction are presented in Table 7.6.

Table 7.6 – Potential types of wind turbine destruction

Nodes	Potential types of destruction
Blades of rotor	Surface damage, cracks, structural cavities; damage to lightning rods
Gondola, force- and acceleration - transmitting elements	Corrosion, cracks
Hydraulic / pneumatic system	Leakage, corrosion
Tower and foundation	Corrosion, cracks
Fuses, sensors and braking systems	Damage, wear
Control system and electric drive unit, transformer station and busbar	Corrosion and pollution of terminals and fasteners

System of Certification (UkrSEPRO) and to the current Ukrainian standards. The energy companies «Oblenergo» obtain voluntary certification of wind turbines. At the same time, the certification of any wind turbine is common practice worldwide (for example, in EU countries is carry out in accordance with the requirements of the international standard ISO 61400).

7.1.3.1 Measures for minimization of risks from wind turbines

In the countries of European Union, wind power plants are located at a distance of 300-400 m from the settlements.

The lands around the wind turbines can be used for agricultural purposes. Usually, the territory nearby the wind turbines has status «free for visiting» (the access to the control panel is prohibited, the thickness of tower protecting metal is 3-4 cm) [5]), in absence of the extreme weather conditions. For some types of extreme wind events (such as tropical cyclones), the expertise for determination of the probability of a wind turbine destruction from wind speed exceeding the constructional limit of wind turbine in specific area is used.

Based on the world practice, the following measures for risk mitigation from high-speed wind shall be undertaken during placement of the wind turbine:

1. Location of the wind turbine. Location of the wind turbines in wind fields with frequent storms, where winds can reach extreme velocities and gusts, the remoteness of potential wind turbines is a good approach to risk mitigation from high-speed wind. Remoteness of location of wind power plan reduces the risk of the third party damage from extreme wind events, but the risk for the wind turbine equipment itself is independent from the distance.

2. Physical and visual warning signs. If the customer decides to build a wind field (-s) in an area with a risk of extreme winds, it is advisable to make the fencing of w, and/ or to install visual warning signs at the edge of each wind field (-s), regardless of their location.

3. Exclusion of the wind turbine from operation. It is guaranteed that the equipment is in the proper working state, and controlled by of the wind turbine control system, which

is in good working order. The wind turbine control system is designed for protection of equipment at extreme wind speed.

4. Operator safety. Access limitation for personnel to the wind turbine, in conditions of extreme wind speeds is also advisable. If the personnel of wind turbine plant should have access to the wind turbine under extreme wind speeds, safety measures shall include stoppage of the wind turbine, placing the wind turbine rotor on the opposite side of the wind turbine observation hatch and parking at the safe distance from the tower.

7.1.3.2 Generalization of emergency management

1. Total number of cases in wind power industry concerning people`s death and serious damages is quite low, but their percentage is high in compassion to other type of industries. On the practice of management by third party risk around potentially dangerous objects, it is established a zone of civil safety (ZCS). This zone is an analogue of SPZ. For example, in a sphere of civil aviation the ZCS established around airports (airdromes or runways) with boarders along contours of individual risk standard values.

2. Risks of exposure from hazardous substances are minimal, but the wind power has unique industrial risks for personnel working in dangerous conditions:

1) separation of blades from the rotor shaft;
2) destruction of the wind turbine, (usually as a result of its coasting);
3) destruction (collapse) of tower;
4) overheating and fire on elements of the wind turbine;
5) extreme weather conditions;
6) work at high altitudes (100 m or more for wind turbines with power 2.5 MW or more;
7) use of rotating equipment;
8) lifting and holding of heavy equipment;
9) work with high electric voltage;
10) exposure to hazardous soluble chemicals during manufacture of rotors;
11) oil spilling;
12) ice layering.

3. There is statistics on accidents at the World Wide Web. The most comprehensive of all existing statistics is the *Caithness Windfarms Information Forum (CWIF, version compiled on September 30, 2009*) [7]. The general statistics of accidents is follows: total number of documented accidents – 674; number of fatal (with fatal accidents) accidents – 59; additionally were documented accidents connected with injuries of people – 37; hitting of ice in people – 27 cases; the number of accidents involving the death of protected species of birds – 24.

4. There is no methodology for calculating the individual or social third party risk for WT. The reliability of individual components of the wind turbine, determined by the number of failures per hour^{-1}, is high. The results of the performed research show that in general, the individual third party risk for the WT is lower than the normative permissible value of 10^{-6} [107]. For example, the third party risk of exposure to an ice fragment in person is estimated at 0.000.000.007, which is equivalent to one hit over 137 500 000 years.

5. As a result of the extreme wind, the destruction of the tower (collapse) of the WT can occur. The zone within which there is a third party risk, in this case is determined by the size of the WT – ~ 100 m. Calculations also show that distance of blades (fragments of blades) scattering for WT rotors with a diameter of 70-80 m and a maximum rotational speed of 20-22 rotations per minute should not exceed 150 m. Practical studies of ice scattering shows that their distance depends on prevailing wind direction and can reach ~ 100 m from the tower of wind turbine.

7.1.4 Working relationship

Expected number of temporary workplaces during «DB WPP» construction works is 250, while simultaneously up to 50-70 people will be occupied in construction works. Mostly the Project company will be hire the local workers to construction phase.

36 permanent work places will be employed during the operation of the Project. Outbound brigades carry out operation, maintenance, repair, and administration of the Project site. According to preliminary calculations, the total number of work staff will comprise of the administration – 8 people's, maintenance workers – 17 people's, staff of central transformer station 35/150 – 11 people's, Table 7.7.

Table 7.7 – Designed staff of Project

№	Name of the staff	Number of people
1.	**Administration**	
1.1	Director of «DB WPP»	1
1.2	Deputy director is the chief dispatcher who combines the responsibilities of the labor protection engineer	1
1.3	Chief Engineer	1
1.4	Chief Accountant	1
1.5	Economist who combines the duties of a cashier	1
1.6	Lawyer	1
1.7	The secretary who combines the duties of a human resources engineer	1
1.8	Manager of the economy, which combines the responsibilities of the driver	1
1.9	*Total:*	**8**
2.	**Industrial and production personnel**	
2.1	Operator «DB WPP»	5
2.2	Operator of the «DB WPP», which combines the responsibilities of the Operational Guardian of the WT	5
2.3	Engineer of operational and technical maintenance and repair of WT, which combines the duties of the driver of special vehicles	2
2.4	Specialist of operational and technical maintenance and repair of wind turbines	3
2.5	Cleaner	1
2.6	Driver who combines the duties of a locksmith mechanic	1
2.7	*Total:*	**17**

№	Name of the staff	Number of people
3.	**Staff CTS 150/35 kV**	
3.1	Head of CTS	1
3.2	Senior Electrician of the CTS	5
3.3	The regular electrician of the CTS, which combines the responsibilities of the Operational Guardian of the WT	5
3.4	*Total:*	11
3.5	**Total for Project:**	**36**

Recruitment procedures will be in line with the Project Company and the Contractor’s employment policies. This will include the aim of providing opportunities for employment of local workforce to the extent possible considering unskilled, semi-skilled and skilled workforce. To avoid spontaneous settlements at the construction sites, no day-laborers will be hired.

The Project Company will seek to maximise the benefits from the Project to local communities in terms of direct and indirect employment, and purchasing of local goods and services during construction. This will include measures such as adopting local employment policies, establishing tenders for procurement of subcontracted goods and services at a scale that local businesses can respond to, ensuring opportunities are advertised locally, and providing training for local people to allow them to obtain jobs relevant for the Project to the extent possible.

7.1.5 Child labor

Child labor in Ukraine has acquired the characteristics inherent in the latter, both in developed and wealthy, and in economically backward countries with high levels of poverty. The actual observance of the special labor rights of minors, which gives them the state, has a single character. The main obstacle for state control over the observance of the rights of minors is their predominant participation in informal employment.

The Ukrainian Code of Labor Law clearly specifies the age from which a person is allowed to work – 16 years. As an exception, the law allows for the employment of 14-15 year old boys and girls, but only with the consent of one of the parents or persons who replace them. For the Project, the minimum age for all types of work related to transportation, installation, commissioning, maintenance, maintenance, repair and testing is 18 years.

7.1.6 Forced labor

Forced labor of refugees will also be avoided through adherence to national law, since refugees are now provided with work permits by the State, which ensures that only refugees that are of working age can be employed.

The related HR personnel of the Project company and Contractors will be responsible of ensuring proper documentation of age, legal status and health status is presented by all applicants, regardless of the position they are applying for.

7.1.7 Working condition and terms of employment

According to work conditions upon the main pressure «noise from wind power plant» and the requirements of the standards and sanitary norms, the economic activities within the sanitary protection zone of the Project are not limited and not subjected to regulations. Labor protection and safety measures provisioned during the construction and operation of «DB WPP» in Projects design shall correspond the acting normative documents of Ukraine.

Only professionally trained workers corresponding to their occupation, should be allowed work in maintenance and repair of the Project equipment. These workers must meet the requirements of the sectoral guideline 34.12.102-95 «Training, instruction and verification of knowledge of employees of enterprises, institutions and organizations of the Ministry of Energy of Ukraine on issues of labor protection and equipment operation. Terms of reference»).

Medical service of «DB WPP» employees will be provided:

Primary aid	at the workplace, using medical first-aid kits, which equipped with appropriate medicines
Emergency aid (ambulance)	if necessary, emergency service can be called (via designated communication line)

Use of sophisticated equipment without structural defects is envisaged to ensure the labor protection and safety of the work places.

The installation and maintenance of equipment of wind turbines at the significant height in before and during thunderstorm as well as upon the wind speed more than 12 m/sec, in icy, rainy and snowy conditions are prohibited.

The construction and installation companies are responsible for the labor protection and safety of construction workers according to labor protection and safety rules of Ukraine.

Since as «DB WPP» operates non-stop, maintenance will be carried out in three shifts per day. The work will be organized in such a way that the personnel will maintain both separate elements of the equipment and the monitor the whole «DB WPP» operation during all three shifts by maintenance detouring along the selected routes. These routes will develop by the administration of the «DB WPP» with consideration of specific features of the wind turbines distribution. The salaries, working conditions and social benefits will be determined by the relevant collective agreement in accordance with the labor legislation of Ukraine.

The qualification requirements of personnel are very high, therefore additional training of professional personnel will be carried out by the that manufacturer of the wind turbine equipment of the company Nordex, which will be installed at the «DB WPP».

7.1.7.1 Construction phase

Construction phase OHS risks associated with «DB WPP» and the OHPL developments are similar to OHS risks stemming from construction activities of other projects. The identified OHS impacts/risks are provided in Table 7.8 and the potential labor related impacts are provided in Table 7.9.

Table 7.8 – Potential OHS impacts and risks identified for construction phase

Risk/Impact	Description
Air Quality	Direct exposure of personnel to dust generated by construction vehicles' movement and improper soil and rock excavation and transportation practices, as well as exposure to other air pollutants generated by working construction equipment and vehicles can result in respiratory problems, which may lead to further illnesses.
Diseases	Communicable and vector borne diseases present a heightened risk both for the personnel (since a large number of workers is involved during construction) and for the communities (due to interaction of personnel and the local communities). However, considering the general meteorological conditions of the region, the relatively small number of personnel required for construction of the WPP and especially due to the fact that on-site accommodation will not be provided, this impact is assessed to be negligible.
Hazards due to Accidents, Incidents (Collisions with Objects and Moving Machinery)	Being struck, trapped and/or entangled by machinery parts or heavy equipment can lead to fatal and nonfatal injuries, especially since heavy equipment operators have limited fields of view of the area close to the equipment they use. For WPP projects, this risk is significant since installation of turbine components require working with heavy equipment, including cranes.
Hazards due to Accidents, Incidents (Other Physical Hazards)	Other OHS risks the construction personnel are potentially prone to include the following: – being struck by sprayed materials during use of power tools such as drills; – eye hazards caused by splatter of solid particles and/or liquid substances and fire sparks during welding; – hot work; – working environment temperature (potential heat exhaustion, dehydration, hypothermia and various other health effects); – excessive exposure to sun (potential dermal problems).
Lifting Operations	Lifting operations will be conducted during installation of wind turbines and pylons for wires, since the components will be transported separately and assembled on-site.
OHPL and Components/ Electrocution	Contact with live power lines components during construction phase is a potential health and safety hazard during testing/commissioning of the OHPLs and the CTS, as electrocution from high voltage lines occur.
Working at Height (and Falling Objects)	Construction activities that involve working with ladders, scaffolding, partially built structures and cranes constitute risks related to working at height. Considered particularly important for

	WPP and the OHPL construction activities, related hazards are caused in most cases by lack of protective equipment use, such as full body harnesses, proper barriers and rails. These risks include the following: – falls from at least 2 meter high work environments into ground, construction equipment, water or other liquids and hazardous substances. – objects that may fall from height on the individuals working below.

Table 7.9 – Potential labor impacts and risks related identified for construction phase

Risk/Impact	Description
Worker's influx	The workforce will be recruited from the local communities (Kherson region) to a large extent; therefore worker influx to the area is expected to be negligible during construction phase. Worker influx is small and limited only to the construction phase since operation phase personnel requirement for the Project is very limited.
Worker's Accommodation	Accommodation conditions are directly related to well-being of personnel in terms of diseases and general morale. These impacts may result from incompliance with related standards (e.g. IFC and EBRD's Workers' accommodation: processes and standards): – provision of potable and other domestic purpose water that are not in line with related standards or lack of sufficient water to ensure hygiene. – improper accommodation conditions such as lack of proper heating, separate beds, general hygiene. – inadequate sanitary facilities. – inadequate canteen/food facilities. – inadequate first aid facilities. – lack of proper insect and rodent control. – lack of proper social facilities (including lack of proper communication tools for workers, since a portion of the personnel will be employed will not be locals). Within the scope of the Project, accommodation will not be provided on-site. Both on site facilities such as sanitary facilities and canteen and the accommodation to be provided outside the Project area will ensure compliance with Project standards.
Dismissal of Workers on Fixed Term Contracts at the End of Construction Phase	A relatively high number of personnel will be involved in construction activities, including contractors' personnel. These workers will have fixed term contracts (covering the construction phase activities) and in case not managed in compliance with applicable legislation, legal requirements and contractual requirements, their dismissal may constitute problems. It

	should be noted that the Project will not cause retrenchment of existing personnel, but dismissal of personnel that will directly be employed only for the construction phase for a limited duration. Therefore, the personnel will be aware of their limited employment duration, as per their contracts. The Project Company and the Contractors will ensure that effective and transparent information dissemination mechanisms are in place to inform the personnel on the issue and that dismissal of each personnel is in line with related legislation, EBRD PR2 and their individual contracts (or collective contracts if the case).
Other Labor Issues	The Project will fully comply with requirements of the Ukrainian Labor law, EBRD PR 2 and IFC PS 2. The Ukrainian Labor Law is in compliance with principles of international labor standards. Therefore; child labor, forced labor and discrimination (of race and gender) will not be tolerated. Equal opportunity, equal rights to wages and benefits and right to join workers' associations will be ensured as per both national legislation and international standards. All contractors will also be responsible of implementing Project standards for management of their workforce. All personnel are required to provide the employer with necessary identification documents, including documentation that proves they are of working age. Therefore, adherence to national legislation will ensure child labor will be avoided both by the Project Company and all Contractors. In addition, child or forced labor of refugees will also be avoided through adherence to national law, since refugees are now provided with work permits by the State, which ensures that only refugees that are of working age can be employed. The related HR personnel of the Project Company and Contractors will be responsible of ensuring proper documentation of age, legal status and health status is presented by all applicants, regardless of the position they are applying for. Evaluation process will be implemented for any potential new supply chain firm and repeated periodically to ensure compliance with Project Standards is continuous. Nonemployee workers such as contracted workers may be employed within the scope of the Project. These employees, employed by the Project Company or by the Contractors, will have the same rights with employee workers in terms of their legal rights and OHS conditions, as well as equal access to the internal employee grievance mechanism.

7.1.7.2 Operation phase

In identification of OHS risks and potential impacts of the Project for the operation phase. The potential OHS impacts/risks and their descriptions are provided below Table 7.10.

Table 7.10 – OHS impacts and risks for operation phase

Risk/Impact	Description
Hazardous Materials	Hazardous materials used potentially for daily operation and maintenance of plant components (e.g. turbines and transformers) pose risk to personnel involved in handling of related hazardous materials such as oils and lubricants, paint, hazardous liquid wastes, pesticides, etc.
Working at Height (and Falling Objects)	Working at height is an issue especially during the operation phase, since maintenance works of turbines is conducted regularly and frequently. Unfavorable weather conditions such as wind speed, extreme temperatures, humidity and moisture may increase the risk of falling. In addition, any object that may fall from height during works conducted at height presents a significant risk for individuals working below, in the case said individuals are working inside the set exclusion zones.
Live OHPL and Components	Contact with live power lines and components is the main and potentially the most fatal impact sourced from maintenance and operation activities of switchyards and the OHPL, as electrocution from high voltage lines occur.
Electric and Magnetic Fields (EMF)	The guidance on limitation of the impact of alternating electric, magnetic and electromagnetic fields (up to 300 GHz) developed by the International Commission for Non-ionizing Radiation Protection (ICNIRP) [23] that is the basis of the sanitary requirements of the relevant European Directive. According to the guidelines, energy transmission is controlled at 50 Hz. The guideline suggests an upper occupational exposure value of 10 kV/m for 50 Hz and states that the provided value includes a sufficient safety margin to prevent stimulation effects from contact currents under all possible conditions (ICNIRP, 1998). Therefore, the 150 kV Project OHPL's EMF level is in the range of 1-2 kV/m and is well below the 10 kV/m limit suggested by ICNIRP (1998). The same study also states that magnetic field measurements conducted around wind turbines are resulting around 0,004 μT. The level of extremely low-frequency electromagnetic radiation close to wind plants is actually lower than EMF generated by use of common household appliances (e.g. hair dryers, microwave ovens, etc.), and even more lower than the average level measured inside and outside suburban homes.The fully information about EMF in Section 4.11.

7.2 Impact mitigation and management

Construction and operation of the Project, as well as construction and operation of any other object, may cause risks for personnel. In case of the Project, all probable risks for personnel will be minimized/avoided due to strictly planning of construction process and risk mitigation/avoidance measures. For mitigation/avoidance of risks for personnel during «DB WPP» construction, the following measures will be provided:

- provision minimum number of personnel in zones of excavation work and other works, formed dust;
- limitation on access of personnel to hazardous materials such as oils and lubricants, paint and other hazardous substances;
- limitation of access of personnel to WTs sites during conduction of any height works on wind turbines, for avoidance of falls of instruments on personnel;
- prohibition on construction works during unfavorable weather conditions;
- daily medical examinations of personnel working on transport and at high altitudes, and periodical medical examinations of all personnel;
- conducting informational lectures for the personnel regarding provision of the first necessary medical assistance;
- observance of the schedule of working hours and organization of favorable conditions for personnel accommodation.

Conclusion: presence of such high-tech enterprises as the «Dnepro-Bugsky WPP» will contribute to the improvement of working conditions and will reduce the outflow of highly professional population.

8 COMMUNITY HEALTH AND SAFETY

8.1 Baseline conditions

8.1.1 Health protection of citizens

The remoteness of the Project from any residential construction diminish its impact on the health and safety of citizens up to complete absence. The appropriate buffer zones for «DB WPP» are introduced in order to prevent the impact of noise and minimize the risk for outsiders (third parties) from staying nearly wind turbine. The activities and staying of the third party in these zones are also restricted in certain conditions.

The activities within the sanitary-protection zone (SPZ) of the «Dnepro-Bugsky WPP» is regulated for the main impact pressure – noise, using for this purpose the «Methodological recommendations on dose assessment of industrial noise». These guidelines describes the doses of non-permanent industrial noise of all types (time oscillating, discontinuous and pulsed) at workplaces.

It is advisable to establish a prohibition on staying the third party at the territory of the SPZ taking into account the existing risk. The prohibition applies for study tour and any type of activity: in a radius of 200 m from the tower of a wind turbine (for meteorological conditions when probability of ice formation on the surface of the blades and threat of ice scattering exist).

The risk of scattering of ice chunks around the wind turbines and damage from accidental detachment of the blade from the rotor shaft when the risk of destruction of the rotor of the WT increases upon wind speeds more than 20 meters/sec. In accordance with the scientific report of the SI «O.M. Marzeiev Institute for Public Health» of NAMSU dated April 24, 2017, № 20/1434; the excerpt from the Protocol of the meeting of the expert commission on establishment and alteration of sizes of the sanitary protection zones (dated May 5, 2017, № 2); and the letter of the SI «O.M. Marzeiev Institute for Public Health» NAMSU № 20/2028 (dated June 9, 2017), the sanitary protection zone for the «Dnepro-Bugsky WPP» of 700 m was established (based on the noise conditions).

The established sanitary protection zone completely covers the permissible distances to residential area from the wind turbines of the «Dnepro-Bugsky WPP» by all possible impacts of the «DB WPP».

8.1.2 Electromagnetic interference

Wind turbines have the potential to cause Electromagnetic Interference (EMI) via three principal mechanisms described below:

- Near field effects: Electromagnetic fields emitted by the generator and switching components in the turbine nacelle or hub have the potential to cause interference to radio signals.
- Diffraction: Wind turbine can directly obstruct a wave’s path of travel by either reflecting or absorbing the wave.
- Reflection/scattering: Rotating blades of a turbine can reflect and scatter a transmitted signal. This may cause the receiver to pick up two signals, with the

signal scattered by the blades causing EMI since is delayed in time or distorted compared to the primary signal.

For the Project, potential for EMI impact is identified for two separate subjects:

- Aviation radars: Projects potential impact on aviation is described in Section 8.1.6. Related approvals will be obtained from relevant authorities as part of the zoning plan approval process (if required), which will ensure that the Project has no potential impacts with regards to this issue or the identified impacts are managed as per the provisions of these approvals.
- The existing GSM communication towers: There are one identified GSM towers, which transmit across the «DB WPP» area (v. Oleksandrivka). For the issue, the Project Company has got approval from the GSM operators.

The basic principle of protecting human health from the electromagnetic field of the OHPL is the establishment of sanitary protection zones for power lines and the reduction of the electric field strength in residential buildings and in places of possible long-term residence of people through the use of protective screens. In accordance with clause 5 of the «Rules for the protection of electric networks» approved by the Cabinet of Ministers of Ukraine from 04.03.97 № 209 (hereinafter – the Rules), the security zones of electric networks are established. The boundaries of sanitary protection zones on the existing OHPL are determined by the criterion of electric field intensity – 1 kV/m.

Table 8.1 – Sanitary zones for the OHPL according to Ukrainian legislation

The voltage of the OHPL	<1 kV	1-20 kV	35 kV	**150 kV**	330 kV	500 kV	750 kV	1150 kV
The size of the sanitary zone	2 m	10 m	15 m	**20 m**	25 m	30 m	40 m	55 m

According to pp. 8, 9 of the Rules in the guard zones of the OHPL, transformer substations, distribution points and devices, it is prohibited to perform any actions that may interfere with the normal operation of the electrical networks, cause their damage or accidents, namely:

- put on the conductive parts of the objects of electric networks and bring to them foreign objects, to rise on supports of electric power transmission lines and electrical equipment of transformer substations, distribution points and devices, to disassemble their elements;
- to build residential, community and country houses;
- ignite the fires;
- launch sports models of aircrafts, kites;
- plant trees and other perennial plantations;
- arrange any landfill, fertilize, feed, straw, wood, other materials;
- to arrange sports grounds for games, stadiums, markets, public transport stops, to carry out any activities related to a large population of people not engaged in the execution of work permitted in the prescribed manner;

- to carry out in underground cable-laying zones power transmission lines with the use of shock mechanisms, to dispose of loads weighing more than 5 tons, to throw and pour corrosive and caustic substances, substances, fuel and lubricants.

One of the major reasons for the damage to the OHPL with the fall of the pylons is the vehicle's run-off on the OHPL pylons and the breakdowns of the wires by mechanisms that have large dimensions in height (truck cranes, flatbeds and other agricultural machines).

Therefore, in order to avoid damage to electrical networks and damage to people and animals by electric power, managers of agricultural enterprises, mechanics and agricultural workers must take measures and adhere to the following safety rules:

- to make slides along the OHPL of 35-150 kV and to ensure the priority harvesting under the indicated lines for the prevention of fires;
- do not touch the pylons during the driveway near the overhead lines, prevent the impact of the machinery, machines and trailers;
- when driving under the OHPL, lifting and pulling parts of mechanisms and hoisting machines must be in a transport position. Moving out of the paths under the cables of the operating OHPL should be carried out in the places of the least sagging of the wires (closer to the pylons);
- do not leave under the wires in the OHPL protection zone motor vehicles, tractors, combines and other self-propelled agricultural machines;
- in the protection zone of the OHPL it is strictly forbidden to set closer than the distance of the above-mentioned security zones, straw scraps, to arrange silos, dumps, to heat the hearths, to water fields with rain-fed installations, etc.;
- during the performance of agricultural work in protected areas of the OHPL with the use of machines and mechanisms, soil cultivation is prohibited within the boundaries of the decomposition around the foundations and the pylons.

Damage OHPL power lines leads to the termination of power supply to consumers, as well as to cases of electrical injuries of the population.

The influence of the electric field on the human body is determined not only by the intensity (intensity) of the field, but also by the time of exposure. The permissible time (in minutes) of a person in an electric field is expressed by an exponential dependence on the intensity of the electric field.

In experiments conducted by many researchers, revealed a clear threshold value of field strength, in which there is a striking change in human reaction. It is determined at 160 kV/m, the lower field strength does not cause any noticeable damage to the living organism.

Non-violation of the upper limit of permissible time provides self-healing of the physiological state of the body during the day without any residual reactions, functional or pathological changes.

Therefore, EMI impacts of the Project are assessed to be negligible within the scope of this assessment. Impacts related to EMF on the other hand are assessed in Section 4.11 of this ESIA Report and the assessment concludes that EMF impacts are negligible.

8.1.3 Existing transport network

Transport conditions of Bilozerskyi District are favorable. Total length of roads with hard cover at the territory of Bilozerskyi District is 278.72 km.

The highway of local importance O 220225 – border of Mykolaiv Region – Stanislav – Bilozerka crosses the territory of Oleksandrivka Village Council. A part of the road that crosses wind field of «DB WPP» has following characteristics: length 8.5 km, road width is 6 m. The road between village Oleksandrivka and border of Mykolaiv Region paved by asphalt, but state of pavement is unsatisfactory (Fig. 8.1).

Fig. 8.1. Road O 220225 that crosses the site of the Project

Existed road infrastructure is convenient for transportation both of common and large-size cargoes. During realization of project from construction «DB WPP» to each object of «DB WPP», the «DB WPP» internal technological roads with strengthened pavement (gravel) will be made. The modernised existing agricultural roads will be used as such technological roads. Currently existing agricultural roads are the agricultural dirt roads not usable in rainy weather and spring flood.

The 200 m buffer zone of engineering infrastructure from road is established for WT placement. Such distance protects vehicles, crossing the territory of «DB WPP», from ice being scattered by WT blades. From wind turbine manufacturer the sections of wind turbines (sections of the tower, nacelle, rotor, blades, etc.) will be transported by sea to the Specialized Sea Port «Olvia», where they will be reloaded to vehicles and delivered to the construction site of «DB WPP».

The length of route from Specialized Sea Port Olvia to the construction site is 32 km. The roads on chosen route corresponds to the requirements for transportation of WT elements by a vehicle (the width not less than 4.5 m and the turning radius of 60 m).

The following measures during transportation of WT elements and the OHPL elements should be introduced:

- road closure along whole route of movement during equipment transportation;
- organization of vehicle convoy escorted by police cars in the beginning and in the end of convoy;

– fixation of WT elements by lashing straps to lashing «eyes» on the platform of semitrailers;
– careful examination of the route of transportation, preparation of the road (if necessary) and getting necessary permits in the department of safety and traffic before transportation of WT elements;
– instruction of personnel about special transportation signals;
– start of every step of convoy transportation (departure, stop, emergency stop) by signal of chief of transportation operation or by signal of brigadier by order of chief of transportation operation. The emergency stop should be performed by signal from any member of team of transportation operation;
– periodical stops during convoy movement for checking the semitrailers and node fixation, especially before road descents or ascents.

Fig. 8.2. Buffer zone of engineering infrastructure for WTs placement (200 m from the road)

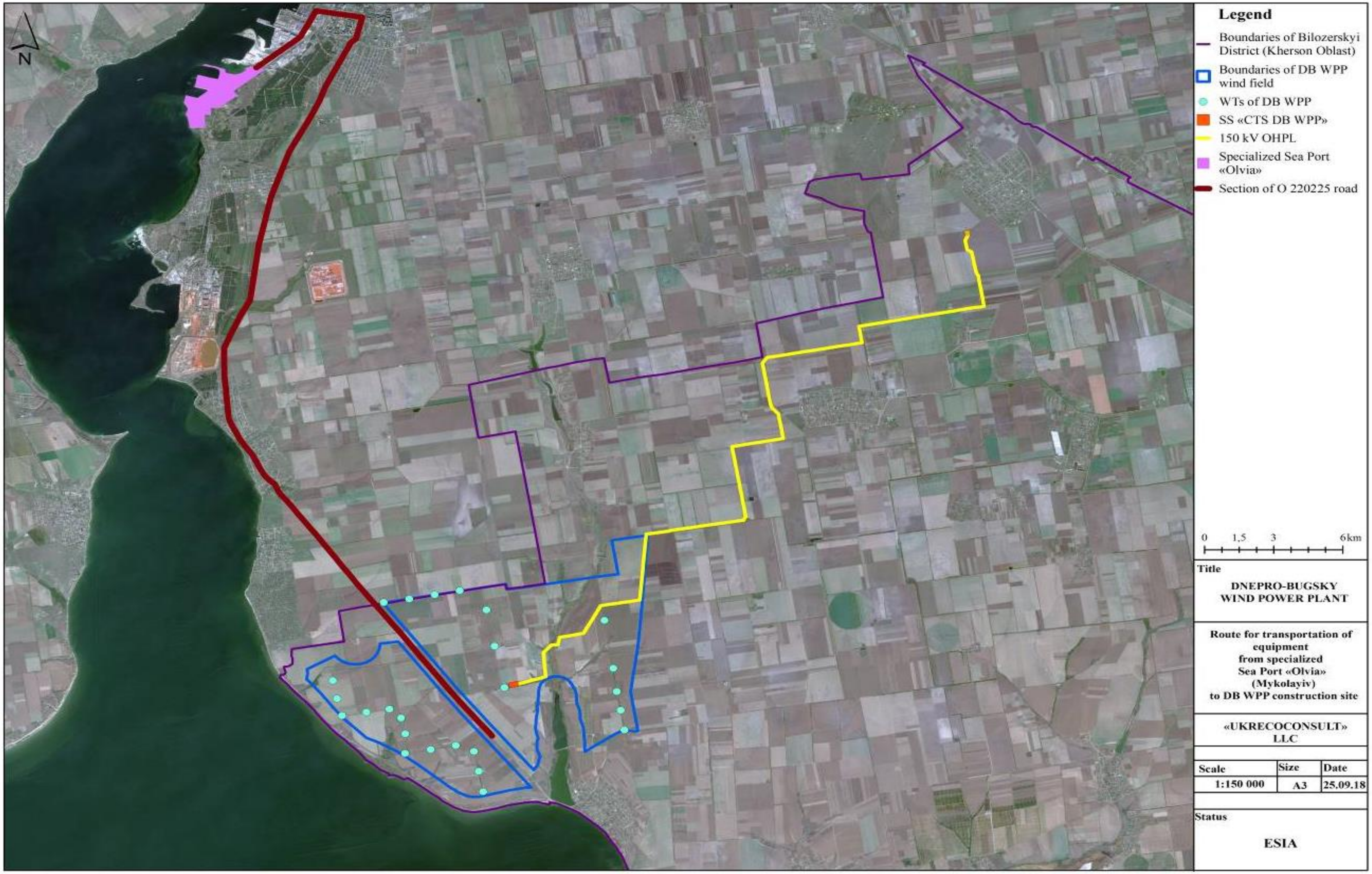


Fig. 8.3. Route for transportation of equipment from specialized Sea Port «Olvia» (Mykolayiv) to «DB WPP» construction site

8.1.4 Lightning potential

Typically, more than 2,500 thunderstorms are active throughout the world at a given moment, producing on the order of 100 flashes per second (*NASA Global Hydrology Resource Center website, https://lightning.nsstc.nasa.gov/data/*). The average lightning discharge releases approximately 55 kWh in only 100 to 300 microseconds. The Regional map of annual lightning strike frequency is given in Fig. 8.4 below. As can be seen, Ukraine is generally in the range of 2 to 8 strikes per km^2 annually.

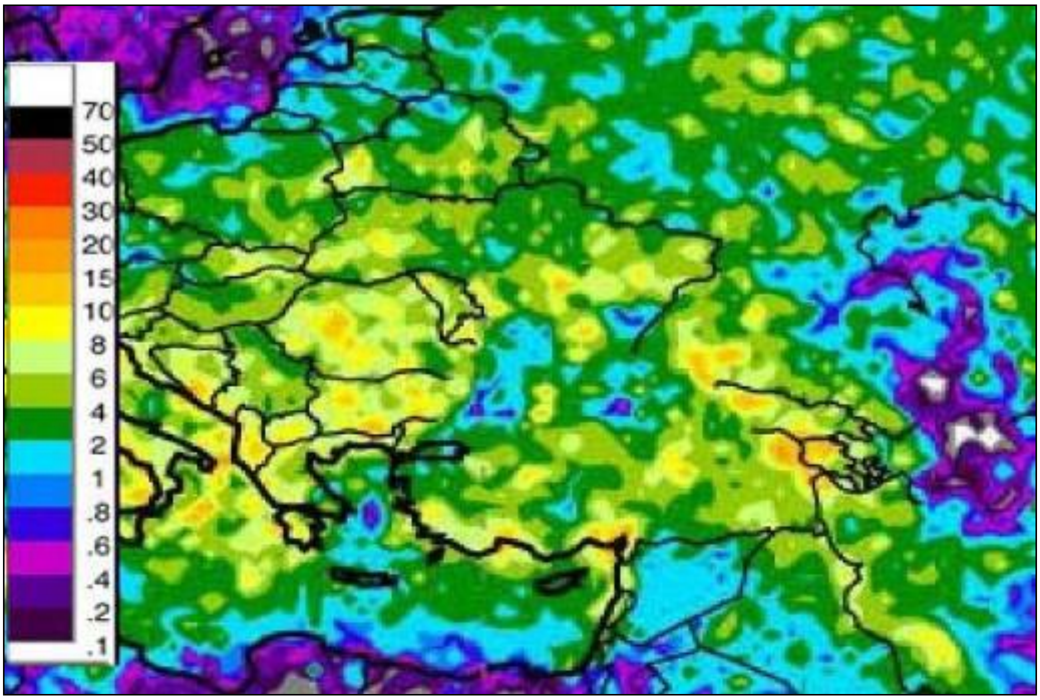


Fig. 8.4. Regional map of annual lightning strike
(average annual number of lightning flashes per km^2)

WTs are structures that are taller than any other natural or man-made structure around them and therefore, lightning may start a fire by striking them. As wind turbine increase in size they attract more lightning. However, modern turbines are equipped with lightning protection systems that transmit the lightning to the ground properly through the arrester and the earthing system and therefore, the effect of lightning does not change with size. Consequentially, since WTs attract lightning more than their surroundings and that they use appropriate earthing systems, well maintained WPPs actually decrease the forest fire risk around them. However, damage by lightning to the turbines is still a possibility.

8.1.5 Fires

According to the information regarding fires occurrence during 2010-2018, in vicinity of the Project site the 24 fires were observed, Fig. 8.5. The Project objects mostly located on field territories. Main reason of fires on field territories are human activities (smoking, stubble fires, sabotage, etc.) and natural phenomena. In case of the Project an additional sources of fires can consider WTs and construction process. For avoidance of field fires, during the Project construction and operation the following steps will be taken.

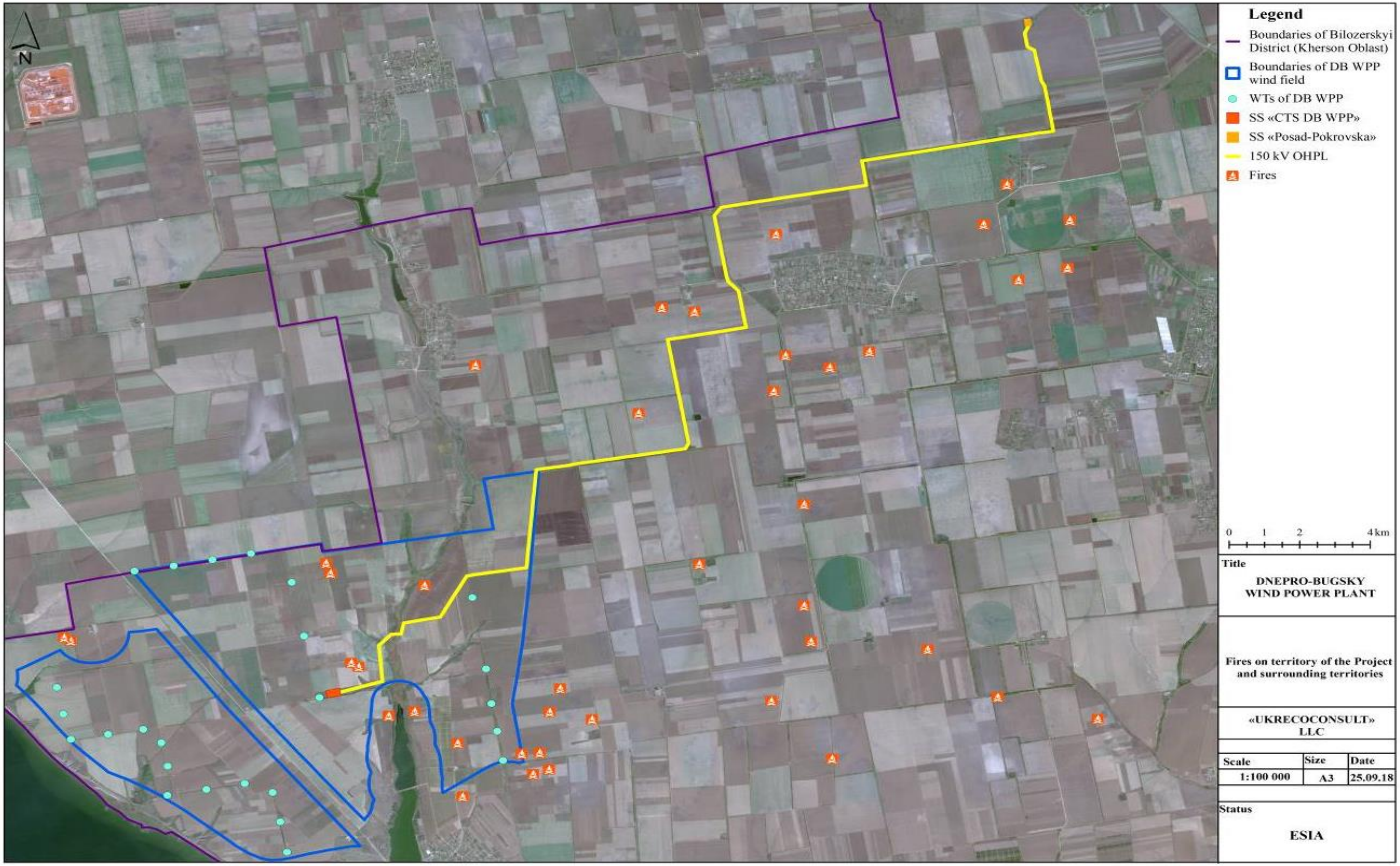


Fig. 8.5. Regional map of fires

Personnel:

- Special infrastructure for personnel will be organized (special places for smoking, places for vacation, and places equipped by fire extinguisher);
- Territory of construction site and wind field will be equipped by special fire extinguisher equipment;
- Informing of personnel about high level of fire hazard will be carrying out.

Natural phenomena:

- Informing of personnel about high level of fire hazard due to weather conditions;
- Works in fire-hazard period will be limited by time.

Wind turbines, the OHPL and construction equipment:

- For avoidance of additional oil spills, the special parking places for construction equipment will be organized;
- State of wind turbines and overhead line will be monitored, and in case of any fault, the turbine will be switch off until the fault will not be fixed;
- Residuals of flammable wastes (domestic wastes, textile with residuals of combustible substances, residuals of electrodes, etc.) will be collected in special places.

8.1.6 Aviation

The closest airports to the Project area is Kherson International Airport, which are at a distance of approximately 44 km north of the Project area. Kherson International Airport (IATA: KHE, ICAO: UKOH) is the international airport, Fig. 8.6.

Fig. 8.6. Regional map of nearest airports

8.2 Impact mitigation and management

Construction and operation of the Project, as well as construction and operation of any other object, may cause risks for community health and safety. In case of the Project, all probable risks for communities will be minimized/avoided due to strictly planning of construction process, compliance of state and international legislation, and risk mitigation/avoidance measures. For mitigation/avoidance of risks for community health and safety during the Project construction, the following measures will be provided:

- location of wind turbines and the OHPL of the Project outside the settlements;
- location of the Project with compliance of sanitary-protection zone of wind turbine (700 meters from residential area);
- informing of population on prohibition to access to wind turbines at unfavorable weather conditions and in winter time (because of ice scattering);
- informing of personnel about of high level of fire hazard due to weather conditions;
- provision of measures for avoidance of fires on territory of the Project and surrounding area – arrangement of special parking places for construction equipment, for minimization of probable oil spills, organization of special places for placing of flammable substances, arrangement of special places with fire extinguishers);
- arrangement of field roads, and maximal use of existing roads for minimization of air pollution by dust and GHG.

Conclusion: location of wind turbines and the overhead lines of the Project outside the settlements and compliance with the sanitary protection zone of wind turbines (700-meters from residential area) ensure absence of impacts on the health and safety of the population.

9 CUMULATIVE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

9.1 Baseline conditions

Probability of significant impacts on environment, human health’s, social and economic components is considered for all stages of project implementation, namely:

a) at the design stage;
b) at the construction stage;
c) at the stage of operation;
d) at the closing stage.

The raw materials necessary for construction and operation of the Project will be supplies by special companies. Provision of construction and operation of the Project by raw materials mined on the territory of construction are not foreseen. Using of water and other resources for technological needs are not foreseen. The chapters were made according to environmental and social policy of EBRD-2014. These subchapters describe world statistic of wind turbine life cycle. They have descriptive character in the part of approaches and measures, which applied in world for minimization of impacts of wind power plants.

Potential environmental impacts that will require mitigation measures during construction and operation the Project are:

– increase of noise level (due to movement of blades and operation of generators of wind turbines);
– increase of the electromagnetic field intensity around objects of the Project (cables, transformer substations);
– higher risk of accidental and operational pollution of air, water and soil (during the construction of the foundations of wind turbines, construction of transformer substations, cable laying and operation of the Project);
– collision of birds and bats with WT and wires causing death and injury;
– damage of vegetation cover during construction works (construction of the WT and the OHPL foundations, transformer substations, and transmission lines);
– loss of agricultural land (allocation of land plots for the construction of WT and the OHPL foundations, transformer substations, cable laying);
– increase of the third party risk (accidental injury and/or death of a person caused by destruction of towers or blades and the spread of their wreckage or ice debris from the surface of blades in the vicinity of the WT);
– fragmentation of the landscape (construction of the WT foundations, transformer substations, the OHPL);
– physical and visual changes of landscapes (installing of WTs with height of 105 m, transformer substations and the OHPL).

Potential recipients of impacts are:

– local population (impacts of electromagnetic radiation, noise effects, detachment of blades wreckage and ice debris, shadow flickering and shining of blades);
– a landscape, visual perception of which will change;

- birds and bats (impact zone – sector of rotor rotation) and other animals during construction process;
- vegetation (zone of impact – construction site and adjoining gully, slopes, etc.);
- soils and groundwater (zone of impact – the territory of the location of WT of the Project, transformer substations, the OHPL etc.).

9.1.1 Transboundary and global impacts

Estimation of gross greenhouse gas emissions (in recount on carbon dioxide), was calculated in accordance with *«EBRD Greenhouse Assessment Methodology»*, (Version 7, 6 July 2010).

According to Guidance Note 3: Data Requirements and Recommended Methods of Calculation, the traditional types of fossil fuels used in the energy industry of Ukraine (coal, oil, natural gas) were chosen for calculation of expected economy of GHG in result of Project realization.

Gross emissions of GHG which will be saved (in recount on carbon dioxide), are presented in Table 9.1.

Table 9.1 – Gross emissions of GHG which will be saved (in recount on carbon dioxide)

№	Type of fossil fuel	CO_2 (tC/year)
1	Anthracite	134579.7059
2	Brown coal	146907.1303
3	Oil	105389.8978
4	Natural gas	81030.46

For obtaining of GHG economy as a result of the Project construction it is necessary to define:

1) Stationary combustion of fossil fuels CO_2:

$$CO_2(m) = F\ (TJ)\ x\ C_{in}\ x\ C_{ox}\ 3.644$$

where F – average annual electricity production (TJ) – Table 9.2; C_{in} – carbon capacity: anthracite – 25.8 tC/*TJ*; brown coal – 27.6 tC/TJ; oil – 20.0 tC/TJ; gas – 15.3 tC/TJ (in accordance to Guidance Note 3). C_{ox} – the oxidizing carbon fraction: coal – 0.98; oil – 0.99; gas – 0.995.

2) To calculate expected emissions by each carbon fraction:

Anthracite: CO_2 = 1452.71 (TJ) x 25.8 (tC/TJ) x 0.98 x 3.644 = 134579.71 (t/year);

Brown coal: CO_2 = 1452.71 (TJ) x 27.6 (tC/ TJ) x 3.644 = 146907.13 (t/year);

Oil: CO_2 = 1452.71 (*TJ*) x 20 (tC/TJ) x 0.99 x 3.644 = 105389.90 (t/year);

Natural gas: CO_2 = 1452.71 (TJ) x 15.3 (tC/ TJ) x 0.995 x 3.644 = 81030.46 (t/year).

Calculated average annual electricity generation by the wind turbine N 149/4.0-4.5 was used for calculations, Table 9.2.

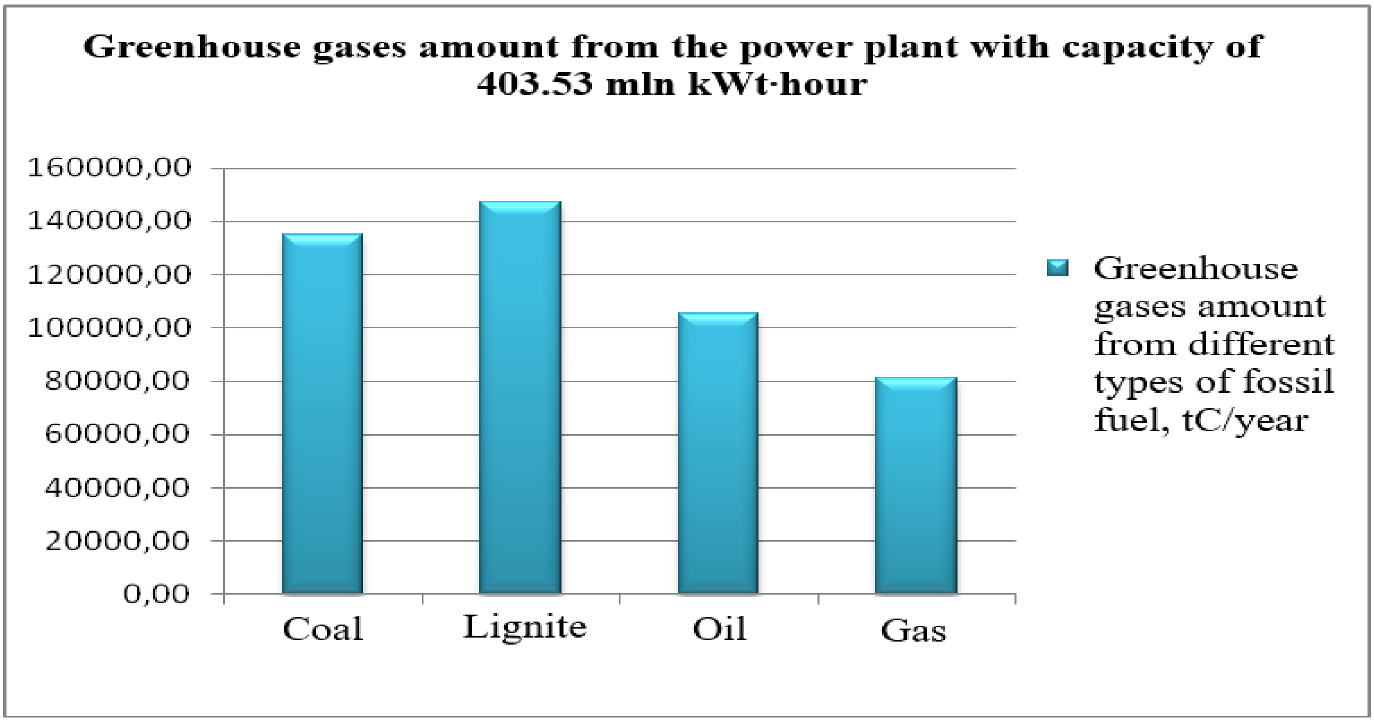


Fig. 9.1. Gross emissions of GHG

Conclusion:Planned average annual productionof electricity by «Dnepro-Bugsky WPP» is 403.53 millions kW*h. At the same conditions, the coal power plant will areate great GHG emissions (135-147 thous. tons of carbon per year). Natural gas will be smallest source of GHG emissions among proposed types of fossil fuel – 81 thous. tons of carbon per year.

9.1.2 National impacts

The impacts of the national level are increase of energy independence of Ukraine, prevention of environmental pollution and absence of risks from the use of fossil and nuclear fuels, promotion to preservation of ecosystem health and recreational value of the landscapes of the Dnipro-Bugsky Estuary for population of Ukraine. Average annual electricity generation and its carbon equivalents are presented in Table 9.2.

Table 9.2 – Average annual electricity production and its equivalents

Equivalent	Units	Nordex N149/4.0-4.5
Annual power generation by «DB WPP»	million kWh·hours	403.53
Conditional fuel	tons	0.14163
Natural gas	m^3	382492.89

9.1.3 Local impacts

At the local level during all stages of the Project construction, the likely significant environmental impacts are not expected. Probability of influence on the natural components of the environment is absent, moreover there is expected positive impacts in social sphere and economy:

- *1) Pollution.* Probability of significant pollution of surface and ground water by fuel, lubricants, transformer and mineral oils, are excluded due to use of these resources in small volumes. Soil pollution is likely only from accidental oil spills in very limited area. Probability of significant air pollution excluded because of short term insignificant volumes of pollutants emissions during construction and closing the Project and due to absence of pollution sources during operation of the Project.
- *2) Impacts on flora and fauna.* Probability of significant impact on flora and fauna on the territory of Project and on the adjacent territories is minimal due to the sufficient distance between the location of Project and well-preserved natural sites and routes of bird migration. Additional reason of impact minimization is the placement of the Project objects and technological roads the on anthropogenically altered lands.
- *3) Population health.* Remoteness of the Project territory from the nearest settlement (village Oleksandrivka, Pravdinske, Posad-Pokrovska) and compliance with all regulatory norms during construction of the Project will reduce probability of significant impacts to minimum.
- *4) Sustainable management of natural resources.* Mineral natural resources necessary for construction and operation of the Project will not be extracted on the construction site of «DB WPP» and the OHPL. Construction materials for the Project will be supplied from the enterprises of the Kherson Region.
- *5) Greenhouse gas emission.* In the phase of the Project construction and dismantling, the emissions of greenhouse gases will be distributed in time and space therefore impacts will be negligible; in the operation phase, the emissions of greenhouse gases will be absent.
- *6) Climate changes and adaptation.* The construction and operation of the Project will not lead to climate change.
- *7) Social and economic impacts.* There are expected significant positive impacts from increased employment, involvement of local and regional suppliers and producers of materials and components to «DB WPP», revenues to local budgets from rent of land plots, support of social sphere and environmental protection.

9.1.3.1 Description of impacts in the phase of «DB WPP» construction

This part defines and describes the positive and negative impacts in accordance with their scope, significance, sphere and duration. In the Project construction phase the following positive or negative impacts are expected, Table 9.3.

Table 9.3 – Description of impacts in the phase of Project construction

Type of impact	Probability of significant impact	Impact description
Water and soil pollution (due to the construction of the WT foundations, transformer substations,	No	Insignificant impact on air quality nearby planned objects and construction equipment is expected. This impact will be temporary

Type of impact	Probability of significant impact	Impact description
communications, etc.).		(during construction phase). Main pollutants are fuel and lubricants. Water resources for technological needs are not used. Impacts on water resources are not expected.
Damage of vegetation cover (because of construction of the WT foundations, transformer substations, the OHPL)	No	The area of vegetation cover damage will be negligible and patchy. Removed layer of productive soils will be used for recultivation.
Fragmentation of the landscape (during construction of WT foundations, transformer substations and the OHPL)	No	Fragmentation of landscape will be local, dispersed and in small volumes, and after completion of construction it will decrease. Land plots, used for technological needs of construction, will be recultivated.
Changing of typical view of landscapes (installation of transforming substations and WT of 105 m in height, the OHPL)	No	Wind turbines changes usual perception of landscapes but modern WT are sufficiently integrated into surrounding landscapes.
Air pollution by emissions from construction equipment or welding works	No	Air pollution has temporary character (during construction phase) and does not exceed installed standards.
Improvement of the region's infrastructure	Positive	Repair of asphalt road and arrangement of field roads with hard cover are expected (this impact will be permanent)
Social impact	Positive	Increase of population employment during construction phase and improvement of life standards are expected.
Economic impact	Positive	Use of resource from region, intensified economic activity, increase of revenues from taxes and rent payments to state and local budgets are expected.

Conclusion: at the stage of the Project construction, the significant impact will be absent due to distributed in time and space construction process, and considered planned mitigation measures.

9.1.3.2 Description of impacts in the phase of «DB WPP» operation

On the stage of «DB WPP» operation the following positive or negative impact are expected, Table 9.4.

Table 9.4 – Description of impacts in the phase of Project operation

Type of impacts	Probability of significant impact	Impact description
Increased noise level (as result of WT blades movement and generator work)	No	Due to sufficient distance from residential area, the impact of increased noise on population is not expected. Insignificant impact on personnel is expected.
Electromagnetic radiation (because of blades movement and generator work)	No	The sufficient distance from residential area allow avoid the impact of electromagnetic fields on population. Insignificant impact on personnel is expected.
Ice and blade detachments (as result of WPP blades movement)	No	The accidental health injuries / deaths of some persons, tourists and personnel is likely. Restricted access to objects of «DB WPP» will be established.
Shadow flickers and blade glints (as result of WPP blades movement)	No	The flickering and glinting impacts will manifest themselves only during daylight hours. The impact on population is absent due to remoteness of WTs from nearest settlements.
Visual influence (at installing of WT with a height 105 m)	No	Wind turbine changes the usual landscape, but modern wind turbines are organically fit into the surrounding landscape.
Changing of habitats and death of birds and bats from the collision with tower and rotor of WT (at height of WT 105 m, and during rotor work)	No	Insignificant impact on flora and fauna is expected.
	Positive	Restriction concerning hunting nearby objects of «DB WPP» will contribute to reduction of impacts on flora and fauna from hunting.
Water quality (risks of accidental spills of fuel and lubricants, transformer liquids, etc.)	No	In the materials of project , the special measures for prevention of water pollution (including ground waters) will be designed.

Type of impacts	Probability of significant impact	Impact description
Improvement of region infrastructure	Positive	Repair of asphalt roads O 220225 and strengthening of field roads by hard cover are expected (this impact will be permanent).
Social impact	Positive	Increase of population employment during the Project operation will be long-term. Increase of professional qualifications and education level will contribute to activation of social life.
Economic impact	Positive	Uninterrupted supply of electricity will contribute to the development of industrial and agricultural production. Economic development will contribute to increase of tourist number and revenues from taxes and rent payments to state /local budgets. The impact will be permanent.
Environmental impact	Positive	Expansion/preservation of green areas in field windbreaks is expected.

Conclusion: in operational phase only the third party risk during extreme weather condition and risk of bird collision with WT and the OHPL (especially in migration period upon difficult meteorological conditions) are impossible to avoid. However, remoteness of the Project location from main routes of bird migration and the planned system of information of population about the danger of being nearby the WTs during extreme weather conditions will minimize the risks that is why probability of significant impacts on the environment and human health during the Project operation are absent. All other risks can be minimized or avoided due to planned technologies, preventive measures, and smart organization of work.

9.1.3.3 Description of impacts in the phase of the Project closing to dismantling

At the stage of closing and dismantling of the Project, the impacts similar to the impacts in construction phase are expected. More attention will be paid to utilization/recycling of wastes and reclamation of land plots.

9.1.4 Social and economic impacts

In all phases of Project implementation and under existing social and economic conditions, any negative social and economic impacts is expected, Table 9.5.

Table 9.5 – Review of probable positive social and economic impacts from implementation of Project

Social and economic aspect	Probability of significant impact	Description and justification of impact assessment
Demography	Positive	The increase of local population employment (up to 250 temporary work places and 37 permanent work places during the Project operation) will improve the demographic situation by reducing the outflow of work force.
Social Structure	Positive	Construction and operation of «DB WPP» will contribute to decreasing migration among young population and highly educated specialists from the rural community
Interaction with local authorities and management	Positive	Construction of the Project will increase revenues to local budgets and increase abilities of local authorities in solution of social problems.
Conflicts and social tension	Absent	Construction of the Project will not cause social tension and conflicts.
Land ownership and land using	Absent	The ownership of lands will not change. The main areas of lands will be rented up to 1 year in the construction phase (with returning for further agricultural production) and long-term rent or servitude for 30 years.
Economic activity	Positive	The agriculture is main branch of economy in Bilozerskyi District. During construction works, local construction organizations will be involved as contractor and subcontractors. Building materials and raw materials from local producers of state and private sectors will be used.

Social and economic aspect	Probability of significant impact	Description and justification of impact assessment
Education	Positive	The educational level of population is favorable for development of high-tech technologies (such as «DB WPP»). The construction and operation of the Project will contribute to increase of population employment, decrease of outflow of working power from village Oleksandrivka and Bilozerskyi District in whole and increase of interest in obtaining of special education in the energy and related industries.
Health's of the population	Absent	Due to remoteness of the Project from village Oleksandrivka (above 700 m), the negative impact from «DB WPP» on population health is not expected.
Gender issues	Positive	The construction of the Project will contribute to return of the male population from outside earnings to village Oleksandrivka.
Vulnerable groups	Absent	The social groups, which may be negatively affected during construction of the Project are absent. As vulnerable the following groups may be considered: a) personnel, maintaining «DB WPP» (will fully comply with requirements of labor legislation of Ukraine and all occupational safety rules on the workplace). b) owners and tenants of land plots, which will used for placement of «DB WPP» objects (this issue will solve

Social and economic aspect	Probability of significant impact	Description and justification of impact assessment
		through compensation for temporary using of lands in generally accepted manner). c) separate persons/unorganized tourists that may be suffer during emergency situations (given issue will solve through compensation in case of accidents, and warning of population about the prohibition of visiting of wind-field in extreme weather conditions, etc.).
Cultural heritage	Positive	Due to conduction of obligatory archeological expertise of places «DB WPP» location, it is expected positive impact in a part of more detailed studying of objects of cultural heritage on the territory of «DB WPP» and preservation of it for the next generation. «Dnepro-Bugsky WPP» will not affect at state of cultural heritage.
Health protection and safety of population	Absent	The sanitary-protection zone in 700 meters (due to noise conditions) that was installed by SI «O.M. Marzeiev institute for public health» NAMSU completely covers the permissible distances of residential area from the WT and the OHPL by all factors of the possible impacts of the Project. By factor of third party risks (due to extreme weather conditions), the buffer zone is equal to 200 meters that corresponds to the projects solution of «DB WPP» construction.

Social and economic aspect	Probability of significant impact	Description and justification of impact assessment
Professional health and safety	Absent	Health protection and safety of personnel during construction and operation of the Project will be provided by carrying out of all project decisions in strict compliance to operating normative documents.
Labor precautions and working conditions	Positive	Labor precaution and safety rules during construction and operation of the Project will be provided by carrying out of all project decisions in strict compliance to operating normative documents.

Conclusion: at the stage of project implementation, the following significant positive socio-economic impacts will prevail, namely: improvement of demographic situation due to decrease of labor force outflow, support of ecological activities at the surrounding territories, improvement of infrastructure in region, etc.

9.1.5 Impacts on technogenic environment

The impacts of wind turbines on means of communication, navigation and monitoring of civil or military aircrafts are absent. The impacts on mobile operator network will also absent. The places for location of the Project objects has been agreed with the senior staff of the Air Forces of the Armed Forces of Ukraine, State Air Traffic Service Enterprise of Ukraine (UkrSATSE), Administration of the State Service for Special Communications and Information Protection of Ukraine (RRT Concern, Kherson Branch), «Lifecell» LLC, «Kyivstar» JSC, «Ukrtelecom» JSC, «MTS Ukraine» PrJSC.

On the territory of the Project, the Habliv Rear and Habliv Middle lighthouses are located. Placement of the wind turbines of the «DB WPP» is agreed with the branch of the State Institution «State Hydrography» – «Mykolayiv District of the State Hydrography».

The location of objects of the «DB WPP» is possible under the following conditions:

1. Ensuring the operation of the Habliv Klim of Bug-Dnipro-Estuary channel 6 (shining in the direction of the estuary cross-section), as indicated on Fig 9.2;
2. Placement of the WTs at the distance from the lighthouses and lighthouse towns. Distance should correspond to regulatory requirements of the current sanitary and epidemiological standards – no less than 700 meters;
3. The warning lights of WT must be «red» constantly;
4. During construction and after its completion the wind turbines should be declared as notable buildings in «Marine Notice».

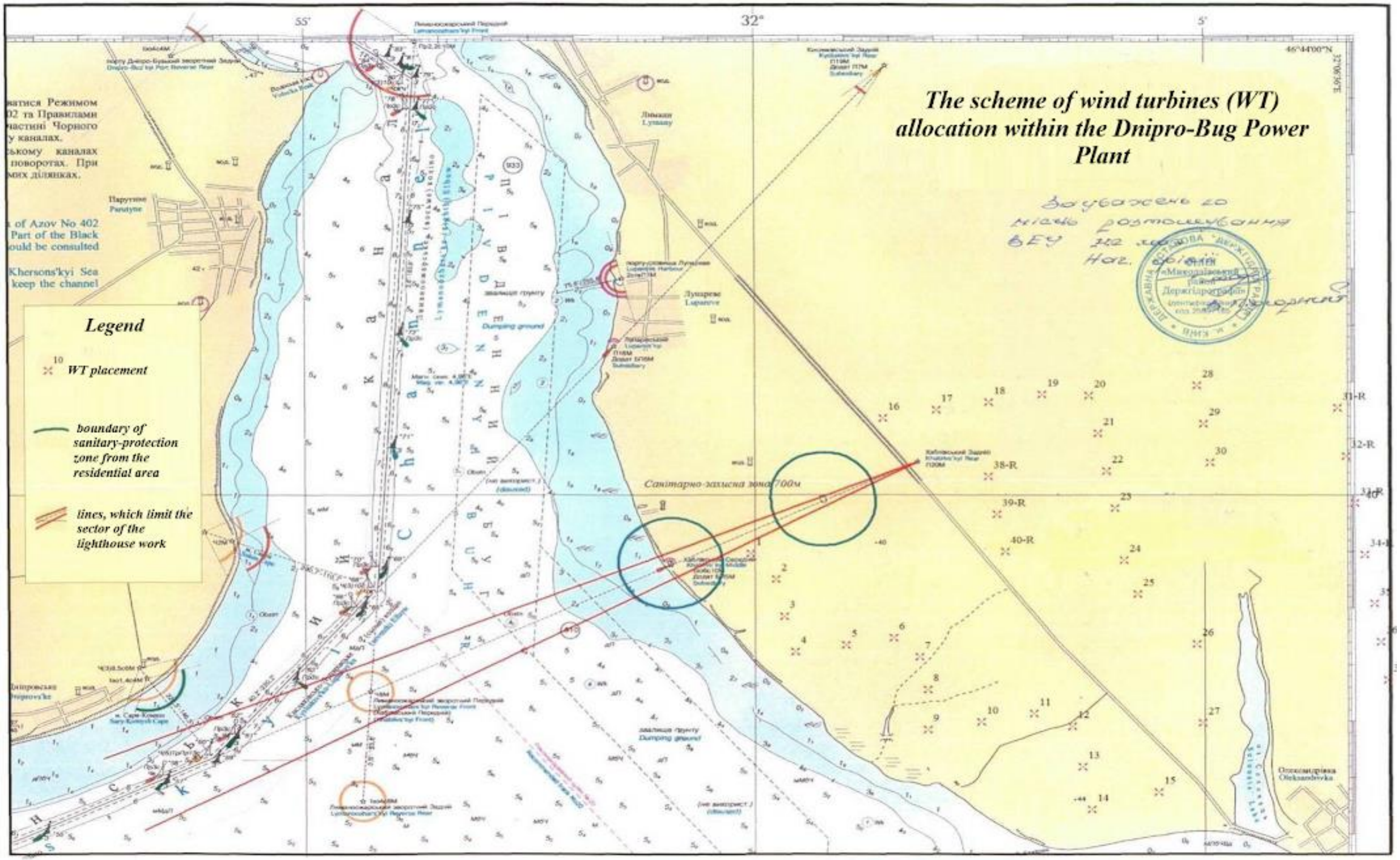


Fig. 9.2. Location of WTs of the «DB WPP» in relation to the location of the Habliv Klim of Bug-Dnipro-Estuary Channel

9.2 Cumulative impacts assessment

Cumulative impacts – impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project.

Cumulative impact assessment (CIA) of the Project is a set of impacts which are the result of the Project construction and operation. Cumulative impacts can be observed on construction stage, but they will be temporary and insignificant, Fig. 9.3.

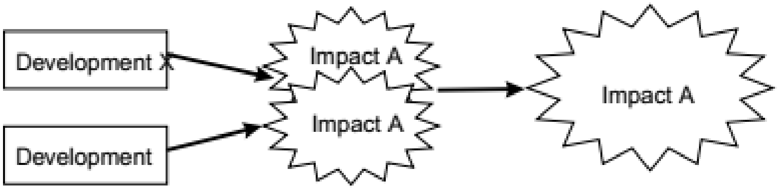


Fig. 9.3. Cumulative impact

Cumulative impact (unlike indirect impacts (Fig. 9.4) and interaction of impacts (Fig. 9.5) defines as additional changes caused by propoused developments in conjunction with others similar developments (objects/projects), or like total effect of all events taken together.

Fig. 9.4. Indirect impacts

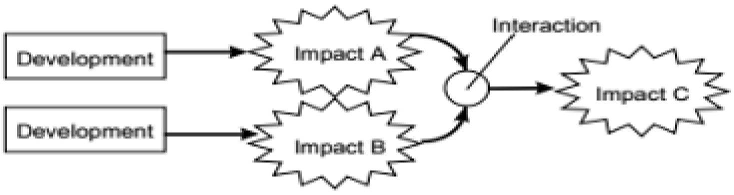


Fig. 9.5. Interaction of impacts

For rapid cumulative impact assessment (RCIA) the following logical framework (which is an iterative six-step process) was used.

The following section presents the implementation of the step-wise methodology and results of the CIA study for the Project. Steps to be followed are listed below:

- Step 1: Scoping Phase I – Valued Environmental and Social Components (VESCs), Spatial and Temporal Boundaries;
- Step 2: Scoping Phase II – Other Activities and Environmental Drivers;
- Step 3: Establish Information on Baseline Status of VESCs;
- Step 4: Assess Cumulative Impacts on VESCs;
- Step 5: Assess Significance of Predicted Cumulative Impacts;
- Step 6: Management of Cumulative Impacts.

Step 1. Scoping Phase I – VESCs, Spatial and Temporal Boundaries.

The good cumulative impact assessment practice suggests that the cumulative impact assessment is conducted with a focus on the environmentally or socially important natural resources, ecosystems or human values, which are referred to as Valued Environmental and Social Components and may include the following:

- physical features (e.g. habitats, wildlife populations);
- social conditions (e.g. health, economics) or
- cultural aspects (e.g. archaeological sites).

Baseline and impact assessment studies conducted in the Project identified the valued environmental and social components considered for the cumulative impact assessment as presented inTable 9.7.

Step 2: Scoping Phase II – Other Activities and Environmental Drivers.

The nearest similar objects to the Project are the Liman WPP (9 MW), the Dmitrovsky WPP of the Ochakivskaya WPP (40 MW) and the Tuzla WPP (18.5 MW). The distance from the Project from the conditional centers of the aforementioned wind farms is 10.5 km, 21.5 km respectively, Table 9.6, Fig. 9.6

Table 9.6 – Short description of closest similar objects to the Project

Characteristics	Ochakiv WPP	Limanska WPP
Nominal capacity of WPP, MW	40	9
Number of WTs, un.	16	3
Company manufacturer	Fuhrlander FL 2500-100	Fuhrlander FL 3000-100
Status	Active	First queue in action

Noise, air pollution, land use, landscapes, and other pressures and impacts, identified as local ones, from wind power plants will not have cumulative influence due to remoteness from each other.

At the territories, where the «DB WPP» will be located, the following significant infrastructure objects are planned only at the territory of the Oleksandrivka village council, namely (Fig. 9.7):

- in the south of the village Oleksandrivka – construction of cargo port «NIBULON» with the estimated area of 26 hectares;
- Oleksandrivka port – Kherson railway of a total length of 32 km;
- East of the village – construction of a solar power plant, 10 MW.

At the same time, in future, such projects will compete for professional human resources, eventually increasing salaries and other benefits for local population and contributing to the improvement of living standards of the local communities.

For the purposes of qualitative impact assessment of «DB WPP» with existing or planned activities the impacts of local significance are not considered. The potential impacts on regional level are presented in Table 9.7.

Table 9.7 – The valued environmental and social components considered for the cumulative impact assessment

Environmental/ Social Components	**Valued Environmental/Social Components**	**Temporal boundaries**	**Spatial boundaries**	**Specific VESCs**
Physical	Key biodiversity area	Long term	Regional	Biodiversity of windbreaks used for placement of WTs and the OHPL transmission pylons.
Physical	Key biodiversity species	Long term	Regional	Bird species: *Gavia arctica*, *Podiceps nigricollis*, *Delichon urbica*, *Turdus merula*, *Turdus philomelos*, *Spinus spinus*, *Emberiza schoeniclus*, *Corvus frigulegus* , *Sturnus vulgaris*, *Larus cachinnans*, *Larus ridibundus*,*Fulica atra*.
Physical	Key biodiversity species	Long term	Regional	Bats: *Pipistrellus kuhlii*, *Nyctalus noctula*
Physical/economic	Land use	Long term	Local	Plots of land at the sites of the main Project objects (WTs and the OHPL) and their security areas
Social	Air quality in local settlement	Short term	Local	Air quality in settlements of Oleksandrivka, Pravdinska, Posad-Pokrovska village councils.
Social	Noise	Short term	Local	Noise in the settlements of Oleksandrivska, Pravdinska, Posad-Pokrovska village councils.
Social	Landscapes	Long term	Local	Visual effects around settlements of Oleksandrivska, Pravdinska, Posad-Pokrovska village councils.
Social	Demography, employment and economic activities	Long term	Local	Demographic structure, employment, small and medium size businesses in the settlements of Oleksandrivska, Pravdinska, Posad-Pokrovska village councils.
Economy	Transport infrastructure	Long term	Regional and local	Local roads of Oleksandrivka, Pravdinska, Posad-Pokrovska village councils.

Fig. 9.6. Distances between the Project and nearest similar objects

Fig. 9.7. Map of future infrastructure projects near the site of the Project

Step 3: Establish Information on Baseline Status of VESCs.

Information on the baseline status of the valued environmental and social components s of «DB WPP» is mainly based on the information gathered for each environmental and socio-economic components in scope of this ESIA study. Thus, relevant information on the baseline status for VESCs that are presented in the relevant chapters of this ESIA Report does not reveal the significant environmental and social impacts of the Project.

Step 4: Assess Cumulative Impacts on VESCs.

Assessment of potential cumulative impacts of the «Dnepro-Bugsky WPP» together with other projects/activities identified in the CIA Study Area on the selected VESCs has been based on a qualitative approach. The cumulative impact potential on the VESCs has been evaluated considering the projects affecting the VESC along with the «Dnepro-Bugsky WPP» (the Project under Assessment). In this regard, the cumulative impact potential on each VESC has been classified as «yes» if the VESC is likely to be affected by other projects in addition to «Dnepro-Bugsky WPP», or «no» is the VESC is to be affected only by «Dnepro-Bugsky WPP», Table 9.9.

Step 5: Assess Significance of Predicted Cumulative Impacts.

Assessment of potential cumulative impacts of the «Dnepro-Bugsky WPP» and other projects/activities identified in the area under consideration was assess qualitatively. The cumulative impact potential on each VESC has been classified as «yes» when mutual impact of «DB WPP» and other existing and planned projects have potential environmental and social impacts or «no» when the VESC is to be affected only by «Dnepro-Bugsky WPP», Table 9.8.

Table 9.8 – Significance of the predicted cumulative impacts

Significance	**Impact**
Severe	Impacts that the decision-maker must take into account as the receptor/resource is irretrievably compromised.
Major	Impacts that may become key decision –making issue.
Moderate	Impacts that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Impacts that are locally significant.
Not Significant	Impacts that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

The impact of the project itself on the VESCs is given in the relevant sections of this report. Significance of predicted cumulative effects on VESCs is given в Table 9.11.

Table 9.9 – Cumulative impact assessment of «DB WPP» and existing and planned economic activities

Environmental/ Social Components	Valued Environmental/ Social Components	Temporal boundaries	Spatial boundaries	Specific VESCs	Project Residual Impact	Probability of cumulative impacts	Cumulative impacts
Physical	Critical Habitats	Long term	Regional	Biodiversity of windbreaks used for placement of WTs and the OHPL transmission supports.	According to ESIA impacts on critical habitats is assessed as minor or negligible to be mitigated to negligible upon implementation of the planned mitigation measures In operation phase the impact on critical habitats assessed as negligible will remain negligible with expected improvement of the state of windbreaks	yes	Currently the existing windbreaks are in very bad conditions within the territory of planned «DB WPP» and its OHPL; expected compensatory tree planting will restore and create new habitats for flora and fauna; protection zone around WTs will prevent additional disturbance to biota, will be additional sources of protection and refuge of animal species thus increasing possibility for migration between «DB WPP» territory and Landscape Reserve «Oleksandrivskyi» and create additional possibility for development of ecological corridors in coordination with similar activities of, Ochakivska and Limanska wind power plants. Security areas around «DB WPP» objects also will contribute to lessened disturbance to biological species.
	Key biodiversity species	Long term	Regional	Bird species: *Gavia arctica, Podiceps nigricollis, Delichon*	As the assessed in ESIA Report, impact on wildlife and invertebrates in the operational	yes	The wind turbines and overhead power line pylons of the Project will be located at the sufficient distances from migrating routes of birds.

				urbica, Turdus merula, Turdus philomelos, Spinus spinus, Emberiza schoeniclus, Corvus frigulegus , Sturnus vulgaris, Larus cachinnans, Larus ridibundus, Fulica atra.	phase assessed as minor or negligible that upon compensatory tree planting and established buffer zones around the objects of the «DB WPP» will serve for reduction of species disturbance. The impacts on bird species, assessed as minor will be mitigated to negligible upon implementation of measures provisioned in biodiversity mitigation and enhancement measures.		Low speed turbines and planned mitigation and enhancement measures will allow avoid undesirable impact on bird populations. Expected minor impact will be further mitigated by long term monitoring and planned mitigation and enhancement measures, in particular in coordination with similar activities in the area of wind field
Physical	Key biodiversity species	Long term	Regional	Bats: *Pipistrellus kuhlii, Nyctalus noctula*	The impacts on bats, assessed as minor and negligible will be reduced or maintain to negligible upon implementation of mitigation and	yes	Bats are insufficiently studied in the investigated area; planned monitoring for better assessment of bats, improvement of windbreaks as habitats of bats and coordinated efforts with existing and planned wind power plants in Oleksandrivka Village Council for creating ecological corridors and

					enhancement measures.		as well as limiting hunting activities in the area will result in long lasting positive impact on bat population at the regional level.
Economy	Transport infrastructure	Long term	Regional and local	Local roads of Oleksandrivka, Pravdinska, Posad-Pokrovska village councils.	Local roads are in near catastrophic conditions. The expected improvement of roads for transportation of building materials and equipment of «DB WPP» and maintenance of technological road in the good conditions in operational phase will have positive socio-economic impact.	yes	Currently available roads in the area of Oleksandrivska, Pravdinska, Posad-Pokrovska Village Councils, particularly in the rural areas, are in very bad conditions. One of preconditions of the local community included in the partnership agreement with «DB WPP» is the improvement of roads that will intensify small and medium size businesses as well as enable the residents of Oleksandrivka, Pravdinska, Posad-Pokrovska Village Councils to sell their household made goods at the markets. The maintenance and improvement of local roads are the responsibilities of local authorities and shall be financed from local budgets that in its turn will benefit from tax revenues from «DB WPP». The present and planned economic activities are facing the similar challenges thus contributing to overall improvement of roads at the regional scale.

Table 9.10 – Qualitative significance of predicted cumulative impact «DB WPP» on valued environmental and social components

Activities/VESC	Biodiversity	Birds	Bats	Land use	Air quality	Noise	Landscapes	Cultural Heritage	Demography	Employment	Agriculture	Tourism	Roads
«DB WPP»													
Ochakivska WPP													
Limanska WPP													
Solar power plant													
Cargo Port «Nibulon»													
Cumulative Impact with «DB WPP»	no	yes	yes	no	no	no	no	no	yes	yes	no	yes	yes

Step 6: Management of Cumulative Impacts.

For the management of cumulative impacts, it is important to underline that the responsibility of the management/mitigation of the cumulative impacts resulting from the actions of multiple stakeholders involves a collective responsibility which requires individual actions to eliminate or minimize the contribution of each action/development. Project level actions to minimize the impacts of «Dnepro-Bugsky WPP» and the OHPL are described in relevant chapters of this ESIA Report.

Indirect and cumulative effects from projects is not expected. Stop working and dismantling of the WTs at the end of its lifetime will not lead to a significant violation of the land or ecosystems of the construction site.

Main short-term and indignificant impacts at construction stage are:

- partial changes in land cover due to preparation of land plots for the installation of wind turbines (arrangement of construction sites, internal stationary technological roads with gravel coating, excavation of pits for foundations, trenches under cable lines);
- insignificant increasing the air pollution level (in the limits of MPC) because of pollution by dust and products of equipment work (in the limits of MPC);
- partial degradation of vegetation cover (only on the sites of wind turbines placement) due to the allocation of land for the installation of wind turbines.

Conclusion: The placement of objects of the Project on given site is optimal because of high wind potential of the region, and due to absence of constructions on the proposed site, absence of objects of historical and cultural heritage and the remoteness of objects nature reserve fund from the territory of wind turbines location.

Table 9.11 – The significance of predicted cumulative impacts VESCs

Ecological/social components	Evaluated environmental/social components	Spatial boundaries	Duration of influence	Significance of influence	Probability of cumulative impact of «DB WPP» with other economic activities
	Noise Impact	Levels of noise in settlements of Oleksandrivska, Pravdinska, Posad-Pokrovska village councils	Expected minor, temporary, increase of noise at the stage of construction of the main project objects (WT and transmission line). The main sources of noise at the construction stage will be vehicles, construction machinery. No significant noise effects are expected at the project exploitation stage. Determination of the expected noise effects from the main project objects to the surrounding settlements is given in the relevant sections of this report.	Minor. The results of the research show that noise levels from the main Project objects that will be formed during the construction and operation stages will not be applied to the nearest settlements, and they do not pose a danger to the population.	Due to remoteness to any residential area amplification of noise or interaction with noise of other economic activities, existing in the area, is not provisioned.
	Air quality	Air quality in settlements of Oleksandrivska, Pravdinska, Posad-Pokrovska village councils	Temporary impact on the construction phase. At the stage of construction of the main project objects, small emissions of pollutants into the atmosphere are expected. The main sources of emissions will be construction machinery, vehicles, welding posts, painting posts.	Minor. The results of the studies indicate that the emissions generated during construction work do not exceed the maximum permissible concentrations. The results of calculation of pollutant emissions from construction equipment at the construction stage are given in the relevant sections of this report.	Due to remoteness to residential areas and only short term increase of combustion exhausts of equipment in the construction phase, no additional impact from WPP and its transmission line is expected as well as its interaction with other economic activities in the area of «DB WPP» construction and operation

Ecological/social components	Evaluated environmental/social components	Spatial boundaries	Duration of influence	Significance of influence	Probability of cumulative impact of «DB WPP» with other economic activities
	Visual effects	Visual effects around settlements of Oleksandrivska, Pravdinska, Posad-Pokrovska Village Councils	Permanent impact. Small visual effects on the area are expected due to the installation of objects up to 105 meters high.	Minor. All Project objects will be located outside of settlements. The results of modeling the visual impact of the main project objects are presented in the relevant sections of this report.	Existing landscapes are agriculturally changed plain landscapes formed many years ago; no significant change of the existing view are expected due to sparse and remote location of WPP and the OHPL objects from residential area of settlements.
Critical habitats	Habitats within «DB WPP» territory and buffer zone around this territory	No critical habitats exist within «DB WPP» territory	Agriculturally changed habitats	Impacts on habitats on in construction and operation phase	No cumulative impact
Bats	Bats populations within the Project site	Bats Classes: *Pipistrellus kuhlii; Nyctalus noctula.*	Temporary impact. The probability of occurrence of situations which will lead to increase of mortality of representatives of *Chiroptera*, namely, collision with the main objects of the Project is expected. This impact will be kept to a minimum by monitoring the mortality of bats in the WPP site and along the route of the OHPL.	The impact on bats can be estimated as a moderate, appearing mainly during the migration period, but as a minor one in general. At the project exploitation stage, special measures are envisaged and the use of special means to minimize the impact of the Project on bats.	Due to ability for migration mostly along liner routes, bat can fly rather long distances at during one night. Therefore, some cumulative impact with existing and planned wind power plants is possible and requires additional studies of the migration routes of bats and bat distribution.Monitoring of bats is provisioned by the «DB WPP» investment project and appropriate protection measures.
Birds	Bird populations within the «DB WPP» site territory	Birds Classes: *Gavia arctica; Podiceps nigricollis;*	Temporary impact. The probability of occurrence of situations which will lead to an increase in the mortality of	The impact on birds can be estimated as a moderate one during the migration period, but is	As birds are able to fly long distances the cumulative impact of existing and planned wind power plants is likely but

Ecological/social components	Evaluated environmental/social components	Spatial boundaries	Duration of influence	Significance of influence	Probability of cumulative impact of «DB WPP» with other economic activities
		Delichon urbicum; Turdus merula; Turdus philomelos; Spinus spinus; Emberiza schoeniclus; Corvus friguleguss; Sturnus vulgaris; Larus cachinnans; Larus ridibundus.	birds as a result of collision with the main objects of the Project is expected. This impact will be minimized by monitoring the mortality of birds at the WPP site and along the route of the OHPL.	minor in general. At the project exploitation stage, protection measures are envisaged, and the use special means to minimize the impact of Project on birds.	estimated as moderate. More monitoring results and regular assessments will allow undertake appropriate measures to protect birds.
Socio-economic conditions	Employment, demography and economic activity	Agriculture. Tourism. Employment Demographic Structure.		Land use at the territory of «DB WPP» and its transmission line will not be affected. Small in size land plots under WPP and its transmission line objects does not exceed totally. Existing archeological sites and potentially attracts tourists but tourist infrastructure is poorly developed.	Sustainable energy supply will boost processing industries of agricultural products, improve logistics and roads and will have long lasting positive economic impact on the area. Improvement of energy supply and tourist services of nearby settlements. New jobs as at «DB WPP» as in increased demand for local services will also attract more qualified people into the region and will increase competitiveness for human

Ecological/social components	Evaluated environmental/social components	Spatial boundaries	Duration of influence	Significance of influence	Probability of cumulative impact of «DB WPP» with other economic activities
				Unemployment in local communities is high and forces local people to migrate in search for better jobs. Population in rural areas such as settlements nearby WPP and the OHPL is getting older as young people leave their villages.	resources thus potential salaries and welfare increase. New jobs, better infrastructure, improvement of cultural life will motivate young people to stay and work in their communities.

10 MAJOR IMPACTS AND RISKS

A) Environmental Impacts:

- Death or injury of birds and bats during migration period caused by collision with rotating blades of wind turbine, in particular, during extreme weather conditions. International experience provides sufficient empirical data, confirming the existence of a risk for birds from operating wind power plants. In Ukraine, the impact of wind power plants on birds and bats is poorly studied because observations of ornithofauna are available only for the periods when industrial wind turbine were absent in Ukraine and can serve as reference or background conditions for future impact assessment. For this reason, the bird and bat observations should continue in the vicinity of individual wind turbines and at the whole the Project territory after putting the Project into operation;
- Probability of the accidents for the third party in extreme weather conditions exists but is possible to minimize by the introduction of appropriate buffer zones and timely informing of the people about restriction on the visiting of the territory of wind power plants in the extreme weather conditions.

B) Social and economic impacts and risks:

- Expected increase of tax revenues and rental payments for land to local budgets will contribute to social and economic development and will have a positive impact on local communities and vulnerable groups of population, in particular.
- To reduce social risks, «DB WPP» LLC concluded an agreement with Oleksandrivka Village Council on social partnership during implementation of the investment project of the «Dnepro-Bugsky WPP». In case of non-fulfillment of the social obligations of «DB WPP» LLC will become liable according to the current Ukrainian legislation. An assessment of social and economic impacts and risks in line with EBRD Environmental and Social Policy, 2014 will continue in more details and for all vulnerable groups.

C) Economic uncertainties such as inflation expectations:

- High profitability of the investment project (by preliminary estimate the internal profitability rate is 14.8 %).

D) Investor risks:

- Lack of sufficient wind potential. Long-term forecasts of the state meteorological station «Ochakiv» located nearby the Project wind field and analysis of wind potential of region for the period from January 2011 to January 2016 carried out by Spanish company «EREDA» showed presence of high wind potential of «DB WPP» wind field;
- Low demand of electricity of «DB WPP». Growth of industrial activities in Ukraine results in increasing demand of electricity, pushes up costs of electricity, produced by gas and coal thermal power plants as well as approaching dates of decommission for the majority of the nuclear power plants in Ukraine in 10-20 years create concerns of industrial consumers;
- Risk of refusal from purchase of electricity generated by wind power plants. The Law of Ukraine on renewable energy guarantees the obligatory purchase of

electricity from renewable energy sources by the state;

- Risk of substantial decrease of commercial electricity prices. The Law of Ukraine on renewable energy guarantees «green» tariff for electricity produced by wind power plants until 2030.

E) Political Instabilities:

- Political instability will not affect implementation of investment project due to availability of proper legislation on the protection of foreign investments and European vector in Ukraine's society.

F) Emergencies such as natural disasters:

The emergencies can occurs because of:

- Increased frequency of fires caused by global climate change;
- Increased frequency of extreme weather conditions resulting in higher risks of destruction of the WPP.

On-going innovations and improvements of design features of wind turbines by the manufacturers of WT increase high reliability of contemporary wind turbines.

G) Lack of highly professional workers for implementation of the Project:

The Project investment will provide:

- Professional training of employees in the required specialties and retraining of workers of support services permanently employed at «DB WPP»;
- Close collaboration with experts in relevant sectors, important for implementation of Project investment, as well as relevant national and international experts and regional environmental organizations for assessing impacts of DP WPP on the environment, social life, and economic activities.

11 COMPENSATORY MEASURES

11.1 Compensation of impacts on natural environment, flora, fauna, specially protected areas of Nature Reserve Fund of Ukraine

Natural vegetation, preserved on the territories adjacent to the construction site of the Project has a significant botanic and environmental value. It has been undergoing and is still undergoing a significant impact caused by human activities, e.g. plowing, flooding of the slopes, the constant burning of dry vegetation, etc., on the still existing steppe and meadow areas.

In order to ensure necessary conditions for the preservation and reproduction of flora and fauna, the following measures are recommended:

Restrictive measures:

The lands and wetlands of the Dnipro-Bugsky Estuary area are important for birds. Therefore, the territory of the Project is located in the part of the Dnipro-Bugsky Estuary area that sufficiently distanced from habits and migratory routes, and other places of special importance for birds. In order to minimize the impact of «DB WPP» on biodiversity and natural ecosystems, the following restrictions on WT installation are introduced:

- 500 m ecological buffer zone from the coastal line of the Dnipro-Bugsky Estuary and the Lake Solonets;
- 100 m buffer zone from the boundaries of the Landscape Reserve «Oleksandrivskiy»;
- maximal use of already existing field roads and anthropogenic forms of relief already deprived of vegetation or soil cover, in order to minimize damage to natural vegetation cover and flora.
- strict prohibition of storage of soil wastes in the pristine steppe lands, gullies, and on the slopes of the estuary that are the centers of conservation of natural flora, adjacent to the «DB WPP» territory.

Organizational measures:

As currently planned Project territory is a part of hunting grounds, the entire ornithofauna in the zone of the wind field is located under strong pressure from hunters in the period from August to January. These factors of bird disturbance provoke increased anxiety and mobility of birds, disorientation, chaotic altitude and speed of flights and, consequently, increased probability of their collision with obstacles.

In order to minimize the disturbance of birds and mammals in the vicinity to wind turbines, it is advisable to promote hunting ban at «DB WPP» territory.

In order to ensure the conservation of biodiversity and natural ecosystems in the area of «DB WPP» impact and the formation of environmentally focused consciousness, important for ensuring the preservation of valuable natural ecosystems in the area of planned «DB WPP», recommended measures are:

- support to Oleksandrivka Village Council for the maintenance of the Landscape

Reserve «Oleksandrivskyi» during the implementation of the «DB WPP» investment project as stated in the agreement on social partnership between Oleksandrivka Village Council and «Dnepro-Bugsky Wind Power Plant» LLC (e.g. to create an environmental resource center for local residents, schoolchildren and other visitors in village Oleksandrivka, to arrange ecological trails, to promote the preparation and publication of visual materials devoted to biological diversity and value of ecosystems of wetlands, steppe territories of the Dnipro-Bugsky Estuary and the Landscape Reserve «Oleksandrivskyi»);

– organization of monitoring of indicator species of flora and fauna, identified in the ESIA Report, during the periods of design, construction, and for at least three years of operation from putting «DB WPP» into operation at «DB WPP» territory and adjacent territory of 5-10 km in width around boundaries of «DB WPP».
– creation of a tourist trail «Kherson Mountains» next to the site of the «DB WPP».

Restoration measures:
– promotion of the development of the national ecological network, in particular by supporting the creation or optimization of existing specially protected areas of the Nature Reserve Fund of Ukraine at planned «DB WPP» and adjacent territories;
– to restore the tree plantations that will be cut off when installing the Project objects in other areas of windbreaks that are not adjacent to the objects of the Project;
– technical and biological reclamation of disturbed lands after the completion of construction and mounting works, as well as compensatory afforestation for protection of agricultural lands from wind erosion and restoration of steppe vegetation cover for protection against water erosion;
– comprehensive environmental monitoring in the area of «DB WPP» impact during its construction and operation in line with monitoring program developed for this purpose.

11.2 Compensation for local population and economy

Construction and operation of the «Dnepro-Bugsky WPP» will result in a temporary withdrawal of agricultural lands and other agricultural assets from the turnover, changes in the habitual mode of management during construction, which will be compensated by payments for short-term use.

The payment for easements was calculated by a single approach to all land plot owners on the Project site, which is the territory of Oleksandrivska, Pravdynska and Posad-Pokrovska Village Councils. The level of payment has been brought to the highest level of living by the village councils involved in the project. Thus, Oleksandrivska and Pravdynska Village Councils are geographically located in the steppe zone in the absence of industrial enterprises and developed transport infrastructure, which negatively affects the level of life, in comparison with the Posad-Pokrovska Village Council. Territorially, the Posad-Pokrovska Village Council is also located in the steppe zone, but along the principal (international road) M-14 (E 58) Odesa-Melitopol-Novoazovsk, which promotes the development of services, trade and warehouse logistics. Consequently, the living standards of the residents of the Posad-Pokrovska Village Council are somewhat higher than of the residents of Oleksandrivska and Pravdynska Village Councils, which was taken into account in determining the payment for the establishment of an easement.

Calculation of the payment for the use of land plots under the easement agreements considered the rent amount specified by the lessor. As for the Oleksandrivska Village Council, the rent amount received by the owners from land leasing is UAH 2.000 per one hectare; as for the Pravdynska and Posad-Pokrovska village councils, the rent amount received by the owners from land leasing is UAH 6.000 per unit and the unit size on average is from 3.5 ha to 7 ha, depending on the quality and category of land. Rent per hectare for Oleksandrivska Village Council is the highest and it is used as the basis for the calculation of the payment for the use of the land plots under easement agreements.

Meetings and consultations with villagers and representatives of local authorities made clear the necessity to take into account a certain type of easement at calculation of the payment amount. Thus, the calculation of the payment included a functional purpose factor which is determined taking into account the validity of easement and the type of land use.

The Project provides for the use of three main types of easements:

- for a partial installation of the support structures of a wind turbine;
- for installation of the support structures of the OHPL;
- for construction sites and other objectives of the Project.

More detailed information is provided in Annex B.

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ANNEXES

TO THE PROJECT OF THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF «DNEPRO-BUGSKY WIND POWER PLANT» (ACCORDING TO REQUIREMENTS OF ENVIROMENTAL AND SOCIAL POLICY EBRD – 2014)

Annex A. CONCLUSION OF STATE ENVIRONMENTAL EXAMINATION FOR «DB WPP»

ХЕРСОНСЬКА ОБЛАСНА ДЕРЖАВНА АДМІНІСТРАЦІЯ
ДЕПАРТАМЕНТ ЕКОЛОГІЇ ТА ПРИРОДНИХ РЕСУРСІВ

пров. Козацький, 10, м. Херсон, Херсонська область, 73026, тел./факс (0552) 26-31-95;

ТОВ «Дніпро-Бузька вітрова електростанція»

ВИСНОВОК №21/06.11.2017 – 064 від 13.12.2017 р.
державної екологічної експертизи
щодо матеріалів ОВНС **«Дніпро-Бузька ВЕС встановленою потужністю до 110 МВт в межах території Олександрівської сільської ради Білозерського району Херсонської області»**

Державна екологічна експертиза виконана Департаментом екології та природних ресурсів обласної державної адміністрації (далі – Департамент) шляхом, визначеним частиною першою статті 37 Закону України «Про екологічну експертизу» у зв'язку із заявкою ТОВ «Дніпро-Бузька вітрова електростанція» від 06.11.2017 р. № 115-24871-39.

Підставою для проведення державної екологічної експертизи є Закон України «Про екологічну експертизу» та постанови Кабінету Міністрів України від 28.08.2013 р. № 808 та від 31.10.1995 р. № 870

Замовник об'єкту: ТОВ «Дніпро-Бузька вітрова електростанція», Херсонська область, Білозерський район, с. Олександрівка, вул. Миру, буд. 10, кімната 1

Розробник матеріалів ОВНС: ТОВ «Укрекоконсалт», кваліфікаційний сертифікат: серія АР № 011040 від 29.04.2015 р

Для проведення державної екологічної експертизи надано:

- заявка на державну екологічну експертизу;
- том ОВНС;
- «Заява про екологічні наслідки діяльності»;
- «Заява про наміри»;
- протоколи громадських слухань жителів с. Олександрівка та інших зацікавлених осіб від 25 квітня 2017 року;
- витяг з протоколу № 5 засідання архітектурно-містобудівної ради при управлінні містобудування та архітектури обласної державної адміністрації від 14 червня 2017 року.

Характеристика об'єкту. Інвестиційний проект «Дніпро-Бузька вітрова електростанція» передбачає будівництво та експлуатацію Дніпро-Бузької вітрової електростанції встановленою потужністю до 110 МВт на узбережжі Дніпро-Бузької затоки (лиману) в західній частині Херсонської області на кордоні з Миколаївською областю. Проектом передбачається розташування від 32 до 40 вітроелектричних установок (далі – ВЕУ) в залежності від моделі та її номінальної потужності (базовий варіант – 33 ВЕУ) з площадками для обслуговування і технологічними проїздами в межах полезахисних лісосмуг та польових господарських шляхів (сільськогосподарських проїздів).

Основними об'єктами Дніпро-Бузької вітрової електростанції є:

- вітроелектричні установки (ВЕУ);
- центральна трансформаторна підстанція (ЦПС) 150/35 кВ;
- диспетчерський пункт вітроелектростанції (ДП);
- комплектний розподільчий пристрій закритого типу першої черги (КРПЗ) 35 кВ;
- кабельні лінії (КЛ) 35 кВ.

ВЕУ представляє собою сталеву вежу, на якій розміщена гондола з електрогенератором, ротором і лопатями. Вежа встановлена на монолітну залізобетонну плиту, що виконана у формі циліндра і спирається на палі та розраховується для кожної ВЕУ індивідуально.

Оцінка впливу планованої діяльності на компоненти довкілля.

Вплив на клімат і мікроклімат Будівництво та експлуатація ДБ ВЕС не призводить до змін клімату.

Вплив на атмосферне повітря. Аналіз технологій та обладнання, які використовуються при виробництві електроенергії ВЕС, свідчить про те, що викидів забруднюючих речовин від обладнання в атмосферу немає, тому забруднення повітря на стадії експлуатації не очікується. Основними чинниками забруднення атмосфери є транспорт, зварювальні роботи, запилення під час будівництва. Введення в експлуатацію ДБ ВЕС передбачається в дві черги будівництва. Викиди забруднюючих речовин в атмосферу при виконанні будівельно-монтажних робіт будуть відбуватися від автотранспортної та будівельної техніки (неорганізовані джерела викидів), при роботі двигунів в атмосферу викидаються: діоксид азоту, оксид азоту, вуглець чорний (сажа), діоксид сірки, оксид вуглецю, вуглеводні насичені та ароматичні. Максимально-секундні викиди забруднюючих речовин, що утворюються під час будівництва ДБ ВЕС, незначні і не призведуть до суттєвих змін складу атмосферного повітря в районі будівництва.

Вплив на атмосферне повітря оцінюється екологічно прийнятним.

Шум та вібрація. Майданчик ДБ ВЕС розташований поза межами населеного пункту с. Олександрівка Білозерського району. Основними джерелами шуму на стадії будівництва є автотранспорт та будівельна техніка, а на стадії експлуатації – ВЕУ та трансформаторна підстанція. Аеродинамічні та механічні випромінювання шуму ВЕУ відбуваються у звуковому та інфразвуковому діапазонах частот. У моделях ВЕУ, що пропонуються для встановлення і експлуатації на ДБ ВЕС, основні джерела шуму знаходяться на висоті понад 120 м і вище над земною поверхнею. Відстань від житлових будівель до найближчих вітроенергетичних установок ДБ ВЕС (три ВЕУ) складає 1700 та більше. Рівні акустичного впливу знаходяться на рівні шуму довкілля та відповідають гранично допустимим нормам шуму для людини.

Рівні інфразвуку, що буде випромінюватися під час експлуатації ВЕУ не перевищують порогові рівні сприйняття людиною.

Джерела шуму знаходяться за межами проекту санітарно-захисної зони для ДБ ВЕС - зони з понаднормативними значеннями шуму. Такий стан не вимагає додаткових заходів із пом'якшення впливу від шумового чинника та його управління.

Вібрація конструкції ВЕУ зумовлена обертанням окремих елементів ВЕУ. Вібрація повністю згасає на рівні несучих елементів та фундаменту вітротурбіни та не передається на прилеглу територію та довкілля.

Для уникнення вібрації буде виконано такі запобіжні заходи:

- обрано відповідний аеродинамічний профіль лопатей для ВЕУ;
- при виготовленні всі обертові елементи вітротурбіни будуть добре збалансовані;
- в конструкції генератора буде застосований демпфер коливань вагою щонайменше 5 т.

Крім того, для дотримання технічних нормативних вимог на майданчику ДБ ВЕС буде встановлено систему моніторингу за вітроустановками - CMS. У разі перевищення вібрації понад нормативні значення буде проводитися технічне обслуговування або поточний ремонт відповідних елементів вітроустановки для приведення вібрації до значень, що не перевищують нормативи безпеки.

Електромагнітне випромінювання. Під час роботи, вітротурбіни та інше устаткування створюють електромагнітне поле, яке може змінюватися в межах території ВЕС, залежно від розміщення обладнання. Значення магнітного поля не перевищують допустимих значень. Таким чином, магнітні поля, що виробляються вітротурбіною і кабельними лініями передач електроструму від вітротурбіни, не створюють загрози здоров'ю людей.

Вплив на геологічне середовище. Для території ДБ ВЕС характерним є розвиток площинної (водно-поверхневий змив), повітряної та руслової ерозії. Всі ВЕУ ДБ ВЕС розташовуються на достатній відстані від місць, потенційно можливого розвитку ярів. При будівництві ДБ ВЕС мінімізується порушення поверхні ландшафту при проведені земляних робіт та відновлюється ґрунтово-рослинний шар після завершення будівництва споруд та прокладання комунікацій. При виявлені розвитку ерозії ґрунтів будуть застосовуватися захисні заходи, зокрема, відновлення родючого шару ґрунтів та рослинного покриву. Будівництво та експлуатація ДБ ВЕС не впливає на активізацію абразії берегової лінії. Плановані місця будівництва об'єктів ДБ ВЕС розміщені на достатній відстані від берегової лінії Дніпро-Бузького лиману та ділянок розвитку абразії, що дозволяє говорити про виключення впливу абразії на об'єкти ВЕС і зворотного впливу ДБ ВЕС на процеси абразії берегової лінії лиману. Будівництво планованої ДБ ВЕС на активізацію карсту не впливає.

Можливе забруднення поверхневих і підземних вод. Прибережна захисна смуга лиманів становить 2 км, для озер – 50 м. В той же час встановлення об'єктів вітроенергетики віднесено до дозволених видів діяльності в межах прибережних смуг лиманів та озер. Відстань до берегової лінії лиману вітроустановок планується на рівні 500 м. Вплив ДБ ВЕС на геологічне середовище Дніпро-Бузького лиману та озера Солонець, а також забруднення та засмічення підземних та поверхневих вод виключені. Для запобігання забруднення ґрунтових вод необхідно мінімізувати потрапляння у ґрунт забруднюючих речовин.

Вплив на поверхневі та підземні води оцінується як екологічно допустимий, за умови виконання заходів передбачених проектом для мінімізації впливу на водне середовище.

Вплив на земельні ресурси. Визначення здатності ґрунтів до просідання, на майданчику спорудження об'єктів ВЕС, буде виконано при проведенні інженерно-геологічних вишукувань на наступних етапах проектування. Параметри просідання ґрунтів будуть враховані при проектуванні фундаментів споруд ДБ ВЕС. Всі об'єкти Дніпро-Бузької ВЕС розміщуються в межах території Олександрівської сільської ради Білозерського району Херсонської області. Для розміщення ВЕУ ДБ ВЕС в базовому варіанті відводяться 33 земельні ділянки (1-й базовий варіант) в існуючих та запроектованих полезахисних лісосмугах, а також на пасовищах і занедбаних господарчих дворах, прямокутної форми, розміром орієнтовно 20х50 м, площею 0,1 га (розмір кожної земельної ділянки, що відводиться в лісосмузі, визначається фактичною шириною лісосмуги з прилеглим до неї господарським шляхом, і відповідної довжини щоб забезпечити необхідну площу для розміщення ВЕУ). Розташування ДБ ВЕС не спричинить змін у землекористуванні та не здійснюватиме впливу на користування земель сільськогосподарського призначення.

Вплив на земельні ресурси характеризується як екологічно допустимий.

Влив на флору і фауну, заповідні об'єкти. Основними чинниками негативного впливу на фіторізноманіття майданчика ДБ ВЕС є механічне знищення або пошкодження рослинного покриву в місцях облаштування технологічних проїздів та монтажних площадок, спорудження фундаментів ВЕУ, центральної трансформаторної підстанції і розподільчого пункту першої черги, прокладання підземних кабельних ліній та складування ґрунту та відходів. Значного впливу на рослинний покрив прилеглих територій, у тому числі ландшафтного заказника «Олександрівський» (оскільки об'єкти ДБ ВЕС зміщені на безпечну відстань від ландшафтного заказника, вплив на рослинний покрив цього об'єкту відсутній), при дотриманні рекомендацій щодо виконання будівельних робіт та експлуатації ДБ ВЕС, не передбачається.

Вздовж берегової смуги Дніпро-Бузького лиману та балок гідрологічної сітки лиману, які межують з південною частиною площадки ВЕС, проходить міграційний коридор птахів. Проте чисельність рідкісних видів низька, тому будівництво і функціонування тут вітрових електроустановок не матиме суттєвого негативного впливу на групу рідкісних птахів.

Влив на флору та фауну оцінюється як незначний.

Вплив на соціальне середовище. Діяльність має позитивний вплив на соціальне середовище, що проявляється у створенні нових робочих місць під час будівництва та експлуатації Дніпро-Бузької ВЕС, залучення місцевих фірм та компаній для постачання матеріалів та обслуговування, що також зменшить відтік робочої сили та покращення демографічної ситуації в селі Олександрівка та Білозерському районі в цілому. За умови функціонування Дніпро-Бузької ВЕС, як центральний, так і місцеві бюджети матимуть досить значні додаткові надходження у вигляді податків і плати за оренду землі, реалізація проекту сприятиме розвитку закладів охорони здоров'я, що фінансуються з бюджету.

Проект будівництва Дніпро-Бузької ВЕС було винесено на громадські обговорення, за результатами яких громада Олександрівської сільської ради підтримала реалізації проекту.

Вплив на соціальне середовище можна охарактеризувати як допустимий.

Вплив на техногенне середовище. Розміщення вітрополя ДБ ВЕС було проведено таким чином, що село Олександрівка розташовано на півдні, південному-сході від ВЕУ ДБ ВЕС, а найближчі житлові будинки розташовані від вітрополя на відстані 1700 м та більше. У відповідності з науковими звітами ДУ «Інститут громадського здоров'я ім. О.М. Марзєєва НАМН України» та висновками державної санітарно-епідеміологічної експертизи Міністерства охорони здоров'я України (№ 20/1434 від 24.04.2017 р.) санітарно-захисна зона для Дніпро-Бузької ВЕС величиною 700 м (із умов шуму) повністю перекриває припустимі відстані віддалення житлової забудови від ВЕУ Дніпро-Бузької ВЕС, також величиною 200 м із умов впливу небезпечних чинників загроз особам третьої сторони. Відповідно до експертних досліджень, впливу від будівництва та експлуатації ДБ ВЕС на історичну та культурну спадщину не передбачається. Об'єкти навколишнього техногенного середовища, що можуть негативно впливати на проектовану діяльність в межах ділянки розташування об'єктів ДБ ВЕС та безпосередній близькості до них відсутні.

Вплив на техногенне середовище є допустимим.

Оцінка ризику планової діяльності. Рівень ризику впливу планованої діяльності на природне середовище, відповідно представлених розрахунків, оцінюється як прийнятний.

Згідно наданих на розгляд матеріалів запобігання виникненню негативного впливу планованої діяльності, яка згідно представлених відомостей визначається екологічно допустимою, на стан навколишнього середовища, виконуватиметься шляхом здійснення відповідних заходів спрямованих на нейтралізацію та запобігання цих впливів, та забезпечення вимог екологічної безпеки, виконання яких є обов'язковим.

Оскільки представлені матеріали ОВНС відповідають положенням і вимогам природоохоронного законодавства та чинних нормативно-правових актів, Департамент вважає екологічно допустимою плановану діяльність щодо реалізації інвестиційного проекту «Дніпро-Бузька вітрова електростанція». Представлені матеріали ОВНС **оцінюються позитивно** та погоджуються.

Висновок затверджується.

Директор Департаменту ДЕПАРТАМЕНТ ЕКОЛОГІЇ ТА ПРИРОДНИХ РЕСУРСІВ ХЕРСОНСЬКОЇ ОБЛАСНОЇ ДЕРЖАВНОЇ АДМІНІСТРАЦІЇ 38697264 УКРАЇНА Ю.А.Попутько

Шевченко Н.І. 26-31-95

ХЕРСОНСЬКА ОБЛАСНА ДЕРЖАВНА АДМІНІСТРАЦІЯ
ДЕПАРТАМЕНТ ЕКОЛОГІЇ ТА ПРИРОДНИХ РЕСУРСІВ

пров. Козацький, 10, м. Херсон, Херсонська область, 73026, тел./факс (0552) 26-31-95;
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код ЄДРПОУ 38697264

__________ № __________

На № __________ від __________

Додаток 5
до Порядку передачі документації
для надання висновку з оцінки впливу
на довкілля та фінансування оцінки
впливу на довкілля

13.11.2018р
(дата офіційного опублікування в Єдиному реєстрі з оцінки впливу на довкілля (автоматично генерується програмними засобами ведення Єдиного реєстру з оцінки впливу на довкілля)

ТОВАРИСТВО З ОБМЕЖЕНОЮ ВІДПОВІДАЛЬНІСТЮ «ДНІПРО-БУЗЬКА ВІТРОВА ЕЛЕКТРОСТАНЦІЯ»,
(код згідно ЄДРПОУ - 40835232)
75050, Херсонська область, Білозерський район, с. Олександрівка, вул. Миру, буд. 10, кв. 1
(заявник та його адреса)

13.11.2018р.
(дата видачі)

15/2018
(номер висновку)

20187311363
(реєстраційний номер справи про оцінку впливу на довкілля планованої діяльності)

017 від 08.11.2018 р.
(номер і дата звіту про громадське обговорення)

ВИСНОВОК
з оцінки впливу на довкілля

За результатами оцінки впливу на довкілля, здійсненої відповідно до статей 3, 6-7, 9 і 14[1] Закону України "Про оцінку впливу на довкілля", планованої діяльності ТОВАРИСТВО З ОБМЕЖЕНОЮ ВІДПОВІДАЛЬНІСТЮ «ДНІПРО-БУЗЬКА ВІТРОВА

ЕЛЕКТРОСТАНЦІЯ» (далі - ТОВ «ДБ ВЕС») щодо нового будівництва повітряної лінії електропередачі 150 кВ від центральної підстанції Дніпро-Бузької ВЕС (далі - ДБ ВЕС) до підстанції 150/35/10 кВ «Посад-Покровська» на території Олександрівської, Правдинської та Посад-Покровської сільських рад Білозерського району Херсонської області (за межами населеного пункту) встановлено, що метою реалізації планованої діяльності є передача електроенергії, що буде вироблятись ДБ ВЕС та забезпечення експлуатуючим підприємством (ТОВ «ДБ ВЕС») розвитку генерації екологічно чистої електроенергії з відновлюваних джерел енергії. Спорудження повітряної ЛЕП планується відповідно до Енергетичної стратегії України на період до 2035 року та Національного плану дій з відновлюваної енергетики на період до 2020 року. Розвиток генерації екологічно чистої електроенергії з відновлюваних джерел енергії відповідає зобов'язанням України щодо Паризької угоди Рамкової конвенції ООН про зміну клімату. Планована траса повітряної ЛЕП загальною довжиною 27,3 км проходитиме територією Олександрівської, Правдинської, Посад-Покровської сільських рад Білозерського району Херсонської області. Проект реалізації планованої діяльності відповідно до звіту з оцінки впливу на довкілля (далі – звіт з ОВД) складається з таких етапів: будівництво нової повітряної ЛЕП від підстанції «ЦПС ДБ ВЕС» до підстанції «Посад-Покровська» напругою 150 кВ, перевлаштування існуючих інженерних споруд по трасі нової повітряної ЛЕП. Опорні конструкції повітряної ЛЕП будуть розташовуватись на землях приватної та державної власності. При проведені будівельно-монтажних робіт буде задіяно ділянку уздовж траси проходження повітряної ЛЕП шириною 10 м, відповідно площа становитиме 27,3 га. Сумарна площа території сільських рад, в межах території яких буде проходити повітряна ЛЕП становить 206,5 км^2. Технологічні проїзди для повітряної ЛЕП на час експлуатації не передбачаються. Відстань між опорами повітряної ЛЕП становитиме від 100 до 150 метрів, в залежності від відстаней між кутовими опорами повітряної ЛЕП.

Площі земель, відведені для встановлення опор повітряної ЛЕП:

Площа земель	**Сільські ради Білозерського району Херсонської області**		
	Олександрівська	**Правдинська**	**Посад-Покровська**
	0,177 га	0,312 га	0,181 га

Загальна довжина повітряної ЛЕП складає: 27,215 кілометрів – дволанцюгова ділянка, 0,108 кілометрів – одноланцюгова ділянка. На повітряній ЛЕП передбачені для підвішування провід марки АС-240/32 (1 провід в фазі) та грозозахисний трос з вмонтованим оптоволоконним модулем на 24 оптичних волокна. Робота устаткування з передачі електроенергії повітряною ЛЕП здійснюватиметься цілодобово. Ремонтне і технічне обслуговування повітряної ЛЕП передбачається здійснювати спеціалізованою компанією за окремою угодою, яка укомплектована відповідним персоналом і оснащена у відповідності з діючими нормами та правилами. Будівництво повітряної ЛЕП планується проводити в одну чергу. Роботи будуть проводитися у такій технологічній послідовності: розробка грунту і влаштування пазух котлованів, встановлення підножників, зворотне засипання пазух котлованів, збір і монтаж опор, встановлення опор, монтаж проводів і троса. Технологія будівництва повітряної ЛЕП не потребує зовнішніх джерел води і електроенергії. Для тимчасового електропостачання буде використано пересувні дизельні електростанції. Для проїзду будівельної техніки заплановано використовувати існуючі автодороги різної категорії і грунтові дороги.

(планована діяльність, тип, основні характеристики та місце провадження планованої діяльності)

Департамент екології та природних ресурсів
Херсонської обласної державної адміністрації
(уповноважений орган)

з урахуванням звіту з оцінки впливу на довкілля будівництва нової повітряної лінії електропередачі 150 кВ від центральної підстанції Дніпро-Бузької ВЕС до підстанції 150/35/10 кВ «Посад-Покровська» на території Олександрівської, Правдинської та Посад-Покровської сільських рад Білозерського району Херсонської області (за межами населеного пункту).

(врахування звіту з оцінки впливу на довкілля)

а також з урахуванням усієї інформації, зауважень і пропозицій, що надійшли протягом строку громадського обговорення (звіт про громадське обговорення разом з таблицею повного, часткового врахування або обґрунтованого відхилення зауважень і пропозицій є невід'ємною частиною цього висновку),

вважає допустимим/~~недопустимим~~ провадження планованої діяльності з огляду на нижченаведене
(зайве викреслити)

За результатами аналізу звіту з ОВД встановлено, що протягом виконання підготовчих і будівельних робіт, реалізації планованої діяльності очікується допустимий вплив на компоненти довкілля.

Вплив на повітряне середовище. Відповідно до звіту з ОВД будівництво повітряної ЛЕП не призведе до значних впливів на повітряне середовище в районі реалізації планованої діяльності. Основними чинниками забруднення повітряного середовища під час виконання підготовчих і будівельних робіт є транспорт, зварювальні роботи та пилоутворення під час будівництва. Максимально-секундні викиди забруднюючих речовин, що утворюються під час будівництва повітряної ЛЕП незначні і не призведуть до суттєвих змін складу атмосферного повітря в районі будівництва.

Шум. Під час проведення будівельних робіт буде відбуватись шумове забруднення довкілля. Шумове та вібраційне забруднення, створюване технологічним обладнанням, має тимчасовий, короткостроковий характер. Робота технологічного обладнання відбуватиметься виключно у робочий час та у відповідності до ДБН А.3.1-5:2016 Організація будівельного виробництва. Під час експлуатації, повітряні лінії електропередачі можуть видавати низький звук, що дзижчить. Проте його не буде чутно у навколишніх населених пунктах, тому що відстань від пропонованої повітряної ЛЕП до найближчих до неї населених пунктів, зокрема до села Солдатське становить близько 0,46 км (опора №26, координати: 46.766978° пн.ш 32.246617° сх.д), село Правдине – близько 0,68 км (опора №85, координати: 46.735536° пн.ш 32.177645° сх.д), що відповідає вимогам законодавства. Інші населені пункти розташовані на достатній відстані (с. Олександрівка – 3,65 км; с. Степова Долина – 2,27 км; с. Посад Покровське – 1,06 км), що забезпечує дотримання санітарно-гігієнічних норм.

Вплив електромагнітного поля. Напруженості електричних та індукції магнітних полів кабельних та повітряної лінії електропередачі, враховуючи проектні напруги і навантаження, мають значення, нижчі за гранично допустимі та не мають негативного впливу на населення і довкілля.

Оцінка впливу на довкілля зумовленого здійсненням операцій у сфері поводження з відходами. Під час робіт з технічного обслуговування та ремонту повітряних ліній електропередач не передбачено утворення відходів. Повітряна ЛЕП відноситься до інженерних мереж, які не виробляють кінцевої продукції, тому відходів виробництва не мають. Повна відповідальність за поводження з відходами, що утворюються на етапі будівництва ЛЕП покладена на організацію, яка буде виконувати будівельні роботи та яка є власником цих відходів.

Вплив на водне середовище. Траса повітряної ЛЕП проходить по вододільній рівнині між річками Дніпро і Південний Буг та не перетинає поверхневих водотоків та водойм.

Найближчими водними об'єктами, що межують з майданчиком будівництва, є Дніпро-Бузький лиман та озеро Солонець. Відповідно до Водного кодексу України прибережна захисна смуга лиманів становить 2 км, а для озер – 50 м. Розміщення об'єктів повітряної ЛЕП в межах цих зон не передбачено. В гідрогеологічному відношенні територія будівництва повітряної ЛЕП розташована в межах Причорноморського артезіанського басейну. Живлення водоносних горизонтів відбувається переважно за рахунок інфільтрації атмосферних опадів, а також інфільтрації іригаційних вод із каналів зрошувальної системи на ділянках її функціонування, та безпосередньо при зрошені сільськогосподарських земель. Загалом на території будівництва повітряної ЛЕП у верхній частині геологічного середовища поширені такі водоносні горизонти: водоносний горизонт солово-деловіальних відкладів, водоносний комплекс еоплейстоцен-пліоценових аловіальних відкладів древніх річкових терас, водоносний комплекс сармат-меотис-понтичних відкладів. Основним водоносним комплексом, що експлуатується для цілей водопостачання є сармат-меотис-понтичний, який в свою чергу є джерелом централізованого водопостачання с. Олександрівка Білозерського району. Згідно зі звітом з ОВД підземні води верхньосарматського водоносного горизонту, що використовуються для водопостачання, є захищеними від поверхневого забруднення.

Вплив на геоморфологію та геологію. Будівництво та експлуатація повітряної ЛЕП не передбачає підвищення показників сейсмічності. На території будівництва існує ризик розвитку таких небезпечних геологічних процесів: просідання лесових грунтів, ерозія грунтів, в меншій мірі підтоплення, карст, абразійно-зсувні процеси приурочені до яружно-балкової мережі. Лесові відклади, що складають верхню частину геологічного середовища, характеризуються досить значними показниками просідання, що проявляється при збільшенні навантаження і при зволоженні відкладів. Тривалий період функціонування Інгулецької зрошувальної системи на території будівництва, незважаючи на припинення в теперішній час, визначає ризик підтоплення території, можливість зміни інженерно-геологічних властивостей лесових відкладів, що, зокрема, може проявлятися у підвищені ризику просідання лесових відкладів чи їх ущільнені. Розвиток яружно-балкової мережі та яружна ерозія відбуваються в активній формі вздовж берегової лінії Дніпро-Бузького лиману поза зоною впливу будівництва повітряної ЛЕП. Будівництво та експлуатація повітряної ЛЕП не впливатимуть на процеси інтенсифікації карстоутворення. Можливість інтенсифікації карсту від запланованої діяльності виключена, внаслідок мінімізації техногенних втрат води в процесі будівництва. Під час будівництва повітряної ЛЕП будуть проводитись земляні роботи – розробка котлованів для монтажу фундаментів металевих опор: на глибину до 2,8 м для фундаментів під анкерно-кутові опори та на глибину до 3,1 м для фундаментів під проміжні опори. Таким чином, вплив на геологічне середовище не очікується.

Вплив на ґрунти. Будівництво та експлуатація повітряної ЛЕП не спричинить значного негативного впливу на грунтове середовище, оскільки обсяги робіт мають обмежений локальний та точковий характер та на завершальній стадії будівництва передбачається проведення рекультиваційних робіт. Під час будівельних робіт буде необхідним проведення очищення земель від рослинності і/або викорчовування. Територія траси повітряної ЛЕП знаходиться на землях, які мають сільськогосподарське призначення, тому ділянки з травою або чагарниками, які потрібно буде видалити є незначними. Крім того, завдяки тому, що територія проекту має плоску поверхню, відсутня проблема регулювання зливових стоків. Під час будівельних робіт буде відбуватися цілеспрямоване ущільнення грунту на невеликих за площею поверхнях. Ущільнений грунт стає менш здатним поглинати опади, що призводить до збільшення стоку і ерозії, також такий грунт менш сприятливий для рослин і тварин.

Вплив на рослинний та тваринний світ. Найбільшого впливу при спорудженні повітряної ЛЕП зазнає видовий склад, якісний стан, кількісні та морфометричні показники дендрофлори полезахисних лісосмуг у місцях запланованого перетину з лінією електропередачі. Мозаїчність розповсюдження деяких видів дендрофлори вказує на те, що вони поширюються природнім шляхом (самосів, розвиток кореневої парості), і їх ліквідація на трасі не матиме значного негативного впливу на стан регіональних екосистем, крім того передбачається їх відновлення. Повітряна ЛЕП здебільшого розташовується у межах сільськогосподарських угідь. Лінія електропередачі проходить через сільськогосподарські угіддя, а також перетинає у верхній частині балку Вовчу, яка служить пасовищем. В цілому, будівництво, експлуатація повітряної ЛЕП та її перехрещення з лісосмугами суттєво не вплине на видовий склад епіфітних угруповань лишайників лісосмуг. Згідно зі звітом з ОВД на території реалізації планованої діяльності встановлено наявність безхребетних, які є типовими для степових та антропогенно-трансформованих біоценозів та не приурочені до тих чи інших ділянок. Видів, які відносяться до охоронних списків виявлено не було. Більшість встановлених видів вважаються шкідниками. Отже, будівництво повітряної ЛЕП фактично не має вплинути на чисельність та видовий розподіл безхребетних в даній місцевості. Згідно з результатами моніторингу за орнітофауною в зоні будівництва повітряної ЛЕП відмічається достатньо низька мобільність птахів. В період спостережень зареєстровано 47 видів птахів, загальною чисельністю 1972 особини за період обліків. В зоні будівництва повітряної ЛЕП зареєстровано 4 види рідкісних птахів, занесених до Червоної книги України (2009). Проте не було виявлено місць великих їх скупчень у передміграційний період, а також не відмічено масової міграції червонокнижних птахів у зоні будівництва повітряної ЛЕП. Ймовірність негативного впливу на рідкісні види птахів, занесених до Червоної книги України (2009), низька через їх малу чисельність на означеній території. Територія, на якій проектується будівництво повітряної ЛЕП, не входить в межі масових зимівель гусеподібних птахів півдня України. За встановленою характеристикою передміграційної, осінньої міграційної і зимової орнітофауни та її територіальної динаміки в зоні будівництва повітряної ЛЕП, можливо прогнозувати низьку вірогідність зіткнення птахів з опорами повітряної ЛЕП на цій території. Будівництво повітряної ЛЕП не вплине на чисельність та видовий розподіл хребетних на території реалізації планованої діяльності, видів, які відносяться до охоронних списків виявлено не було.

Території та об'єкти природно-заповідного фонду. За даними Європейського агентства з охорони довкілля траса повітряної ЛЕП знаходиться за межами об'єктів Смарагдової мережі. Повітряна ЛЕП пролягає за межами територій, що важливі для птахів і біорізноманіття за даними організації «BirdLife International». Повітряна ЛЕП знаходиться за межами територій, що мають статус Рамсарських угідь. Основними коридорами міграцій в районі простягання повітряної ЛЕП є берегова зона Дніпро-Бузького лиману і балки його гідрологічної мережі. Траса повітряної ЛЕП прокладена таким чином, щоб її будівництво та експлуатація не чинили впливу на критичні оселища ландшафтного заказника «Олександрівський» (цілинних степових ділянок, деревно-чагарникових угруповань тощо), берегової лінії Дніпро-Бузького лиману та озера Солонець.

Пам'ятки історії та археологія. Територія планованої діяльності не належить до земель історико-культурного призначення у зв'язку з відсутністю археологічних об'єктів та історичного культурного шару. Виключенням є виявлений курган (в районі координат 46.672256° пн.ш 32.104417° сх.д) площею до 0,2 га та його уніфікованої охоронної зони 25 м від поли кургану (кінця поховальної споруди). Дотримання меж охоронної зони виключає будь-який вплив будівництва і експлуатації повітряної ЛЕП на архітектуру, культурні та історичні пам'ятки.

Вплив на землекористування. Вплив реалізації планованої діяльності на сільськогосподарські землі в переважній більшості матиме тимчасовий характер на час проведення будівельно-монтажних робіт, за виключенням земель зайнятих безпосередньо опорними конструкціями повітряної ЛЕП. Очікуваним впливом на землекористування на період будівництва повітряної ЛЕП буде втрата посівів. В ході експлуатації повітряної

ЛЕП власники та користувачі будуть обмеженні у використанні земель, у зв'язку з встановленням охоронних зон ЛЕП 150 кВ по 25 метрів в обидві сторони від проекції крайніх проводів.

Згідно з даними, наведеними у звіті з ОВД, реалізація планованої діяльність не суперечить вимогам та положенням чинного природоохоронного законодавства, вплив на довкілля визначається допустимим.

(обґрунтовується допустимість провадження планованої діяльності / обґрунтовується її недопустимість)

Екологічні умови провадження планованої діяльності:

1. Для планованої діяльності встановлюються такі умови використання території та природних ресурсів під час виконання підготовчих і будівельних робіт та провадження планованої діяльності, а саме:

- забезпечити зберігання відходів, що утворюються при виконанні підготовчих та будівельно-монтажних робіт в спеціально відведених місцях. Обладнати будівельний майданчик планованої діяльності спеціальними інвентарними контейнерами та урнами для збору будівельних і побутових відходів;

- забезпечити вивезення та передачу спеціалізованим підприємствам у сфері поводження з відходами для подальшої утилізації, переробки, видалення або захоронення відходів, що утворюються при виконанні підготовчих та будівельно-монтажних робіт. Вивезення відходів повинно здійснюватися в спеціально відведені місця в закритих контейнерах або спеціальним транспортом, що запобігає розпорошенню відходів під час його транспортування;

- при проведенні підготовчих та будівельних робіт використовувати тільки спеціалізовану техніку у технічно справному стані. Здійснювати контроль протягом проведення будівельних робіт за технічним станом спеціалізованої техніки та автотранспорту;

- підготовчі та будівельні роботи повинні здійснюватися кваліфікованими будівельно-монтажними організаціями з дотриманням заходів техніки безпеки та охорони навколишнього природного середовища;

- недопущення забруднення паливо-мастильними матеріалами ґрунтів на території реалізації планованої діяльності. У разі виявлення такого забруднення забезпечити вжиття заходів щодо його ліквідації;

- забезпечити мінімальний розмір поверхні видалення землі для проведення будівельних робіт;

- будівельні матеріали, що використовуватимуться, повинні відповідати нормативним рівням радіаційних параметрів;

- здійснювати якісний монтаж обладнання;

- використовувати обладнання виключно за його призначенням;

- визначити та розмежувати межі будівельних майданчиків, включаючи місця, де будівельна техніка буде переміщатися та зберігатися та місця встановлення побутових, санітарно-технічних споруд;

- за можливості та в першу чергу використовувати існуючи дороги для пересування будівельного обладнання та вантажних машин;

- забезпечити зберігання паливно-мастильних матеріалів у спеціально відведених місцях, не допускати їх розміщення на відкритому просторі;

- заправку транспортних засобів та спеціалізованої будівельної техніки, їх технічне обслуговування здійснювати на спеціально призначених майданчиках із суворим контролем розливу нафтопродуктів або за межами території реалізації планованої діяльності;

- забезпечити зберігання вийнятого грунту без змішування горизонтів, захищати його від забруднення.

- з метою підвищення пильності птахів встановити сигнальні кулі-маркери, що забезпечать візуальне відлякування, запобігання зіткнення з проводами повітряної ЛЕП в районі перетину балки Вовча;

- передбачити пошарове повернення мінерального шару грунту та рекультивацію рослинного шару грунту після виконання будівельних робіт. З метою запобігання ерозії грунту зачищену землю повторно засаджувати місцевою рослинністю;

- вжити заходів щодо запобігання перевищення нормативного рівня шуму, що створюється роботою встановленого обладнання;

- використовувати територію охоронної зони лінії електропередачі 150 кВ відповідно до Правил охорони електричних мереж, затверджених постановою Кабінету Міністрів України від 04 березня 1997 р. № 209;

- для запобігання забруднення грунтових вод мінімізувати потрапляння у грунт забруднюючих речовин;

- при будівництві повітряної ЛЕП враховувати обмеження до зон санітарної охорони експлуатаційних свердловин;

- при проведенні будівельних робіт повітряної ЛЕП враховувати особливості землекористування прилеглих до території реалізації планованої діяльності земельних ділянок, зокрема у посівний період та жнива регулювати проведення будівельних робіт;

- перед початком будівництва з дослідної ділянки 3, визначеної звітом з ОВД, повітряної ЛЕП провести трансплантацію слані лишайника Flavoparmelia caperata, що занесений до Червоного списку Херсонської області до найближчої моніторингової ділянки зазначеної у звіті з ОВД;

- дотримуватися меж охоронної зони виявленого кургану (в районі координат 46.672256° пн.ш 32.104417° сх.д) площею до 0,2 га.

2. Для планованої діяльності встановлюються такі умови щодо запобігання виникненню надзвичайних ситуацій та усунення їх наслідків, а саме:

2.1. Розробити та погодити у встановленому порядку план локалізації та ліквідації аварійних ситуацій і аварій після реалізації планованої діяльності;

2.2. Забезпечити виконання заходів, що дозволяють мінімізувати ризик виникнення надзвичайних ситуацій при провадженні планованої діяльності, а також забезпечують запобігання чи пом'якшення впливу можливих надзвичайних ситуацій на довкілля до допустимого, незначного рівня та виконання заходів реагування на надзвичайні ситуації, а саме:

- вживання заходів з запобігання випадкового контакту працівників з частинами, що перебувають під напругою;

- дотримуватися правил пожежної безпеки при виконанні підготовчих та будівельних робіт та забезпечити недопущення виникнення надзвичайних ситуацій на прилеглих до території реалізації планованої діяльності земельних ділянках;

- дотримання правил експлуатації механізмів, своєчасне проведення регламентних робіт та профілактичних ремонтів;

- влаштування захисного відключення електрообладнання при перевантаженнях і короткому замиканні;

- проведення регулярних перевірок технологічного обладнання, будівельних машин для виявлення витоку мастильних матеріалів або інших легкозаймистих рідин та вживання невідкладних заходів щодо ліквідації таких розливів;

- проведення навчання працівників з роботи з легкозаймистими матеріалами, а також вивчення методів запобігання і ліквідації загорання;

- дотримання трудової і виробничої дисципліни, правил техніки безпеки;

- обов'язкове додержання вимог пожежної безпеки;

- будівництво споруд з урахуванням категорії пожежної небезпеки, ступеня вогнестійкості, а також з дотриманням необхідних розривів між ними;

- заземлення всіх металевих частин, які можуть опинитися під напругою;

- своєчасне проведення профілактичних оглядів і ремонтів обладнання силами спеціалізованих організацій;

- улаштування системи блискавкозахисту;

- застосування гідроізоляції всіх підземних споруд і комунікацій;

- застосування антикорозійного захисту для всіх металоконструкцій;

- дотримання трудової і виробничої дисципліни, правил техніки безпеки.

3. Для планованої діяльності встановлюються такі умови щодо зменшення транскордонного впливу планованої діяльності,* а саме:

Підстави для здійснення процедури оцінки транскордонного впливу відсутні.

4. На суб'єкта господарювання покладається обов'язок із здійснення таких компенсаційних заходів**:

4.1. Відшкодування збитків заподіяних природним рослинним ресурсам шляхом здійснення відповідних компенсаційних заходів, а саме: передбачити висадження дерев, чагарників та інших видів рослинної біоти в лісосмугах, узбіччях доріг тощо;

4.2. Надання компенсації за шкоду врожаям та втрату потенційного доходу протягом часу монтажу та встановлення опор (на етапі будівництва) власникам та користувачам, чиї земельні ділянки перетинаються повітряною лінією електропередачі, та які лежать в межах охоронної зони.

5. На суб'єкта господарювання покладається обов'язок із запобігання, уникнення, зменшення (пом'якшення), усунення, обмеження впливу планованої діяльності на довкілля**, а саме:

Якщо за результатами післяпроектного моніторингу випливає, що негативний вплив планованої діяльності перевищує очікуваний відповідно до звіту з ОВД, суб'єкт господарювання за власний рахунок здійснює заходи, спрямовані на зменшення, пом'якшення або повне усунення зазначеного впливу. Необхідні заходи визначаються за результатами післяпроектного моніторингу.

6. На суб'єкта господарювання покладається обов'язок із здійснення післяпроектного моніторингу**, а саме:

6.1. Проводити моніторинг стану забруднення грунтів на території реалізації планованої діяльності під час проведення будівельних робіт щодо його забруднення паливно-мастильними матеріалами та іншими речовинами;

6.2. Проводити моніторинг впливу планованої діяльності на орнітофауну під час проведення будівельних робіт та на протязі року після закінчення будівництва повітряної ЛЕП.

Інформацію про результати післяпроектного моніторингу, відповідні висновки за результатами їх аналізу, визначені та здійсненні запобіжні заходи надавати до Департаменту екології та природних ресурсів Херсонської обласної державної адміністрації після кожного звітного періоду до 10 січня наступного за звітним роком.

7. На суб'єкта господарювання покладається обов'язок із здійснення додаткової оцінки впливу на довкілля на іншій стадії проектування**, а саме:

Відповідно до звіту з оцінки впливу на довкілля планованої діяльності та за результатами його аналізу здійснення додаткової оцінки впливу на довкілля не передбачається.

(зазначаються строки та обґрунтовується така вимога)

Висновок з оцінки впливу на довкілля є обов'язковим для виконання. Екологічні умови, передбачені у цьому висновку, є обов'язковими.

Висновок з оцінки впливу на довкілля втрачає силу через п'ять років у разі, якщо не було прийнято рішення про провадження планованої діяльності.

Начальник відділу оцінки впливу на довкілля та поводження з відходами Департаменту екології та природних ресурсів (керівник структурного підрозділу з оцінку впливу на довкілля уповноваженого органу)	(підпис)	Н.ШЕВЧЕНКО (ініціали, прізвище)
Директор Департаменту екології та природних ресурсів (керівник уповноваженого територіального /заступник керівника уповноваженого центрального органу)	(підпис)	Ю.ПОПУТЬКО (ініціали, прізвище)

ДЕПАРТАМЕНТ ЕКОЛОГІЇ ТА ПРИРОДНИХ РЕСУРСІВ ХЕРСОНСЬКОЇ ОБЛАСНОЇ ДЕРЖАВНОЇ АДМІНІСТРАЦІЇ * 38697264 * УКРАЇНА

* Якщо здійснювалася процедура оцінки транскордонного впливу.

** Якщо з оцінки впливу на довкілля випливає така необхідність.

Наталія Шевченко
Надія Бреус 26 31 95

Annex B. SUMMARY ON LAND ACQUISITION AND RESETTLEMENT IMPACTS

1. The EBRD Performance Requirement 5 on Land Acquisition, Involuntary Resettlement and Economic Displacement (hereinafter – PR 5) applies to this Project, the main goals of which are as follows:

- to avoid or, when unavoidable, minimize, involuntary resettlement by exploring alternative project designs;
- to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of and access to assets and land by:
  - providing compensation for loss of assets at replacement cost;
  - ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected;
  - ·to improve or, at a minimum, restore the livelihoods, income earning capacity and standards of living of all displaced persons, including those who have no legally recognisable rights or claims to the land, to pre-displacement levels or to levels prevailing prior to the beginning of Project implementation, whichever is higher.

2. For the purpose of this Project the Livelihoods Restoration Plan (LRP) will be prepared which will take into consideration the requirements of the Ukrainian legislation and EBRD PR 5. The project will not cause physical displacement; all impacts are limited to short term and long term temporary easements and restrictions to be imposed due to installation of supporting structures of towers, overhead lines, and other project related works. Other impacts include the damage to standing crops and partial loss of productivity of affected agricultural lands.

3. A total of 279 land parcels will be affected out of which 138 are registered/legalized, 141 are legalizable. There no non-legalizable/unauthorized land parcels. Total land required for the Project is 1,131,000 square meter (sqm) equivalents to 113.1 hectare (ha). Out of the total land required, 920,000 sqm (92 ha) is private land and 210,100 sqm (21.1 ha) is state land. Total number of agricultural parcel is 279. None private non-agricultural parcels are affected by the Project. No trees will be affected due to use of private land for the Project. Total area of 920,000 sqm (92.00 ha) is affected by cereals crops. No structures are affected. No cases of residential tenants have been recorded. There are no households, who will lose more than 10% of their productive asserts due to land related impacts in the Project. No cases of vulnerable households have been recorded. Total number of affected households is 295. The summary of impacts related to land acquisition is given in Table B-1.

Table B-1 Summary of Impacts related to Land Acquisition

№	Impacts	Unit of Quantification	Quantity
1	Total Land Requirement	Square meter (Hectare)	1,131,000 sqm (113.1 ha)
2	Private Land	Square meter (Hectare)	920,000 sqm (92 ha)
3	State Land	Square meter (Hectare	210,100 sqm (21.1 ha)

№	Impacts	Unit of Quantification	Quantity
4	Land parcels	Number	279
5	Registered Parcel	Number	138
6	Legalizable Parcel	Number	141
7	Non-legalizable/unauthorized Parcel	Number	0
8	Agricultural Land Parcel	Number	279
9	Non-Agricultural Land Parcels	Number	0
10	Area of Agricultural Land (Registered and Legalizable)	Square Meter	920,000 sqm (92 ha)
11	Area of Agricultural Land (Non- Legalizable)		0
12	Area of Non-Agricultural Land	Square Meter	0 sqm (0 ha)
13	Area under Cereals Crop Cultivation	Square Meter (Hectare)	920,000 sqm (92 ha)
14	Area under Vegetables Crop Cultivation	Square Meter (Hectare)	0 sqm (0 ha)
15	Fruit Trees	Number	0
16	Non Fruit/Timber Trees	Number	0
17	Total number of structures	Number	0
18	Residential Houses	Number	0
19	Commercial Structures/ Shops	Number	0
20	Structures needing Relocation	Number	0
21	Severely Affected Households	Number	0
22	Vulnerable Households	Number	0
23	Affected Households	Number	295

Source: Census Survey, November, 2017 to November, 2018

3. The households living in the Project area are not having a good quality of life. Due to the lack of active business activity in the area of development of the Project many families or some family members moved to the nearest cities (Kherson or Mykolaiv) or abroad in search of work. For example, Oleksandrivka and Pravdino village councils are geographically located in the steppe zone of southern Ukraine with no industrial enterprises and transport infrastructure which limits the employment and income-generating opportunities for the local population. At the same time, if we compare the level of employment and income of the population of these villages with Posad-Pokrovske Village, the standard of living of the local population of the latter is somewhat higher, since the M-14 Odessa-Melitopol-Novoazovsk international road passes through its territory.

The main activity of the households, living in the Project area, is growing of agricultural crops (vegetables and fruits), breeding of cattle, hens. The source of income is the proceeds from the sale of grown products, obtained sour-milk products, eggs and meat in local markets.

The average monthly expenses of households are at the level of about 3,500 UAH, while their largest part (40%) is spent on food. Other expenses, such as health care, clothing, water and electricity make an average of 60%. The majority of local population relies on pensions for their main source of income. The proposed Project will benefit the local population as this will bring development to the area in terms of local employment during the Project implementation. The local community is eager to be employed for the Project related works.

4. During 2017-2018, around 200 consultation meetings were held with the owners and users of land involved for Project construction within the territory of Oleksandrivska, Pravdynska and Posad-Pokrovska village councils to ensure awareness of affected people. Consultations with public and stakeholders were held over several stages of the Project, among which are public hearings during development of a detailed territory plan, environmental impact assessment and inventory of land plots.

Format of consultations were individual and group ones, which involved both men and women participants. Consultations were held with all land owners and users and included, among other things, information on the issues relating to land use during construction and operation of a wind power plant and an overhead line, the rights and obligations with regard to the Project, information on compensation and entitlements for losses incurred, the details of signing servitude agreements. The consultations will be continued throughout the Project cycle.

5. The project information will be further disseminated through disclosure of LRP. LRP will be translated to Ukrainian language and will be made available at the «DB WPP» LLC office and at affected village level upon request.

6. A grievance mechanism is established to allow affected people to appeal any disagreeable decision, practice or activity arising from land or other assets compensation. The affected people will be fully informed of their rights and of the procedures for addressing complaints whether verbally or in writing during further consultations and during the compensation payment. The affected people may file a complaint to the office of «DB WPP» LLC. The contact person for receiving complaints, objections and proposals from the affected households is the Head of «DB WPP» LLC. The affected people can approach the court of law at any time.

7. The legal and policy framework of the Project is based on national legislations related to land in Ukraine and EBRD's PR 5. Based on the analysis of applicable laws and policies and EBRD's Policy requirement, Project related principles have been adopted. The affected people entitled for compensation and livelihoods rehabilitation provisions under the Project are: (i) who have formal legal rights to the land (including customary and traditional rights recognised under national laws); (ii) who do not have formal legal rights to land at the time of the census, but who have a claim to land that is recognised or recognisable under national laws; or (iii) who have no recognisable legal right or claim to the land they occupy.

8. Key Policy Principles to be adopted by the Project are:

- Efforts must be made to avoid and minimize involuntary resettlement impacts whenever possible – especially physical displacement. When resettlement cannot be avoided, mitigation of potential impacts is required;
- Ensure that the affected households without titles to land are eligible to resettlement assistance and compensation for the loss of non-land assets;
- If resettlement impacts occur, the resettlement or/and livelihood restoration plan need to be prepared, specifying the affected persons' entitlements, livelihoods restoration strategy, institutional arrangements, monitoring and reporting requirements, budget, and time-bound implementation schedule;
- Extend the compensation and provide other resettlement entitlements before physical and economic displacement take place;
- Meaningful consultations need to be carried out with the affected people, which involves consulting affected parties on their entitlements and rights;
- Special provisions should be made for those affected people who belong to the vulnerable groups, so as to improve their living standards and well being;
- Ensure that the project monitors and assesses the resettlement outcomes, impacts on standards of living of the affected people, and if the objectives of the resettlement and/or livelihoods restoration plan have been achieved;
- A grievance redress mechanism needs to be put in place to receive and facilitate the resolution of affected people's concerns;
- In cases when temporary easements or other forms of restrictions are imposed on land plots, the project needs to ensure that the affected people are compensated for temporary impacts associated with the easements/restrictions and the affected lands are restored to pre-project level.

9. All compensation related costs will be considered an integral part of the Project cost. The total estimated cost for the LRP for Project is approximately 23,32 million UAH equivalents to Euro 728725,00.

10. «DB WPP» LLC will have lead responsibility for implementation of the Project as well acquisition of land and implementation of the LRP. «DB WPP» LLC is assisted by a number of private agencies in the design, construction and operation of the Project. The Project will cover three villages in one administrative district.

11. The time for implementation of the LRP will be scheduled as per the overall project implementation. All activities related to the economic displacement must be planned to ensure that compensation is paid prior to displacement and commencement of civil works, where it is possible. Public consultations, monitoring and grievance redress will be undertaken throughout the Project duration. «DB WPP» LLC will monitor and assess the progress of implementation of the LRP. The extent of monitoring activities will be commensurate with the Project's risks and impacts. In addition to recording the progress in compensation payment and other land acquisition activities, «DB WPP» LLC will prepare an annual monitoring report to ensure that the implementation of the LRP has produced the desired outcomes. The results will be communicated to the EBRD annually. Immediately after the implementation of the LRP the «DB WPP» LLC will prepare the

Completion Report, which will be submitted to EBRD for review and approval. Table B-2 provides information on some problems that have been solved during the consultation.

Table B-2 – Impact on land and resettlement

Some issues that were solved during group or individual consultations on land issues	
Oleksandrivka Village Council of Bilozersky District of Kherson Oblast Period of consultations – August 2017-November 2018	
Issue	**Issue solution**
On 01.03.2018 Pekaliuk I.S. addressed to representatives of «DB WPP» LLC with the following problem. His mother Pekaliuk Tetiana owns a land on the part of which the servitude is to be established and she is abroad in Russian Federation. He wanted to know if he could sign agreements and receive funds on the basis of power of attorney?	Pekaliuk I.S. issue is addressed the following way: - it was explained that the agreement can be signed provided he has a power of attorney certified by notary and it contains clear and specific powers to sign agreement and to receive funds due according to this agreement; - it was separately explained that according to the article 13 of the Convention on legal aid and legal relations in civil, family and criminal cases the power of attorney issued by the notary in Russian Federation does not require any additional legalization (as apostille or in any other form); - a sample of power of attorney text is provided. **Issue is solved: Pekaliuk T. provided her son Pekaliuk I.S. with duly executed power of attorney, the servitude agreements have been concluded.**
On 01.06.2018 Lehka T.S. addressed to representatives of «DB WPP» LLC with the issue of re-registration of the ownership rights to a land plot after the death of her husband.	Lehka T.S. received counseling assistance and explanation of the procedure of re-registration of inherited property, also she has been offered to represent her interests before notary bodies in order to receive inheritance certificate. Lehka T.S. agreed for assistance, she provided representative of «DB WPP» LLC with relevant power of attorney. **Issue is solved: Inheritance certificate have been received, the servitude agreements have been concluded.**
On 02.10.2018 it was identified that Bartashuk L.O. who has right to ¾ of land plot, has registered inheritance rights for ½ of land plot. (inheritance right for ¼ of land plot belongs to her sister Kozlionkova T.O.) However, Bartashuk L.O. didn't receive inheritance certificate for ¼ of the land plot.	It was explained to Bartashuk L.O. that she needs to visit Alpieieva T.V. state notary of Bilozerka State Notary Office who is responsible for inheritance case in order to obtain inheritance certificate for ¼ of land plot and its further registration with the Register of Property Rights to Immovable Property. **Issue is solved: Inheritance certificate has been received, the copy of the document has been sent to land management organization for manufacturing servitude technical documentation and further conclusion of servitude agreement.**
Pravdyne Village Council of Bilozerskyi district of Kherson Oblast Period of consultations – June 2018-November 2018	
Issue	**Issue solution**
On 15.10.2018 it was identified that Kyianu N.P. as of the stated date has invalid passport as she didn't update the photo after she turned to be 45 years old.	Kyianu N.P. was explained the provision of the Law of Ukraine "On citizenship", provision on the passport of the citizen of Ukraine (Resolution of the Verkhovna Rada of June 26, 1992 N 2503-XII), the emphasis was put on the fact of impossibility to conclude agreements and receipt of funds as her passport is invalid. Kyianu N.P. was provided consultation while solving the issue with relevant territorial

	subdivision of State Migration Service of Ukraine. **Issue is solved: photo has been updated, servitude agreements have been concluded.**
On 16.10.2018 it was identified that Vasnovych S.P. has unregistered inherited land plots including household plot and house land plot.	Vasnovych S.P. was provided a consultation and explained the procedure of inheritance re-registration as well as offered assistance. **Issue is solved: the works on the development of land management documentation have been performed, the land plots have been registered with state land cadaster, the inheritance certificate (for household land plot and house land plot) has been issued.**
On 18.10.2018 it was identified that the households of Shkarbul N.A. and her son Shkarbul V.O. lost state acts on the ownership rights to the land plots granted to them as a result of land parceling and that they don't have cadastral numbers to the land plots.	Shkarbul N.A. and Shkarbul V.O. received the consultation on the procedure of recovery of lost documents and assignment of cadastral numbers. **Issue is solved: archive certified copies of state acts have been received but the originals of state acts have been found by the land plots user. The works on the development of land management documentation have been performed, the land plots have registered with state land cadaster, cadastral numbers have assigned.**
On 03.09.2018 Hlukhov A.V. addressed to representatives of «DB WPP» LLC and informed that he was going to stay in Kharkiv Oblast till the end of the calendar year therefore he would not be able to sign servitude agreement and receive funds due to it.	Hlukhov A.V. was offered to visit any notary in order to certify the power of attorney issued to the name of the person he trusts to that he/she could sign the agreement and receive funds. The representatives of «DB WPP» LLC prepared the text of power of attorney in digital format. Hlukhov A.P. accepted the assistance, the power of attorney has been drawn up. **Issue is solved: power of attorney has been duly executed and issued to the authorized person, the servitude agreement has been concluded.**
Posad-Pokrovske Village Council of Bilozersky district of Kherson Oblast. Period of consultations – June 2018-November 2018	
Issue	**Issue solution**
On 16.09.2018 Tatochenko A.M. informed representatives of «DB WPP» LLC that he has inherited the land plot after the death of his mother which is confirmed with inheritance certificate and relevant record in the act on the ownership right, however the land plot is not registered with the State Land Cadaster and State Registerof property rights to immovable property.	Tatochenko A.M. has been explained that in order to amend the information on the land plot in State land cadaster it is necessary to develop land management technical documentation with regard to restoration of the boundaries of the land plot, then this technical documentation and digital medium has to be submitted to State land cadaster for the assignment of cadastral number and further receipt of the extract which contains the cadastral number; the ownership right can be registered with the Register of Property Rights to Immovable Property after conclusion of servitude agreement (simultaneously with servitude agreement). Tatochenko A.M has been recommended to consult certified land surveyors who according to the Law of Ukraine "On Land Management" has right to develop technical documentation. **Issue is solved: information on land plot has been entered into State land cadaster, the cadastral number has been assigned, the servitude agreement has been concluded.**

Key Gaps between Ukrainian Legislation and Lenders' Requirements.

The key gaps between Ukrainian legislation and Lenders' requirements, relevant for this project, include:

- there is no requirement in the Ukrainian legislation on the development of Resettlement Action Plans, based on the results of a socio economic baseline assessment, as well as its disclosure;
- persons who have no legal rights or claims to the land they occupy are not registered through any census and Ukrainian legislation does not require the implementation of a socio-economic baseline assessment (survey) for any category of affected persons;
- persons who have no recognizable legal right or claim to the land they occupy are not entitled to compensation / assistance under Ukrainian land acquisition laws;
- compensation under national legislation is provided at the real value of affected assets at the moment of when damages were incurred. Registration and transaction costs are not taken into account in the calculation of compensation;
- there is no requirement to consult affected people during resettlement planning and implementation under Ukrainian legislation;
- the establishment of a project specific grievance mechanism to address land securizaion complaints and grievances, outside of courts, is not foreseen by Ukrainian legislation;
- there are no requirements in Ukrainian legislation for monitoring and evaluation of the resettlement/livelihood restoration process and outcomes.

Key Compensation Principles.

To overcome the gaps listed in the previous section «DB WPP» LLC has committed to implementing the following compensation principles:

- avoid or at least minimize economical displacement, for example, by advance notification of the land owners/users on the use of land during construction and installation works, using existing access roads and tracks to the extent possible to avoid/minimise crossing of land, carrying out regular maintenance outside of the growing season, etc.;
- persons who have no recognizable legal right to the land they use are entitled to compensation for the crops they lose as well as for cash compensation for imposing restrictions on the use of land plots due to the placement of towers of overhead line;
- forced evictions is not required;
- a socio economic survey of affected people/households has been implemented, to assess individual impacts, provide baseline information and design appropriate resettlement/livelihood restoration measures, as described in this Plan;
- meaningful consultations have been and will continue to be carried out throughout the development and implementation of this Plan;

- compensation for servitude is provided at the moment of conclusion of servitude agreements; at the request of land users the compensation for imposing restrictions on the use of land plots due to the placement of towers of overhead line years is paid in two instalments (50% in proportion to the concluded servitude agreements with land owners with who they lease the land, 50% after the beginning of construction works); compensation for lost crops will be provided after the losses are incurred based on the real cost of the lost crops;
- all compensation will be provided equally to men and women;
- a grievance mechanism through which all affected people can submit their complaints and grievances in relation to compensation and resettlement and expect a prompt response will be established by «DB WPP» LLC within one month from the approval and disclosure of this Plan;
- internal and external monitoring of all compensation will be regularly carried out and reported on.

Compensation to Economically Displaced Persons.

This section defines the compensation payments and the payment procedure, as well as the categories of persons entitled to such payments.

Main provisions.

The grounds for compensation payments to owners and users of land plots are as follows:

- temporary use of agricultural land for the purpose of the Project;
- imposing of restrictions for energy facilities in accordance with the laws of Ukraine regarding the use of land plots;
- deterioration of quality of soil cover and other useful properties of agricultural land;
- loss of profit due to loss or damage to agricultural crops.
- The incurred damages/restrictions will be compensated by:
- payment for the establishment of a servitude;
- payment for restrictions on the use of land plots;
- reclamation of land at own expense of «DB WPP»;
- compensation for losses in case of loss or damage to agricultural crops.

The Project identified 4 categories of persons entitled to compensation and assistance in the restoration of livelihoods:

- owners who have duly executed rights to a land plot;
- lessees (users) who have duly executed rights to a land plot;
- lessees (users) who have no duly executed rights to a land plot, but use such land plot.

There are no other categories of persons entitled to compensation and assistance in the restoration of livelihoods.

Assessment of compensation.

Payment for the establishment of an easement on private land.

The payment for easements was calculated by a single approach to all land plot owners on the Project site, which is the territory of Oleksandrivska, Pravdynska and Posad-Pokrovska Village Councils. The level of payment has been brought to the highest level of living by the village councils involved in the project. Thus, Oleksandrivska and Pravdynska Village Councils are geographically located in the steppe zone in the absence of industrial enterprises and developed transport infrastructure, which negatively affects the level of life, in comparison with the Posad-Pokrovska Village Council. Territorially, the Posad-Pokrovska Village Council is also located in the steppe zone, but along the principal (international road) M-14 (E 58) Odesa-Melitopol-Novoazovsk, which promotes the development of services, trade and warehouse logistics. Consequently, the living standards of the residents of the Posad-Pokrovska Village Council are somewhat higher than of the residents of Oleksandrivska and Pravdynska Village Councils, which was taken into account in determining the payment for the establishment of an easement.

Calculation of the payment for the use of land plots under the easement agreements considered the rent amount specified by the lessor. As for the Oleksandrivska Village Council, the rent amount received by the owners from land leasing is UAH 2000 per one hectare; as for the Pravdynska and Posad-Pokrovska village councils, the rent amount received by the owners from land leasing is UAH 6000 per unit and the unit size on average is from 3.5 ha to 7 ha, depending on the quality and category of land. Rent per hectare for Oleksandrivska Village Council is the highest and it is used as the basis for the calculation of the payment for the use of the land plots under easement agreements.

Meetings and consultations with villagers and representatives of local authorities made clear the necessity to take into account a certain type of easement at calculation of the payment amount. Thus, the calculation of the payment included a functional purpose factor which is determined taking into account the validity of easement and the type of land use. The Project provides for the use of three main types of easements:

– for a partial installation of the support structures of a wind turbine;
– for installation of the support structures of the OHPL;
– for construction sites and other objectives of the Project.

Estimation of the factor for the first and second types of easement took into account the absence of seizure of the land plot from the owner and the possibility of its use for functional purpose; considering the long validity period of the easement (i.e., 30 years), factor 3 has been applied.

Estimation of the factor for the third type of easement also took into account the absence of seizure of the land plot from the owner and the possibility of its use for functional purpose; considering the significantly shorter validity period of the easement (i.e., 3 years), factor 2 has been applied.

The payment is calculated by the formula:

$$P = O_{sq/m} \text{ x } V_{sq/m} \text{ x } 30/3 \text{ x } FPF \text{ x } BF,$$

where,

P – payment for the use of land plots under the easement agreements;

$O_{sq/m}$ – rent amount per square meter of land, which is UAH 0.20 (UAH 2000/10000 sq m);
$V_{sq/m}$ – area used: for the partial installation of the support structures of a wind turbine - average is 500 sq m, for installation of the support structures of the OHPL with mounting area - average is 1000 sq m; for construction sites and other purposes – average is 5000 sq m;
30/3 – the term of validity of the easement agreement; for the partial installation of the support structures of a wind turbine it is 30 years, for installation of the support structures of the OHPL it is 30 years; for construction sites and other purposes it is 3 years;
FPF – functional purpose factor: for the partial installation of the support structures of a wind turbine it is 3, for installation of the support structures of the OHPL it is 3; for construction sites and other purposes it is 2;
BF – is 1.6 balancing purpose factor to cover possible reduction of state aid to households in the current year, which is provided for repayment of expenses for utilities;

Thus, amount of payment:

- for a partial installation of the support structures of a wind turbine with rounding up to a greater number is UAH 15000 (0.20 x 500 x 30 x 3 x 1.6);
- for installation of the support structures of OHL with rounding up to a greater number is UAH 30000 (0.20 x 1000 x 30 x 3 x 1.6);
- for construction sites and other purposes with rounding up to a greater number is UAH 10000 (0.20 x 5000x 3 x 2 x 1.6).

Payment for setting restrictions on the use of land plots.

Normative acts of Ukraine provide for compensation both to land owners and users for the set restrictions on the use of land plots. Thus, according to the Law of Ukraine «On Energy Lands and Legal Regime of Special Zones of Energy Generating Facilities», owners and users of land have the right to recover reasonable amount of damages incurred by them due to restrictions on the use of their land within special zones of energy facilities.

Persons entitled to the above compensation shall be the persons having acquired the right of ownership or use of land plots before the land is allocated for the construction of the corresponding energy facility. The provisions of equality of the right to compensation of both - the owner and the user were applied to estimate the amount of compensation to users of land plots. The meetings with the users of land plots resulted in an agreement upon the fairness of determining the level of compensation at the level of payment under the easement agreements to the owners of the land plots.

Taking it into account, the user of the land plots receives in addition a payment for the restrictions on the use of land plots in amount of UAH 30000. The multiplying factor equal to three is applied to irrigated lands which corresponds to the level of increase in yield on such lands.

Land reclamation.

Restoration of disturbed lands will be carried out in two stages of reclamation: technical and biological.

The technical stage of reclamation is a complex of engineering works consisting of:

– removal and storage of the fertile soil and potentially fertile layers;
– leveling of the surface, flattening, benching and fixing slopes of dumps;
– coverage of the levelled surface with a layer of fertile soil or potentially fertile rocks.

The scope of work of the technical stage of reclamation depends on the condition of the disturbed lands areas and the type of planned use. Areas provided and prepared for eligibility for non-agricultural use (for industrial construction, roads, etc.) remain in the use of «DB WPP» LLC. After the technical stage of reclamation, areas purposed for agriculture are returned or transferred to agricultural enterprises for the purpose of biological reclamation and subsequent use by purpose.

The removal of the fertile soil layer is obligatory for all types of works for the construction of industrial, residential and other facilities, roads and hydraulic structures. The removed layer is stored or transported to unproductive land located nearby (eroded, sandy, alkaline soil, etc.) for further restoration of the fertility of the disturbed lands.

The depth of removal of the fertile layer is determined by the depth of the humus profile of the soil and the content of humus in it. The humus accumulative horizon of soil is removed.

The biological stage of the reclamation is a set of measures to create a favourable water-air and nutrient soil regimes for agricultural and forestry crops.

The complex of measures of biological reclamation of land for agricultural use is determined by the physical and chemical properties of undersoils and applied fertile soil layer or potentially fertile rock. This set includes the introduction of crop rotation, crop-rich and with the use of green manure, application of higher volume of organic and mineral fertilizers, mulching, etc.

All measures connected with the reclamation of land will be carried out at the expense of «DB WPP» LLC.

Compensation for losses in case of loss of or damage to agricultural crops.

In order to assess the losses of agricultural production, due to the limited time use of land for the period of construction, calculations will be made on the basis of the average yield of agricultural crop lost or damaged during the course of the work, and the price indexes of such crops. This procedure was agreed directly with users of the land plots. In addition, the calculation will include a lost profit, which refers to the revenues that land users could receive if part of the land plot would not be used within the construction and installation work.

Rent and establishment of easement for state-owned land.

Land lease is a contractual fixed-term paid ownership and use of the land plot necessary for the lessee to conduct business and other activities. The relations regarding the land lease are regulated by the Land Code of Ukraine, the Civil Code of Ukraine, the Law of Ukraine «On Land Lease», the laws of Ukraine, and other normative and legal acts.

A land lease agreement is an agreement by which the lessor is obliged to transfer to the lessee for a fee the land for ownership and use for a certain period, and the lessee is obliged to use the land plot in accordance with the terms of the contract and the requirements of the land laws.

According to the Tax Code of Ukraine, land lease payment refers to taxes and duties, which by virtue of the requirements of paragraph 14.1.147 of Clause 14.1 of Article 14 of the same code is a mandatory payment as a part of the tax on property, which is in the form of a land tax or rent for land plots of state and communal property.

According to the paragraph 14.1.136 of Clause 14.1 of Article 14 of the Tax Code of Ukraine, rent for land plots of state and communal property is a mandatory payment which shall be made by the lessee to the lessor for the use of the land plot.

According to Clause 285.5 of the Tax Code, the rent amount is stipulated in the lease agreement, but the annual payment may not be less than 3 per cent of the normative and monetary valuation and may not exceed 12 per cent of the normative and monetary valuation.

Annual rent for land lease agreements concluded with «DB WPP» LLC was at the rate of 5% of its normative and monetary valuation.

The procedure for establishing easements on the state-owned land property and the respective payment calculation are not specified separately by the laws of Ukraine and shall be carried out by analogy of lease of the state-owned land plots.

Grievance Mechanism.

The grievance mechanism is intended to enable affected persons to express their dissatisfaction by filing complaints and ensuring an effective and prompt handling of the complaints. Complaints may contain dissatisfaction regarding all aspects of the preparation and implementation of the Project.

The grievance mechanism will provide prompt and effective handling and resolution of the complaints in a transparent manner that will be available to all segments of the communities affected by the Project without charge and punishment. Such a procedure shall not restrict access to judicial or administrative remedies.

Shall the affected persons be not satisfied with the results, they will be able to go to court at any stage of the grievance process.

Filing and handling of complaints.

The affected person may file a substantiated complaint to the office of «DB WPP» LLC. The contact person for receiving complaints (objections, proposals) from the affected persons is the Head of the «DB WPP» LLC.

The complaint shall contain the following data:

- surname, name, patronymic, place of residence of the complainant;
- the matter of the filed claim and the justification.

The complaint shall be in writing and signed and dated by the complainant. The complaint shall be sent by mail or personally delivered by the complainant.

If necessary, the complainant may submit the documents necessary for consideration of the complaint, which, after its consideration, are returned to the complainant.

On the basis of the received complaint (objection, proposal), the Head of the «DB WPP» LLC or authorised by him person shall conduct investigation and inspection.

According to the results of investigations and inspections, the Head of «DB WPP» LLC in the term of no more than fifteen (15) days shall take one of the following decisions:

1) to dismiss a complaint;
2) to satisfy the complaint in full or in a certain part and to offer a solution to the issue raised by the complainant.

If the affected person is dissatisfied with the result of the inspection and the proposal submitted, the Head of the «DB WPP» LLC or authorised by him person shall look for an alternative solution to this issue.

If there is no alternative and the person does not agree to resolve the issue through negotiation and compromise, the affected person is entitled to apply to the court in accordance with national laws.

The complaint is considered «to be handled» after receipt of a solution satisfactory for both parties and after taking effective measures to remedy the situation.

The term to implement the proposed solution will depend on the nature of the decision and will be agreed by the parties additionally, with the actions for its implementation to be completed within one month.

The Head of the «DB WPP» LLC may decide to dismiss the complaint if the complainant failed to substantiate the complaint or if there is an obvious threat of speculation or fraud.

In such cases, the actions of the Head of «DB WPP» LLC for investigation of the grounds of the complaint and the conclusion shall be duly documented and the complainant shall be informed of such a situation.

The Head of «DB WPP» LLC shall dismiss no complaints due to formalistic bases and is obliged to provide time to eliminate the shortcomings of the complaint.

The Head of «DB WPP» LLC shall inform relevant communities about the process of receiving and handling of complaints in its interaction with them, as well as regularly report to the public on its application, ensuring the protection of the privacy of the individuals concerned.

The process of receiving and handling of the complaints will be tactful and unbiassed and will provide timely responses to the needs and concerns of stakeholders.

Monitoring.

The monitoring of the livelihood restoration process will be conducted in accordance with the requirements of the EBRD and will include the participation of key stakeholders, the affected communities, in particular.

The monitoring is carried out to:

(i) determine whether the Project is actually implemented in accordance with the requirements of the EBRD; and
(ii) (ii) make the conclusions, allocate resources and identify opportunities for continuous improvement.

The subject of monitoring includes as follows:

– proper implementation of the measures envisaged by the Plan;
– consultation and public information;
– social impacts and issues identified at the stage of socio-economic evaluation;

- compensation to displaced persons;
- complaints received from affected persons and external stakeholders, as well as the results of their handling;
- all regulatory requirements for monitoring and reporting, etc.

Availability of necessary systems, resources and personnel will be provided for monitoring. The relevant experts will analyse the results of the monitoring and, if necessary, initiate corrective measures.

Third parties, including independent experts, local communities or public organizations, will be involved, if necessary, to supplement or verify monitoring information.

The Project provides for internal and external monitoring, as well as an audit.

Internal monitoring.

The internal monitoring system will be implemented with the obligatory recording of the following indicators:

- the number of consultations and public awareness activities held;
- the number of affected people/households and types of impacts;
- the number and type of affected assets (land, non-residential buildings, agricultural crops, trees, etc.);
- total expenses for compensation, restoration of livelihoods;
- the number of disturbed and reclaimed land plots;
- amount and percentage of paid compensations;
- the number of signed compensation agreements;
- the number of signed easement agreements;
- the number of signed lease agreements;
- types of measures taken to restore livelihoods, progress in implementation, number of beneficiaries;
- the number of successful and outstanding claims;
- the number of open court cases, etc.

External monitoring.

Independent experts will carry out activities related to:

- analysis of the carried-out activities to ensure compliance with the Plan and proper implementation of the main measures envisaged by the Plan;
- analysis and verification of the results of internal monitoring. Verification will include interviews with affected persons and other stakeholders;
- preparation of recommendations for amendments to the Plan necessary to improve its implementation;
- analysis of detected deviations from the Plan, including assessment of their impact on the timing of implementation and the budget of the Project.

Audit.

Within the framework of the Project, independent experts will audit the implementation of the Plan with outcomes and findings reflected in the audit report.

The audit will be carried out after all Plan measures have been implemented and it is possible to define the final results of Plan implementation.

The audit will include examination of all related documentation, internal monitoring results and external monitoring reports. Auditors can also conduct evaluative surveys and consultations with a sample from affected persons and other stakeholders.

The audit will determine whether measures to restore livelihoods and improve the lives of affected persons have been properly implemented.

The audit report will identify further steps to be taken to successfully implement the Project.

Based on the results of the monitoring and audit, all necessary corrective and preventive measures will be identified and represented in the updated Plan upon approval with the EBRD and implemented further.

In Fig. B-1 – Fig. B-3 provide land of plots for «DB WPP» and the OHPL.

Fig. B-1. General land of plots for Project

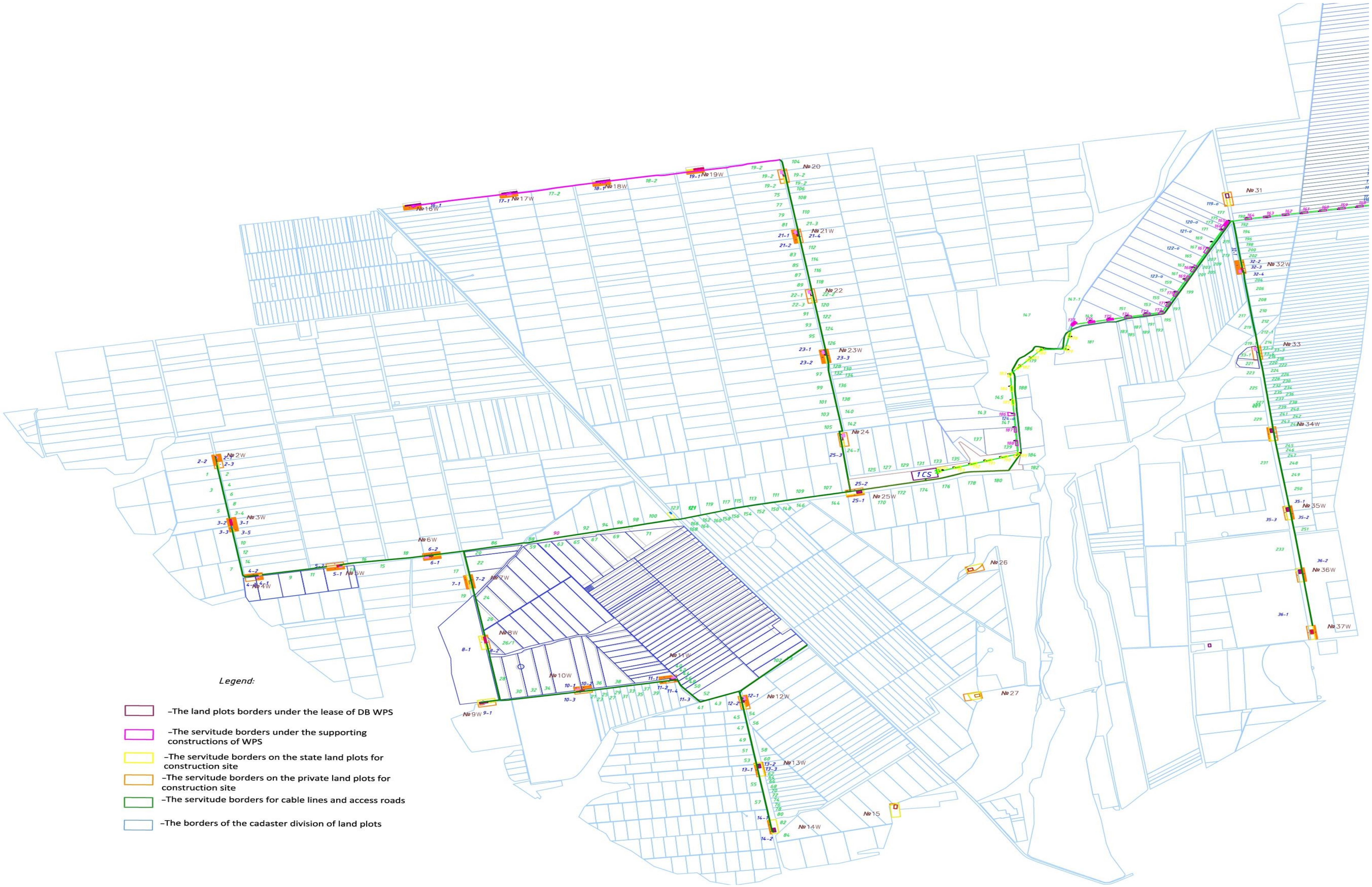

Fig. B-2. Land plots for «DB WPP»

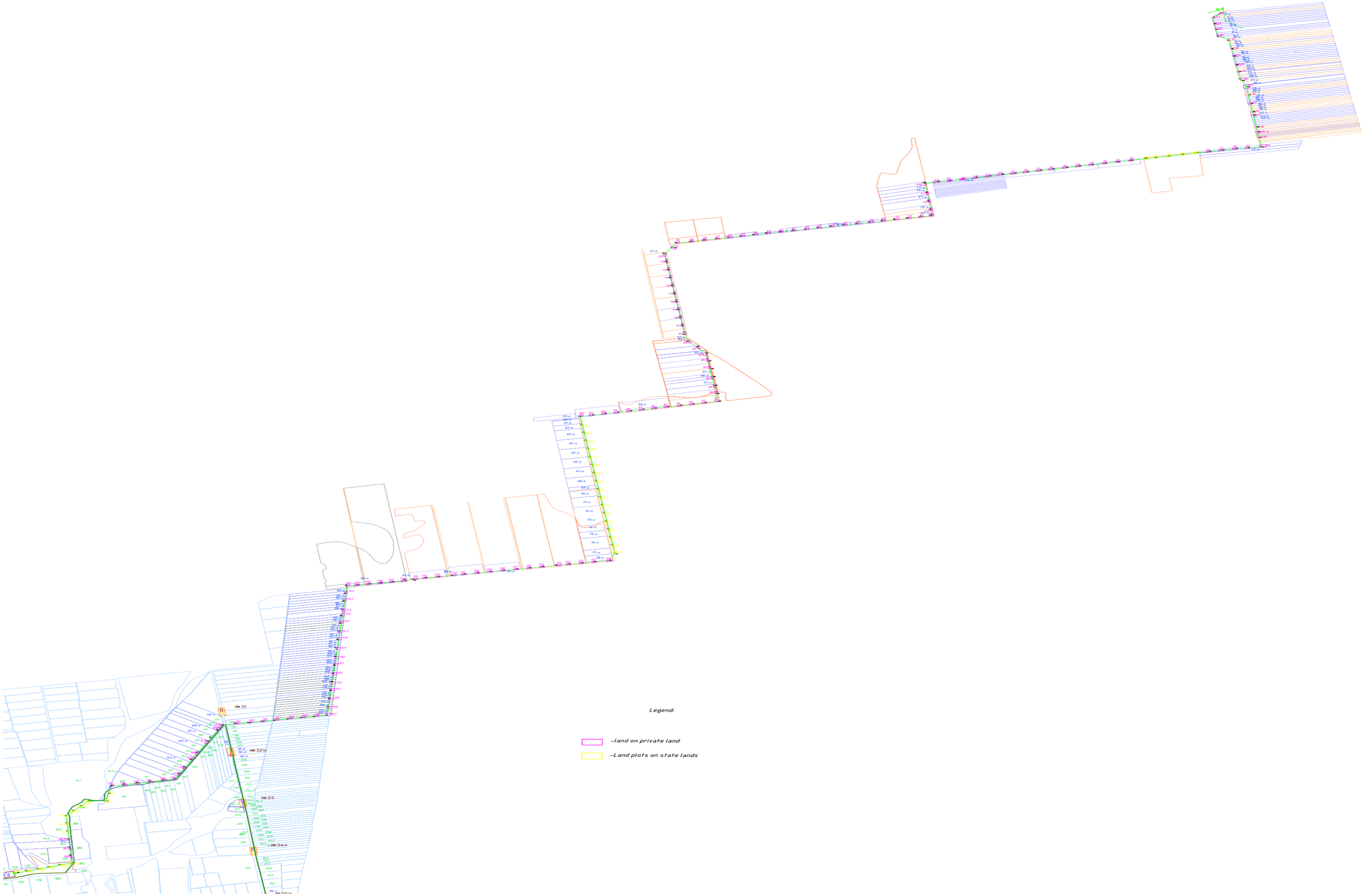

Fig. B-3. General Land plots for the OHPL

Table B-3 – Information about the Lands for «DB WPP»

Sequence number in accordance with the map B-2	Type of land use	GPS Coordinates				Cadastral number of the land plot	Purpose of the land plot	Type of ownership	Total area of the land plot, hectare	The area of the land plot used by «DB WPP» LLC, ha	Land owner	Type of document confirming the right to use «DB WPP» LLC land plot
1CS	For placement and operation of the central substation and control room	429291.725	5167097.712	46.65370725° N	32.07589239° E	6520380500:02:001:0163	land energy	State	1.8	1.8	Kherson regional state administration	The lease agreement dated 13.10.2017
		429488.606	5167132.492	46.65404095° N	32.07845983° E							
		429504.257	5167043.895	46.65324539° N	32.07867788° E							
		429307.377	5167009.115	46.65291169° N	32.07611049° E							
2W	For placement of wind turbines	423767.786	5167255.523	46.65452141° N	32.00368301° E	6520380500:02:001:0151	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated October 25, 2017
		423784.572	5167258.576	46.65455079° N	32.00390186° E							
		423795.063	5167200.897	46.65403299° N	32.00404848° E							
		423778.301	5167197.846	46.65400363° N	32.00382995° E							
2-1	For placement of underground supporting structures					6520380500:02:004:0031	agricultural land	Private	5.1599	0.0349	Zachesa Nikolai Andreevich	The Agreement of easement of April 20, 2013
	For placing construction machines and construction machinery					6520380500:02:004:0031	agricultural land	Private	5.1599	0,2174	Zachesa Nikolai Andreevich	The Agreement of easement of April 20, 2018
2-2	For placing construction machines and construction machinery					6520380500:02:001:0226	agricultural land	Private	5.3362	0.1852	Polovenko Alevtina Ivanovna	The Agreement of easement on May 22, 2018
3W	For placement of wind turbines	423886.339	5166605.450	46.64868556° N	32.00533946° E	6520380500:02:001:0150	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated October 25, 2017
		423902.791	5166608.443	46.64871436° N	32.00555393° E							
		423913.523	5166549.434	46.64818462° N	32.00570389° E							
		423897.191	5166546.459	46.64815599° N	32.00549098° E							
3-1	For placement of underground supporting structures					6520380500:02:004:0124	agricultural land	Private	5.16	0.0359	Hasan Vitaliy	The Agreement of easement on March 27, 2018
	For placing construction machines and construction machinery					6520380500:02:004:0124	agricultural land	Private	5.16	0.313	Hasan Vitaliy	The Agreement of easement on March 27, 2018
3-2	For placing construction machines and construction machinery					6520380500:02:004:0007	agricultural land	Private	4.9319	0.1394	Baranova Nina	The Agreement of easement on 22.05.2018
3-3	For placing construction machines and construction machinery					6520380500:02:004:0015	agricultural land	Private	5.1602	0.0981	Grigorchuk Fedor	The Agreement of easement on 31.05.2018
3-4	For placing construction machines and construction machinery					6520380500:02:004:0025	agricultural land	Private	5.16	0.0474	Hasan Lidiya	The Agreement of easement on 31.05.2018
3-5	For placing construction machines and construction machinery					6520380500:02:001:0023	agricultural land	Private	5.16	0.091	Manoha Irina	The Agreement of easement on 04.07.2018
4W	For placement of wind turbines	424116.609	5166038.623	46.64361139° N	32.00844140° E	6520380500:02:001:0172	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated October 25, 2017
		424118.558	5166025.812	46.64349633° N	32.00846897° E							
		424042.386	5166014.044	46.64338182° N	32.00747573° E							
		424040.411	5166026.872	46.64349702° N	32.00744781° E							
4-1	For placement of underground supporting structures					6520380500:02:009:0002	agricultural land	Private	4.42	0.0328	Revenko Galina	The Agreement of easement on 04.04.2018
	Для For placing construction machines and construction machinery					6520380500:02:009:0002	agricultural land	Private	4.42	0.1919	Revenko Galina	The Agreement of easement on 04.04.2018
4-2	For placing construction machines and construction machinery					6520380500:02:001:0064	agricultural land	Private	5.1599	0.2464	Babuschok Svetlana	The Agreement of easement on 05.06.2018

Sequence number in accordance with the map B-2	Type of land use	GPS Coordinates				Cadastral number of the land plot	Purpose of the land plot	Type of ownership	Total area of the land plot, hectare	The area of the land plot used by «DB WPP» LLC, ha	Land owner	Type of document confirming the right to use «DB WPP» LLC land plot
5W	For placement of wind turbines	424779.734	5166147.262	46.64466368° N	32.01708735° E	6520380500:02:001:0149	land energy	State	0,1	0.1	Kherson regional state administration	The lease agreement dated 25.01.2018
		424783.173	5166123.558	46.64445077° N	32.01713615° E							
		424740.389	5166117.581	46.64439220° N	32.01657815° E							
		424737.190	5166139.654	46.64459045° N	32.01653276° E							
5-1	For placement of underground supporting structures					6520380500:02:009:0005	agricultural land	Private	4.36	0.0105	Pekaliuk Tatyana	The Agreement of easement on 04.04.2018
	For placing construction machines and construction machinery					6520380500:02:009:0005	agricultural land	Private	4.36	0.3433	Pekaliuk Tatyana	The Agreement of easement on 04.04.2018
5-2	For placing construction machines and construction machinery					6520380500:02:005:0010	agricultural land	State	0.9487	0.3067	Belozersk regional state administration of the Kherson region	
6W	For placement of wind turbines	425499.251	5166245.354	46.64562669° N	32.02647214° E	6520380500:02:001:0160	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated October 25, 2017
		425501.575	5166230.689	46.64549499° N	32.02650487° E							
		425434.932	5166220.117	46.64539245° N	32.02563586° E							
		425432.619	5166234.709	46.64552350° N	32.02560329° E							
6-1	For placement of underground supporting structures					6520380500:02:010:0026	agricultural land	Private	5.077	0.0309	Chernyschov Viacheslav	The Agreement of easement on 20.04.2018
	For placing construction machines and construction machinery					6520380500:02:010:0026	agricultural land	Private	5.077	0.4144	Chernyschov Viacheslav	The Agreement of easement on 20.04.2018
6-2	For placing construction machines and construction machinery					6520380500:02:006:0007	agricultural land	Private	5.49	0.2884	Baranov Oleg	The Agreement of easement on 22.05.2018
7W	For placement of wind turbines	425785.287	5165979.159	46.64326320° N	32.03025214° E	6520380500:02:001:0143	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated 25.01.2018
		425799.446	5165981.876	46.64328922° N	32.03043669° E							
		425812.429	5165914.256	46.64268221° N	32.03061718° E							
		425798.082	5165911.501	46.64265583° N	32.03043018° E							
7-1	For placement of underground supporting structures					6520380500:02:010:0028	agricultural land	Private	5.5891	0.0065	Chernyschov Igor	The Agreement of easement on 20.04.2018
	For placing construction machines and construction machinery					6520380500:02:010:0028	agricultural land	Private	5.5891	0.2872	Chernyschov Igor	The Agreement of easement on 20.04.2018
7-2	For placing construction machines and construction machinery					6520380500:02:011:0003	agricultural land	Private	3.27	0.2516	Bezrodniy Aleksandr	The Agreement of easement on 18.06.2018
8W	For placement of wind turbines	425900.705	5165401.228	46.63807572° N	32.03185283° E	6520380500:02:001:0152	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated 25.01.2018
		425915.853	5165404.137	46.63810357° N	32.03205026° E							
		425928.003	5165340.856	46.63753551° N	32.03221913° E							
		425912.679	5165337.913	46.63750733° N	32.03201942° E							
8-1	For placement of underground supporting structures					6520380500:02:001:0244	agricultural land	State	30	0.04	The Main Department of the State Geodetic Inventory in the Kherson region	
	For placing construction machines and construction machinery					6520380500:02:001:0244	agricultural land	State	30	0.4	The Main Department of the State Geodetic Inventory in the Kherson region	

Sequence number in accordance with the map B-2	Type of land use	GPS Coordinates				Cadastral number of the land plot	Purpose of the land plot	Type of ownership	Total area of the land plot, hectare	The area of the land plot used by «DB WPP» LLC, ha	Land owner	Type of document confirming the right to use «DB WPP» LLC land plot
9W	For placement of wind turbines	425933.209	5164741.704	46.63214489° N	32.03238325° E	6520380500:02:001:0175	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated 25.01.2018
		425935.693	5164726.301	46.63200656° N	32.03241816° E							
		425872.079	5164716.044	46.63190723° N	32.03158886° E							
		425869.623	5164731.271	46.63204398° N	32.03155434° E							
9-1	For placement of underground supporting structures					6520380500:02:029:0004	agricultural land	State	20.59	0.039	The Main Department of the State Geodetic Inventory in the Kherson region	
	For placing construction machines and construction machinery					6520380500:02:029:0004	agricultural land	State	20.59	0.4739	The Main Department of the State Geodetic Inventory in the Kherson region	
8-1	placing construction machines and construction machinery					6520380500:02:001:0244	agricultural land	State	30	0.3	The Main Department of the State Geodetic Inventory in the Kherson region	
10W	For placement of wind turbines	426700.828	5164862.201	46.63331349° N	32.04239095° E	6520380500:02:001:0142	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated October 25, 2017
		426703.074	5164847.194	46.63317870° N	32.04242267° E							
		426637.303	5164837.351	46.63308294° N	32.04156509° E							
		426635.100	5164852.068	46.63321513° N	32.04153397° E							
10-1	For placement of underground supporting structures					6520380500:02:013:0005	agricultural land	Private	10.67	0.0314	Goman Aleksandr	The Agreement of easement on 19.04.2018
	For placing construction machines and construction machinery					6520380500:02:013:0005	agricultural land	Private	10.67	0.1695	Goman Aleksandr	The Agreement of easement on 19.04.2018
10-2	For placing construction machines and construction machinery					6520380500:02:013:0006	agricultural land	Private	5.2	0.2563	Grigorieva Tamara	The Agreement of easement on 18.06.2018
10-3	For placing construction machines and construction machinery					6520380500:02:015:0011	agricultural land	State	49.94	0.2047	The Main Department of the State Geodetic Inventory in the Kherson region	
11W	For placement of wind turbines	427419.961	5164981.683	46.63446685° N	32.05176587° E	6520380500:02:001:0159	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated October 25, 2017
		427423.606	5164958.982	46.63426297° N	32.05181706° E							
		427380.693	5164952.090	46.63419631° N	32.05125758° E							
		427377.047	5164974.792	46.63440019° N	32.05120638° E							
11-1	For placement of underground supporting structures					6520380500:02:013:0010	agricultural land	Private	2	0.0164	Fedischev Viacheslav	The Agreement of easement on 22.05.2018
	For placing construction machines and construction machinery					6520380500:02:013:0010	agricultural land	Private	2	0.345	Fedischev Viacheslav	The Agreement of easement on 22.05.2018
11-2	For placing construction machines and construction machinery					6520380500:02:015:0004	agricultural land	Private	2	0.0822	Bartoschuk Natalia	The Agreement of easement on 31.05.2018
11-3	For placing construction machines and construction machinery					6520380500:02:015:0002	agricultural land	Private	2	0.0443	Olga Kotliarenko	The Agreement of easement on 31.05.2018
11-4	For placing construction machines and construction machinery					6520380500:02:001:0238	agricultural land	State	1.99	0.1655	The Main Department of the State Geodetic Inventory in the	

Sequence number in accordance with the map B-2	Type of land use	GPS Coordinates				Cadastral number of the land plot	Purpose of the land plot	Type of ownership	Total area of the land plot, hectare	The area of the land plot used by «DB WPP» LLC, ha	Land owner	Type of document confirming the right to use «DB WPP» LLC land plot
											Kherson region	
12W	For placement of wind turbines	427939.679 427958.337 427968.194 427949.527	5164781.921 5164785.477 5164733.767 5164730.260	46.63272543° N 46.63275944° N 46.63229520° N 46.63226163° N	32.05858606° E 32.05882921° E 32.05896604° E 32.05872276° E	6520380500:02:001:0158	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated October 25, 2017
12-1	For placement of underground supporting structures					6520380500:02:018:0001 (6520380500:02:001:0230)	agricultural land	Private	4.36	0.0298	Osipenko Svetlana	The Agreement of easement on 20.04.2018
	For placing construction machines and construction machinery					6520380500:02:018:0001 (6520380500:02:001:0230)	agricultural land	Private	4.36	0.3298	Osipenko Svetlana	The Agreement of easement on 20.04.2018
12-2	For placing construction machines and construction machinery					6520380500:02:001:0236	agricultural land	State	2	0.2	The Main Department of the State Geodetic Inventory in the Kherson region	
13W	For placement of wind turbines	428068.558 428093.145 428100.309 428075.723	5164094.686 5164099.165 5164059.825 5164055.348	46.62655544° N 46.62659838° N 46.62624516° N 46.62620224° N	32.06037656° E 32.06069700° E 32.06079669° E 32.06047627° E	6520380500:02:001:0141	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated October 25, 2017
13-1	For placing construction machines and construction machinery					6520380500:02:017:0035	agricultural land	Private	2	0.1346	Kovalchuk Viktor	The Agreement of easement on 31.05.2018
13-2	For placing construction machines and construction machinery					6520380500:02:001:0237	agricultural land	State	1	0,0372	The Main Department of the State Geodetic Inventory in the Kherson region	
13-3	For placing construction machines and construction machinery					5520380500:02:001:0235	agricultural land	State	1	0,0437	The Main Department of the State Geodetic Inventory in the Kherson region	
14W	For placement of wind turbines	428187.463 428212.061 428219.125 428194.526	5163437.147 5163441.562 5163402.205 5163397.790	46.62065155° N 46.62069390° N 46.62034052° N 46.62029817° N	32.06203177° E 32.06235233° E 32.06245069° E 32.06213013° E	6520380500:02:001:0140	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated October 25, 2017
14-1	For placing construction machines and construction machinery					6520380500:02:017:0078	agricultural land	Private	2	0.1167	Schegol Liudmila	The Agreement of easement on 18.06.2018
14-2	For placing construction machines and construction machinery					6520380500:02:017:0079	agricultural land	Private	2	0.0763	Bazdyreva Galina	The Agreement of easement on 22.05.2018
16W	For placement of wind turbines	425279.706 425402.293 425403.747 425280.971	5169828.987 5169849.981 5169841.472 5169821.508	46.67784774° N 46.67805032° N 46.67797391° N 46.67778058° N	32.02302297° E 32.02462217° E 32.02464256° E 32.02304072° E	6520380500:02:001:0168	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated October 25, 2017
16-1	For placement of underground supporting structures					6520380500:03:001:0001	agricultural land	Private	4.3604	0.0481	Puzan Liudmila	The Agreement of easement on 04.04.2018
	For placing construction machines and construction machinery					6520380500:03:001:0001	agricultural land	Private te	4.3604	0.5051	Puzan Liudmila	The Agreement of easement on 04.04.2018
	For laying underground cable line					6520380500:03:001:0001	agricultural land	Private	4.3604	0.1613	Пузан Людмила/Puzan Liudmila	The Agreement of easement on 11.05.2018
17W	For placement of wind turbines	426166.160	5169973.736	46.67924856° N	32.03458857° E	6520380500:02:001:0169	land energy	State	0.1	0.1	Kherson regional	The lease agreement

Sequence number in accordance with the map B-2	Type of land use	GPS Coordinates				Cadastral number of the land plot	Purpose of the land plot	Type of ownership	Total area of the land plot, hectare	The area of the land plot used by «DB WPP» LLC, ha	Land owner	Type of document confirming the right to use «DB WPP» LLC land plot
		426167.403	5169965.508	46.67917466° N	32.03460614° E						state administration	25.01.2018
		426048.490	5169946.194	46.67898775° N	32.03305463° E							
		426047.161	5169954.349	46.67906098° N	32.03303594° E							
17-1	For placement of underground supporting structures					6520380500:03:001:0017	agricultural land	Private	4.8904	0.0473	Smiyuha Maria	The Agreement of easement on 27.03.2018
17-1	For placing construction machines and construction machinery					6520380500:03:001:0017	agricultural land	Private	4.8904	0.5018	Smiyuha Maria	The Agreement of easement on 27.03.2018
17-1	For laying underground cable line					6520380500:03:001:0017	agricultural land	Private	4.8904	0.0611	Smiyuha Maria	The Agreement of easement on 11.05.2018
17-2	For laying underground cable line					6520380500:03:001:0032	agricultural land	Private	4.8893	0.101	Uleyskaya Nadezhda	The Agreement of easement on 05.06..2018
18W	For placement of wind turbines	426901.752	5170094.074	46.68041210° N	32.04418631° E	6520380500:02:001:0148	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement 13.10.2017
		426903.227	5170085.011	46.68033071° N	32.04420703° E							
		426794.037	5170067.281	46.68015924° N	32.04278232° E							
		426792.608	5170076.056	46.68023805° N	32.04276223° E							
18-1	For placement of underground supporting structures					6520380500:03:001:0052	agricultural land	Private	4.3604	0.0454	Vovk Nikolay	The Agreement of easement on 11.05.2018
	For placing construction machines and construction machinery					6520380500:03:001:0052	agricultural land	Private	4.3604	0.4929	Vovk Nikolay	The Agreement of easement on 11.05.2018
	For laying underground cable line					6520380500:03:001:0052	agricultural land	Private	4.3604	0.0814	Vovk Nikolay	The Agreement of easement on 11.05.2018
18-2	For laying underground cable line					6520380500:03:001:0078	agricultural land	Private	4.36	0.1153	Galuschka Ekaterina	The Agreement of easement on 05.06.2018
19W	For placement of wind turbines	427644.036	5170218.344	46.68161095° N	32.05387135° E	6520380500:02:001:0139	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement 25.10.2017
		427646.158	5170205.527	46.68149585° N	32.05390110° E							
		427568.930	5170193.017	46.68137493° N	32.05289338° E							
		427566.794	5170205.383	46.68148597° N	32.05286350° E							
19-1	For placement of underground supporting structures					6520380500:03:001:0102	agricultural land	Private	4.36	0.0356	Orlova Victoria	The Agreement of easement on 18.06.2018
	For placing construction machines and construction machinery					6520380500:03:001:0102	agricultural land	Private	4.36	0.4505	Orlova Victoria	The Agreement of easement on 18.06.2018
	For laying underground cable line					6520380500:03:001:0102	agricultural land	Private	4.36	0.0784	Orlova Victoria	The Agreement of easement on 18.06.2018
19-2	For laying underground cable line					6520380500:03:001:0127	agricultural land	Private	4.36	0.1289	Solop Anatoliy	The Agreement of easement on 05.06.2018
21W	For placement of wind turbines	428377.535	5169569.084	46.67584776° N	32.06356223° E	6520380500:02:001:0138	land energy	State	0,1	0.1	Kherson regional state administration	The lease agreement dated 13.10.2017
		428395.242	5169572.239	46.67587805° N	32.06379322° E							
		428404.975	5169517.485	46.67538640° N	32.06392897° E							
		428387.253	5169514.409	46.67535683° N	32.06369777° E							
21-1	For placement of underground supporting structures					6520380500:03:001:0134	agricultural land	Private	4.36	0.0325	Yuschenko Sofia	The Agreement of easement on 27.03.2018

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	For placing construction machines and construction machinery					6520380500:03:001:0134	agricultural land	Private	4.36	0.2638	Yuschenko Sofia	The Agreement of easement on 27.03.2018
21-2	For placing construction machines and construction machinery					6520380500:03:001:0135	agricultural land	Private	4.6	0.1729	Kostrykina Nina	The Agreement of easement on 31.05.2018
21-3	For placing construction machines and construction machinery					6520380500:03:001:0157	agricultural land	Private	4.56	0.0452	Kandyba Nikolay	
21-4	For placing construction machines and construction machinery					6520380500:03:001:0158	agricultural land	Private	4.41	0.1997	Yakubovich Maria	
23W	For placement of wind turbines	428595.399	5168346.174	46.66486718° N	32.06659980° E	6520380500:02:001:0156	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated 25.01.2018
		428613.106	5168349.336	46.66489753° N	32.06683074° E							
		428622.860	5168294.587	46.66440592° N	32.06696670° E							
		428605.140	5168291.503	46.66437629° N	32.06673558° E							
23-1	placement of underground supporting structures					6520380500:03:001:0145	agricultural land	Private	5.8201	0.0325	Miroschnichenko Vladimir	The Agreement of easement on 04.04.2018
	For placing construction machines and construction machinery					6520380500:03:001:0145	agricultural land	Private	5.8201	0.1268	Miroschnichenko Vladimir	The Agreement of easement on 04.04.2018
23-2	For placing construction machines and construction machinery					6520380500:03:001:0146	agricultural land	Private	5.8204	0.3095	Miroschnichenko Vladimir	The Agreement of easement on 22.05.2018
23-3	For placing construction machines and construction machinery					6520380500:03:001:0168	agricultural land	Private	5.7381	0.2374	Duriagin Anatoliy	The Agreement of easement on 05.06.2018
25W	For placement of wind turbines	428896.187	5166906.392	46.65194386° N	32.07075315° E	6520380500:02:001:0155	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated 13.10.2017
		428900.826	5166881.836	46.65172339° N	32.07081755° E							
		428861.535	5166874.412	46.65165242° N	32.07030529° E							
		428856.896	5166898.969	46.65187290° N	32.07024087° E							
25-1	For placing construction machines and construction machinery					6520380500:04:004:0002	agricultural land	Private	6.7257	0.2325	Bartoschuk Pavel	The Agreement of easement on 31.05.2018
25-2	For placing construction machines and construction machinery					6520380500:02:001:0161	agricultural land	State	16.1751	0.1436	The Main Department of the State Geodetic Inventory in the Kherson region	
25-3	For placing construction machines and construction machinery					6520380500:02:001:0001	agricultural land	Private	5.4829	0.0509	Zobenko Tatiana	The Agreement of easement on 04.07.2018
32W	For placement of wind turbines	431897.860	5169190.124	46.67280521° N	32.10963939° E	6520380500:02:001:0144	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated 13.10.2017
		431917.619	5169193.176	46.67283469° N	32.10989723° E							
		431925.251	5169143.780	46.67239098° N	32.11000430° E							
		431905.492	5169140.727	46.67236151° N	32.10974646° E							
32-1	For placement of underground supporting structures					6520380500:02:001:0227	agricultural land	Private	3.1433	0.0281	Legkaya Tatiana	The Agreement of easement on 04.07.2018
	For placing construction machines and construction machinery					6520380500:02:001:0227	agricultural land	Private	3.1433	0.4228	Legkaya Tatiana	The Agreement of easement on 04.07.2018
32-2	For placing construction machines and construction machinery					6520380500:03:012:0006	agricultural land	Private	2.4513	0.0759	Zahara Zinaida	The Agreement of easement on 31.05.2018
32-3	For placing construction machines and construction machinery					6520380500:02:001:0246	agricultural land	State	2.5	0.0881	The Main Department of the	

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											State Geodetic Inventory in the Kherson region	
32-4	For placing construction machines and construction machinery					6520380500:03:012:0008	agricultural land	Private	2.61	0.0181	Zahara Piotr	The Agreement of easement on 31.05.2018
34W	For placement of wind turbines	432132.864 432157.625 432163.039 432138.278	5167538.027 5167541.410 5167501.793 5167498.409	46.65796316° N 46.65799611° N 46.65764017° N 46.65760721° N	32.11295465° E 32.11327774° E 32.11335433° E 32.11303124° E	6520380500:02:001:0133	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated 13.10.2017
34-1	For placing construction machines and construction machinery					6520380500:02:001:0183	agricultural land	Private	5.8703	0.3122	Yuzhalina Aleksandra	The Agreement of easement on 18.06.2018
35W	For placement of wind turbines	432259.939 432284.606 432291.027 432266.360	5166728.004 5166732.017 5166692.549 5166688.537	46.65068725° N 46.65072585° N 46.65037136° N 46.65033277° N	32.11473432° E 32.11505605° E 32.11514574° E 32.11482402° E	6520380500:02:001:0134	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated 13.10.2017
35-1	For placing construction machines and construction machinery					6520380500:04:008:0005	agricultural land	Private	2.9335	0.0971	Zahara Andrey	The Agreement of easement on 18.06.2018
35-2	For placing construction machines and construction machinery					6520380500:04:008:0006	agricultural land	Private	2.9323	0.0759	Zahara Zinaida	The Agreement of easement on 22.05.2018
36W	For placement of wind turbines	432358.480 432383.201 432389.073 432364.353	5166090.639 5166094.308 5166054.756 5166051.087	46.64496203° N 46.64499755° N 46.64464224° N 46.64460672° N	32.11611538° E 32.11643784° E 32.11652035° E 32.11619791° E	6520380500:02:001:0135	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated 13.10.2017
36-1	For placing construction machines and construction machinery					6520380500:02:001:0063	agricultural land	State	38.2069	0.1896	The Main Department of the State Geodetic Inventory in the Kherson region	
36-2	For placing construction machines and construction machinery					6520380500:04:009:0001	agricultural land	Private	28.35	0.2445	Yurenko Sergey	The Agreement of easement on 06.09.2018
37W	For placement of wind turbines	432450.382 432475.102 432480.975 432456.254	5165471.753 5165475.424 5165435.871 5165432.201	46.63940241° N 46.63943793° N 46.63908262° N 46.63904710° N	32.11740670° E 32.11772912° E 32.11781163° E 32.11748920° E	6520380500:02:001:0136	land energy	State	0.1	0.1	Kherson regional state administration	The lease agreement dated 13.10.2017
36-1	For placing construction machines and construction machinery					6520380500:02:001:0063	agricultural land	State	38.2069	0.2048	The Main Department of the State Geodetic Inventory in the Kherson region	
36-2	For placing construction machines and construction machinery					6520380500:04:009:0001	agricultural land	Private	28.35	0.2451	Yurenko Sergey	The Agreement of easement on 06.09.2018
1R	For transportation of construction materials and wind-turbine components, laying underground cable line from wind turbine number 2 to wind turbine number 14 + location of construction equipment					6520380500:02:001:0243	agricultural land	State	27.7121	3.4413	The Main Department of the State Geodetic Inventory in the Kherson region	

Sequence number in accordance with the map B-2	Type of land use	GPS Coordinates				Cadastral number of the land plot	Purpose of the land plot	Type of ownersh ip	Total area of the land plot, hectare	The area of the land plot used by «DB WPP» LLC, ha	Land owner	Type of document confirming the right to use «DB WPP» LLC land plot
2R	For the transport of building materials and wind turbine components, the laying of an underground cable line from the central substation to the wind turbine number 16 and up to the wind turbine number 25					6520380500:02:001:0242	agricultural land	State	28.9896	2.4898	The Main Department of the State Geodetic Inventory in the Kherson region	
25-2	For placing construction machines and construction machinery, aying underground cable line					6520380500:02:001:0161	agricultural land	State	16.1751	0.2151	The Main Department of the State Geodetic Inventory in the Kherson region	
3R	For the transport of building materials and wind turbine components, the laying of an underground cable line from the central substation to the wind turbine number 32					6520380500:02:001:0245	agricultural land	State	0.7916	0.6532	The Main Department of the State Geodetic Inventory in the Kherson region	
4R	For transportation of construction materials and wind-turbine components, laying underground cable line from wind turbine number 31 to wind turbine number 37					6520380500:02:001:0234	agricultural land	State	20.7839	2.8026	The Main Department of the State Geodetic Inventory in the Kherson region	The lease agreement dated 13.10.2017

Table B-4 – Information about the Lands for the OHPL

№	GPS Coordinates				Area, square meter	Type of ownership	Land owner	Cadastral number of the land plot	Land user
1	442859.260	5182047.888	46.78953013 N	32.25133464 E	96,4 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385000:06:014:0001	Data is not available
1-a	442899.862	5182060.112	46.78964360 N	32.25186504 E	50,7 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385000:06:007:0001	Data is not available
2	442889.307	5181994.205	46.78904964 N	32.25173498 E	96,4 + 400	Private	Haidai Vitalii Volodymyrovych	6520385000:07:009:0011	Farm Household «Bogyslav-Zemlya»
3	442796.224	5181918.541	46.78836082 N	32.25052496 E	50,7 + 400	Private	Kutnich Mariia Oleksiivna	6520385000:04:001:0164	Agro company «Rodnichek»
4	442813.964	5181815.088	46.78743143 N	32.25077029 E	23,04 + 400	Private	Hryhor`Ieva Olha Fedorivna	6520385000:07:009:0017	Farm Household «Bogyslav-Zemlya»
5	442831.704	5181711.638	46.78650208 N	32.25101560 E	23,04 + 400	Private	Yablunovskyi Ivan Vasylovych	6520385000:07:009:0020	Farm Household «Bogyslav-Zemlya»
6	442849.986	5181605.023	46.78554429 N	32.25126841 E	50,7 + 400	Private	Prytula Oleksandr Oleksandrovych	6520385000:07:009:0023	Farm Household «Bogyslav-Zemlya»
7	442980.412	5181531.057	46.78488988 N	32.25298619 E	74,3 + 400	Private	Shapoval Taisa Vasylivna	6520385000:04:001:0211	Agro company «Rodnichek»
8	443007.436	5181386.820	46.78359430 N	32.25335815 E	23,04 + 400	Private	Chernushenko Mykola Ivanovych	6520385000:04:001:0201	Data is not available
9	443034.129	5181244.353	46.78231461 N	32.25372554 E	23,04 + 400	Private	Maksymenko Mykola Mykytovych	6520385000:04:001:0143	Farm Household «Bogyslav-Zemlya»
10	443061.743	5181096.972	46.78099079 N	32.25410557 E	23,04 + 400	Private	Ilnytskyi Mykola Mykhailovych	6520385000:07:009:0039	Farm Household «Bogyslav-Zemlya»
11	443083.834	5180979.068	46.77993173 N	32.25440959 E	23,04 + 400	Private	Tatochenko Viktor Volodymyrovych	6520385000:07:009:0043	Farm Household «Bogyslav-Zemlya»
12	443109.749	5180840.772	46.77868950 N	32.25476621 E	128,1 + 400	Private	Tatochenko Viktor Volodymyrovych	6520385000:07:009:0047	Data is not available
13	443171.323	5180719.278	46.77760151 N	32.25558780 E	128,1 + 400	Private	Lapsha Hanna Arkadiivna	6520385000:06:006:0002	Data is not available
14	443195.620	5180566.216	46.77622627 N	32.25592501 E	23,04 + 400	Private	Lapsha Hanna Arkadiivna	6520385000:06:006:0030	Data is not available
15	443217.857	5180426.056	46.77496696 N	32.25623364 E	23,04 + 400	Private	Yablunovskyi Mykola Mykolaiovych	6520385000:06:006:0026	Data is not available
16	443241.360	5180277.965	46.77363637 N	32.25655980 E	23,04 + 400	Private	Tatochenko Anatolii Mykhailovych	6520385000:04:001:0298	Data is not available
17	443252.105	5180210.108	46.77302670° N	32.25670894° E	23,04 + 400	Private	Gladysh Vasyl Dmytrovych	6520385000:04:001:0171	Data is not available
18	443280.978	5180028.460	46.77139462° N	32.25710956° E	23,04 + 400	Private	Kovalov Volodymyr Mykolaievych	no cadastral number	Data is not available
18-a	443294.733	5179941.321	46.77061167° N	32.25730049° E	23,04 + 400	Private	Gaydenko Dmytro Leointievich	no cadastral number	Data is not available
19	443311.867	5179833.690	46.76964462 N	32.25753818 E	23,04 + 400	Private	Khmelevska Liubov Olehivna	6520385000:06:006:0030	Data is not available
20	443335.648	5179683.841	46.76829825 N	32.25786815 E	96,4 + 400	Private	Karpin Mykhailo Mykhailovych	6520385000:06:007:0001	Agro company «Rodnichek»
21	443195.136	5179659.249	46.76806501 N	32.25603108 E	50,7 + 400	Private	Karpin Mykhailo Mykhailovych	6520385000:06:007:0001	Agro company «Rodnichek»
22	443050.120	5179647.058	46.76794295 N	32.25413349 E	50,7 + 400	Private	Karpin Mykhailo Mykhailovych	6520385000:06:007:0001	Agro company «Rodnichek»
23	442907.442	5179622.086	46.76770605 N	32.25226812 E	23,04 + 400	Private	Karpin Mykhailo Mykhailovych	6520385000:06:007:0001	Agro company «Rodnichek»
24	442764.665	5179597.097	46.76746896 N	32.25040148 E	23,04 + 400	Private	Karpin Mykhailo Mykhailovych	6520385000:06:007:0001	Agro company «Rodnichek»
25	442621.889	5179572.108	46.76723184 N	32.24853486 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385000:04:001:0153	FG «Crystal»
26	442474.189	5179546.258	46.76698651 N	32.24660389 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385000:04:001:0153	FG «Crystal»
27	442326.489	5179520.407	46.76674115 N	32.24467294 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385000:04:001:0153	FG «Crystal»
28	442178.789	5179494.556	46.76649575 N	32.24274200 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385000:04:001:0153	FG «Crystal»

№	GPS Coordinates				Area, square meter	Type of ownership	Land owner	Cadastral number of the land plot	Land user
29	442036.013	5179469.568	46.76625850 N	32.24087545 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385000:04:001:0153	FG «Crystal»
30	441908.006	5179447.164	46.76604578 N	32.23920200 E	23,04 + 400	Private	Chmilova Tetiana Pavlivna	6520385000:06:014:0031	Farm Household «Bogyslav-Zemlya»
31	441760.306	5179421.313	46.76580029 N	32.23727112 E	23,04 + 400	Private	Chmilova Tetiana Pavlivna	6520385000:06:014:0031	Farm Household «Bogyslav-Zemlya»
32	441612.606	5179395.462	46.76555477 N	32.23534025 E	23,04 + 400	Private	Chmilova Tetiana Pavlivna	6520385000:06:014:0031	Farm Household «Bogyslav-Zemlya»
33	441464.906	5179369.612	46.76530922 N	32.23340940 E	23,04 + 400	Private	Chernenko Vasyl Vasylovych	6520385000:06:014:0016	Farm Household «Bogyslav-Zemlya»
34	441317.206	5179343.761	46.76506363 N	32.23147857 E	23,04 + 400	Private	Chernenko Vasyl Vasylovych	6520385000:06:014:0016	Farm Household «Bogyslav-Zemlya»
35	441169.506	5179317.910	46.76481801 N	32.22954775 E	23,04 + 400	Private	Chernenko Vasyl Vasylovych	6520385000:06:014:0016	Farm Household «Bogyslav-Zemlya»
36	441021.806	5179292.060	46.76457236 N	32.22761696 E	23,04 + 400	Private	Petiurenko Serhii Volodymyrovych	6520385000:06:014:0001	Farm Household «Bogyslav-Zemlya»
37	440879.029	5179267.071	46.76433487 N	32.22575054 E	23,04 + 400	Private	Petiurenko Serhii Volodymyrovych	6520385000:06:014:0001	Farm Household «Bogyslav-Zemlya»
38	440736.252	5179242.082	46.76409735 N	32.22388414 E	23,04 + 400	Private	Petiurenko Serhii Volodymyrovych	6520385000:06:014:0001	Farm Household «Bogyslav-Zemlya»
39	440593.476	5179217.093	46.76385979 N	32.22201775 E	23,04 + 400	Private	Petiurenko Serhii Volodymyrovych	6520385000:06:014:0001	Farm Household «Bogyslav-Zemlya»
40	440450.699	5179192.104	46.76362221 N	32.22015138 E	23,04 + 400	Private	Danylevska Svitlana Ivanivna	6520385000:06:015:0064	Data is not available
41	440312.845	5179167.976	46.76339279 N	32.21834938 E	23,04 + 400	Private	Danylevska Svitlana Ivanivna	6520385000:06:015:0064	Data is not available
42	440170.068	5179142.987	46.76315515 N	32.21648305 E	23,04 + 400	Private	Danylevska Svitlana Ivanivna	6520385000:06:015:0064	Data is not available
43	440032.215	5179118.860	46.76292567 N	32.21468108 E	23,04 + 400	Private	Danylevska Svitlana Ivanivna	6520385000:06:015:0064	Data is not available
44	439894.361	5179094.733	46.76269616 N	32.21287913 E	23,04 + 400	Private	Danylevskyi Mykola Pavlovych	6520385000:06:015:0065	Data is not available
45	439746.661	5179068.882	46.76245023 N	32.21094849 E	128,1 + 400	Private	Danylevskyi Mykola Pavlovych	6520385000:06:015:0065	Data is not available
46	439603.488	5179043.823	46.76221181 N	32.20907703 E	128,1 + 400	Private	Kharina Svitlana Vitaliivna	6520385500:04:007:0013	«Vikol Expo», LLC
47	439624.555	5178900.819	46.76092692 N	32.20937172 E	23,04 + 400	Private	Maievska Liudmyla Vasylivna	6520385500:04:007:0016	«Tavria Pravdine», LLC
48	439645.681	5178757.420	46.75963848 N	32.20966721 E	23,04 + 400	Private	Muradova Nataliia Andriivna	6520385500:04:001:0055	«Tavria Pravdine», LLC
49	439666.807	5178614.020	46.75835004 N	32.20996268 E	23,04 + 400	Private	Matvii Emiliia Pankivna	6520385500:04:005:0011	Data is not available
50	439685.301	5178488.482	46.75722209 N	32.21022134 E	57 + 550	Private	Muradov Arkadii Serhiiovych	6520385500:04:001:0341	«Tavria Pravdine», LLC
51	439544.213	5178464.883	46.75699697 N	32.20837719 E	23,04 + 400	Private	Muradov Arkadii Serhiiovych	6520385500:04:001:0341	«Tavria Pravdine», LLC
52	439406.182	5178441.795	46.75677670 N	32.20657299 E	23,04 + 400	Private	Muradov Arkadii Serhiiovych	6520385500:04:001:0341	«Tavria Pravdine», LLC
53	439268.150	5178418.706	46.75655640 N	32.20476882 E	23,04 + 400	Private	Muradov Arkadii Serhiiovych	6520385500:04:001:0341	«Tavria Pravdine», LLC
54	439125.189	5178394.794	46.75632820 N	32.20290022 E	23,04 + 400	Private	Mokrytskyi Mykola Anatoliiovych	6520385500:04:005:0028	Data is not available
55	438982.228	5178370.881	46.75609998 N	32.20103164 E	23,04 + 400	Private	Dobrolevska Taisiia Anatoliivna	6520385500:04:005:0027	Data is not available
56	438839.267	5178346.968	46.75587172 N	32.19916308 E	23,04 + 400	Private	Mokrytska Liudmyla Anatoliivna	6520385500:04:005:0026	Data is not available
57	438696.306	5178323.055	46.75564343 N	32.19729453 E	23,04 + 400	Private	Mokrytska Kateryna Anatoliivna	6520385500:04:005:0025	Data is not available
58	438553.344	5178299.143	46.75541511 N	32.19542600 E	23,04 + 400	Private	Mokrytska Liudmyla Anatoliivna	6520385500:04:005:0011	Data is not available
59	438410.383	5178275.230	46.75518677 N	32.19355748 E	23,04 + 400	Private	Diachenko Rostyslav Mykhailovych / Diachenko Oleh	6520385500:04:005:0010	«Vikol Expo», LLC
60	438272.352	5178252.141	46.75496626 N	32.19175342 E	23,04 + 400	Private	Diachenko Rostyslav Mykhailovych / Diachenko Oleh	6520385500:04:005:0010	«Vikol Expo», LLC
61	438129.390	5178228.229	46.75473785 N	32.18988493 E	23,04 + 400	Private	Diachenko Rostyslav Mykhailovych / Diachenko Oleh	6520385500:04:005:0010	«Vikol Expo», LLC
62	437986.429	5178204.316	46.75450942 N	32.18801646 E	23,04 + 400	Private	Alieieksieiev Oleksandr Viktorovych	6520385500:04:003:0004	«Tavria Pravdine», LLC

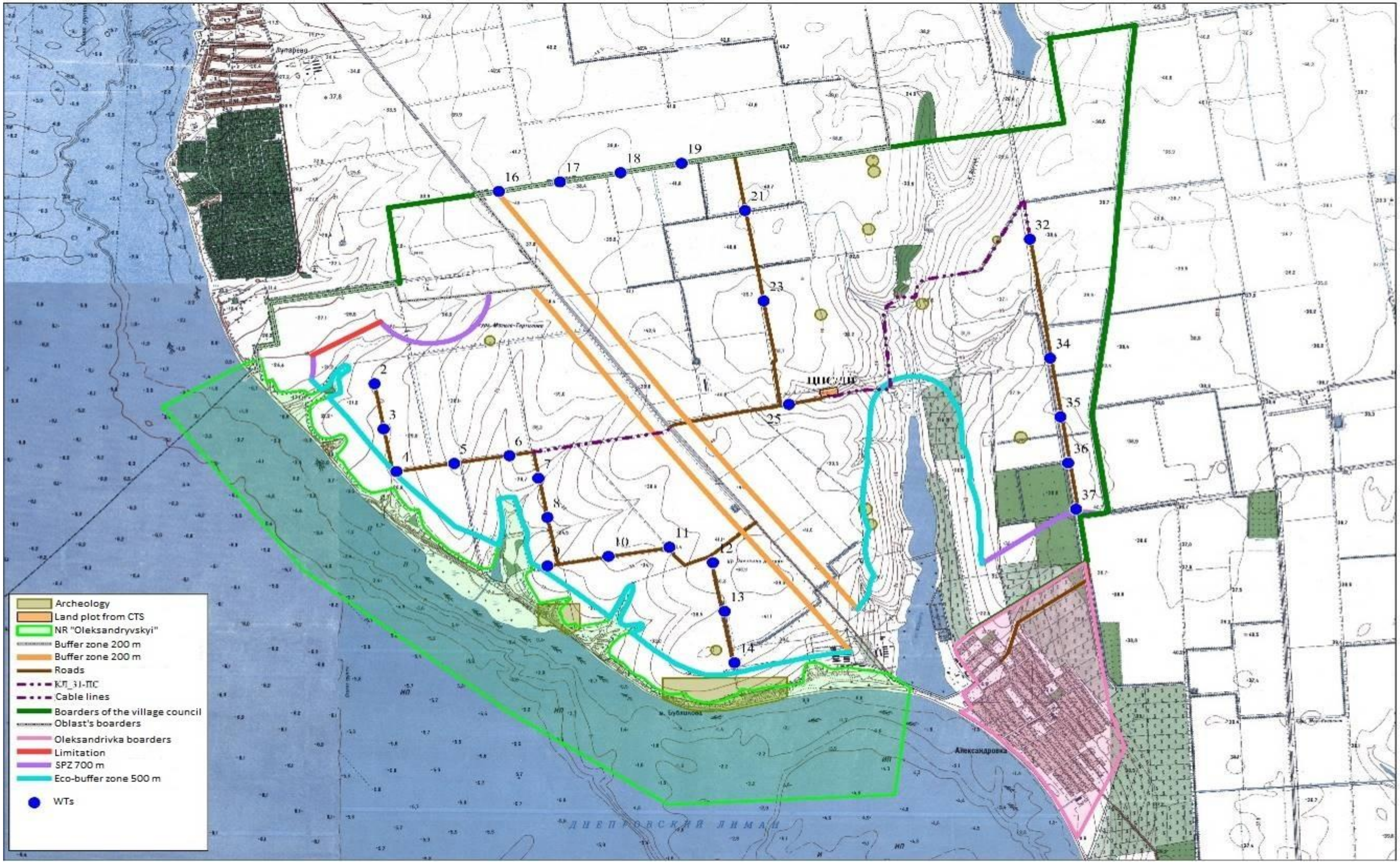
№	GPS Coordinates				Area, square meter	Type of ownership	Land owner	Cadastral number of the land plot	Land user
63	437848.397	5178181.228	46.75428883 N	32.18621244 E	23,04 + 400	Private	Alieieksieiev Oleksandr Viktorovych	6520385500:04:003:0004	«Tavria Pravdine», LLC
64	437705.436	5178157.315	46.75406033 N	32.18434400 E	23,04 + 400	Private	Alieieksieiev Oleksandr Viktorovych	6520385500:04:003:0004	«Tavria Pravdine», LLC
65	437562.474	5178133.402	46.75383180 N	32.18247558 E	23,04 + 400	Private	Alieieksieiev Oleksandr Viktorovych	6520385500:04:003:0004	«Tavria Pravdine», LLC
66	437424.443	5178110.314	46.75361112 N	32.18067160 E	23,04 + 400	Private	Alieieksieiev Oleksandr Viktorovych	6520385500:04:003:0004	«Tavria Pravdine», LLC
67	437281.481	5178086.401	46.75338253 N	32.17880321 E	23,04 + 400	Private	Shkarbul Nina Andriivna	6520385500:04:001:0343	Data is not available
68	437138.520	5178062.488	46.75315391 N	32.17693484 E	23,04 + 400	Private	Shkarbul Nina Andriivna	6520385500:04:001:0343	Data is not available
69	436995.558	5178038.575	46.75292526 N	32.17506648 E	23,04 + 400	Private	Shkarbul Viktor Oleksandrovych	6520385500:04:001:0343	Data is not available
70	436852.108	5178014.580	46.75269580 N	32.17319175 E	50,7 + 400	Private	Shkarbul Viktor Oleksandrovych	6520385500:04:001:0343	Data is not available
71	436796.301	5177938.361	46.75200468 N	32.17247163 E	128,1 + 400	Private	Bila Halyna Leontiivna	6520385500:04:008:0024	«Vikol Expo», LLC
72	436715.151	5177827.527	46.75099968 N	32.17142453 E	128,1 + 400	Private	Dembrovska Olena Illivna	6520385500:04:001:0232	Data is not available
73	436737.819	5177686.792	46.74973547 N	32.17174068 E	23,04 + 400	Private	Dembrovska Olena Illivna	6520385500:04:001:0232	Data is not available
74	436760.073	5177548.623	46.74849430 N	32.17205106 E	23,04 + 400	Private	Dembrovska Olena Illivna	6520385500:05:005:0002	Data is not available
75	436782.327	5177410.454	46.74725314 N	32.17236142 E	23,04 + 400	Private	Dembrovska Olena Illivna	6520385500:04:001:0217	Data is not available
76	436804.582	5177272.286	46.74601197 N	32.17267177 E	23,04 + 400	Private	Tlustenko Liudmyla Oleksiivna	6520385500:04:001:0351	Data is not available
77	436826.837	5177134.117	46.74477080 N	32.17298210 E	23,04 + 400	Private	Tlustenko Liudmyla Oleksiivna	6520385500:04:001:0351	Data is not available
78	436849.091	5176995.948	46.74352963 N	32.17329241 E	23,04 + 400	Private	Striletska Yanina Yosypivna	6520385500:04:001:0130	Data is not available
79	436871.346	5176857.779	46.74228846 N	32.17360271 E	23,04 + 400	Private	Striletskyi Anatolii Hryhorovych	6520385500:05:005:0006	Data is not available
80	436893.600	5176719.611	46.74104729 N	32.17391300 E	23,04 + 400	Private	Striletskyi Anatolii Hryhorovych	6520385500:05:005:0006	Data is not available
81	436915.855	5176581.442	46.73980612 N	32.17422328 E	23,04 + 400	Private	Demchuk Oleksandr Vasylovych	no cadastral number	Data is not available
82	436938.064	5176443.555	46.73856748 N	32.17453290 E	74,3 + 400	Private	Svystilnyk Halyna Vasylivna	6520385500:04:001:0211	Data is not available
83	436977.618	5176318.340	46.73744449 N	32.17506778 E	74,3 + 400	Private	Demchuk Serhii Vasylovych	6520385500:04:001:0348	Data is not available
84	437074.337	5176211.840	46.73649530 N	32.17634825 E	23,04 + 400	Private	Medvedieva Nadiia Ivanivna	6520385500:05:006:0021	ФОП Стрілецький А.Г.
85	437171.308	5176105.112	46.73554406 N	32.17763199 E	50,7 + 400	Private	Shevchenko Vasyl Ivanovych	6520385500:04:001:0363	Data is not available
86	437193.039	5175971.922	46.73434763 N	32.17793461 E	23,04 + 400	Private	Tatochenko Vasyl Stepanovych	6520385500:05:006:0018	Data is not available
87	437213.965	5175843.665	46.73319550 N	32.17822601 E	23,04 + 400	Private	Vansovych Serhii Petrovych	6580385500:04:001:0346	Data is not available
88	437237.306	5175700.609	46.73191044 N	32.17855102 E	23,04 + 400	Private	Kosturova Liubov Mykhailivna	6520385500:05:006:0030	Data is not available
89	437261.451	5175552.620	46.73058106 N	32.17888722 E	23,04 + 400	Private	Skriabina Raisa Oleksandrivna	6520385500:05:006:0013	Data is not available
90	437284.792	5175409.564	46.72929600 N	32.17921220 E	23,04 + 400	Private	Polishchuk Oksana Viacheslavivna	6520385500:04:001:0360	Data is not available
91	437307.167	5175272.426	46.72806410 N	32.17952372 E	57 + 550	Private	Reshotka H.V.	6520385500:04:001:0358	Data is not available
92	437169.225	5175248.808	46.72783862 N	32.17772186 E	23,04 + 400	Private	Reshotka H.V.	6520385500:04:001:0358	Data is not available
93	437031.283	5175225.189	46.72761311 N	32.17592001 E	23,04 + 400	Private	Reshotka H.V.	6520385500:04:001:0358	Data is not available
94	436893.341	5175201.571	46.72738757 N	32.17411818 E	23,04 + 400	Private	Reshotka H.V.	6520385500:04:001:0358	Data is not available
95	436750.473	5175177.109	46.72715395 N	32.17225201 E	23,04 + 400	Private	Suprun Raisa Volodymyrivna	6520385500:04:001:0356	Data is not available
96	436612.530	5175153.490	46.72692835 N	32.17045021 E	23,04 + 400	Private	Suprun Raisa Volodymyrivna	6520385500:04:001:0356	Data is not available
97	436474.588	5175129.872	46.72670272 N	32.16864843 E	23,04 + 400	Private	Suprun Raisa Volodymyrivna	6520385500:04:001:0356	Data is not available
98	436336.646	5175106.253	46.72647707 N	32.16684666 E	23,04 + 400	Private	Suprun Raisa Volodymyrivna	6520385500:04:001:0356	Data is not available
99	436193.778	5175081.791	46.72624333 N	32.16498056 E	23,04 + 400	Private	Savytska Avhusta Vasylivna	6520385500:05:008:0034	«Tavria Pravdine», LLC
100	436055.835	5175058.173	46.72601762 N	32.16317882 E	23,04 + 400	Private	Savytska Avhusta Vasylivna	6520385500:05:008:0034	«Tavria Pravdine», LLC
101	435917.893	5175034.554	46.72579188 N	32.16137710 E	23,04 + 400	Private	Savytska Avhusta Vasylivna	6520385500:05:008:0034	«Tavria Pravdine», LLC
102	435777.156	5175010.457	46.72556153 N	32.15953888 E	57 + 550	Private	Savytska Avhusta Vasylivna	6520385500:05:008:0034	«Tavria Pravdine», LLC
103	435799.935	5174870.145	46.72430117 N	32.15985655 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0365	FG «Nyva»
104	435822.363	5174732.004	46.72306030 N	32.16016930 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0365	FG «Nyva»
105	435844.790	5174593.863	46.72181942 N	32.16048204 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0365	FG «Nyva»

№	GPS Coordinates				Area, square meter	Type of ownership	Land owner	Cadastral number of the land plot	Land user
106	435867.217	5174455.722	46.72057855 N	32.16079476 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0365	FG «Nyva»
107	435890.445	5174312.648	46.71929336 N	32.16111863 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
108	435912.873	5174174.507	46.71805249 N	32.16143132 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
109	435935.300	5174036.366	46.71681161 N	32.16174400 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
110	435957.728	5173898.225	46.71557073 N	32.16205666 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
111	435980.956	5173755.150	46.71428554 N	32.16238048 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
112	436003.383	5173617.010	46.71304466 N	32.16269311 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
113	436025.811	5173478.869	46.71180378 N	32.16300573 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
114	436048.238	5173340.728	46.71056289 N	32.16331833 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
115	436071.467	5173197.653	46.70927769 N	32.16364208 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
116	436093.894	5173059.512	46.70803681 N	32.16395466 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
117	436116.322	5172921.371	46.70679592 N	32.16426722 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
118	436138.749	5172783.230	46.70555504 N	32.16457976 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
119	436161.580	5172642.608	46.70429185 N	32.16489791 E	74,3 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520385500:04:001:0371	Djyzhevskiy Mychailo Mychailovych
120	436093.870	5172518.145	46.70316544 N	32.16402955 E	50,7 + 400	Private	Kyianu Nina Petrivna	6520385500:05:014:0030	«Tavria Pravdine», LLC
121	435949.815	5172496.664	46.70295837 N	32.16214833 E	23,04 + 400	Private	Kyianu Nina Petrivna	6520385500:05:014:0030	«Tavria Pravdine», LLC
122	435806.462	5172475.300	46.70275238 N	32.16027630 E	23,04 + 400	Private	Kyianu Nina Petrivna	6520385500:05:014:0029	«Tavria Pravdine», LLC
123	435663.096	5172453.917	46.70254619 N	32.15840410 E	23,04 + 400	Private	Kyianu Nina Petrivna	6520385500:05:014:0029	«Tavria Pravdine», LLC
124	435519.735	5172432.525	46.70233989 N	32.15653199 E	23,04 + 400	Private	Kyianu Nina Petrivna	6520385500:05:014:0029	«Tavria Pravdine», LLC
125	435371.425	5172410.421	46.70212668 N	32.15459527 E	23,04 + 400	Private	Ponomarova Liudmyla Vasylivna	6520385500:04:001:0159	«Vikol Expo», LLC
126	435228.052	5172389.029	46.70192032 N	32.15272303 E	23,04 + 400	Private	Ponomarova Liudmyla Vasylivna	6520385500:04:001:0159	«Vikol Expo», LLC
127	435084.683	5172367.657	46.70171411 N	32.15085085 E	23,04 + 400	Private	Hlukhov Andrii Pavlovych	6520385500:04:001:0308	«Tavria Pravdine», LLC
128	434936.414	5172345.548	46.70150076 N	32.14891470 E	23,04 + 400	Private	Hlukhov Andrii Pavlovych	6520385500:04:001:0308	«Tavria Pravdine», LLC
129	434793.034	5172324.161	46.70129435 N	32.14704242 E	23,04 + 400	Private	Hlukhov Andrii Pavlovych	6520385500:04:001:0308	«Tavria Pravdine», LLC
130	434649.683	5172302.791	46.70108807 N	32.14517052 E	23,04 + 400	Private	Dzhyzhevskyi Andrii Leonidovych	6520385500:05:013:0012	«Tavria Pravdine», LLC
131	434501.358	5172280.673	46.70087453 N	32.14323370 E	23,04 + 400	Private	Dzhyzhevskyi Andrii Leonidovych	6520385500:05:013:0012	«Tavria Pravdine», LLC
132	434357.987	5172259.284	46.70066802 N	32.14136158 E	23,04 + 400	Private	Dzhyzhevskyi Andrii Leonidovych	6520385500:05:013:0012	«Tavria Pravdine», LLC
133	434214.630	5172237.915	46.70046164 N	32.13948965 E	23,04 + 400	Private	Prokof`Ieva Lidiia Vasylivna	6520385500:05:013:0010	«Tavria Pravdine», LLC
134	434071.279	5172216.532	46.70025512 N	32.13761782 E	23,04 + 400	Private	Prokof`Ieva Lidiia Vasylivna	6520385500:05:013:0010	«Tavria Pravdine», LLC
135	433923.009	5172194.431	46.70004162 N	32.13568177 E	128,1 + 400	Private	Prokof`Ieva Lidiia Vasylivna	6520385500:05:013:0010	«Tavria Pravdine», LLC
136	433835.637	5172168.176	46.69979673 N	32.13454281 E	128,1 +400	Private	Teslia Viktor Oleksandrovych	6520385500:04:001:0361	Data is not available
137	433703.242	5172149.172	46.69961262 N	32.13281397 E	23,04 + 400	Private	Teslia Viktor Oleksandrovych	6520385500:04:001:0361	Data is not available
138	433574.618	5172130.722	46.69943384 N	32.13113437 E	23,04 + 400	Private	Teslia Viktor Oleksandrovych	6520385500:04:001:0361	Data is not available

№	GPS Coordinates				Area, square meter	Type of ownership	Land owner	Cadastral number of the land plot	Land user
139	433445.968	5172112.243	46.69925478 N	32.12945446 E	23,04 + 400	Private	Teslia Viktor Oleksandrovych	6520385500:04:001:0361	Data is not available
140	433317.329	5172093.769	46.69907573 N	32.12777470 E	23,04 + 400	Private	Dudnik Viktor Volodymyrovych	6520385500:04:001:0289	Data is not available
141	433187.552	5172075.151	46.69889525 N	32.12608010 E	57 + 550	Private	Dudnik Viktor Volodymyrovych	6520385500:04:001:0289	Data is not available
142	433175.088	5171947.011	46.69774098 N	32.12593568 E	23,04 + 400	Private	Kramarovskyi Adolf Ivanovych	6520380500:03:005:0018	«Super Nyva», LLC
143	433162.020	5171812.682	46.69653095 N	32.12578428 E	23,04 + 400	Private	Baranova Yevheniia Petrivna	6520380500:03:005:0021	Data is not available
144	433148.472	5171673.390	46.69527623 N	32.12562734 E	23,04 + 400	Private	Hupal Mykola Ivanovych	6520380500:03:005:0025	«Super Nyva», LLC
145	433137.342	5171558.970	46.69424554 N	32.12549840 E	23,04 + 400	Private	Mazan Tetiana Volodymyrivna	6520380500:03:005:0026	«Super Nyva», LLC
146	433125.244	5171434.602	46.69312524 N	32.12535826 E	23,04 + 400	Private	Rubashenko Albina Volodymyrivna	6520380500:03:005:0029	Data is not available
147	433111.211	5171290.334	46.69182569 N	32.12519571 E	23,04 + 400	Private	Vitinnik Mariia Hryhorivna	6520380500:03:005:0033	«Super Nyva», LLC
148	433097.177	5171146.067	46.69052614 N	32.12503316 E	23,04 + 400	Private	Buleha Tetiana Volodymyrivna	6520380500:03:005:0036	Data is not available
149	433068.460	5170850.828	46.68786665 N	32.12470055 E	23,04 + 400	Private	Pysarenko Tetiana Fedorivna	6520380500:03:005:0040	«Super Nyva», LLC
150	433054.594	5170708.292	46.68658270 N	32.12453996 E	23,04 + 400	Private	Horychak Oleksandr Volodymyrovych	6520380500:03:005:0044	Data is not available
151	433040.560	5170564.025	46.68528314 N	32.12437745 E	23,04 + 400	Private	Yanyk Mariia Petrivna	6520380500:03:005:0047	«Super Nyva», LLC
152	433026.527	5170419.758	46.68398359 N	32.12421494 E	23,04 + 400	Private	Syhnaievskyi Volodymyr Yuzefovych	6520380500:03:005:0051	Data is not available
153	433012.010	5170270.516	46.68263923 N	32.12404683 E	23,04 + 400	Private	Bashlo Viktor Vasylovych	6520380500:03:005:0055	Data is not available
154	432997.977	5170126.248	46.68133967 N	32.12388434 E	23,04 + 400	Private	Baranov Oleh Vitaliiovych	6520380500:03:005:0058	Data is not available
155	432983.944	5169981.981	46.68004012 N	32.12372186 E	23,04 + 400	Private	Panasenko Nina Oleksandrivna	6520380500:03:005:0062	Data is not available
156	432970.279	5169841.502	46.67877469 N	32.12356364 E	23,04 + 400	Private	Panasenko Nataliia Pavlivna	6520380500:03:005:0065	Data is not available
157	432828.039	5169820.735	46.67857356 N	32.12170705 E	57 + 550	Private	Sholudko Oleksandr Anatoliiovych	6520380500:03:005:0068	«Super Nyva», LLC
158	432684.611	5169799.793	46.67837072 N	32.11983498 E	23,04 + 400	Private	Sholudko Oleksandr Anatoliiovych	6520380500:03:005:0068	«Super Nyva», LLC
159	432536.238	5169778.130	46.67816085 N	32.11789837 E	23,04 + 400	Private	Sholudko Oleksandr Anatoliiovych	6520380500:03:005:0068	«Super Nyva», LLC
160	432387.865	5169756.467	46.67795095 N	32.11596178 E	23,04 + 400	Private	Sholudko Oleksandr Anatoliiovych	6520380500:03:005:0068	«Super Nyva», LLC
161	432239.491	5169734.804	46.67774102 N	32.11402520 E	23,04 + 400	Private	Sholudko Oleksandr Anatoliiovych	6520380500:03:005:0068	«Super Nyva», LLC
162	432091.118	5169713.141	46.67753105 N	32.11208863 E	23,04 + 400	Private	Matenkevych Oleh Adolfovych	6520380500:03:005:0016	«Super Nyva», LLC
163	433083.144	5171001.800	46.68922659 N	32.12487062 E	23,04 + 400	Private	Matenkevych Oleh Adolfovych	6520380500:03:005:0016	«Super Nyva», LLC
164	431947.690	5169692.200	46.67732805 N	32.11021664 E	74,3 + 400	Private	Matenkevych Oleh Adolfovych	6520380500:03:005:0016	«Super Nyva», LLC
165	431802.541	5169663.564	46.67705561 N	32.10832328 E	74,3 + 400	Private	Stefan Halyna Opanasivna	6520380500:03:004:0014	Data is not available
166	431754.121	5169577.731	46.67627833 N	32.10770298 E	74,3 + 400	Private	Dovhan Liudmyla Opanasivna	6520380500:03:004:0013	«Super Nyva», LLC
167	431646.066	5169386.185	46.67454375 N	32.10631878 E	74,3 + 400	Private	Bazdyriev Ivan Ivanovych	6520380500:03:004:0010	«Super Nyva», LLC
168	431538.010	5169194.640	46.67280914 N	32.10493467 E	74,3 + 400	Private	Bartashuk Liudmyla Oleksandrivna	6520380500:03:004:0008	Data is not available
169	431466.792	5169068.394	46.67166587 N	32.10402246 E	23,04 + 400	Private	Kulikov Anatolii Fantinovych	6520380500:03:004:0007	«Super Nyva», LLC
170	431395.574	5168942.148	46.67052260 N	32.10311029 E	23,04 + 400	Private	Sedliar Raisa Lukinichna	6520380500:03:004:0005	«Super Nyva», LLC
171	431334.179	5168833.315	46.66953701 N	32.10232397 E	23,04 + 400	Private	Voitovych Yuhyna Yukhymivna	6520380500:03:004:0004	«Super Nyva», LLC
172	431278.697	5168734.964	46.66864633 N	32.10161340 E	50,7 + 400	Private	Vitynnyk Vasyl Ivanovych	6520380500:03:004:0003	«Super Nyva», LLC
173	431138.955	5168710.026	46.66840757 N	32.09979052 E	23,04 + 400	Private	Vitynnyk Vasyl Ivanovych	6520380500:03:004:0002	«Super Nyva», LLC
174	430991.341	5168683.682	46.66815534 N	32.09786497 E	23,04 + 400	Private	Vitynnyk Vasyl Ivanovych	6520380500:03:004:0002	«Super Nyva», LLC
175	430848.647	5168658.217	46.66791148 N	32.09600362 E	23,04 + 400	Private	Khavrych Sofiia Savelivna	6520380500:03:004:0001	Data is not available
176	430701.032	5168631.874	46.66765918 N	32.09407810 E	23,04 + 400	Private	Khavrych Sofiia Savelivna	6520380500:03:004:0001	Data is not available
177	430566.524	5168607.870	46.66742925 N	32.09232356 E	57 + 550	Private	Khavrych Sofiia Savelivna	6520380500:03:004:0001	Data is not available
178	430538.358	5168482.747	46.66630044 N	32.09197426 E	23,04 + 400	State	Bilozerska RDA	6520380500:03:010:0001	FG «Agro-Era»
179	430510.324	5168358.210	46.66517693 N	32.09162661 E	57 + 550	State	Bilozerska RDA	6520380500:03:010:0001	FG «Agro-Era»
180	430320.521	5168351.184	46.66509399 N	32.08914688 E	74,3 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0239	Data is not available
181	430238.251	5168267.631	46.66433360 N	32.08808422 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0239	Data is not available
182	430156.188	5168184.289	46.66357512 N	32.08702426 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0239	Data is not available

№	GPS Coordinates				Area, square meter	Type of ownership	Land owner	Cadastral number of the land plot	Land user
183	430074.373	5168101.199	46.66281893 N	32.08596755 E	50,7 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0240	Data is not available
184	430084.039	5167968.247	46.66162362 N	32.08611404 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0240	Data is not available
185	430094.187	5167828.665	46.66036870 N	32.08626784 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0240	Data is not available
186	430104.335	5167689.083	46.65911378 N	32.08642162 E	23,04 + 400	Private	Trishchan Serhii Mykolaiovych	6520380500:03:007:0006	PC «UKAN»
187	430114.483	5167549.501	46.65785886 N	32.08657540 E	23,04 + 400	Private	Piven Mykhailo Petrovych	6520380500:03:007:0008	Data is not available
188	430124.632	5167409.919	46.65660393 N	32.08672917 E	23,04 + 400	Private	Piven Mykhailo Petrovych	6520380500:03:007:0008	Data is not available
189	430134.074	5167280.043	46.65543628 N	32.08687224 E	57 + 550	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0161	Data is not available
190	430010.788	5167244.691	46.65510530 N	32.08526651 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0161	Data is not available
191	429885.869	5167208.869	46.65476991 N	32.08363951 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0161	Data is not available
192	429765.754	5167174.426	46.65444740 N	32.08207512 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0161	Data is not available
193	429640.835	5167138.604	46.65411196 N	32.08044816 E	23,04 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0161	Data is not available
194	429514.315	5167102.324	46.65377220 N	32.07880038 E	74,3 + 400	State	The Main Department of the State Geodetic Inventory in the Kherson region	6520380500:02:001:0161	Data is not available

Annex C. GENERAL SCHEME OF «DB WPP» OBJECTS LOCATION



Annex D. ROUTE OF PASSING OF THE OHPL OF SUBSTATION «DB WPP» - SUBSTATION «POSAD-POKROVSKA»

Annex E. PHYTOCOENOTIC CHARACTERISTIC OF AREAS USED FOR WTs INSTALLATION

№ of description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
№ of unit	5	19	34	31	7	8	10	17	37	36	9	12	6	4	11	25	14	13	35	26	18	24	16	33	32	15	27	2	3	20	21	22	23
Projective coverage A	75	60	70	60	20	0	0	0	10	20	20	2	0	10	0	15	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Projective coverage B	15	15	50	50	70	75	60	50	40	40	35	35	30	20	20	15	10	15	27	25	15	5	2	10	10	0	0	0	0	0	0	0	0
Projective coverage C	80	60	90	80	90	80	90	60	97	90	90	95	95	90	90	100	90	90	95	100	50	100	90	90	90	90	55	91	91	91	91	91	93
Syntaxon number		1									2												3			4				5			
Tier A																																	
Acer negundo	.	.	40	.	.	.	.	.	10	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Armeniaca vulgaris	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.
Elaeagnus angustifolia	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fraxinus pensylvannica	.	15	.	45	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gleditsia triacanthos	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Quercus robur	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Robinia pseudoacacia	15	.	30	.	20	.	.	.	.	5	20	.	.	10	.	5	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sophora japonica	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Uimus pumila	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tier B	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acer negundo	.	.	30	.	.	.	.	.	10	25	.	.	.	.	.	.	.	.	2	.	.	.	.	5	4		.	.	.	.	.	.	.
Amorpha fruticosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Armeniaca vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Elaeagnus angustifolia	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.
Fraxinus pennsylvanica	.	7	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.
Gleditsia triacanthos	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	3	.	.	.	.	.	.	.	.	.
Lonicera tatarica	.	.	.	.	.	.	.	.	.	.	4	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Malus domestica	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Prunus divaricata	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.
Prunus stepposa	.		.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Quercus robur	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2	3	.	.	.	.	.	.	.	.
Robinia pseudoacacia	5	.	15	30	70	70	60	50	30	15	30	35	30	20	20	10	10	15	15	15	.	.	1	.	3	.	.	.	.	.	.	.	.
Rosa canina	1	.	.	.	1	.	2	.	.	.	1	.	1	.	2	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Sambucus nigra	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Uimus pumila	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.
Ulmus laevis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tier C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anisantha sterilis	30	15	35	30	15	30	20	.	60	40	20	1	.	30	10	25	.	1	50	.	.	.	15	.	.	.	.	.	.	.	.	.	.
Galium aparine	20	20	30	25	15	30	15	20	20	30	.	2	5	20	10	20	.	3	15	10	10	1	.	.	.	.	.	.	.	.	.	.	.
Ballota nigra	7	.	10	.	.	2	3	.	1	.	3	.	.	15	1	.	1	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.

№ of description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
№ of unit	5	19	34	31	7	8	10	17	37	36	9	12	6	4	11	25	14	13	35	26	18	24	16	33	32	15	27	2	3	20	21	22	23
Projective coverage A	75	60	70	60	20	0	0	0	10	20	20	2	0	10	0	15	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Projective coverage B	15	15	50	50	70	75	60	50	40	40	35	35	30	20	20	15	10	15	27	25	15	5	2	10	10	0	0	0	0	0	0	0	0
Projective coverage C	80	60	90	80	90	80	90	60	97	90	90	95	95	90	90	100	90	90	95	100	50	100	90	90	90	90	55	91	91	91	91	91	93
Syntaxon number		1									2												3			4				5			
Elytrigia repens	10	10	5	10		20	30	20	1	+	40	20	40	20	30	15	15	20	5	30	20	40	15	35	40	.	.	.	.	.	.	.	.
Poa angustifolia	5	1	.	10	20	5	5	.	.	.	5	30	15	.	5	10	25	20	.	.	10	20	30	20	15	.	.	.	.	.	.	.	.
Artemisia austriaca	.	2	.	3	.	.	.	.	.	.	10	10	3	.	.	5	35	30	.	.	5	20		20	10	5	.	.	.	.	.	.	.
Cardaria draba	.	.	.	.	.	.	.	20	+	.	.	3	.	.	5	.	3	5	10	.	15	1	.	.	2	1	.	.	.	.	.	.	.
Convolvulus arvensis	.	.	.	.	.	.	.	.	.	r	1	1	3	.	.	1	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.
Falcaria vulgaris	1	.	1	+	1	.	.	.	.	.	.	.	.	3	.	1	1	1	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.
Salvia nemorosa	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Bromopsis inermis	.	.	.	.	3	.	.	.	.	.	.	.	.	.	15	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.
Artemisia absinthium	5	.	.	1	10	5	7	.	.	.	5	.	.	10	10	5	3	3	.	10	.	.	.	.	.	40	5	.	.	.	.	.	.
Onopordon acanthium	.	.	.	.	.	1	.	.	+	.	+	+	.	.	.	1	+	.	.	.	.	.	.	.	.	10	30	.	.	.	.	.	.
Atriplex oblongifolia	2	.	.	.	.	.	1	.	.	.	1	.	.	1	.	1	1	2	.	.	.	.	+	1	.	1	.	.	.	.	.	.	.
Atriplex saggitata	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.
Rumex patientia	5	1	2	.	5	2	2	3	1	.	1	.	.	5	.	1	+	1	+	1	1	.	3	.	1	1	1	.	.	.	.	.	.
Sisymbrium loeselii	.	.	.	.	.	.	.	.	.	.	.	1	.	1	1	.	1	1	.	.	.	.	.	1	5	20	1	.	.	.	.	.	.
Triticum durum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	90	90	90	90	90	90
Helianthus annuus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Chenopodium album	.	.	1	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	+	.	1	.	.	+	.	r	.	+	1
Capsella bursa-pastoris	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.
Consolida paniculata	1	.	.	.	1	.	1	.	.	.	.	1	1	.	.	1	1	1	.	.	.	+	.	.	.	.	.	r	.	.	+	r	.
Conyza canadensis	.	.	.	.	1	1	.	.	.	.	.	.	5	.	+	.	.	.	.	.	.	.	1	.	+	.	.	.	r	r	r	.	.
Amaranthus albus	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	.	r	.	.
Amaranthus retroflexus	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	+	.	r	r
Fallopia convolvulus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	r	.	.
Setaria viridis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	+	.	r	r
Achillea nobilis	.	.	.	.	.	.	.	.	.	.	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Achillea pannonica	.	.	.	r	.	.	3	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.
Achillea setacea	+	+	.	.	.	.	.	.	.	.	.	7	2	.	1		3	3	.	.	+	r	1	3	.	.	1	.	.	.	.	.	.
Aegilops cylindrica	1	.	.	.	.	.		.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Agropyron pectinatum	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Amrosia artemisifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	r	.	.	+	.
Anisantha tectorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		5	.	.	.	.	20	10	15	30	10	.	.	.	.	.	.
Anthemis ruthenica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.

№ of description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
№ of unit	5	19	34	31	7	8	10	17	37	36	9	12	6	4	11	25	14	13	35	26	18	24	16	33	32	15	27	2	3	20	21	22	23
Projective coverage A	75	60	70	60	20	0	0	0	10	20	20	2	0	10	0	15	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Projective coverage B	15	15	50	50	70	75	60	50	40	40	35	35	30	20	20	15	10	15	27	25	15	5	2	10	10	0	0	0	0	0	0	0	0
Projective coverage C	80	60	90	80	90	80	90	60	97	90	90	95	95	90	90	100	90	90	95	100	50	100	90	90	90	90	55	91	91	91	91	91	93
Syntaxon number		1									2												3			4				5			
Anthriscus cerefolius	.	.	.	.	.	.		.	.	.	.		5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arctium lappa	.	.	.	.	.	.	.	.	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Artemisia scoparia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Artemisia vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.			1	.	.	.	.	.	.	.	.	.	.	.	.	.
Asparagus verticillatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1			.	.	.	.	.	.	.	.	.	.	.	.	.
Asperugo procumbens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Atriplex heterosperma	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bromus squarrosus	.	.	.	1	2	1	.	.	.	.	.	1	5	.	.	1	2	.	.	.	.	.	5	5	10	1	.	.	.	.	.	.	.
Buglossoides arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Carduus acanthoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
Carduus nutans	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	r		2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea diffusa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	+	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Chondrilla juncea	.	.	.	.	1		1	1	.	.	.	.	1	.	.	.	.	1	.	.	1	+	2	1	1	.	.	.	.	.	.	.	r
Chondrilla latifolia	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cichorium intybus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Cirsium arvense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	5	.	.	.	1	5	.	.	.	.	.	.	.	.	.	.	.	.
Cirsium vulgare	.	+	.	.	10	.	.	+	1	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Conium maculatum	.	.	.	.	.	.	.	.	10	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Coronilla varia	.	1	.	.	.	.	.	.	.	.		1	.	.	.	.	.	1	.	.	3	2	.	.	3	.	.	.	.	.	.	.	.
Crepis rhoedifolia	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Cucubalus baccifer	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Descurainia sophia	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Echium vulgare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Elytrigia elongata	.	.	.	.	.	.	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erodium cicutarium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia agraria	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	2	.	.	3	.	1	.	1	.	.	.	.	.	.	.	.
Euphorbia virgata	.	.	.	1	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.
Festuca valesiaca	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Filago arvensis	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Galatella villosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium humifusum	1	5	.	.	.	.	1	.	.	.	10	1	.	.	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Geranium pussilum	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.

№ of description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
№ of unit	5	19	34	31	7	8	10	17	37	36	9	12	6	4	11	25	14	13	35	26	18	24	16	33	32	15	27	2	3	20	21	22	23
Projective coverage A	75	60	70	60	20	0	0	0	10	20	20	2	0	10	0	15	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Projective coverage B	15	15	50	50	70	75	60	50	40	40	35	35	30	20	20	15	10	15	27	25	15	5	2	10	10	0	0	0	0	0	0	0	0
Projective coverage C	80	60	90	80	90	80	90	60	97	90	90	95	95	90	90	100	90	90	95	100	50	100	90	90	90	90	55	91	91	91	91	91	93
Syntaxon number		1									2												3			4				5			
Grindelia squarrosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Hypericum elegans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Hypericum perforatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria cristata	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lactuca serriola	.	1	.	.	1	1	1	.	1	r	1	3	1	.	.	3	.	3	+	2	.	1	5	.	7	.	1	.	.	.	.	.	.
Lactuca tatarica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lavathera thuringiaca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Linaria bieberteinii	.	3	.	.	5	.	2	2	.	.	1	3	5	.	.	.	3	3	.	.	2	5	3	3	.	.	.	.	.	.	.	.	.
Lycopsis orientalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Medicago falcata	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melandrium album	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melilotus officinalis	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Otites densiflora	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa bulbosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.
Poa compressa	.	.	.	.	.	2	3	.	.	.	.	2	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygonum aviculare	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygonum novoascanicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Potentilla argentea	.	+	.	.	1	.	.	+	.	.	.	1	.	.	2	.	5	5	.	.	1	3	.	.	.	3	.	.	.	.	.	.	.
Potentilla laciniosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla recta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Pterotheca sancta	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Salvia aethiopis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	+	.	.	.	.	.	.
Salsola tragus	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Seseli tortuosum	1	2	.	+	1	.	+	3	.	.	.	2	1	1	5	1	1	1		3	1	3	3	+	+	1	1	.	.	.	.	.	.
Sisymbrium altissimum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Stellaria media	.	1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Taraxacum officinale	1	.	.	.	.	1	1	.	.	.	+	.	.	.	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Torilis japonica	.	.	.	+	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon major	.	.	.	.	+	.	.	.	.	.	+	+	+	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Trifolium diffusum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tripleurospermum	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

№ of description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
№ of unit	5	19	34	31	7	8	10	17	37	36	9	12	6	4	11	25	14	13	35	26	18	24	16	33	32	15	27	2	3	20	21	22	23
Projective coverage A	75	60	70	60	20	0	0	0	10	20	20	2	0	10	0	15	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Projective coverage B	15	15	50	50	70	75	60	50	40	40	35	35	30	20	20	15	10	15	27	25	15	5	2	10	10	0	0	0	0	0	0	0	0
Projective coverage C	80	60	90	80	90	80	90	60	97	90	90	95	95	90	90	100	90	90	95	100	50	100	90	90	90	90	55	91	91	91	91	91	93
Syntaxon number		1									2												3			4				5			
inodorum																																	
Veronica arvensis	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Veronica polita	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Vicia villosa	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Xeranthemum annuum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.

Annex F. PHYTOCOENOTIC CHARACTERISTIC OF AREAS USED FOR SUBSTATIONS CONSTRUCTION

№ description	**1**
№ of substation	CTS/CP
Projective coverage A	0
Projective coverage B	0
Projective coverage C	80
Tier A	-
Tier B	-
Rosa canina	-
Tier C	
Elytrigia repens	20
Poa angustifolia	5
Achillea setacea	3
Artemisia absinthium	3
Lactuca serriola	3
Sisymbrium loeselii	3
Tragopogon major	+
Seseli tortuosum	2
Bromus squarrosus	3
Salvia aethiopis	1
Poa bulbosa	5
Rumex patientia	
Pterotheca sancta	
Convolvulus arvensis	
Anisantha tectorum	
Vicia villosa	
Capsella bursa-pastoris	
Euphorbia virgata	
Falcaria vulgaris	
Linaria biebersteinii	
Papaver dubium	
Artemisia austriaca	20
Verbascum banaticus	r
Allium guttatum	r
Senecio erucifolius	1
Potentilla argentea	3
Xeranthemum annuum	5
Sisymbrium altissimum	2
Anthemis ruthenica	3
Hypericum elegans	1
Salvia nemorosa	5
Centaurea diffusa	1

№ description	1
Sideritis montana	1
Echium vulgare	1
Otites densiflora	1
Achillea nobilis	1
Nigella arvensis	+
Trifolium arvense	1
Cichorium intybus	1
Conyza canadensis	2

Annex G. PHOTOS OF WOODED AREA WHERE PLACEMENT OF WTs ARE PLANNED

Annex H. INVENTORY CARDS ABOUT QUALITATIVE STATE AND MORPHOMETRIC INDICATORS OF DENDROLOGICAL COVERAGE ON «DB WPP» TERRITORY

Inventory Card № 4				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	6
Robinia pseudoacacia	Root sprouts	Unsatisfactory	18	<5
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	10
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	6
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	7
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	8
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	11
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	17
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	10
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	6
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	7

Inventory Card № 5				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Ulmus pumila	Multi-trunk tree	Unsatisfactory	1	5
Ulmus pumila	One-trunk tree	Satisfactory	1	8
Ulmus pumila	One-trunk tree	Satisfactory	1	15
Ulmus pumila	Multi-trunk tree	Unsatisfactory	2	10
Ulmus pumila	One-trunk tree	Satisfactory	1	13
Ulmus pumila	One-trunk tree	Satisfactory	3	9

Inventory Card № 5				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Ulmus pumila	One-trunk tree	Satisfactory	1	18
Ulmus pumila	Root sprouts	Unsatisfactory	1	8
Ulmus pumila	Multi-trunk tree	Unsatisfactory	2	12
Ulmus pumila	Multi-trunk tree	Unsatisfactory	1	16
Ulmus pumila	Multi-trunk tree	Unsatisfactory	1	8
Ulmus pumila	One-trunk tree	Satisfactory	1	15
Ulmus pumila	One-trunk tree	Satisfactory	1	11
Ulmus pumila	Multi-trunk tree	Unsatisfactory	1	9
Ulmus pumila	One-trunk tree	Satisfactory	1	5
Ulmus pumila	Root sprouts	Unsatisfactory	1	<5
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	10
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	3	10
Robinia pseudoacacia	Root sprouts	Unsatisfactory	21	<5
Robinia pseudoacacia	One-trunk tree	Satisfactory	2	7
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	14
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	9
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	2	11
Robinia pseudoacacia	Root sprouts	Unsatisfactory	6	6
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	20
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	9
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	10
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	14

Inventory Card № 6				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	146	<5
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	16
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	13

Inventory Card № 7				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	182	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	2	8
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	18
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	7

Inventory Card № 8				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	124	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	8	6
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	15
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	10
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	2	7
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	8

Inventory Card № 9				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	7
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	10
Robinia pseudoacacia	Root sprouts	Unsatisfactory	63	<5
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	12
Robinia pseudoacacia	One-trunk tree	Satisfactory	3	8
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	14
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	8
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	18
Robinia pseudoacacia	One-trunk tree	Satisfactory	2	10
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	10
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	7
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	8

Inventory Card № 10				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	23	7
Robinia pseudoacacia	Root sprouts	Unsatisfactory	123	<5
Robinia pseudoacacia	One-trunk tree	Satisfactory	2	12
Robinia pseudoacacia	One-trunk tree	Satisfactory	6	9
Ulmus pumila	Root sprouts	Unsatisfactory	1	<5

Inventory Card № 11				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	64	<5
Acer platanoides	Root sprouts	Unsatisfactory	1	<5
Acer platanoides	Root sprouts	Unsatisfactory	1	10

Inventory Card № 12				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	12	6
Robinia pseudoacacia	Root sprouts	Unsatisfactory	122	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	7	8
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	16
Acer platanoides	One-trunk tree	Satisfactory	1	34
Acer platanoides	One-trunk tree	Satisfactory	1	18

Inventory Card №13				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	116	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	8
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	6
Robinia pseudoacacia	Multi-trunk tree	Unsatisfactory	1	12
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	15

Inventory Card № 14

The name of the breed of trees and its main types and forms	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Robinia pseudoacacia	Root sprouts	Unsatisfactory	32	<5
Robinia pseudoacacia	One-trunk tree	Satisfactory	4	9
Robinia pseudoacacia	One-trunk tree	Satisfactory	2	6
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	14
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	10

Inventory Card № 16

The name of the breed of trees and its main types and forms	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Robinia pseudoacacia	Root sprouts	Unsatisfactory	2	-

Inventory Card № 17

The name of the breed of trees and its main types and forms	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Robinia pseudoacacia	Root sprouts	Unsatisfactory	67	<5
Robinia pseudoacacia	One-trunk tree	Satisfactory	1	10

Inventory Card № 18

The name of the breed of trees and its main types and forms	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Quercus robur	One-trunk tree	Satisfactory	1	32

Inventory Card № 18				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Fraxinus pennsylvanica	One-trunk tree	Satisfactory	1	18
Fraxinus pennsylvanica	Root sprouts	Unsatisfactory	16	<5
Quercus robur	Root sprouts	Unsatisfactory	11	<5
Prunus divaricata	Root sprouts	Unsatisfactory	7	<5
Prunus divaricata	Multi-trunk tree	Satisfactory	1	20
Robinia pseudoacacia	Root sprouts	Unsatisfactory	2	<5
Fraxinus pennsylvanica	Root sprouts	Unsatisfactory	1	13

Inventory Card № 19				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Quercus robur	One-trunk tree	Satisfactory	1	38
Prunus divaricata	Root sprouts	Unsatisfactory	23	<5
Acer platanoides	Multi-trunk tree	Unsatisfactory	1	11
Quercus robur	One-trunk tree	Satisfactory	3	24
Fraxinus pennsylvanica	One-trunk tree	Satisfactory	6	22
Fraxinus pennsylvanica	Root sprouts	Unsatisfactory	53	<5
Quercus robur	One-trunk tree	Satisfactory	2	33
Fraxinus pennsylvanica	One-trunk tree	Satisfactory	3	18
Elaeagnus angustifolia	Root sprouts	Unsatisfactory	27	<5
Fraxinus pennsylvanica	One-trunk tree	Satisfactory	4	13
Quercus robur	One-trunk tree	Satisfactory	1	40
Fraxinus pennsylvanica	Root sprouts	Unsatisfactory	1	15

Inventory Card № 19				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Quercus robur	Multi-trunk tree	Unsatisfactory	1	30
Quercus robur	Multi-trunk tree	Unsatisfactory	1	45
Fraxinus pennsylvanica	One-trunk tree	Satisfactory	1	30

Inventory Card № 24				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Gleditsia triacanthos	Root sprouts	Unsatisfactory	12	<5

Inventory Card № 25				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	3	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	31	6
Robinia pseudoacacia	One-trunk tree	Satisfactory	5	14
Elaeagnus angustifolia	One-trunk tree	Satisfactory	2	15
Elaeagnus angustifolia	One-trunk tree	Satisfactory	1	10
Elaeagnus angustifolia	Root sprouts	Unsatisfactory	3	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	10
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	9
Robinia pseudoacacia	Root sprouts	Unsatisfactory	38	<5
Quercus robur	Root sprouts	Unsatisfactory	7	<5

Inventory Card № 26				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	84	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	5	6
Gleditsia triacanthos	Root sprouts	Unsatisfactory	25	<5
Fraxinus pennsylvanica	Root sprouts	Unsatisfactory	17	<5
Rosa canina	Bush	Satisfactory	1	<5

Inventory Card № 32				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Quercus robur	Root sprouts	Unsatisfactory	4	<5

Inventory Card № 32				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Acer negundo	Root sprouts	Unsatisfactory	11	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	9	<5
Rosa canina	Bush	Satisfactory	1	<5

Inventory Card № 33				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Gleditsia triacanthos	Root sprouts	Unsatisfactory	17	<5
Quercus robur	Root sprouts	Unsatisfactory	2	<5
Acer negundo	Root sprouts	Unsatisfactory	8	<5
Quercus robur	Root sprouts	Unsatisfactory	1	7

Inventory Card № 34				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	42	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	8	7
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	11
Robinia pseudoacacia	Root sprouts	Unsatisfactory	2	12
Acer negundo	Root sprouts	Unsatisfactory	15	10
Acer negundo	Root sprouts	Unsatisfactory	17	7
Acer negundo	Root sprouts	Unsatisfactory	24	<5

Inventory Card № 34				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Acer negundo	Root sprouts	Unsatisfactory	4	12
Amorpha fruticosa	Bush	Satisfactory	7	<5
Sambucus nigra	Bush	Satisfactory	1	<5
Acer negundo	Root sprouts	Unsatisfactory	3	17

Inventory Card № 35				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	103	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	10	7
Robinia pseudoacacia	Root sprouts	Unsatisfactory	11	10
Robinia pseudoacacia	Root sprouts	Unsatisfactory	3	14
Amorpha fruticosa	Bush	Satisfactory	11	<5
Acer negundo	Root sprouts	Unsatisfactory	4	<5

Inventory Card № 36				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Acer negundo	Root sprouts	Unsatisfactory	57	<5
Acer negundo	Root sprouts	Unsatisfactory	9	6
Acer negundo	Root sprouts	Unsatisfactory	4	8

Inventory Card № 36				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Robinia pseudoacacia	Root sprouts	Unsatisfactory	20	<5
Acer negundo	Root sprouts	Unsatisfactory	5	15
Acer negundo	Root sprouts	Unsatisfactory	13	12
Robinia pseudoacacia	Root sprouts	Unsatisfactory	14	10
Acer negundo	Root sprouts	Unsatisfactory	1	16
Acer negundo	Root sprouts	Unsatisfactory	28	10
Acer negundo	Root sprouts	Unsatisfactory	11	7
Acer negundo	Root sprouts	Unsatisfactory	1	17

Inventory Card № 37				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Acer negundo	Root sprouts	Unsatisfactory	82	<5
Acer negundo	Root sprouts	Unsatisfactory	23	8
Acer negundo	Root sprouts	Unsatisfactory	5	12
Robinia pseudoacacia	Root sprouts	Unsatisfactory	113	<5
Gleditsia triacanthos	Root sprouts	Unsatisfactory	2	<5
Acer negundo	Root sprouts	Unsatisfactory	2	11
Robinia pseudoacacia	Root sprouts	Unsatisfactory	1	11
Prunus divaricata	Root sprouts	Unsatisfactory	3	<5
Acer negundo	Root sprouts	Unsatisfactory	1	17
Acer negundo	Root sprouts	Unsatisfactory	2	16
Acer negundo	Root sprouts	Unsatisfactory	1	10
Sambucus nigra	Bush	Satisfactory	1	<5

Inventory Card of projected road between sites №35 – 37				
The name of the breed of trees and its main types and forms	**Plant life-form**	**Quality**	**Amount**	**Diameter of trunk (cm)**
Acer negundo	Root sprouts	Unsatisfactory	854	<5
Sambucus nigra	Bush	Satisfactory	6	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	754	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	98	6
Acer negundo	Root sprouts	Unsatisfactory	102	8
Acer negundo	Root sprouts	Unsatisfactory	116	6
Acer negundo	Root sprouts	Unsatisfactory	126	12
Gleditsia triacanthos	Root sprouts	Unsatisfactory	3	<5
Prunus divaricata	Root sprouts	Unsatisfactory	9	12
Acer negundo	Root sprouts	Unsatisfactory	7	15
Acer negundo	Root sprouts	Unsatisfactory	11	17
Robinia pseudoacacia	Root sprouts	Unsatisfactory	35	12
Acer negundo	Root sprouts	Unsatisfactory	3	20
Acer negundo	Root sprouts	Unsatisfactory	2	27
Pyrus communis	Root sprouts	Unsatisfactory	1	6
Armeniaca vulgaris	Root sprouts	Unsatisfactory	1	14

Annex I. WOOD AND SHRUB VEGETATION AT THE INTERSECTIONS OF THE OHPL AND FOREST BELTS

Research site 1

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Robinia pseudoacacia	Root sprouts	Unsatisfactory	10	10
Acer negundo	Root sprouts	Unsatisfactory	2	5
Acer negundo	Root sprouts	Unsatisfactory	9	11
Acer negundo	One-trunk tree	Satisfactory	2	32
Gleditsia triacanthos	One-trunk tree	Satisfactory	2	40
Fraxinus pennsylvanica	One-trunk tree	Satisfactory	1	54
Gleditsia triacanthos	One-trunk tree	Unsatisfactory	1	13
Crataegus monogyna	Root sprouts	Unsatisfactory	1	<5
Acer negundo	Root sprouts	Unsatisfactory	1	<5

Research site 2

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Elaeagnus angustifolia	Multi-trunk tree	Satisfactory	1	25
Robinia pseudoacacia	Root sprouts	Unsatisfactory	20	<5
Armeniaca vulgaris	Root sprouts	Unsatisfactory	2	<5

Research site 3

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Acer negundo	Root sprouts	Unsatisfactory	12	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	4	13

Research site 6

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Elaeagnus angustifolia	One-trunk tree	Unsatisfactory	1	30
Morus alba	One-trunk tree	Satisfactory	1	14
Rosa canina	Bush	Unsatisfactory	1	<5

Research site 7

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Populus nigra	Root sprouts	Unsatisfactory	8	<5
Prunus divaricata	Root sprouts	Unsatisfactory	7	<5
Populus nigra	One-trunk tree	Satisfactory	1	65

Research site 8

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Ulmus pumila	One-trunk tree	Satisfactory	1	60
Ulmus pumila	Root sprouts	Unsatisfactory	6	<5
Ulmus pumila	Root sprouts	Unsatisfactory	2	9
Ulmus pumila	Root sprouts	Unsatisfactory	1	13

Monitoring site 1

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Ulmus pumila	Root sprouts	Unsatisfactory	24	<5
Ulmus pumila	Root sprouts	Unsatisfactory	5	5
Ulmus pumila	Root sprouts	Unsatisfactory	2	8
Ulmus pumila	Root sprouts	Unsatisfactory	1	12

Monitoring site 2

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Ulmus pumila	Root sprouts	Unsatisfactory	10	<5
Ulmus pumila	One-trunk tree	Satisfactory	1	50
Ulmus pumila	Root sprouts	Unsatisfactory	2	35
Gleditsia triacanthos	Root sprouts	Unsatisfactory	9	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	25	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	3	10

Monitoring site 3

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Gleditsia triacanthos	Root sprouts	Unsatisfactory	4	9
Gleditsia triacanthos	Root sprouts	Unsatisfactory	6	<5
Armeniaca vulgaris	Root sprouts	Unsatisfactory	1	<5

Monitoring site 4

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Robinia pseudoacacia	Root sprouts	Unsatisfactory	17	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	2	8
Robinia pseudoacacia	Root sprouts	Unsatisfactory	6	11
Rosa canina	Bush			
Ulmus pumila	Root sprouts	Unsatisfactory	5	18
Ulmus pumila	Root sprouts	Unsatisfactory	2	11
Ulmus pumila	Root sprouts	Unsatisfactory	7	<5

Monitoring site 5

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Robinia pseudoacacia	Root sprouts	Unsatisfactory	132	<5
Robinia pseudoacacia	Root sprouts	Unsatisfactory	4	10
Robinia pseudoacacia	Root sprouts	Unsatisfactory	5	6

Monitoring site 6

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Robinia pseudoacacia	Root sprouts	Unsatisfactory	5	10
Robinia pseudoacacia	Root sprouts	Unsatisfactory	2	13
Robinia pseudoacacia	Root sprouts	Unsatisfactory	2	7

Monitoring site 7

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Amorpha fruticosa	Bush	Unsatisfactory	52	<5
Ulmus pumila	Root sprouts	Unsatisfactory		23
Acer negundo	Root sprouts	Unsatisfactory	2	<5
Acer negundo	One-trunk tree	Satisfactory	1	25
Acer negundo	One-trunk tree	Satisfactory	1	28
Armeniaca vulgaris	One-trunk tree	Satisfactory	1	37
Acer negundo	One-trunk tree	Satisfactory	1	46
Quercus robur	Root sprouts	Unsatisfactory	13	<5
Acer negundo	Root sprouts	Unsatisfactory	1	15

Monitoring site 8

The name of the breed	Plant life-form	Quality	Amount	Diameter of trunk (cm)
Robinia pseudoacacia	Root sprouts	Unsatisfactory	4	7
Robinia pseudoacacia	Root sprouts	Unsatisfactory	66	<5

Annex J. LIST OF VASCULAR PLANTS FROM THE NATURE-PROTECTION LISTS ON THE TERRITORY OF THE LANDSCAPE RESERVE «OLEKSANDRYVSKYI»

Plants included in the Regional Red List of Kherson Region	
Adonis vernalis	горицвіт весняний
Stipa capillata	ковила волосиста
Stipa lessingiana Trin. et Rupr.	ковила Лессінга
Stipa pulcherrima	ковила найкрасивіша
Stipa pennata	ковила пірчаста
Stipa ucrainica	ковила українська
Stipa asperella Klokov et Ossycznjk	Ковила шорстка
Astrodaucus littoralis	Моровиця прибережна
Elytrigia stipifolia	пирій ковилолистий
Tulipa hypanica Klokov et Zoz	тюльпан бузький
Crocus reticulatus Steven ex Adams	шафран сітчастий
Clematis integrifolia L.	ломиніс цілолистий
Gymnospermium odessatum	гімноспермiум одеський, голонасінник одеський
Plants included in the Red List of Ukraine	
Astragalus odessanus	астрагал одеський
Gymnospermium odessanum	голонасінник одеський
Adonis vernalis	горицвіт весняний
Adonis wolgensis,	горицвіт волзький
Genista scythyca	дрік скіфський
Orchis palustris	Зозулинець болотний
Stipa capillata	ковила волосиста
Stipa lessingiana	ковила Лессінга
Stipa pulcherrima	Ковила найкрасивіша
Stipa pennata	Ковила пірчаста
Stipa ucrainica	Ковила українська
Stipa. asperella	Ковила шорстка
Astrodaucus littoralis	морковниця прибережна
Carex secalina	осока житня
Galanthus elwesii	підсніжник Ельвеза
Colchicum ancyrense	пізньоцвіт ангарський
Elytrigia stipifolia	пирій ковилолистий
Eremogone cephalotes	пустельниця головчаста
Ornithogalum boucheanum	рястка Буше
Pulsatilla nigricans	сон чорніючий
Tulipa schrenkii	тюльпан Шренка
Tulipa hypanica	Тюльпан бузький
Crocus reticulatus	шафран сітчастий

Plants included to the European Red List	
Adonis vernalis	горицвіт весняний
Elytrigia stipifolia	пирій ковилолистий
Carex secalina	осока житня
Galanthus elwesii	підсніжник Ельвеза
Plants included to the IUCN Red List of Threatened Species	
Orchis palustris	Зозулинець болотний
Stipa lessingiana	ковила Лессінга
Stipa pulcherrima	Ковила найкрасивіша
Galanthus elwesii	підсніжник Ельвеза

Annex K. PHOTOS OF WOODED AREA WHERE PLACEMENT OF THE OHPL ARE PLANNED

Annex L. DETAILED RESULTS OF ORNITOLOGICAL RESEARCHES FOR «DB WPP» SITE

Period end of spring migration, nesting (May-June 2017)

Table 1. Species composition and frequency of bird encounters in the vicinity of the location of the «Dnepro-Bugsky WPP» in May-June 2017

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	Latin name			
1.	Пірникоза чорношия	*Podiceps nigricollis*	3	Р	N
2.	Пірникоза сірощока	*Podiceps grisegena*	5	Н	N
3.	Пірникоза велика	*Podiceps cristatus*	12	Ф	N
4.	Пелікан рожевий	*Pelecanus onocrotalus*	3	Р	D
5.	Баклан великий	*Phalacrocorax carbo*	12	Ф	D
6.	Чепура велика	*Egretta alba*	6	З	D
7.	Чепура мала	*Egretta garzetta*	5	Н	D
8.	Чапля сіра	*Ardea cinerea*	10	Ф	D
9.	Гуска сіра	*Anser anser*	2	Р	Z
10.	Лебідь-шипун	*Cygnus olor*	4	Н	D
11.	Галагаз	*Tadorna tadorna*	10	Ф	D
12.	Крижень	*Anas platyrhynchos*	8	З	N
13.	Чирянка велика	*Anas querquedula*	2	Р	N
14.	Чернь чубата	*Aythya fuligula*	1	Р	N
15.	Крех середній	*Mergus serrator*	2	Р	N
16.	Лунь лучний	*Circus pygargus*	4	Н	D
17.	Лунь очеретяний	*Circus aeruginosus*	11	Ф	D
18.	Канюк звичаний	*Buteo buteo*	1	Р	D
19.	Орлан-білохвіст	*Haliaeetus albicilla*	2	Р	O
20.	Балабан	*Falco cherrug*	1	Р	D
21.	Куріпка сіра	*Perdix perdix*	8	З	D
22.	Фазан	*Phasianus colchicus*	9	Ф	O
23.	Лиска	*Fulica atra*	12	Ф	N
24.	Пісочник морський	*Charadrius alexandrinus*	7	З	N
25.	Чайка	*Vanellus vanellus*	6	З	N
26.	Коловодник лісовий	*Tringa ochropus*	4	Н	N
27.	Коловодник болотяний	*Tringa glareola*	3	Н	N
28.	Набережник	*Actitis hypoleucos*	2	Р	N
29.	Коловодник чорний	*Tringa erythropus*	2	Р	N
30.	Побережник малий	*Calidris minuta*	7	З	N
31.	Мартин каспійський	*Larus ichthyaetus*	3	Н	D
32.	Мартин середземноморський	*Larus melanocephalus*	4	Н	D
33.	Мартин звичайний	*Larus ridibundus*	11	Ф	O

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	Latin name			
34.	Мартин жовтоногий	*Larus cachinnans*	12	Ф	O
35.	Крячок каспійський	*Hydroprogne caspia*	1	Р	D
36.	Крячок рябодзьобий	*Thalasseus sandvicensis*	9	Ф	D
37.	Крячок річковий	*Sterna hirundo*	10	Ф	D
38.	Крячок малий	*Sterna albifrons*	7	З	D
39.	Припутень	*Columba palumbus*	9	Ф	O
40.	Горлиця звичайна	*Streptopelia turtur*	4	Н	D
41.	Зозуля	*Cuculus canorus*	8	З	D
42.	Сиворакша	*Coracias garrulus*	3	Н	N
43.	Рибалочка	*Alcedo atthis*	6	Н	D
44.	Бджолоїдка звичайна	*Merops apiaster*	11	Ф	D
45.	Одуд	*Upupa epops*	8	З	D
46.	Крутиголовка	*Jynx torquilla*	2	Р	D
47.	Дятел звичайний	*Dendrocopos major*	4	Н	O
48.	Дятел сирійський	*Dendrocopos syriacus*	3	Н	O
49.	Ластівка берегова	*Riparia riparia*	8	З	N
50.	Ластівка сільська	*Hirundo rustica*	11	Ф	N
51.	Ластівка міська	*Delichon urbica*	2	Р	N
52.	Посмітюха	*Galerida cristata*	11	Ф	O
53.	Жайворонок польовий	*Alauda arvensis*	4	Н	D
54.	Жайворонок степовий	*Melanocorypha calandra*	7	З	O
55.	Плиска біла	*Motacilla alba*	12	Ф	D
56.	Щеврик лісовий	*Anthus trivialis*	4	Н	D
57.	Сорокопуд терновий	*Lanius collurio*	6	З	N
58.	Сорокопуд чорнолобий	*Lanius minor*	6	З	N
59.	Вивільга	*Oriolus oriolus*	6	З	N
60.	Шпак звичайний	*Sturnus vulgaris*	12	Ф	Z
61.	Сорока	*Pica pica*	6	З	O
62.	Галка	*Corvus monedula*	9	Ф	O
63.	Грак	*Corvus frugilegus*	12	Ф	O
64.	Ворона сіра	*Corvus cornix*	12	Ф	O
65.	Крук	*Corvus corax*	10	Ф	O
66.	Очеретянка ставкова	*Acrocephalus scirpaceus*	2	Р	N
67.	Очеретянка велика	*Acrocephalus arundinaceus*	11	Ф	N
68.	Кропив’янка сіра	*Sylvia communis*	8	З	N
69.	Вівчарик весняний	*Phylloscopus trochilus*	7	З	N
70.	Вівчарик-ковалик	*Phylloscopus collybita*	5	Н	N

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	**Latin name**			
71.	Мухоловка мала	*Ficedula parva*	4	Н	Z
72.	Мухоловка сіра	*Muscicapa striata*	9	Ф	D
73.	Трав'янка чорноголова	*Saxicola torquata*	3	Н	D
74.	Кам’янка звичайна	*Oenanthe oenanthe*	5	Н	D
75.	Кам’яна лиса	*Oenanthe pleschanka*	9	Ф	D
76.	Кам’янка попеляста	*Oenanthe isabellina*	2	Р	D
77.	Горихвістка звичайна	*Phoenicurus phoenicurus*	2	Р	D
78.	Соловейко східний	*Luscinia luscinia*	2	Р	D
79.	Дрізд чорний	*Turdus merula*	6	З	D
80.	Дрізд співочий	*Turdus philomelos*	2	Р	D
81.	Синиця блакитна	*Parus caeruleus*	11	Ф	O
82.	Синиця велика	*Parus major*	12	Ф	O
83.	Горобець хатній	*Passer domesticus*	8	З	O
84.	Горобець польовий	*Passer montanus*	12	Ф	O
85.	Зяблик	*Fringilla coelebs*	11	Ф	D
86.	Зеленяк	*Chloris chloris*	9	Ф	D
87.	Щиглик	*Carduelis carduelis*	10	Ф	D
88.	Коноплянка	*Acanthis cannabina*	9	Ф	D
89.	Костогриз	*C.coccothraustes*	9	Ф	D
90.	Просянка	*Emberiza calandra*	11	Ф	D
91.	Вівсянка звичайна	*Emberiza citrinella*	9	Ф	D
92.	Вівсянка очеретяна	*Emberiza schoeniclus*	3	Н	D
93.	Вівсянка садова	*Emberiza hortulana*	7	З	D

Symbols: F – background (met during 9-12 records), C – normal (met during 6-8 records), N – a few (met during 3-5 records); P – rare (met during 1-2 records), N – mostly a night migrant, D – mostly day migrant, Z – mixed type (day + night) type of migration. O – settled species.

Table 2. Number of birds in the vicinity of the location of the «Dnepro-Bugsky WPP» in May-June 2017 (route records)

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km^2 (lim)**
1.	Пірникоза чорношия	*Podiceps nigricollis*	7	0.08-0.11
2.	Пірникоза сірощока	*Podiceps grisegena*	12	0.13-0.16
3.	Пірникоза велика	*Podiceps cristatus*	176	17.3-17.7
4.	Пелікан рожевий	*Pelecanus onocrotalus*	3	0.04-0.06
5.	Баклан великий	*Phalacrocorax carbo*	45	0.43 -0.47
6.	Чепура велика	*Egretta alba*	18	0.15-0.17
7.	Чепура мала	*Egretta garzetta*	9	0.09-0.11
8.	Чапля сіра	*Ardea cinerea*	18	0.16-0.19
9.	Гуска сіра	*Anser anser*	42	0.43-0.50
10.	Лебідь-шипун	*Cygnus olor*	7	0.08-0.10

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km^2 (lim)**
11.	Галагаз	*Tadorna tadorna*	23	0.19-0.28
12.	Крижень	*Anas platyrhynchos*	12	0.10-0.14
13.	Чирянка велика	*Anas querquedula*	28	0.27-0.32
14.	Чернь чубата	*Aythya fuligula*	22	0.20-0.24
15.	Крех середній	*Mergus serrator*	3	0.03-0.05
16.	Лунь лучний	*Circus pygargus*	2	0.02-0.03
17.	Лунь очеретяний	*Circus aeruginosus*	5	0.04-0.06
18.	Канюк звичаний	*Buteo buteo*	1	0.01-0.02
19.	Орлан-білохвіст	*Haliaeetus albicilla*	1	0.01-0.02
20.	Балабан	*Falco cherrug*	2	0.02-0.03
21.	Куріпка сіра	*Perdix perdix*	38	0.35-0.39
22.	Фазан	*Phasianus colchicus*	26	0.23-0.28
23.	Лиска	*Fulica atra*	84	0.83-0.87
24.	Пісочник морський	*Charadrius alexandrinus*	2	0.02-0.03
25.	Чайка	*Vanellus vanellus*	12	0.10-0.13
26.	Коловодник лісовий	*Tringa ochropus*	3	0.03-0.05
27.	Коловодник болотяний	*Tringa glareola*	5	0.05-0.07
28.	Набережник	*Actitis hypoleucos*	14	0.12-0.15
29.	Коловодник чорний	*Tringa erythropus*	2	0.02-0.03
30.	Побережник малий	*Calidris minuta*	11	0.10-0.12
31.	Мартин каспійський	*Larus ichthyaetus*	6	0.06-0.09
32.	Мартин середземноморський	*Larus melanocephalus*	23	0.21-0.24
33.	Мартин звичайний	*Larus ridibundus*	294	2.87-3.18
34.	Мартин жовтоногий	*Larus cachinnans*	800	7.95-8.05
35.	Крячок каспійський	*Hydroprogne caspia*	2	0.02-0.03
36.	Крячок рябодзьобий	*Thalasseus sandvicensis*	180	1.82-1.95
37.	Крячок річковий	*Sterna hirundo*	309	3.00-3.38
38.	Крячок малий	*Sterna albifrons*	18	0.16-0.20
39.	Припутень	*Columba palumbus*	6	0.06-0.09
40.	Горлиця звичайна	*Streptopelia turtur*	18	0.16-0.19
41.	Зозуля	*Cuculus canorus*	4	0.03-0.06
42.	Сиворакша	*Coracias garrulus*	23	0.21-0.24
43.	Рибалочка	*Alcedo atthis*	16	0.14-0.19
44.	Бджолоїдка звичайна	*Merops apiaster*	230	2.25-2.41
45.	Одуд	*Upupa epops*	10	0.09-0.11
46.	Крутиголовка	*Jynx torquilla*	2	0.02-0.03
47.	Дятел звичайний	*Dendrocopos major*	9	0.07-0.10

№ п/п	Species Ukrainian name	 Latin name	Number of individuals абс. (lim)	 на 1 km^2 (lim)
48.	Дятел сирійський	*Dendrocopos syriacus*	6	0.06-0.09
49.	Ластівка берегова	*Riparia riparia*	600	5.94-6.05
50.	Ластівка сільська	*Hirundo rustica*	58	0.55-0.63
51.	Ластівка міська	*Delichon urbica*	23	0.19-0.25
52.	Посмітюха	*Galerida cristata*	8	0.07-0.09
53.	Жайворонок польовий	*Alauda arvensis*	35	0.33-0.36
54.	Жайворонок степовий	*Melanocorypha calandra*	10	0.09-0.11
55.	Плиска біла	*Motacilla alba*	22	0.19-0.24
56.	Щеврик лісовий	*Anthus trivialis*	1	0.01-0.02
57.	Сорокопуд терновий	*Lanius collurio*	34	0.32-0.37
58.	Сорокопуд чорнолобий	*Lanius minor*	6	0.05-0.07
59.	Вивільга	*Oriolus oriolus*	4	0.04-0.06
60.	Шпак звичайний	*Sturnus vulgaris*	3200	31.98-32.09
61.	Сорока	*Pica pica*	6	0.06-0.09
62.	Галка	*Corvus monedula*	15	0.15-0.17
63.	Грак	*Corvus frugilegus*	250	2.44-2.49
64.	Ворона сіра	*Corvus cornix*	23	0.19-0.26
65.	Крук	*Corvus corax*	8	0.07-0.09
66.	Очеретянка ставкова	*Acrocephalus scirpaceus*	2	0.02-0.03
67.	Очеретянка велика	*Acrocephalus arundinaceus*	27	0.28-0.32
68.	Кропив’янка сіра	*Sylvia communis*	3	0.03-0.05
69.	Вівчарик весняний	*Phylloscopus trochilus*	33	0.32-0.40
70.	Вівчарик-ковалик	*Phylloscopus collybita*	20	0.22-0.23
71.	Мухоловка мала	*Ficedula parva*	12	0.14-0.16
72.	Мухоловка сіра	*Muscicapa striata*	5	0.5-0.6
73.	Трав'янка чорноголова	*Saxicola torquata*	2	0.03-0.05
74.	Кам’янка звичайна	*Oenanthe oenanthe*	3	0.03-0.05
75.	Кам’яна лиса	*Oenanthe pleschanka*	15	0.16-0.18
76.	Кам’янка попеляста	*Oenanthe isabellina*	1	0.01-0.02
77.	Горихвістка звичайна	*Phoenicurus phoenicurus*	7	0.72-0.81
78.	Соловейко східний	*Luscinia luscinia*	4	0.04-0.06
79.	Дрізд чорний	*Turdus merula*	40	0.43-0.47
80.	Дрізд співочий	*Turdus philomelos*	12	0.15-0.18
81.	Синиця блакитна	*Parus caeruleus*	15	0.16-0.19
82.	Синиця велика	*Parus major*	56	0.55-0.57
83.	Горобець хатній	*Passer domesticus*	34	0.38-0.43
84.	Горобець польовий	*Passer montanus*	520	51.9-52.3

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km^2 (lim)**
85	Зяблик	*Fringilla coelebs*	12	0.11-0.14
86.	Зеленяк	*Chloris chloris*	6	0.07-0.09
87.	Щиглик	*Carduelis carduelis*	5	0.05-0.08
88.	Коноплянка	*Acanthis cannabina*	5	0.05-0.08
89.	Костогриз	*C.coccothraustes*	4	0.04-0.06
90.	Просянка	*Emberiza calandra*	43	0.02-0.03
91.	Вівсянка звичайна	*Emberiza citrinella*	2	0.03-0.05
92.	Вівсянка очеретяна	*Emberiza schoeniclus*	1	0.01-0.03
93.	Вівсянка садова	*Emberiza hortulana*	16	0.18-0.21
Total:			**7796**	**7,9 ос./ км^2**

Table 3. Relative number of birds in the vicinity of the location of the «Dnepro-Bugsky WPP» May-June 2017 (at monitoring points)

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km^2 (lim)**
1.	Пірникоза велика	*Podiceps cristatus*	7	0.06-0.09
4.	Лебідь-шипун	*Cygnus olor*	2	0.03-0.05
5.	Галагаз	*Tadorna tadorna*	12	0.10-0.14
6.	Крижень	*Anas platyrhynchos*	5	0.05-0.08
7.	Лунь очеретяний	*Circus aeruginosus*	2	0.03-0.05
8.	Канюк звичаний	*Buteo buteo*	1	0.01-0.02
9.	Орлан-білохвіст	*Haliaeetus albicilla*	1	0.01-0.02
11.	Фазан	*Phasianus colchicus*	3	0.03-0.05
12.	Лиска	*Fulica atra*	4	0.04-0.06
13.	Мартин звичайний	*Larus ridibundus*	8	0.08-0.10
14.	Мартин жовтоногий	*Larus cachinnans*	22	0.22-0.24
15.	Припутень	*Columba palumbus*	5	0.04-0.07
16.	Горлиця звичайна	*Streptopelia turtur*	12	0.11-0.13
17.	Зозуля	*Cuculus canorus*	5	0.05-0.08
18.	Сиворакша	*Coracias garrulus*	8	0.08-0.09
19.	Рибалочка	*Alcedo atthis*	1	0.01-0.02
20.	Бджолоїдка звичайна	*Merops apiaster*	240	2.37-2.44
21.	Одуд	*Upupa epops*	2	0.03-0.05
22.	Крутиголовка	*Jynx torquilla*	1	0.01-0.02
23.	Дятел звичайний	*Dendrocopos major*	3	0.03-0.05
24.	Дятел сирійський	*Dendrocopos syriacus*	4	0.04-0.06
25.	Ластівка берегова	*Riparia riparia*	46	0.44-0.50
26.	Ластівка сільська	*Hirundo rustica*	120	1.17-1.23
27.	Ластівка міська	*Delichon urbica*	2	0.03-0.05
28.	Посмітюха	*Galerida cristata*	4	0.04-0.06
29.	Жайворонок польовий	*Alauda arvensis*	26	0.24-0.28

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km ^{2} (lim)**
30.	Жайворонок степовий	*Melanocorypha calandra*	33	0.30-0.35
31.	Плиска біла	*Motacilla alba*	5	0.05-0.08
32.	Щеврик лісовий	*Anthus trivialis*	1	0.01-0.02
33.	Сорокопуд терновий	*Lanius collurio*	12	0.10-0.14
34.	Сорокопуд чорнолобий	*Lanius minor*	2	0.02-0.04
35.	Вивільга	*Oriolus oriolus*	4	0.04-0.06
36.	Шпак звичайний	*Sturnus vulgaris*	1300	12.96-13.09
37.	Сорока	*Pica pica*	4	0.04-0.06
38.	Галка	*Corvus monedula*	12	0.10-0.14
39.	Грак	*Corvus frugilegus*	490	4.88-5.00
40.	Ворона сіра	*Corvus cornix*	29	0.27-0.34
41.	Крук	*Corvus corax*	12	0.12-0.14
42.	Кропив’янка сіра	*Sylvia communis*	2	0.03-0.05
43.	Мухоловка сіра	*Muscicapa striata*	5	0.05-0.08
44.	Трав'янка чорноголова	*Saxicola torquata*	2	0.03-0.05
45.	Кам’янка звичайна	*Oenanthe oenanthe*	2	0.03-0.05
46.	Кам’яна лиса	*Oenanthe pleschanka*	12	0.10-0.14
47.	Кам’янка попеляста	*Oenanthe isabellina*	1	0.01-0.02
48.	Горихвістка звичайна	*Phoenicurus phoenicurus*	3	0.03-0.05
49.	Соловейко східний	*Luscinia luscinia*	1	0.01-0.02
50.	Дрізд чорний	*Turdus merula*	3	0.03-0.05
51.	Дрізд співочий	*Turdus philomelos*	1	0.01-0.02
52.	Синиця блакитна	*Parus caeruleus*	15	0.13-0.17
53.	Синиця велика	*Parus major*	27	0.25-0.33
54.	Горобець хатній	*Passer domesticus*	6	0.05-0.09
55.	Горобець польовий	*Passer montanus*	160	1.53-1.65
56.	Зяблик	*Fringilla coelebs*	4	0.04-0.06
57.	Зеленяк	*Chloris chloris*	35	0.32-0.38
58.	Щиглик	*Carduelis carduelis*	70	0.68-0.73
59.	Коноплянка	*Acanthis cannabina*	5	0.05-0.08
60.	Костогриз	*C.coccothraustes*	3	0.03-0.05
61.	Просянка	*Emberiza calandra*	25	0.24-0.27
Total:			**2832**	**5.42 ос./ км^2**

Pre-migratory clusters of birds - the beginning of autumn migrations (August) 2016

Table 4. Species composition and frequency of bird encounters in the area of the location of the «Dnepro-Bugsky WPP» in August-September 2016

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	Latin name			
1.	Пірникоза мала	*Podiceps ruficollis*	2	Р	N
2.	Пірникоза велика	*Podiceps cristatus*	11	Ф	N
3.	Пелікан рожевий	*Pelecanus onocrotalus*	1	Р	D
4.	Баклан великий	*Phalacrocorax carbo*	12	Ф	D
5.	Чепура велика	*Egretta alba*	5	Н	D
6.	Чепура мала	*Egretta garzetta*	4	Н	D
7.	Чапля сіра	*Ardea cinerea*	11	Ф	D
8.	Гуска сіра	*Anser anser*	1	Р	Z
9.	Лебідь-шипун	*Cygnus olor*	3	Н	D
10.	Галагаз	*Tadorna tadorna*	9	Ф	D
11.	Крижень	*Anas platyrhynchos*	12	Ф	N
12.	Попелюх	*Aythya ferina*	10	Ф	N
13.	Чернь білоока	*Aythya nyroca*	1	Р	N
14.	Лунь лучний	*Circus pygargus*	3	Н	D
15.	Лунь очеретяний	*Circus aeruginosus*	9	Ф	D
16.	Яструб великий	*Accipiter gentilis*	4	Н	O
17.	Канюк звичаний	*Buteo buteo*	2	Р	D
18.	Орлан-білохвіст	*Haliaeetus albicilla*	2	Р	O
19.	Балабан	*Falco cherrug*	2	Р	D
20.	Підсоколик великий	*Falco subbuteo*	1	Р	D
21.	Фазан	*Phasianus colchicus*	9	Ф	O
22.	Лиска	*Fulica atra*	12	Ф	N
23.	Пісочник морський	*Charadrius alexandrinus*	8	З	N
24.	Чайка	*Vanellus vanellus*	4	Н	N
25.	Коловодник лісовий	*Tringa ochropus*	3	Н	N
26.	Коловодник великий	*Tringa nebularia*	3	Н	N
27.	Набережник	*Actitis hypoleucos*	3	Н	N
28.	Плавунець круглодзьобий	*Phalaropus lobatus*	2	Р	N
29.	Брижач	*Philomachus pugnax*	6	З	N
30.	Побережник малий	*Calidris minuta*	8	З	N
31.	Побережник чорногрудий	*Calidris alpina*	8	З	N
32.	Кульон великий	*Numenius arquata*	1	Р	N
33.	Мартин каспійський	*Larus ichthyaetus*	8	З	D
34.	Мартин	*Larus*	4	Н	D

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	**Latin name**			
	середземноморський	*melanocephalus*			
35.	Мартин звичайний	*Larus ridibundus*	12	Ф	O
36.	Мартин тонкодзьобий	*Larus genei*	6	З	D
37.	Мартин жовтоногий	*Larus cachinnans*	12	Ф	O
38.	Крячок каспійський	*Hydroprogne caspia*	9	Ф	D
39.	Крячок рябодзьобий	*Thalasseus sandvicensis*	9	Ф	D
40.	Крячок річковий	*Sterna hirundo*	10	Ф	D
41.	Крячок малий	*Sterna albifrons*	7	З	D
42.	Припутень	*Columba palumbus*	9	Ф	O
43.	Горлиця звичайна	*Streptopelia turtur*	4	Н	D
44.	Зозуля	*Cuculus canorus*	8	З	D
45.	Сиворакша	*Coracias garrulus*	3	Н	N
46.	Рибалочка	*Alcedo atthis*	5	Н	D
47.	Бджолоїдка звичайна	*Merops apiaster*	9	Ф	D
48.	Одуд	*Upupa epops*	8	З	D
49.	Крутиголовка	*Jynx torquilla*	2	Р	D
50.	Дятел звичайний	*Dendrocopos major*	4	Н	O
51.	Дятел сирійський	*Dendrocopos syriacus*	3	Н	O
52.	Ластівка берегова	*Riparia riparia*	8	З	N
53.	Ластівка сільська	*Hirundo rustica*	11	Ф	N
54.	Посмітюха	*Galerida cristata*	11	Ф	O
55.	Плиска біла	*Motacilla alba*	12	Ф	D
56.	Щеврик лісовий		4	Н	D
57.	Сорокопуд чорнолобий	*Lanius minor*	6	З	N
58.	Вивільга	*Oriolus oriolus*	6	З	N
59.	Шпак звичайний	*Sturnus vulgaris*	12	Ф	Z
60.	Сорока	*Pica pica*	6	З	O
61.	Ворона сіра	*Corvus cornix*	9	Ф	O
62.	Крук	*Corvus corax*	10	Ф	O
63.	Очеретянка ставкова	*Acrocephalus scirpaceus*	2	Р	N
64.	Очеретянка велика	*Acrocephalus arundinaceus*	6	З	N
65.	Кропив'янка сіра	*Sylvia communis*	1	Р	N
66.	Вівчарик весняний	*Phylloscopus trochilus*	3	Н	N
67.	Вівчарик-ковалик	*Phylloscopus collybita*	3	Н	N
68.	Мухоловка мала	*Ficedula parva*	3	Н	Z
69.	Мухоловка сіра	*Muscicapa striata*	6	З	D

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	**Latin name**			
70.	Трав'янка чорноголова	*Saxicola torquata*	3	Н	D
71.	Кам’янка звичайна	*Oenanthe oenanthe*	5	Н	D
72.	Кам’яна лиса	*Oenanthe pleschanka*	8	З	D
73.	Кам’янка попеляста	*Oenanthe isabellina*	2	Р	D
74.	Горихвістка звичайна	*Phoenicurus phoenicurus*	2	Р	D
75.	Соловейко східний	*Luscinia luscinia*	2	Р	D
76.	Дрізд чорний	*Turdus merula*	6	З	D
77.	Синиця блакитна	*Parus caeruleus*	11	Ф	O
78.	Синиця велика	*Parus major*	12	Ф	O
79.	Горобець польовий	*Passer montanus*	8	З	O
80.	Зяблик	*Fringilla coelebs*	11	Ф	D
81.	Зеленяк	*Chloris chloris*	7	З	D
82.	Щиглик	*Carduelis carduelis*	7	З	D
83.	Коноплянка	*Acanthis cannabina*	5	Н	D
84.	Просянка	*Emberiza calandra*	11	Ф	D
85	Вівсянка очеретяна	*Emberiza schoeniclus*	3	Н	D
86.	Вівсянка садова	*Emberiza hortulana*	7	З	D

Table 5. Number of birds in the vicinity of the location of the «Dnepro-BugskyWPP» in August-September 2016 (route records)

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km^2 (lim)**
1.	Пірникоза мала	*Podiceps ruficollis*	3	0.04-0.06
2.	Пірникоза велика	*Podiceps cristatus*	365	3.80-3.92
3.	Пелікан рожевий	*Pelecanus onocrotalus*	3	0.04-0.06
4.	Баклан великий	*Phalacrocorax carbo*	290	3.12-3.18
5.	Чепура велика	*Egretta alba*	19	0.18-0.21
6.	Чепура мала	*Egretta garzetta*	12	0.13-0.16
7.	Чапля сіра	*Ardea cinerea*	71	0.75-0.84
8.	Гуска сіра	*Anser anser*	19	0.21-0.27
9.	Лебідь-шипун	*Cygnus olor*	45	0.48-0.51
10.	Галагаз	*Tadorna tadorna*	7	0.08-0.11
11.	Крижень	*Anas platyrhynchos*	174	1.82-1.93
12.	Попелюх	*Aythya ferina*	230	2.37-2.67
13.	Чернь білоока	*Aythya nyroca*	26	0.27-0.32
14.	Лунь лучний	*Circus pygargus*	6	0.07-0.08
15.	Лунь очеретяний	*Circus aeruginosus*	11	0.12-0.14
16.	Яструб великий	*Accipiter gentilis*	2	0.03-0.05
17.	Канюк звичаний	*Buteo buteo*	3	0.04-0.06

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km^2 (lim)**
18.	Орлан-білохвіст	*Haliaeetus albicilla*	1	0.02-0.03
19.	Балабан	*Falco cherrug*	2	0.03-0.05
20.	Підсоколик великий	*Falco subbuteo*	1	0.02-0.03
21.	Фазан	*Phasianus colchicus*	45	0.52-0.67
22.	Лиска	*Fulica atra*	1647	17.19-17.32
23.	Пісочник морський	*Charadrius alexandrinus*	46	0.55-0.65
24.	Чайка	*Vanellus vanellus*	4	0.06-0.08
25.	Коловодник лісовий	*Tringa ochropus*	22	0.31-0.37
26.	Коловодник великий	*Tringa nebularia*	6	0.06-0.07
27.	Набережник	*Actitis hypoleucos*	4	0.05-0.06
28.	Плавунець круглодзьобий	*Phalaropus lobatus*	6	0.07-0.08
29.	Брижач	*Philomachus pugnax*	92	0.95-1.08
30.	Побережник малий	*Calidris minuta*	20	0.22-0.25
31.	Побережник чорногрудий	*Calidris alpina*	120	1.26-1.32
32.	Кульон великий	*Numenius arquata*	5	0.06-0.08
33.	Мартин каспійський	*Larus ichthyaetus*	29	0.32-0.38
34.	Мартин середземноморський	*Larus melanocephalus*	80	0.85-1.00
35.	Мартин звичайний	*Larus ridibundus*	8300	83.5-83.75
36.	Мартин тонкодзьобий	*Larus genei*	180	1.82-1.95
37.	Мартин жовтоногий	*Larus cachinnans*	6500	65.25-66.38
38.	Крячок каспійський	*Hydroprogne caspia*	10	0.13-0.18
39.	Крячок рябодзьобий	*Thalasseus sandvicensis*	500	5.12-5.22
40.	Крячок річковий	*Sterna hirundo*	620	6.27-6.35
41.	Крячок малий	*Sterna albifrons*	410	4.37-4.42
42.	Припутень	*Columba palumbus*	12	0.15-0.19
43.	Горлиця звичайна	*Streptopelia turtur*	22	0.22-0.25
44.	Зозуля	*Cuculus canorus*	4	0,05-0.06
45.	Сиворакша	*Coracias garrulus*	5	0.06-0.09
46.	Рибалочка	*Alcedo atthis*	8	0.09-0.11
47.	Бджолоїдка звичайна	*Merops apiaster*	97	1.12-1.21
48.	Одуд	*Upupa epops*	6	0.07-0.09
49.	Крутиголовка	*Jynx torquilla*	3	0.04-0.05
50.	Дятел звичайний	*Dendrocopos major*	5	0.06-0.07
51.	Дятел сирійський	*Dendrocopos syriacus*	7	0.08-0.09
52.	Ластівка берегова	*Riparia riparia*	153	1.63-1.72
53.	Ластівка сільська	*Hirundo rustica*	180	1.83-1.93
54.	Посмітюха	*Galerida cristata*	32	0.36-0.41

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km^2 (lim)**
55.	Плиска біла	*Motacilla alba*	42	0.43-0.52
56.	Щеврик лісовий	*Anthus trivialis*	6	0.06-0.07
57.	Сорокопуд чорнолобий	*Lanius minor*	4	0.05-0.06
58.	Вивільга	*Oriolus oriolus*	6	0.06-0.07
59.	Шпак звичайний	*Sturnus vulgaris*	4800	48.22-48.34
60.	Сорока	*Pica pica*	16	0.17-0.19
61.	Ворона сіра	*Corvus cornix*	66	0.73-0.76
62.	Крук	*Corvus corax*	14	0.15-0.17
63.	Очеретянка ставкова	*Acrocephalus scirpaceus*	2	0.03-0.05
64.	Очеретянка велика	*Acrocephalus arundinaceus*	4	0.05-0.06
65.	Кропив’янка сіра	*Sylvia communis*	1	0.02-0.03
66.	Вівчарик весняний	*Phylloscopus trochilus*	14	0.15-0.17
67.	Вівчарик-ковалик	*Phylloscopus collybita*	5	0.06-0..07
68.	Мухоловка мала	*Ficedula parva*	3	0.04-0.06
69.	Мухоловка сіра	*Muscicapa striata*	43	0.45-0.50
70.	Трав'янка чорноголова	*Saxicola torquata*	4	0.05-0.06
71.	Кам’янка звичайна	*Oenanthe oenanthe*	12	0.14-0.16
72.	Кам’яна лиса	*Oenanthe pleschanka*	52	0.55-0.64
73.	Кам’янка попеляста	*Oenanthe isabellina*	2	0.03-0.05
74.	Горихвістка звичайна	*Phoenicurus phoenicurus*	11	0.12-0.14
75.	Соловейко східний	*Luscinia luscinia*	5	0.06-0.08
76.	Дрізд чорний	*Turdus merula*	18	0.19-0.22
77.	Синиця блакитна	*Parus caeruleus*	47	0.52-061
78.	Синиця велика	*Parus major*	64	0.68-0.73
79.	Горобець польовий	*Passer montanus*	42	0.44-0.50
80.	Зяблик	*Fringilla coelebs*	43	0.45-0.55
81.	Зеленяк	*Chloris chloris*	12	0.13-0.15
82.	Щиглик	*Carduelis carduelis*	37	0.43-0.47
83.	Коноплянка	*Acanthis cannabina*	34	0.38-0.43
84.	Просянка	*Emberiza calandra*	483	48.5-48.9
85.	Вівсянка очеретяна	*Emberiza schoeniclus*	4	0.05-0.06
86.	Вівсянка садова	*Emberiza hortulana*	56	0.57-0.64
Total:			**26392**	**15.8 ос./ км^2**

Table 6. Relative number of birds in the vicinity of the location of the «Dnepro-Bugsky WPP» in August-September 2016 (at monitoring points)

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km^2 (lim)**
1.	Пірникоза велика	*Podiceps cristatus*	8	0.09-0.13
2.	Чапля сіра	*Ardea cinerea*	4	0.05-0.06
3.	Гуска сіра	*Anser anser*	19	0.20-0.27
4.	Крижень	*Anas platyrhynchos*	5	0.06-0.08
5.	Лунь лучний	*Circus pygargus*	5	0.06-0.08
6.	Лунь очеретяний	*Circus aeruginosus*	4	0.05-0.06
7.	Яструб великий	*Accipiter gentilis*	1	0.02-0.03
8.	Канюк звичаний	*Buteo buteo*	2	0.03-0.05
9.	Орлан-білохвіст	*Haliaeetus albicilla*	1	0.02-0.03
10.	Фазан	*Phasianus colchicus*	16	0.18-0.21
11.	Коловодник лісовий	*Tringa ochropus*	2	0.03-0.05
12.	Лиска	*Fulica atra*	23	0.26-0.29
13.	Мартин звичайний	*Larus ridibundus*	62	0.67-0.69
14.	Крячок річковий	*Sterna hirundo*	27	0.31-0.35
15.	Припутень	*Columba palumbus*	2	0.03-0.05
16.	Горлиця звичайна	*Streptopelia turtur*	4	0.05-0.06
17.	Бджолоїдка звичайна	*Merops apiaster*	139	1.42-1.47
18.	Одуд	*Upupa epops*	4	0.05-0.06
19.	Крутиголовка	*Jynx torquilla*	1	0.02-0.03
20.	Дятел звичайний	*Dendrocopos major*	2	0.03-0.05
21.	Ластівка сільська	*Hirundo rustica*	33	0.35-0.39
22.	Плиска біла	*Motacilla alba*	2	0.03-0.05
23.	Вивільга	*Oriolus oriolus*	1	0.02-0.03
24.	Шпак звичайний	*Sturnus vulgaris*	700	7.03-7.06
25.	Сорока	*Pica pica*	5	0.06-0.08
26.	Ворона сіра	*Corvus cornix*	10	0.12-0.14
27.	Крук	*Corvus corax*	1	0.02-0.03
28.	Вівчарик весняний	*Phylloscopus trochilus*	2	0.03-0.05
29.	Мухоловка мала	*Ficedula parva*	4	0.05-0.06
30.	Мухоловка сіра	*Muscicapa striata*	18	0.19-0.22
31.	Кам’янка попеляста	*Oenanthe isabellina*	6	0.08-0.09
32.	Горихвістка звичайна	*Phoenicurus phoenicurus*	1	0.02-0.03
33.	Соловейко східний	*Luscinia luscinia*	2	0.03-0.05
34.	Синиця блакитна	*Parus caeruleus*	1	0.02-0.03
35.	Синиця велика	*Parus major*	23	0.25-0.27
36.	Горобець польовий	*Passer montanus*	16	0.18-0.20
37.	Зяблик	*Fringilla coelebs*	2	0.03-0.05

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km ^{2} (lim)**
38.	Зеленяк	*Chloris chloris*	32	0.34-0.36
40.	Коноплянка	*Acanthis cannabina*	1	0.02-0.03
41.	Просянка	*Emberiza calandra*	80	0.84-0.87
42.	Вівсянка очеретяна	*Emberiza schoeniclus*	3	0.04-0.06
43.	Вівсянка садова	*Emberiza hortulana*	7	0.08-009
44.	**Total:**		**1281**	**3,22 ос./ км^2**

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The period of autumn migrations (October 2016)

Table 7. Species composition and frequency of bird encounters in the area of the «Dnepro-Bugsky WPP» location in October 2016

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	**Latin name**			
1.	Гагара чорношия	*Gavia arctica*	1	Р	N
2.	Пірникоза мала	*Podiceps ruficollis*	3	Н	N
3.	Пірникоза чорношия	*Podiceps nigricollis*	1	Р	N
4.	Пірникоза сірощока	*Podiceps grisegena*	5	Н	N
5.	Пірникоза велика	*Podiceps cristatus*	7	З	D
6.	Баклан великий	*Phalacrocorax carbo*	12	Ф	D
7.	Чепура велика	*Egretta alba*	11	Ф	Z
8.	Чапля сіра	*Ardea cinerea*	12	Ф	Z
9.	Гуска сіра	*Anser anser*	3	Н	Z
10.	Гуска білолоба	*Anser albifrons*	3	Н	Z
11.	Лебідь-шипун	*Cygnus olor*	6	Н	Z
12.	Галагаз	*Tadorna tadorna*	7	З	N
13.	Крижень	*Anas platyrhynchos*	8	З	N
14.	Чирянка велика	*Anas querquedula*	9	Ф	N
15.	Попелюх	*Aythya ferina*	9	Ф	N
16.	Чернь чубата	*Aythya fuligula*	8	З	N
17.	Крех великий	*Mergus merganse*	3	Н	Z
18.	Лунь польовий	*Circus cyaneus*	4	Н	D
19.	Яструб малий	*Accipiter nisus*	4	Н	D
20.	Канюк звичайний	*Buteo buteo*	5	Н	D
21.	Орлан-білохвіст	*Haliaeetus albicilla*	3	Н	O
22.	Балабан	*Falco cherrug*	3	Н	O
23.	Куріпка сіра	*Perdix perdix*	4	Н	O
24.	Фазан	*Phasianus colchicus*	7	З	O
25.	Журавель сірий	*Grus grus*	5	Н	Z
26.	Лиска	*Fulica atra*	11	Ф	N
27.	Сивка морська	*Pluvialis squatarol*	5	Н	N
28.	Пісочник морський	*Charadrius alexandrinus*	8	З	N

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	**Latin name**			
29.	Чайка	*Vanellus vanellus*	9	Ф	N
30.	Коловодник болотяний	*Tringa glareola*	4	Н	N
31.	Коловодник чорний	*Tringa erythropus*	4	Н	N
32.	Плавунець круглодзьобий	*Phalaropus lobatus*	3	Н	N
33.	Брижач	*Philomachus pugnax*	9	Ф	N
34.	Побережник малий	*Calidris minuta*	10	Ф	N
35.	Мартин каспійський	*Larus ichthyaetus*	7	З	O
36.	Мартин звичайний	*Larus ridibundus*	12	Ф	O
37.	Мартин жовтоногий	*Larus cachinnans*	12	Ф	O
38.	Мартин сивий	*Larus canus*	11	Ф	D
39.	Крячок рябодзьобий	*Thalasseus sandvicensis*	8	З	D
40.	Сова вухата	*Asio otus*	3	Н	O
41.	Дятел звичайний	*Dendrocopos major*	4	Н	O
42.	Дятел сирійський	*Dendrocopos syriacus*	7	З	O
43.	Ластівка берегова	*Riparia riparia*	5	Н	D
44.	Ластівка сільська	*Hirundo rustica*	3	Н	D
45.	Ластівка міська	*Delichon urbica*	2	Р	N
46.	Посмітюха	*Galerida cristata*	10	Ф	O
47.	Жайворонок степовий	*Melanocorypha calandra*	7	З	O
48.	Плиска біла	*Motacilla alba*	11	Ф	D
49.	Шпак звичайний	*Sturnus vulgaris*	12	Ф	D
50.	Сорока	*Pica pica*	10	Ф	O
51.	Галка	*Corvus monedula*	11	Ф	O
52.	Грак	*Corvus frugilegus*	9	Ф	O
53.	Ворона сіра	*Corvus cornix*	11	Ф	O
54.	Крук	*Corvus corax*	11	Ф	O
55.	Волове очко	*Troglodytes troglodytes*	12	Ф	D
56.	Вівчарик весняний	*Phylloscopus trochilus*	4	Н	D
57.	Вівчарик-ковалик	*Phylloscopus collybita*	6	З	N
58.	Золотомушка жовточуба	*Regulus regulus*	6	З	N
59.	Мухоловка строката	*Ficedula hypoleuca*	12	Ф	D
60.	Мухоловка мала	*Ficedula parva*	6	Н	D
61.	Трав’янка	*Saxicola torquata*	9	Ф	D

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	Latin name			
	чорноголова				
62.	Горихвістка звичайна	*Phoenicurus phoenicurus*	7	З	D
63.	Вільшанка	*Erithacus rubecula*	2	Р	D
64.	Чикотень	*Turdus pilaris*	6	З	D
65.	Дрізд чорний	*Turdus merula*	1	Р	D
66.	Дрізд співочий	*Turdus philomelos*	2	Р	D
67.	Синиця довгохвоста	*Aegithalos caudatus*	3	Н	D
68.	Синиця блакитна	*Parus caeruleus*	8	З	O
69.	Синиця велика	*Parus major*	12	Ф	O
70.	Горобець хатній	*Passer domesticus*	8	З	O
71.	Горобець польовий	*Passer montanus*	11	Ф	O
72.	Зяблик	*Fringilla coelebs*	11	Ф	D
73.	В'юрок	*Fringilla montifringilla*	7	З	D
74.	Зеленяк	*Chloris chloris*	8	З	D
75.	Чиж	*Spinus spinus*	5	Н	D
76.	Щиглик	*Carduelis carduelis*	6	З	D
77.	Коноплянка	*Acanthis cannabina*	6	З	D
78.	Костогриз	*C.coccothraustes*	9	Ф	D
79.	Просянка	*Emberiza calandra*	12	Ф	O
80.	Вівсянка звичайна	*Emberiza citrinella*	9	Ф	D
81.	Вівсянка очеретяна	*Emberiza schoeniclus*	5	Н	D

Table 8. Number of birds in the area of the «Dnepro-Bugsky WPP» location in October 2016 (route records)

№ п/п	Species		Number of individuals	
	Ukrainian name	Latin name	абс. (lim)	на 1 km^2 (lim)
1.	Гагара чорношия	*Gavia arctica*	1	0.02-0,03
2.	Пірникоза мала	*Podiceps ruficollis*	27	0.29-0,34
3.	Пірникоза чорношия	*Podiceps nigricollis*	48	052-0,56
4.	Пірникоза сірощока	*Podiceps grisegena*	80	0.87-0,93
5.	Пірникоза велика	*Podiceps cristatus*	416	4.22-4,37
6.	Баклан великий	*Phalacrocorax carbo*	207	2.17-2,25
7.	Чепура велика	*Egretta alba*	1	0.02-0,03
8.	Чапля сіра	*Ardea cinerea*	6	0.07-0,08
9.	Гуска сіра	*Anser anser*	298	3.05-3,12
10.	Гуска білолоба	*Anser albifrons*	470	4.67-4,98
11.	Лебідь-шипун	*Cygnus olor*	73	0.78-0,84
12.	Галагаз	*Tadorna tadorna*	27	0.29-0,32
13.	Крижень	*Anas platyrhynchos*	116	1.17-1,32

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km ^{2} (lim)**
14.	Чирянка велика	*Anas querquedula*	25	0.28-0.30
15.	Попелюх	*Aythya ferina*	142	1.50-1.56
16.	Чернь чубата	*Aythya fuligula*	234	2.42-2.48
17.	Крех великий	*Mergus merganse*	4	0.05-0.07
18.	Лунь польовий	*Circus cyaneus*	8	0.09-0.10
19.	Яструб малий	*Accipiter nisus*	3	0.04-0.06
20.	Канюк звичайний	*Buteo buteo*	6	0.07-0.09
21.	Орлан-білохвіст	*Haliaeetus albicilla*	2	0.03-0.05
22.	Балабан	*Falco cherrug*	1	0.02-0.03
23.	Куріпка сіра	*Perdix perdix*	43	0.46-0.50
24.	Фазан	*Phasianus colchicus*	44	0.49-0.53
25.	Журавель сірий	*Grus grus*	176	1.79-1.82
26.	Лиска	*Fulica atra*	786	7.91-8.03
27.	Сивка морська	*Pluvialis squatarol*	1	0.02-0.03
28.	Пісочник морський	*Charadrius alexandrinus*	28	0.29-0.31
29.	Чайка	*Vanellus vanellus*	17	0.19-0.22
30.	Коловодник болотяний	*Tringa glareola*	19	0.21-0.24
31.	Коловодник чорний	*Tringa erythropus*	7	0.07-0.10
32.	Плавунець круглодзьобий	*Phalaropus lobatus*	5	0.06-0.07
33.	Брижач	*Philomachus pugnax*	57	0.67-0.72
34.	Побережник малий	*Calidris minuta*	35	0.38-0.42
35.	Мартин каспійський	*Larus ichthyaetus*	12	0,13-0.19
36.	Мартин звичайний	*Larus ridibundus*	980	9.91-10.15
37.	Мартин жовтоногий	*Larus cachinnans*	1720	17.25-17.34
38.	Мартин сивий	*Larus canus*	283	2.92-2.99
39.	Крячок рябодзьобий	*Thalasseus sandvicensis*	9	0.09-0.10
40.	Сова вухата	*Asio otus*	4	0.05-0.07
41.	Дятел звичайний	*Dendrocopos major*	6	0.07-0.09
42.	Дятел сирійський	*Dendrocopos syriacus*	14	0.16-0.19
46.	Посмітюха	*Galerida cristata*	27	0.29-0.33
47.	Жайворонок степовий	*Melanocorypha calandra*	32	0.38-0.44
48.	Плиска біла	*Motacilla alba*	42	0.45-0.51
49.	Шпак звичайний	*Sturnus vulgaris*	1161	11.75-12.10
50.	Сорока	*Pica pica*	18	0.20-0.25
51.	Галка	*Corvus monedula*	270	2.79-3.06
52.	Грак	*Corvus frugilegus*	3479	34.82-34.95
53.	Ворона сіра	*Corvus cornix*	42	4.51-4.68

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km^2 (lim)**
54.	Крук	*Corvus corax*	14	0.16-0.19
55.	Волове очко	*Troglodytes troglodytes*	46	0.47-0.53
56.	Вівчарик весняний	*Phylloscopus trochilus*	2	0.03-0.05
57.	Вівчарик-ковалик	*Phylloscopus collybita*	12	0.13-0.19
58.	Золотомушка жовточуба	*Regulus regulus*	84	0.85-0.99
59.	Мухоловка строката	*Ficedula hypoleuca*	23	0.26-0.30
60.	Мухоловка мала	*Ficedula parva*	37	0.39-0.46
61.	Трав’янка чорноголова	*Saxicola torquata*	4	0.05-0.07
62.	Горихвістка звичайна	*Phoenicurus phoenicurus*	9	0.09-0.10
63.	Вільшанка	*Erithacus rubecula*	32	0.38-0.44
64.	Чикотень	*Turdus pilaris*	375	3.86-3.96
65.	Дрізд чорний	*Turdus merula*	6	0.07-0.09
66.	Дрізд співочий	*Turdus philomelos*	3	0,04-0.06
67.	Синиця довгохвоста	*Aegithalos caudatus*	38	0.41-0.48
68.	Синиця блакитна	*Parus caeruleus*	35	0.38-0.44
69.	Синиця велика	*Parus major*	85	0.93-1.03
70.	Горобець хатній	*Passer domesticus*	78	0.82-0.94
71.	Горобець польовий	*Passer montanus*	259	2.62-2.71
72.	Зяблик	*Fringilla coelebs*	540	5.55-5.64
73.	В’юрок	*Fringilla montifringilla*	26	0.28-0.34
74.	Зеленяк	*Chloris chloris*	32	0.38-0.44
75.	Чиж	*Spinus spinus*	67	0.71-0.76
76.	Щиглик	*Carduelis carduelis*	39	043-0.51
77.	Коноплянка	*Acanthis cannabina*	4	0.05-0.07
78.	Костогриз	*C.coccothraustes*	87	0.93-1.03
79.	Просянка	*Emberiza calandra*	82	0.90-1.00
80.	Вівсянка звичайна	*Emberiza citrinella*	68	0.72-0.77
81.	Вівсянка очеретяна	*Emberiza schoeniclus*	14	0.16-0.19
Total:			**13753**	**13,22 ос./ км^2**

Table 9. Relative number of birds in the area of the «Dnepro-Bugsky WPP» location in October 2016 (at monitoring points)

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**Average**	**Limit**
1.	Пірникоза сірощока	*Podiceps grisegena*	57	0.61-0.69
2.	Пірникоза велика	*Podiceps cristatus*	6	0.07-0.09
3.	Гуска сіра	*Anser anser*	293	3.01-3.12
4.	Гуска білолоба	*Anser albifrons*	590	6.00-6.12
5.	Лебідь-шипун	*Cygnus olor*	30	0.35-0.38

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**Average**	**Limit**
6.	Галагаз	*Tadorna tadorna*	4	0.05-0.07
7.	Крижень	*Anas platyrhynchos*	38	0.42-0.49
8.	Чернь чубата	*Aythya fuligula*	235	2.40-2.45
9.	Лунь польовий	*Circus cyaneus*	7	0.07-0.10
10.	Яструб малий	*Accipiter nisus*	2	0.03-0.05
11.	Канюк звичайний	*Buteo buteo*	5	0.06-0.08
12.	Орлан-білохвіст	*Haliaeetus albicilla*	1	0.02-0.03
13.	Журавель сірий	*Grus grus*	291	3.02-3.09
14.	Лиска	*Fulica atra*	23	0.24-0.28
15.	Мартин звичайний	*Larus ridibundus*	645	6.52-6.57
16.	Мартин жовтоногий	*Larus cachinnans*	538	5.47-5.54
17.	Мартин сивий	*Larus canus*	107	1.10-1.14
18.	Дятел звичайний	*Dendrocopos major*	4	0.05-0.07
19.	Дятел сирійський	*Dendrocopos syriacus*	2	0.03-0.05
20.	Посмітюха	*Galerida cristata*	18	0.20-0.24
21.	Плиска біла	*Motacilla alba*	16	0.18-0.20
22.	Шпак звичайний	*Sturnus vulgaris*	315	3.19-3.22
23.	Сорока	*Pica pica*	14	0.16-0.19
24.	Грак	*Corvus frugilegus*	1900	19.10-19.35
25.	Ворона сіра	*Corvus cornix*	19	0.22-0.26
26.	Крук	*Corvus corax*	5	0.06-0.08
27.	Чикотень	*Turdus pilaris*	138	1.42-1.47
28.	Дрізд чорний	*Turdus merula*	13	0.14-0.16
29.	Дрізд співочий	*Turdus philomelos*	5	0.06-0.08
30.	Синиця велика	*Parus major*	71	0.74-0.78
31.	Горобець польовий	*Passer montanus*	126	1.30-1.33
32.	Зяблик	*Fringilla coelebs*	5	0.55-0.57
33.	В’юрок	*Fringilla montifringilla*	2	0.03-0.05
34.	Зеленяк	*Chloris chloris*	11	0.13-0.19
35.	Чиж	*Spinus spinus*	27	0.30-0.32
36.	Щиглик	*Carduelis carduelis*	2	0.03-0.05
37.	Коноплянка	*Acanthis cannabina*	1	0.02-0.03
38.	Костогриз	*C.coccothraustes*	45	0.49-0.53
39.	Просянка	*Emberiza calandra*	65	0.69-0.71
40.	Вівсянка звичайна	*Emberiza citrinella*	2	0.03-0.05
41.	Вівсянка очеретяна	*Emberiza schoeniclus*	4	0.05-0.07
	Total:		**5682**	**7,45 ос./ км^2**

Wintering period (December 2016 - February 2017)

Table 10. Species composition and frequency of bird encounters in the area of the «Dnepro-Bugsky WPP» location in December-February 2016-2017

№	Species		Q-ty meeting	Status
	Ukrainian name	**Latin name**		
1.	Гуска білолоба	*Anser albifrons*	2	Р
2.	Лебідь-шипун	*Cygnus olor*	3	Н
3.	Лебідь-кликун	*Cygnus cygnus*	1	Р
4.	Крижень	*Anas platyrhynchos*	5	Н
5.	Лунь польовий	*Circus cyaneu*	7	З
6.	Яструб великий	*Accipiter gentilis*	12	Ф
7.	Яструб малий	*Accipiter nisu*	11	Ф
8.	Зимняк	*Buteo lagopus*	12	Ф
9.	Канюк звичайний	*Buteo buteo*	3	Н
10.	Орлан-білохвіст	*Haliaeetus leucoryphus*	3	Н
11.	Сапсан	*Falco peregrinus*	6	З
12.	Боривітер звичайний	*Falco tinnunculus*	7	З
13.	Куріпка сіра	*Perdix perdix*	8	З
14.	Фазан	*Phasianus colchicus*	9	Ф
15.	Мартин звичайний	*Larus ridibundus*	9	Ф
16.	Мартин жовтоногий	*Larus cachinnans*	8	З
17.	Мартин сивий	*Larus canus*	3	Н
18.	Сич хатній	*Athene noctua*	4	Н
19.	Дятел звичайний	*Dendrocopos major*	4	Н
20.	Дятел сирійський	*Dendrocopos syriacus*	5	Н
21.	Посмітюха	*Galerida cristata*	3	Н
22.	Жайворонок степовий	*Melanocorypha calandra*	3	Н
23.	Сорокопуд сірий	*Lanius excubitor*	4	Н
24.	Шпак звичайний	*Sturnus vulgaris*	7	З
25.	Сойка	*Garrulus glandarius*	5	Н
26.	Сорока	*Pica pica*	11	Ф
27.	Галка	*Corvus monedula*	5	Н
28.	Грак	*Corvus frugilegus*	8	З
29.	Ворона сіра	*Corvus cornix*	9	Ф
30.	Крук	*Corvus cora*	4	Н
31.	Волове очко	*Troglodytes troglodytes*	4	Н
32.	Золотомушка жовточуба	*Regulus regulus*	3	Н
33.	Вільшанка	*Erithacus rubecula*	9	Ф
34.	Чикотень	*Turdus pilaris*	10	Ф
35.	Дрізд чорний	*Turdus merula*	7	З
36.	Синиця вусата	*Panurus biarmicu*	12	Ф

№	Species		Q-ty meeting	Status
	Ukrainian name	**Latin name**		
37.	Синиця довгохвоста	*Aegithalos caudatus*	12	Ф
38.	Синиця блакитна	*Parus caeruleus*	11	Ф
39.	Синиця велика	*Parus major*	8	З
40.	Підкоришник звичайний	*Certhia familiaris*	3	Н
41.	Горобець хатній	*Passer domesticus*	2	Р
42.	Горобець польовий	*Passer montanus*	7	З
43.	Зяблик	*Fringilla coelebs*	5	Н
44.	В'юрок	*Fringilla montifringilla*	3	Н
45.	Зеленяк	*Chloris chloris*	2	Р
46.	Чиж	*Spinus spinus*	10	Ф
47.	Щиглик	*Carduelis carduelis*	7	З
48.	Коноплянка	*Acanthis cannabina*	11	Ф
49.	Костогриз	*Coccothraustes coccothrauste*	12	Ф
50.	Просянка	*Emberiza calandra*	10	Ф
51.	Вівсянка звичайна	*Emberiza citrinella*	11	Ф
52.	Вівсянка очеретяна	*Emberiza schoeniclus*	9	Ф

Table 11. Number of birds in the area of the «Dnepro-Bugsky WPP» location in December 2016 - February 2017 (route records)

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km^2 (lim)**
1.	Гуска білолоба	*Anser albifrons*	80	0,87-0,93
2.	Лебідь-шипун	*Cygnus olor*	8	0,09-010
3.	Лебідь-кликун	*Cygnus cygnus*	17	0,19-0,22
4.	Крижень	*Anas platyrhynchos*	23	0,26-0,30
5.	Лунь польовий	*Circus cyaneu*	6	0,07-0,08
6.	Яструб великий	*Accipiter gentilis*	1	0,02-0,03
7.	Яструб малий	*Accipiter nisus*	3	0,04-0,06
8.	Зимняк	*Buteo lagopus*	57	0,67-0,72
9.	Канюк звичайний	*Buteo buteo*	6	0,07-0,09
10.	Орлан-білохвіст	*Haliaeetus leucoryphus*	1	0,02-0,03
11.	Сапсан	*Falco peregrinus*	1	0,02-0,03
12.	Боривітер звичайний	*Falco tinnunculus*	3	0,04-0,06
13.	Куріпка сіра	*Perdix perdix*	24	0,27-0,31
14.	Фазан	*Phasianus colchicus*	17	0,19-0,22
15.	Мартин звичайний	*Larus ridibundus*	6	0,07-0,09
16.	Мартин жовтоногий	*Larus cachinnans*	284	2,93-3,16
17.	Мартин сивий	*Larus canus*	89	0,93-0,99
18.	Сич хатній	*Athene noctua*	2	0,03-0,05

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km ^{2} (lim)**
19.	Дятел звичайний	*Dendrocopos major*	1	0,02-0,03
20.	Дятел сирійський	*Dendrocopos syriacus*	3	0,04-0,06
21.	Посмітюха	*Galerida cristata*	24	0,27-0,31
22.	Жайворонок степовий	*Melanocorypha calandra*	28	0,29-0,31
23.	Сорокопуд сірий	*Lanius excubitor*	4	0,05-0,07
24.	Шпак звичайний	*Sturnus vulgaris*	300	3,11-3,17
25.	Сойка	*Garrulus glandarius*	5	0,06-0,07
26.	Сорока	*Pica pica*	17	0,19-0,22
27.	Галка	*Corvus monedula*	219	0,21-0,24
28.	Грак	*Corvus frugilegus*	4000	40,07-40,10
29.	Ворона сіра	*Corvus cornix*	25	0,29-0,33
30.	Крук	*Corvus cora*	9	0,09-010
31.	Волове очко	*Troglodytes troglodytes*	6	0,07-0,09
32.	Золотомушка жовточуба	*Regulus regulus*	84	0,89-0,96
33.	Вільшанка	*Erithacus rubecula*	3	0,04-0,06
34.	Чикотень	*Turdus pilaris*	376	3,82-3,96
35.	Дрізд чорний	*Turdus merula*	6	0,07-0,09
36.	Синиця вусата	*Panurus biarmicu*	14	0,16-0,19
37.	Синиця довгохвоста	*Aegithalos caudatus*	27	0,29-0,33
38.	Синиця блакитна	*Parus caeruleus*	38	0,39-0,46
39.	Синиця велика	*Parus major*	48	0,52-0,56
40.	Підкоришник звичайний	*Certhia familiaris*	1	0,02-0,03
41.	Горобець хатній	*Passer domesticus*	18	0,20-0,25
42.	Горобець польовий	*Passer montanus*	270	2,79-3,06
43.	Зяблик	*Fringilla coelebs*	174	1,72-1,95
44.	В'юрок	*Fringilla montifringilla*	80	0,85-0,90
45.	Зеленяк	*Chloris chloris*	63	0,66-0,70
46.	Чиж	*Spinus spinus*	46	0,47-0,53
47.	Щиглик	*Carduelis carduelis*	220	2,22-2,25
48.	Коноплянка	*Acanthis cannabina*	120	1,24-1,33
49.	Костогриз	*Coccothraustes coccothrauste*	11	0,15-0,21
50.	Просянка	*Emberiza calandra*	23	0,26-0,30
51.	Вівсянка звичайна	*Emberiza citrinella*	37	0,39-0,46
52.	Вівсянка очеретяна	*Emberiza schoeniclus*	1	0,02-0,03
Total:			**6930**	**8,7 ос./ км^2**

Table 12. Relative number of birds in the area of the deployment of the «Dnepro-Bugsky WPP» in December 2016. - February 2017 (at monitoring points)

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**Average**	**Limit**
1.	Лебідь-кликун	*Cygnus cygnus*	2	0,03-0,05
2.	Крижень	*Anas platyrhynchos*	16	0,18-0,21
3.	Лунь польовий	*Circus cyaneu*	4	0,05-0,06
4.	Яструб великий	*Accipiter gentilis*	1	0,02-0,03
5.	Яструб малий	*Accipiter nisus*	5	0,06-0,08
6.	Зимняк	*Buteo lagopus*	10	0,12-0,14
7.	Канюк звичайний	*Buteo buteo*	1	0,02-0,03
8.	Орлан-білохвіст	*Haliaeetus leucoryphus*	2	0,03-0,05
9.	Сапсан	*Falco peregrinus*	1	0,02-0,03
10.	Боривітер звичайний	*Falco tinnunculus*	11	0,12-0,18
11.	Куріпка сіра	*Perdix perdix*	22	0,24-0,31
12.	Фазан	*Phasianus colchicus*	1	0,02-0,03
13.	Мартин звичайний	*Larus ridibundus*	62	0,67-0,69
14.	Мартин жовтоногий	*Larus cachinnans*	27	0,31-0,35
15.	Мартин сивий	*Larus canus*	2	0,03-0,05
17.	Дятел звичайний	*Dendrocopos major*	4	0,05-0,06
18.	Дятел сирійський	*Dendrocopos syriacus*	13	0,16-0,18
19.	Посмітюха	*Galerida cristata*	4	0,05-0,06
21.	Сорокопуд сірий	*Lanius excubitor*	2	0,03-0,05
22.	Шпак звичайний	*Sturnus vulgaris*	33	0,35-0,39
23.	Сойка	*Garrulus glandarius*	2	0,03-0,05
24.	Сорока	*Pica pica*	1	0,02-0,03
25.	Галка	*Corvus monedula*	27	2,09-3,06
26.	Грак	*Corvus frugilegus*	5	0,06-0,08
27.	Ворона сіра	*Corvus cornix*	10	0,12-0,14
28.	Крук	*Corvus cora*	1	0,02-0,03
29.	Волове очко	*Troglodytes troglodytes*	2	0,03-0,05
30.	Золотомушка жовточуба	*Regulus regulus*	4	0,05-0,06
31.	Вільшанка	*Erithacus rubecula*	1	0,02-0,03
32.	Чикотень	*Turdus pilaris*	6	0,08-0,09
33.	Дрізд чорний	*Turdus merula*	1	0,02-0,03
35.	Синиця довгохвоста	*Aegithalos caudatus*	1	0,02-0,03
36.	Синиця блакитна	*Parus caeruleus*	23	0,25-0,27
37.	Синиця велика	*Parus major*	16	0,18-0,20
38.	Підкоришник звичайний	*Certhia familiaris*	2	0,03-0,05
39.	Горобець хатній	*Passer domesticus*	32	0,34-0,36
40.	Горобець польовий	*Passer montanus*	1	0,02-0,03

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**Average**	**Limit**
41.	Зяблик	*Fringilla coelebs*	85	0,88-0,97
42.	Зеленяк	*Chloris chloris*	3	0,04-0,06
43.	Чиж	*Spinus spinus*	7	0,08-0,09
44.	Щиглик	*Carduelis carduelis*	8	0,09-0,13
	Total:		**587**	**0,45 ос./ км^2**

Annex M. DETAILED RESULTS OF ORNITOLOGICAL RESEARCHES FOR THE OHPL SITE

Period of autumn migrations (September-October 2017).

Table 1. Species composition and frequency of bird encounters in the area of construction of the OHPL from Substation «DB WPP» to Substation «Posad-Pokrovskaya» in September-October 2017

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	**Latin name**			
1.	Чепура велика	*Egretta alba*	1	Р	Z
2.	Чепура мала	*Egretta garzetta*	1	Р	D
3.	Чапля сіра	*Ardea cinerea*	2	Р	Z
4.	Крижень	*Anas platyrhynchos*	2	Р	N
5.	Лунь польовий	*Circus cyaneus*	3	Н	D
6.	Лунь очеретяний	*Circus aeruginosus*	2	Р	Z
7.	Яструб великий	*Accipiter gentilis*	1	Р	O
8.	Канюк звичаний	*Buteo buteo*	2	Р	D
9.	Балабан	*Falco cherrug*	1	Р	O
10.	Фазан	*Phasianus colchicus*	4	Н	O
11.	Журавель сірий	*Grus grus*	1	Р	Z
12.	Лиска	*Fulica atra*	3	Н	N
13.	Коловодник лісовий	*Tringa ochropus*	2	Р	N
14.	Брижач	*Philomachus pugnax*	2	Р	N
15.	Побережник малий	*Calidris minuta*	1	Р	N
16.	Мартин жовтоногий	*Larus cachinnans*	6	З	O
17.	Горлиця садова	*Streptopelia decaocto*	1	Р	O
18.	Жовна сива	*Picus canus*	1	Р	O
19.	Дятел звичайний	*Dendrocopos major*	4	Н	O
20.	Дятел сирійський	*Dendrocopos syriacus*	5	Н	O
21.	Посмітюха	*Galerida cristata*	8	З	O
22.	Плиска біла	*Motacilla alba*	11	Ф	D
23.	Шпак звичайний	*Sturnus vulgaris*	12	Ф	D
24.	Сорока	*Pica pica*	9	Ф	O
25.	Галка	*Corvus monedula*	7	З	O
26.	Грак	*Corvus frugilegus*	9	Ф	O
27.	Ворона сіра	*Corvus cornix*	11	Ф	O
28.	Крук	*Corvus corax*	4	Н	O
29.	Вівчарик весняний	*Phylloscopus trochilus*	2	Р	D
30.	Вівчарик-ковалик	*Phylloscopus collybita*	1	Р	N
31.	Мухоловка мала	*Ficedula parva*	5	Н	D
32.	Мухоловка сіра	*Muscicapa striata*	4	Н	Z
33.	Кам'янка звичайна	*Oenanthe oenanthe*	2	Р	Z
34.	Горихвістка звичайна	*Phoenicurus*	6	З	D

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	Latin name			
		phoenicurus			
35.	Вільшанка	*Erithacus rubecula*	2	Р	D
36.	Дрізд чорний	*Turdus merula*	3	Н	D
37.	Синиця чорна	*Periparus ater*	2	Р	D
38.	Синиця блакитна	*Parus caeruleus*	8	З	O
39.	Синиця велика	*Parus major*	12	Ф	O
40.	Горобець хатній	*Passer domesticus*	8	З	O
41.	Горобець польовий	*Passer montanus*	11	Ф	O
42.	Зяблик	*Fringilla coelebs*	10	Ф	D
43.	В’юрок	*Fringilla montifringilla*	4	Н	D
44.	Зеленяк	*Chloris chloris*	8	З	D
45.	Чиж	*Spinus spinus*	5	Н	D
46.	Щиглик	*Carduelis carduelis*	7	З	D
47.	Коноплянка	*Acanthis cannabina*	7	З	D
48.	Костогриз	*C.coccothraustes*	2	Р	D
49.	Просянка	*Emberiza calandra*	11	Ф	O
50.	Вівсянка очеретяна	*Emberiza schoeniclus*	2	Р	D

Symbols: F – background (met during 9-12 records), C – normal (met during 6-8 records), N – a few (met during 3-5 records); P – rare (met during 1-2 records), N – mostly a night migrant, D – mostly day migrant, Z – mixed type (day + night) type of migration, O – settled species.

Table 2. Number of birds in the area of construction of the OHPL from Substation «DB WPP» to Substation «Posad-Pokrovskaya» in September-October 2017 (route records)

№ п/п	Species		Number of individuals	
	Ukrainian name	Latin name	абс. (lim)	на 1 km ^{2} (lim)
1.	Чепура велика	*Egretta alba*	2	0,03-0,04
2.	Чепура мала	*Egretta garzetta*	1	0,02-0,03
3.	Чапля сіра	*Ardea cinerea*	4	0,04-0,06
4.	Крижень	*Anas platyrhynchos*	14	0,15-0,18
5.	Лунь польовий	*Circus cyaneus*	6	0,07-0,08
6.	Лунь очеретяний	*Circus aeruginosus*	2	0,03-0,04
7.	Яструб великий	*Accipiter gentilis*	1	0,02-0,03
8.	Канюк звичаний	*Buteo buteo*	5	0,05-0,08
9.	Балабан	*Falco cherrug*	1	0,02-0,03
10.	Фазан	*Phasianus colchicus*	37	0,38-0,40
11.	Журавель сірий	*Grus grus*	22	0,24-0,27
12.	Лиска	*Fulica atra*	8	0,81-0,92
13.	Коловодник лісовий	*Tringa ochropus*	1	0,02-0,03
14.	Брижач	*Philomachus pugnax*	3	0,04-0,05
15.	Побережник малий	*Calidris minuta*	2	0,03-0,04

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km ^{2} (lim)**
16.	Мартин жовтоногий	*Larus cachinnans*	126	1,27-1,31
17.	Горлиця садова	*Streptopelia decaocto*	1	0,02-0,03
18.	Жовна сива	*Picus canus*	1	0,02-0,03
19.	Дятел звичайний	*Dendrocopos major*	5	0,05-0,08
20.	Дятел сирійський	*Dendrocopos syriacus*	9	0,09-0,11
21.	Посмітюха	*Galerida cristata*	22	0,23-0,26
22.	Плиска біла	*Motacilla alba*	19	0,21-0,23
23.	Шпак звичайний	*Sturnus vulgaris*	340	3,45-3,52
24.	Сорока	*Pica pica*	11	0,12-0,15
25.	Галка	*Corvus monedula*	16	0,17-0,20
26.	Грак	*Corvus frugilegus*	380	3,82-3,95
27.	Ворона сіра	*Corvus cornix*	20	0,21-0,23
28.	Крук	*Corvus corax*	6	0,06-0,09
29.	Вівчарик весняний	*Phylloscopus trochilus*	12	0,14-0,18
30.	Вівчарик-ковалик	*Phylloscopus collybita*	4	0,04-0,06
31.	Мухоловка мала	*Ficedula parva*	20	0,21-0,24
32.	Мухоловка сіра	*Muscicapa striata*	26	0,28-0,34
33.	Кам'янка звичайна	*Oenanthe oenanthe*	4	0,04-0,06
34.	Горихвістка звичайна	*Phoenicurus phoenicurus*	5	0,05-0,08
35.	Вільшанка	*Erithacus rubecula*	4	0,04-0,06
36.	Дрізд чорний	*Turdus merula*	16	0,18-0,23
37.	Синиця чорна	*Periparus ater*	10	0,12-0,13
38.	Синиця блакитна	*Parus caeruleus*	6	0,07-0,09
39.	Синиця велика	*Parus major*	33	0,35-0,38
40.	Горобець хатній	*Passer domesticus*	8	0,09-0,13
41.	Горобець польовий	*Passer montanus*	35	0,38-0,44
42.	Зяблик	*Fringilla coelebs*	120	1,21-1,23
43.	В’юрок	*Fringilla montifringilla*	5	0,05-0,08
44.	Зеленяк	*Chloris chloris*	85	0,88-0,92
45.	Чиж	*Spinus spinus*	27	0,30-0,33
46.	Щиглик	*Carduelis carduelis*	125	1,28-1,32
47.	Коноплянка	*Acanthis cannabina*	96	0,98-1,09
48.	Костогриз	*C.coccothraustes*	8	0,09-0,12
49.	Просянка	*Emberiza calandra*	210	2,13-2,16
50.	Вівсянка очеретяна	*Emberiza schoeniclus*	3	0,04-0,05
Total:			**1927**	**1,94 ос./ км ^{2}**

Table 3. Relative number of birds in the area of construction of the OHPL from Substation «DB WPP» to Substation «Posad-Pokrovskaya» in September-October 2017 (at monitoring points)

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**Average**	**Limit**
1.	Крижень	*Anas platyrhynchos*	2	0,03-0,04
2.	Лунь польовий	*Circus cyaneus*	2	0,03-0,04
3.	Канюк звичайний	*Buteo buteo*	1	0,02-0,03
4.	Лиска	*Fulica atra*	5	0,05-0,08
5.	Мартин жовтоногий	*Larus cachinnans*	28	0,30-0,34
6.	Дятел звичайний	*Dendrocopos major*	2	0,03-0,04
7.	Дятел сирійський	*Dendrocopos syriacus*	2	0,03-0,04
8.	Посмітюха	*Galerida cristata*	18	0,19-0,24
9.	Плиска біла	*Motacilla alba*	6	0,07-0,08
10.	Шпак звичайний	*Sturnus vulgaris*	290	3,00-3,12
11.	Сорока	*Pica pica*	4	0,04-0,06
12.	Грак	*Corvus frugilegus*	180	1,85-1,92
13.	Ворона сіра	*Corvus cornix*	12	0,13-0,17
14.	Крук	*Corvus corax*	5	0,06-0,08
15.	Дрізд чорний	*Turdus merula*	3	0,04-0,05
16.	Синиця велика	*Parus major*	42	0,45-0,48
17.	Горобець польовий	*Passer montanus*	182	1,86-1,95
18.	Зяблик	*Fringilla coelebs*	150	1,55-1,57
19.	В’юрок	*Fringilla montifringilla*	2	0,03-0,05
20.	Зеленяк	*Chloris chloris*	65	0,69-0,73
21.	Чиж	*Spinus spinus*	20	0,25-0,30
22.	Щиглик	*Carduelis carduelis*	5	0,06-0,08
23.	Коноплянка	*Acanthis cannabina*	40	0,42-0,45
24.	Костогриз	*C.coccothraustes*	5	0,06-0,08
25.	Просянка	*Emberiza calandra*	28	0,30-0,34
26.	Вівсянка очеретяна	*Emberiza schoeniclus*	1	0,02-0,03
	Total:		**1100**	**1,12 ос./ км^2**

<u>Wintering period (December - February, 2017-2018)</u>

Table 4. Species composition and frequency of bird encounters in the area of construction of the OHPL from Substation «DB WPP» to Substation «Posad-Pokrovskaya» in December - February 2017-2018

№	Species		Q-ty meeting	Status
	Ukrainian name	**Latin name**		
1.	Крижень	*Anas platyrhynchos*	2	Р
2.	Лунь польовий	*Circus cyaneu*	3	Н
3.	Яструб великий	*Accipiter gentilis*	1	Р
4.	Яструб малий	*Accipiter nisu*	3	Н

№	Species		Q-ty meeting	Status
	Ukrainian name	Latin name		
5.	Зимняк	*Buteo lagopus*	12	Ф
6.	Канюк звичайний	*Buteo buteo*	3	Н
7.	Боривітер звичайний	*Falco tinnunculus*	2	Р
8.	Куріпка сіра	*Perdix perdix*	3	Н
9.	Фазан	*Phasianus colchicus*	9	Ф
10.	Мартин жовтоногий	*Larus cachinnans*	2	Р
11.	Мартин сивий	*Larus canus*	2	Р
12.	Дятел звичайний	*Dendrocopos major*	2	Р
13.	Дятел сирійський	*Dendrocopos syriacus*	5	Н
14.	Посмітюха	*Galerida cristata*	4	Н
15.	Жайворонок степовий	*Melanocorypha calandra*	1	Р
16.	Сорокопуд сірий	*Lanius excubitor*	1	Р
17.	Шпак звичайний	*Sturnus vulgaris*	7	З
18.	Сорока	*Pica pica*	10	Ф
19.	Галка	*Corvus monedula*	7	З
20.	Грак	*Corvus frugilegus*	8	З
21.	Ворона сіра	*Corvus cornix*	4	Н
22.	Крук	*Corvus cora*	4	Н
23.	Волове очко	*Troglodytes troglodytes*	2	Р
24.	Золотомушка жовточуба	*Regulus regulus*	2	Р
25.	Вільшанка	*Erithacus rubecula*	2	Р
26.	Дрізд чорний	*Turdus merula*	8	З
27.	Синиця довгохвоста	*Aegithalos caudatus*	2	Р
28.	Синиця блакитна	*Parus caeruleus*	8	З
29.	Синиця велика	*Parus major*	12	Ф
30.	Підкоришник звичайний	*Certhia familiaris*	1	Р
31.	Горобець хатній	*Passer domesticus*	4	Н
32.	Горобець польовий	*Passer montanus*	8	З
33.	Зяблик	*Fringilla coelebs*	5	Н
34.	В’юрок	*Fringilla montifringilla*	3	Н
35.	Зеленяк	*Chloris chloris*	4	Н
36.	Чиж	*Spinus spinus*	4	Н
37.	Щиглик	*Carduelis carduelis*	2	Р
38.	Коноплянка	*Acanthis cannabina*	1	Р
40.	Просянка	*Emberiza calandra*	5	Н

Symbols: F – background (met during 9-12 records), C – normal (met during 6-8 records), N – a few (met during 3-5 records); P – rare (met during 1-2 records).

Table 5. Number of birds in the area of construction of the OHPL from Substation «DB WPP» to Substation «Posad-Pokrovska» in December-February 2017-2018 (route records)

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km^2 (lim)**
1.	Крижень	*Anas platyrhynchos*	4	0,04-0,06
2.	Лунь польовий	*Circus cyaneu*	3	0,03-0,04
3.	Яструб великий	*Accipiter gentilis*	1	0,02-0,03
4.	Яструб малий	*Accipiter nisus*	3	0,03-0,04
5.	Зимняк	*Buteo lagopus*	18	0,19-0,22
6.	Канюк звичайний	*Buteo buteo*	4	0,04-0,06
7.	Боривітер звичайний	*Falco tinnunculus*	3	0,03-0,04
8.	Куріпка сіра	*Perdix perdix*	19	0,20-0,27
9.	Фазан	*Phasianus colchicus*	22	0,24-0,29
10.	Мартин жовтоногий	*Larus cachinnans*	12	0,12-0,16
11.	Мартин сивий	*Larus canus*	20	2,03-2,16
12.	Дятел звичайний	*Dendrocopos major*	2	0,02-0,03
13.	Дятел сирійський	*Dendrocopos syriacus*	5	0,05-0,08
14.	Посмітюха	*Galerida cristata*	20	0,21-0,27
15.	Жайворонок степовий	*Melanocorypha calandra*	6	0,07-0,09
16.	Сорокопуд сірий	*Lanius excubitor*	1	0,02-0,03
17.	Шпак звичайний	*Sturnus vulgaris*	169	1,71-1,90
18.	Сорока	*Pica pica*	15	0,16-0,20
19.	Галка	*Corvus monedula*	85	0,87-0,94
20.	Грак	*Corvus frugilegus*	175	1,77-1,92
21.	Ворона сіра	*Corvus cornix*	19	0,19-0,23
22.	Крук	*Corvus cora*	6	0,07-0,10
23.	Волове очко	*Troglodytes troglodytes*	3	0,03-0,04
24.	Золотомушка жовточуба	*Regulus regulus*	27	0,28-0,33
25.	Вільшанка	*Erithacus rubecula*	3	0,04-0,06
26.	Дрізд чорний	*Turdus merula*	11	0,12-0,15
27.	Синиця довгохвоста	*Aegithalos caudatus*	6	0,08-0,10
28.	Синиця блакитна	*Parus caeruleus*	15	0,16-0,18
29.	Синиця велика	*Parus major*	42	0,42-0,49
30.	Підкоришник звичайний	*Certhia familiaris*	1	0,02-0,03
31.	Горобець хатній	*Passer domesticus*	19	0,20-0,25
32.	Горобець польовий	*Passer montanus*	27	2,79-3,06
33.	Зяблик	*Fringilla coelebs*	212	2,18-2,35
34.	В’юрок	*Fringilla montifringilla*	6	0,07-0,10
35.	Зеленяк	*Chloris chloris*	47	0,48-0,52
36.	Чиж	*Spinus spinus*	32	0,34-0,41

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**на 1 km ^{2} (lim)**
37.	Щиглик	*Carduelis carduelis*	184	1,90-2,02
38.	Коноплянка	*Acanthis cannabina*	32	0,34-0,41
39.	Костогриз	*Coccothraustes coccothrauste*	19	0,21-0,28
40.	Просянка	*Emberiza calandra*	64	0,66-0,72
Total:			**1358**	**1,40 ос./ км^2**

Table 6. The relative number of birds in the area of construction of the OHPL from the Substation «DB WPP» to Substation «Posad-Pokrovska» in December-February 2017-2018 (at monitoring points)

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**Average**	**Limit**
1.	Лунь польовий	*Circus cyaneu*	2	0,02-0,04
2.	Яструб малий	*Accipiter nisus*	1	0,02-0,03
3.	Зимняк	*Buteo lagopus*	10	0,12-0,14
4.	Канюк звичайний	*Buteo buteo*	1	0,02-0,03
5.	Боривітер звичайний	*Falco tinnunculus*	3	0,03-0,04
6.	Куріпка сіра	*Perdix perdix*	7	0,08-0,11
7.	Фазан	*Phasianus colchicus*	5	0,05-0,08
8.	Мартин жовтоногий	*Larus cachinnans*	25	0,26-0,28
9.	Мартин сивий	*Larus canus*	12	0,12-0,16
10.	Дятел звичайний	*Dendrocopos major*	1	0,02-0,03
11.	Дятел сирійський	*Dendrocopos syriacus*	4	0,04-0,06
12.	Посмітюха	*Galerida cristata*	10	0,11-0,14
13.	Сорокопуд сірий	*Lanius excubitor*	1	0,02-0,03
14.	Шпак звичайний	*Sturnus vulgaris*	74	0,76-0,84
15.	Сорока	*Pica pica*	1	0,02-0,03
16.	Галка	*Corvus monedula*	28	0,29-0,35
17.	Грак	*Corvus frugilegus*	50	0,52-0,58
18.	Ворона сіра	*Corvus cornix*	4	0,04-0,06
19.	Крук	*Corvus cora*	2	0,02-0,04
20.	Волове очко	*Troglodytes troglodytes*	1	0,02-0,03
21.	Золотомушка жовточуба	*Regulus regulus*	12	0,13-0,15
22.	Вільшанка	*Erithacus rubecula*	1	0,02-0,03
23.	Дрізд чорний	*Turdus merula*	3	0,03-0,04
24.	Синиця блакитна	*Parus caeruleus*	14	0,15-0,17
25.	Синиця велика	*Parus major*	23	0,24-0,26
26.	Підкоришник звичайний	*Certhia familiaris*	1	0,02-0,03

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**Average**	**Limit**
27.	Горобець хатній	*Passer domesticus*	32	0,34-0,36
28.	Горобець польовий	*Passer montanus*	40	0,42-0,45
29.	Зяблик	*Fringilla coelebs*	120	1,22-1,31
30.	Зеленяк	*Chloris chloris*	18	0,19-0,22
31.	Чиж	*Spinus spinus*	17	0,19-0,20
32.	Щиглик	*Carduelis carduelis*	9	0,10-0,14
	Total:		**532**	**0,57 ос./ км^2**

<u>Period of spring migration, beginning of nesting (April-May 2018)</u>

Table 7. Species composition and frequency of bird encounters in the area of construction of the OHPL from Substation «DB WPP» to Substation «Posad-Pokrovskaya» in April-May 2018

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	**Latin name**			
1.	Пірникоза велика	*Podiceps cristatus*	2	Р	N
2.	Чапля сіра	*Ardea cinerea*	4	Н	D
3.	Лебідь-шипун	*Cygnus olor*	1	Р	D
4.	Крижень	*Anas platyrhynchos*	4	Н	N
5.	Чирянка велика	*Anas querquedula*	1	Р	N
6.	Лунь очеретяний	*Circus aeruginosus*	12	Ф	D
7.	Яструб великий	*Accipiter gentilis*	1	Р	O
8.	Канюк звичаний	*Buteo buteo*	1	Р	D
9.	Орлан-білохвіст	*Haliaeetus albicilla*	1	Р	O
10.	Підсоколик великий	*Falco subbuteo*	2	Р	D
11.	Боривітер звичайний	*Falco tinnunculus*	8	З	D
12.	Куріпка сіра	*Perdix perdix*	3	Н	D
13.	Перепілка звичайна	*Coturnix coturnix*	2	Р	N
14.	Фазан	*Phasianus colchicus*	2	Р	O
15.	Лиска	*Fulica atra*	1	Р	N
16.	Чайка	*Vanellus vanellus*	2	Р	N
17.	Довгоніг	*Himantopus himantopus*	1	Р	N
18.	Мартин звичайний	*Larus ridibundus*	3	Н	O
19.	Мартин жовтоногий	*Larus cachinnans*	5	Н	O
20.	Крячок річковий	*Sterna hirundo*	3	Н	D
21.	Припутень	*Columba palumbus*	2	Р	O
22.	Горлиця садова	*Streptopelia decaocto*	1	Р	O
23.	Одуд	*Upupa epops*	7	З	D
24.	Дятел звичайний	*Dendrocopos major*	1	Р	O
25.	Ластівка берегова	*Riparia riparia*	10	Ф	N
26.	Ластівка сільська	*Hirundo rustica*	11	Ф	N

№ п/п	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	Latin name			
27.	Посмітюха	*Galerida cristata*	11	Ф	O
28.	Жайворонок польовий	*Alauda arvensis*	4	Н	D
29.	Жайворонок степовий	*Melanocorypha calandra*	8	З	O
30.	Щеврик польовий	*Anthus campestris*	9	Ф	D
31.	Щеврик лісовий	*Anthus trivialis*	2	Р	D
32.	Плиска жовта	*Motacilla flava*	9	Ф	D
33.	Плиска чорноголова	*Motacilla feldegg*	10	Ф	D
34.	Плиска біла	*Motacilla alba*	10	Ф	D
35.	Шпак звичайний	*Sturnus vulgaris*	12	Ф	Z
36.	Сорока	*Pica pica*	8	З	O
37.	Сойка	*Garrulus glandarius*	1	Р	O
38.	Галка	*Corvus monedula*	9	Ф	O
39.	Грак	*Corvus frugilegus*	10	Ф	O
40.	Ворона сіра	*Corvus cornix*	12	Ф	O
41.	Крук	*Corvus corax*	9	Ф	O
42	Очеретянка велика	*Acrocephalus arundinaceus*	1	Р	N
43.	Кропив'янка сіра	*Sylvia communis*	7	З	N
44.	Вівчарик весняний	*Phylloscopus trochilus*	2	Р	N
45.	Вівчарик жовтобровий	*Phylloscopus sibilatrix*	2	Р	
46.	Мухоловка сіра	*Muscicapa striata*	4	Н	D
47.	Кам'янка звичайна	*Oenanthe oenanthe*	2	Р	D
48.	Кам'янка попеляста	*Oenanthe isabellina*	2	Р	N
49.	Горихвістка чорна	*Phoenicurus ochruros*	1	Р	N
50.	Соловейко східний	*Luscinia luscinia*	2	Р	D
51.	Дрізд чорний	*Turdus merula*	2	Р	D
52.	Дрізд співочий	*Turdus philomelos*	2	Р	D
53.	Синиця блакитна	*Parus caeruleus*	10	Ф	O
54.	Синиця велика	*Parus major*	12	Ф	O
55.	Горобець хатній	*Passer domesticus*	6	З	O
56.	Горобець польовий	*Passer montanus*	8	З	O
57.	Зяблик	*Fringilla coelebs*	11	Ф	D
58.	Зеленяк	*Chloris chloris*	3	Н	D
59.	Щиглик	*Carduelis carduelis*	8	З	D
60.	Коноплянка	*Acanthis cannabina*	3	Н	D
61.	Костогриз	*C.coccothraustes*	2	Р	D
62.	Просянка	*Emberiza calandra*	9	Ф	D

Symbols: F – background (met during 9-12 records), C – normal (met during 6-8 records), N – a few (met during 3-5 records); P – rare (met during 1-2 records), N – mostly a night migrant, D – mostly day migrant, Z – mixed type (day + night) type of migration, O – settled species.

Table 8. Number of birds in the area of construction of the OHPL from Substation «DB WPP» to the Substation «Posad-Pokrovska» in April-May 2018

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**abs. (lim)**	**on 1 km ^{2} (lim)**
1.	Пірникоза велика	*Podiceps cristatus*	2	0,01-0,02
2.	Чапля сіра	*Ardea cinerea*	5	0,04-0,05
3.	Лебідь-шипун	*Cygnus olor*	4	0,03-0,04
4.	Крижень	*Anas platyrhynchos*	3	0,02-0,03
5.	Чирянка велика	*Anas querquedula*	8	0,07 -0,08
6.	Лунь очеретяний	*Circus aeruginosus*	6	0,05-0,06
7.	Яструб великий	*Accipiter gentilis*	1	0,01-0,02
8.	Канюк звичаний	*Buteo buteo*	1	0,01-0,02
9.	Орлан-білохвіст	*Haliaeetus albicilla*	1	0,01-0,02
10.	Підсоколик великий	*Falco subbuteo*	2	0,01-0,02
11.	Боривітер звичайний	*Falco tinnunculus*	8	0,07-0,08
12.	Куріпка сіра	*Perdix perdix*	2	0,01-0,02
13.	Перепілка звичайна	*Coturnix coturnix*	2	0,01-0,02
14.	Фазан	*Phasianus colchicus*	3	0,02-0,03
15.	Лиска	*Fulica atra*	4	0,03-0,04
16.	Чайка	*Vanellus vanellus*	2	0,01-0,02
17.	Довгоніг	*Himantopus himantopus*	3	0,02-0,03
18.	Мартин звичайний	*Larus ridibundus*	12	0,11-0,13
19.	Мартин жовтоногий	*Larus cachinnans*	37	0,36-0,38
20.	Крячок річковий	*Sterna hirundo*	27	0,26-0,28
21.	Припутень	*Columba palumbus*	1	0,01-0,02
22.	Горлиця садова	*Streptopelia decaocto*	1	0,01-0,02
23.	Одуд	*Upupa epops*	7	0,06-0,07
24.	Дятел звичайний	*Dendrocopos major*	1	0,01-0,02
25.	Ластівка берегова	*Riparia riparia*	12	0,11-0,13
26.	Ластівка сільська	*Hirundo rustica*	2	0,01-0,02
27.	Посмітюха	*Galerida cristata*	11	0,10-0,11
28.	Жайворонок польовий	*Alauda arvensis*	22	0,20-0,23
29.	Жайворонок степовий	*Melanocorypha calandra*	47	0,46-0,48
30.	Щеврик польовий	*Anthus campestris*	2	0,01-0,02
31.	Щеврик лісовий	*Anthus trivialis*	2	0,01-0,02
32.	Плиска жовта	*Motacilla flava*	1	0,01-0,02
33.	Плиска чорноголова	*Motacilla feldegg*	4	0,03-0,04
34.	Плиска біла	*Motacilla alba*	7	0,06-0,08
35.	Шпак звичайний	*Sturnus vulgaris*	122	1,20-1,24
36.	Сорока	*Pica pica*	12	0,10-0,12
37.	Сойка	*Garrulus glandarius*	2	0,01-0,02

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**abs. (lim)**	**on 1 km ^{2} (lim)**
38.	Галка	*Corvus monedula*	12	0,10-0,12
39.	Грак	*Corvus frugilegus*	112	1,10-1,12
40.	Ворона сіра	*Corvus cornix*	16	0,15-0,16
41.	Крук	*Corvus corax*	8	0,07-0,08
42	Очеретянка велика	*Acrocephalus arundinaceus*	2	0,01-0,02
43.	Кропив’янка сіра	*Sylvia communis*	3	0,02-0,03
44.	Вівчарик весняний	*Phylloscopus trochilus*	1	0,01-0,02
45.	Вівчарик жовтобровий	*Phylloscopus sibilatrix*	2	0,01-0,02
46.	Мухоловка сіра	*Muscicapa striata*	7	0,06-0,08
47.	Кам’янка звичайна	*Oenanthe oenanthe*	3	0,02-0,03
48.	Кам’янка попеляста	*Oenanthe isabellina*	6	0,05-0,06
49.	Горихвістка чорна	*Phoenicurus ochruros*	2	0,01-0,02
50.	Соловейко східний	*Luscinia luscinia*	2	0,01-0,02
51.	Дрізд чорний	*Turdus merula*	22	0,20-0,22
52.	Дрізд співочий	*Turdus philomelos*	4	0,03-0,04
53.	Синиця блакитна	*Parus caeruleus*	12	0,10-0,12
54.	Синиця велика	*Parus major*	44	0,40-0,45
55.	Горобець хатній	*Passer domesticus*	16	0,15-0,16
56.	Горобець польовий	*Passer montanus*	80	0,77-0,80
57.	Зяблик	*Fringilla coelebs*	33	0,30-0,33
58.	Зеленяк	*Chloris chloris*	6	0,05-0,06
59.	Щиглик	*Carduelis carduelis*	27	0,25-0,27
60.	Коноплянка	*Acanthis cannabina*	5	0,04-0,05
61.	Костогриз	*C.coccothraustes*	7	0,06-0,08
62.	Просянка	*Emberiza calandra*	56	0,54-0,57
Total:			**877**	**1,42 ос./ км^2**

Table 9. The relative number of birds in the area of construction of the OHPL from Substation «DB WPP» to Substation «Posad-Pokrovska» in April-May 2018 (at monitoring points)

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**on 1 km ^{2} (lim)**
1.	Чапля сіра	*Ardea cinerea*	1	0,01-0,02
2.	Лебідь-шипун	*Cygnus olor*	4	0,03-0,04
3.	Лунь очеретяний	*Circus aeruginosus*	1	0,01-0,02
5.	Канюк звичаний	*Buteo buteo*	1	0,01-0,02
6.	Боривітер звичайний	*Falco tinnunculus*	3	0,02-0,03
7.	Куріпка сіра	*Perdix perdix*	1	0,01-0,02
8.	Припутень	*Columba palumbus*	1	0,01-0,02
9.	Одуд	*Upupa epops*	1	0,01-0,02

10.	Дятел звичайний	*Dendrocopos major*	1	0,01-0,02
11.	Ластівка сільська	*Hirundo rustica*	8	0,07-0,08
12.	Жайворонок степовий	*Melanocorypha calandra*	10	0,10-0,11
13.	Щеврик польовий	*Anthus campestris*	3	0,02-0,03
14.	Плиска жовта	*Motacilla flava*	1	0,01-0,02
15.	Плиска біла	*Motacilla alba*	8	0,07-0,09
16.	Шпак звичайний	*Sturnus vulgaris*	14	0,12-0,14
17.	Сорока	*Pica pica*	3	0,02-0,03
18.	Сойка	*Garrulus glandarius*	5	0,04-0,05
19.	Галка	*Corvus monedula*	4	0,03-0,04
20.	Грак	*Corvus frugilegus*	1	0,01-0,02
21.	Ворона сіра	*Corvus cornix*	4	0,03-0,04
22.	Крук	*Corvus corax*	3	0,02-0,03
24.	Кам’янка попеляста	*Oenanthe isabellina*	2	0,01-0,02
25.	Синиця велика	*Parus major*	11	0,10-0,12
26.	Горобець польовий	*Passer montanus*	15	0,13-0,15
27.	Зяблик	*Fringilla coelebs*	92	0,88-0,94
29.	Костогриз	*C.coccothraustes*	3	0,02-0,03
30.	Просянка	*Emberiza calandra*	27	0,25-0,29
	Total:		**228**	**0,53 ос./ км^2**

Premigration clusters of birds - the beginning of autumn migrations (August 2018)

Table 10. Species composition and frequency of bird encounters in the area of construction of the OHPL from Substation «DB WPP» to Substation «Posad-Pokrovska» in August 2018

№	**Species**		**Q-ty meeting**	**Status**	**Type migration**
	Ukrainian name	**Latin name**			
1.	Крижень	*Anas platyrhynchos*	1	Р	D
2.	Лунь лучний	*Circus pygargus*	11	Ф	D
3.	Лунь очеретяний	*Circus aeruginosus*	2	Р	D
4.	Канюк звичаний	*Buteo buteo*	3	Н	D
5.	Боривітер звичайний	*Falco tinnunculus*	12	Ф	D
6.	Мартин звичайний	*Larus ridibundus*	3	Н	O
7.	Мартин жовтоногий	*Larus cachinnans*	11	Ф	O
8.	Крячок річковий	*Sterna hirundo*	6	З	D
9.	Припутень	*Columba palumbus*	3	Н	O
10.	Горлиця звичайна	*Streptopelia turtur*	6	З	D
11.	Горлиця садова	*Streptopelia decaocto*	5	Н	O
12.	Сиворакша	*Coracias garrulus*	3	Н	N
13.	Бджолоїдка звичайна	*Merops apiaster*	12	Ф	D
14.	Одуд	*Upupa epops*	8	З	D
15.	Крутиголовка	*Jynx torquilla*	1	Р	D

№	Species		Q-ty meeting	Status	Type migration
	Ukrainian name	**Latin name**			
16.	Дятел звичайний	*Dendrocopos major*	3	Н	O
17.	Дятел сирійський	*Dendrocopos syriacus*	2	Р	O
18.	Ластівка берегова	*Riparia riparia*	12	Ф	N
19.	Ластівка сільська	*Hirundo rustica*	11	Ф	N
20.	Посмітюха	*Galerida cristata*	11	Ф	O
21.	Жайворонок степовий	*Melanocorypha calandra*	4	Н	O
22.	Плиска біла	*Motacilla alba*	12	Ф	D
23.	Плиска жовта	*Motacilla flava*	7	З	D
24.	Щеврик лісовий	*Anthus trivialis*	3	Н	D
25.	Сорокопуд чорнолобий	*Lanius minor*	8	З	N
26.	Сорокопуд терновий	*Lanius collurio*	5	Н	Z
27.	Шпак звичайний	*Sturnus vulgaris*	12	Ф	Z
28.	Сорока	*Pica pica*	6	З	O
29.	Ворона сіра	*Corvus cornix*	10	Ф	O
30.	Крук	*Corvus corax*	5	Н	O
31.	Кропив'янка сіра	*Sylvia communis*	1	Р	N
32.	Вівчарик весняний	*Phylloscopus trochilus*	3	Н	N
33.	Вівчарик-ковалик	*Phylloscopus collybita*	2	Р	N
34.	Мухоловка мала	*Ficedula parva*	2	Р	Z
35.	Мухоловка сіра	*Muscicapa striata*	3	Н	D
36.	Кам'янка звичайна	*Oenanthe oenanthe*	4	Н	D
37.	Горихвістка звичайна	*Phoenicurus phoenicurus*	2	Р	D
38.	Соловейко східний	*Luscinia luscinia*	2	Р	D
39.	Дрізд чорний	*Turdus merula*	2	Р	D
40.	Синиця блакитна	*Parus caeruleus*	11	Ф	O
41.	Синиця велика	*Parus major*	12	Ф	O
42	Горобець польовий	*Passer montanus*	10	Ф	O
43.	Горобець хатній	*Passer domesticus*	8	З	O
44.	Зяблик	*Fringilla coelebs*	8	З	D
45.	Зеленяк	*Chloris chloris*	6	З	D
46.	Щиглик	*Carduelis carduelis*	6	З	D
47.	Просянка	*Emberiza calandra*	10	Ф	D

Symbols: F – background (met during 9-12 records), C – normal (met during 6-8 records), N – a few (met during 3-5 records); P – rare (met during 1-2 records), N – mostly a night migrant, D – mostly day migrant, Z – mixed type (day + night) type of migration, O – settled species.

Table 11. Number of birds in the area of construction of the OHPL from Substation «DB WPP» to Substation «Posad-Pokrovska» in August 2018 (route records)

№ п/п	**Species**		**Number of individuals**	
	Ukrainian name	**Latin name**	**абс. (lim)**	**on1 km ^{2} (lim)**
1.	Крижень	*Anas platyrhynchos*	10	0.08-0,10
2.	Лунь лучний	*Circus pygargus*	27	0,25 -0,27
3.	Лунь очеретяний	*Circus aeruginosus*	10	0,08-0,10
4.	Канюк звичаний	*Buteo buteo*	3	0,02-0,03
5.	Боривітер звичайний	*Falco tinnunculus*	22	0,20-0,22
6.	Мартин звичайний	*Larus ridibundus*	33	0,30-0,33
7.	Мартин жовтоногий	*Larus cachinnans*	37	0,35-0,37
8.	Крячок річковий	*Sterna hirundo*	13	0,11-0,13
9.	Припутень	*Columba palumbus*	4	0,04-0,06
10.	Горлиця звичайна	*Streptopelia turtur*	8	0,06-0,08
11.	Горлиця садова	*Streptopelia decaocto*	6	0,04-0,06
12.	Сиворакша	*Coracias garrulus*	4	0,03-0,04
13.	Бджолоїдка звичайна	*Merops apiaster*	59	0,57-0,60
14.	Одуд	*Upupa epops*	8	0,06-0,08
15.	Крутиголовка	*Jynx torquilla*	1	0,01-0,02
16.	Дятел звичайний	*Dendrocopos major*	2	0,01-0,02
17.	Дятел сирійський	*Dendrocopos syriacus*	1	0,01-0,02
18.	Ластівка берегова	*Riparia riparia*	80	0,78-0,81
19.	Ластівка сільська	*Hirundo rustica*	260	2,57-2,61
20.	Посмітюха	*Galerida cristata*	22	0,20-0,22
21.	Жайворонок степовий	*Melanocorypha calandra*	70	0,67-0,70
22.	Плиска біла	*Motacilla alba*	12	0,10-0,12
23.	Плиска жовта	*Motacilla flava*	18	0,16-0,18
24.	Щеврик лісовий	*Anthus trivialis*	3	0,02-0,03
25.	Сорокопуд чорнолобий	*Lanius minor*	11	0,09-0,11
26.	Сорокопуд терновий	*Lanius collurio*	6	0,04-0,06
27.	Шпак звичайний	*Sturnus vulgaris*	500	4,95-5,00
28.	Сорока	*Pica pica*	8	0,07-0,08
29.	Ворона сіра	*Corvus cornix*	14	0,11-0,14
30.	Крук	*Corvus corax*	10	0,07-0,10
31.	Кропив’янка сіра	*Sylvia communis*	1	0,01-0,02
32.	Вівчарик весняний	*Phylloscopus trochilus*	2	0,01-0,02
33.	Вівчарик-ковалик	*Phylloscopus collybita*	7	0,5-0,07

№ п/п	Species		Number of individuals	
	Ukrainian name	**Latin name**	**абс. (lim)**	**on1 km ^{2} (lim)**
34.	Мухоловка мала	*Ficedula parva*	6	0,04-0,06
35.	Мухоловка сіра	*Muscicapa striata*	8	0,06-0,08
36.	Кам'янка звичайна	*Oenanthe oenanthe*	5	0,4-0,05
37.	Горихвістка звичайна	*Phoenicurus phoenicurus*	2	0,01-0,02
38.	Соловейко східний	*Luscinia luscinia*	2	0,01-0,02
39.	Дрізд чорний	*Turdus merula*	1	0,01-0,02
40.	Синиця блакитна	*Parus caeruleus*	14	0,11-0,14
41.	Синиця велика	*Parus major*	18	0,16-0,18
42	Горобець польовий	*Passer montanus*	10	0,08-0,10
43.	Горобець хатній	*Passer domesticus*	9	0,07-0,09
44.	Зяблик	*Fringilla coelebs*	73	0.70-0,73
45.	Зеленяк	*Chloris chloris*	34	0,30-0,34
46.	Щиглик	*Carduelis carduelis*	19	0,16-0,19
47.	Просянка	*Emberiza calandra*	37	0,35-0,37
Total:			**1510**	**1,45 ос./ км ^{2}**

Table 12. The relative number of birds in the area of construction of the OHPL from the Substation «DB WPP» to the Substation «Posad-Pokrovska» in August 2018 (at monitoring points)

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**abs. (lim)**	**on 1 км ^{2} (lim)**
1.	Бджолоїдка звичайна	*Merops apiaster*	50	0,48-0,50
2.	Одуд	*Upupa epops*	1	0,01-0,02
3.	Ластівка берегова	*Riparia riparia*	10	0,08-0,10
4.	Ластівка сільська	*Hirundo rustica*	20	0,17-0,20
5.	Посмітюха	*Galerida cristata*	2	0,01-0,02
6.	Жайворонок степовий	*Melanocorypha calandra*	4	0,03-0,04
7.	Плиска біла	*Motacilla alba*	2	0,01-0,02
8.	Плиска жовта	*Motacilla flava*	27	0,25-0,27
9.	Щеврик лісовий	*Anthus trivialis*	1	0,01-0,02
10.	Сорокопуд чорнолобий	*Lanius minor*	3	0,02-0,03
11.	Сорокопуд терновий	*Lanius collurio*	11	0,08-0,11
12.	Шпак звичайний	*Sturnus vulgaris*	200	1,96-2,05
13.	Сорока	*Pica pica*	1	0,01-0,02
14.	Ворона сіра	*Corvus cornix*	1	0,01-0,02
15.	Крук	*Corvus corax*	7	0,05-0,07
16.	Кропив'янка сіра	*Sylvia communis*	1	0,01-0,02
17.	Мухоловка сіра	*Muscicapa striata*	2	0,01-0,02
18.	Кам'янка звичайна	*Oenanthe oenanthe*	1	0,01-0,02
19.	Горихвістка звичайна	*Phoenicurus phoenicurus*	1	0,01-0,02

№	Species		Number of individuals	
	Ukrainian name	**Latin name**	**abs. (lim)**	**on 1 км^2 (lim)**
20.	Соловейко східний	*Luscinia luscinia*	2	0,01-0,02
21.	Дрізд чорний	*Turdus merula*	3	0,02-0,03
22.	Синиця блакитна	*Parus caeruleus*	2	0,01-0,02
23.	Синиця велика	*Parus major*	11	0,08-0,11
24.	Горобець польовий	*Passer montanus*	40	0,37-0,40
25.	Горобець хатній	*Passer domesticus*	5	0,03-0,05
26.	Зяблик	*Fringilla coelebs*	3	0,02-0,03
Total:			**462**	**0,44 ос./ км^2**

Annex N. MONITORING PLAN FOR BIRDS

AIM OF MONITORING – expert assessment of impacts of wind turbines on birds population of territory where the installation of «Dnepro-Bugsky wind power plant» is planned.

MAIN METHODOLOGY OF MONITORING – systematic counting of birds during all seasons of year – spring migration, nesting, after nesting and autumn migration, wintering.

BASE OF MONITORING – map of monitoring area on which the boundaries of all available biotopes are indicated (with indication of their area), scheme existing or projected WTs and Power Lines.

EQUIPMENT – optical devices for observing by birds (binoculars 10-20-fold, telescopes tubes x20-x60), long-focus optics cameras, GPS devices, radar.

GENERAL METHODOLOGY OF FIELD WORKS (RESEARCHES)

All territory of site (all available biotopes, strips along the boundaries of projected areas (lines) for the installation of wind turbines) must be researched (covered by countings).

Before the beginning of field works, the description of all isotopes, their areas, landscape features, anthropogenic loading and expected threats to birds is carrying out.

With the help of the device, fixs the coordinates of the counting areas – by perimeters, checkpoints – in the place of laying point, route lines – at the beginning, at the finish, and also every 100-300 m. The length of the route in each biotope – 2 km. This length may varies depending on the size of biotopes, but it should by sufficient for obtaining of representation data about birds in described biotope. Counting route allows to obtain information about spreading of background species on the territory. In places of birds accumulation, the point counting is carrying out. If the area is large, then on the route, such points for the counting of birds accumulation are made every 2 km. Searches for small numbers and rare species require special extra outputs.

Placed route lines and checkpoints must be mapped. For the registration of the migration of birds, the flight of which occurs above 200 m, the radar is use.

WINTER PERIOD

Features: unequal distribution of birds, they are mainly moved by large flocks, and concentrates on the places where they find the most food.

The main species of birds: main species of birds in winter period is small sparrow-like birds – Carduelis cannabina, Fringilla coelebs, Emberiza citrinella, Spinus spinus, Chloris chloris, etc). The clusters form goose-like and other wintering wetlands birds. An important component, both in terms of species and in absolute numbers, is predatory birds (*Haliaeetus albicilla, Accipiter gentilis, Accipiter nisus, Buteo lagopus, Buteo buteo, Circus cyaneus, Falco columbarius, Falco peregrinus, Falco cherrug*), which hunts both on wetland and small sparrow-like birds, and on small rodents that populate the fields.

Important biotopes: beveled fields of grain crops, corn, sunflower, perlholy, field windbreaks, inland water bodies, seaside.

Methodical recommendations: counting of birds by route and / or point method.

Counting can be done throughout the entire daylight hours. It is desirable to avoid countings during severe frosts, winds and snow. In the conditions of deep snow cover, it is advisable to pay attention to the crossings, of the corn and sunflower fields, as well as field windbreaks - in these biotopes the highest concentration of birds will be observed. To track the dynamics of the winter population of birds, it is expedient to set up monitoring routes, which are used to keep records of birds once per month. The number of such routes depends on the size of the surveyed area. They should be laid in such a way that they represent the territory to be surveyed, ideally - in percentage terms, the length of the monitoring routes in different biotopes should correspond to the percentage of these biotopes in the area where the evaluation is required. It is also important that monitoring routes cover the important biotopes of birds during this period. The accounts on these routes need to be conducted at regular intervals once a month, but to take into account the influence of weather conditions. In the windbreaks, the absolute bird record is carrying out on the route, with future recalculation of density of the birds population ‒individuals per 1 km of the route. In open landscapes, the recount is spent on 1 km².

PERIOD OF SPRING MIGRATION

Features: the individual observations with certain period of time are not important in this period. During period of spring migration it is necessary to carrying out full study of the migration, with its terms, peaks, species composition and number of migrants, main directions and height of flight to assess the potential impact of wind power plants on migratory birds. The full coverage of all waves of migrants requires daily observation at a point (route) for at least 30 days - during this time, the probability of skipping the main migrants is minimal. Usually intensive migration begins in mid-March and lasts until mid-May, but weather conditions are significantly affected on this process. A frosty weather in March may lead to shifting migration terms of certain species on the beginning of April, but then the migration will be more intensively, and the period of migration will be reduced. Sudden cold weather forces the birds to stay on forage areas, sometimes up to two weeks.

The main species of birds: all species migration of which passes through «DB WPP» territory – representatives of the Order Pelecanus, Ciconiidae, Anseriformes (*Anser albifrons, Anser fabalis, Anser anser, Cygnini*, different types of ducks, etc.), Falconiformes, Galliformes, Gruiformes, Pluvialis apricaria, Piciformes, small birds of the Order Passeriformes. Important biotopes: pods (there is a concentration of migratory clusters of crane), winter rape and cereals (there is observed gooses and crane), reservoirs.

Methodical recommendations: to study migration the methodology of E.Kumari is used (1955, 1979). Its main provisions are set out below.

Duration of observations – 8 hours per day: 4 hours in the morning and 4 hours in evening. Morning observations begins half an hour before sunrise and spend at one and the same point, and evening observations completes with the sunset and spend on the route. The observation point is selected within the surveyed area, but if possible on the so-called "Guiding line" (river valley, banks of internal reservoirs, mountain ranges, hills, seacoast), which will direct birds in a certain direction. It should be located in a place where the territory is well looked. Observations during each hour recorded individually, and list of species start from the beginning individually for each hour. Observation on constant evening route complements observation at the point. Evening route should be constant, and the return path must differs with counting route. It is better to loop the route, moves in one direction with speed 1,2-1,5 km/hour. Migration of day predator birds happens mainly in day. It means that, on the period of the 2-3 hours from the 14 to the 18 o'clock, at conditions of good weather, and due to reduced time in the morning hours, the intensive flight (migration) of day predator birds may be observed.

NESTING PERIOD

Features: birds are territorial, movements are insignificant and only for the purpose of seeking food.

Main species of birds: nesting species of birds of the wetlands, open landscapes exposed to disturbances in places where wind turbines are installed; predatory birds that hunt there.

Important biotopes: wetlands, open landscapes in places where wind turbines will be installed, windbreaks nearby for identification of nests of the prey birds, that can hunting on open landscapes, and fall under the blade.

Methodical recommendations: counting of bird nests it is expedient to carry out on monitoring routes 2 times per month, for identification of all nesting species. Counting must based on the principle of winter counting routes, but taking into account the fact that birds are kept on permanent sites. Birds counting is carrying out in the morning (from the 5 to the 10 o'clock) in the conditions of good weather – absence of strong rain, wind, etc. Counting in daily hours, for the registration of day predatory birds, which are active mainly in the afternoon, and evening counting for observation of *Crex crex, Perdix perdix*, and other species, the peak of which is in the evening hours are necessary. The countings of birds in the windbreaks can be carried out along the edge, if the windbreaks is loose, and in the center of the windbreaks, if it is dense and has several rows. The population density of birds is presented in pairs per 1 km of route for the windbreaks, in pairs on 1 km² of territory for open landscapes.

AFTER NESTING PERIOD AND AUTUMN MIGRATION PERIOD

Features: birds move from place to place, but these movements, unlike spring migration, are not intense, they may be delayed in a certain area for a long time if they find enough food there. Main species of birds: representatives of the Order Pelecanus, Ciconiidae, Anseriformes (Anser albifrons, Anser fabalis, Anser anser, Cygnini, different types of ducks, etc.), Galliformes, Gruiformes, Charadriiformes, which are actively moving, including through the land from the reservoir to the reservoir; Falconiformes, which during this period are the most vulnerable, since they climb over open landscapes, slowly moving, and therefore can easily get on a blade; small birds of the Order Passeriformes in this period, move large flocks (Sturnus vulgaris, Fringillidae, Emberiza citrinella, etc).

Important biotopes: agricultural landscapes, first of all−beveled fields, as well as crossings and other open landscapes, internal reservoirs, seaside.

Methodical recommendations: counting of birds on monitoring sites (routes)−point or route. Migration during this period is not intense, therefore, point records should be conducted only in the days favorable to it. At other times it is expedient to conduct route records, trying to reach different biotopes within the territory where WPP will be placed, to assess the impact of WTs on different groups of birds. Study of bay predatory birds migration should be carried out from 14 to 18 o'clock, when the flight of these species occurs most intensively. It is important to estimate the altitude and direction of migration for all species.

SCHEDULE OF WORK BY MONTHS

Month	Type of works	Number of days	Number of field hours per day	Total number of field hours
December	Counting of birds on monitoring routes one times per month	7	6	30
January	Counting of birds on monitoring routes one times per month	7	6	30
February	Counting of birds on monitoring routes one times per month	7	6	30
March	Counting of migratory birds on point (route)	20	8	160
April	Counting of migratory birds on point (route)	20	8	160
May	Counting of birds on monitoring routes 2 times per month with interval 2 weeks	2x7	6	84
June	Counting of birds on monitoring routes 2 times per month with interval 2 weeks	2x7	6	84
July	Counting of birds on monitoring routes one times per month	10	6	60
August	Counting of birds on monitoring routes one times per month	10	6	60
September	Counting of migratory birds on point (route) with interval 2 weeks	10+10	6	120
October	Counting of migratory birds on point (route) with interval 2 weeks	10+10	6	120
November	Counting of migratory birds on point (route)	10+10	6	120
Total		169 days	1058 hours	

Annex O. MONITORING PLAN OF IMPACT OF THE «DNEPRO-BUGSKY WIND POWER PLANT («DB WPP») ON BATS POPULATIONS

MONITORING PROGRAM

Monitoring Program is developed with using of special guidance documents designed to study the impact of wind energy on the death of bats (Guidelines for Consideration of Bats in Wind Farm Projects Revision 2014; Comprehensive Guide to Studying Wind Energy/Wildlife Interactions. Prepared for the National Wind Coordinating Collaborative, Washington, D.C., USA. 2011; Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions, 2010). In general, the planned work is limited to search of dead animals, documenting of necessary information,collection of dead animals, and analysis of receive information that are source for preparing of recommendations.

Monitoring Program foresees two types of field studies:

Searching of dead animals: Documenting of information about bats death because of collision with WTs (during the year, especially in spring and autumn periods);

Research of natural factors (impacts of environment, climatic conditions, impacts of predators) and their impact on results of dead bats searches.

General methodology of searching researches

It is recommended to search dead bats by one group during monitoring period. Such approach is used for minimization of bias due to different search capabilities. Types of searching will be described below.

Searching of dead animals: Documenting of information about bats death because of collision with WTs.

Researches of bats mortality foresees regular searching of dead animals by whole area of WTs location. Such researches allows to define number of dead bats during a certain amounts of time. Searches of dead animals should begin in the morning with the sunrise and continues until sunset.

Carcass searches should consider the following:

The sub-sample of wind turbines that are monitored should include all habitat types and any significant wildlife habitat present at the site, and should cover the spatial distribution of the wind turbines. Wind turbines should be selected through a scientifically defensible system (e.g. stratification);

The time required to search each turbine will vary depending on the surrounding habitat (e.g. open field vs. forest, etc.) and individual searchers, but searchers should aim for a consistent search time for all surveyed turbines (e.g. 20 minutes per turbine);

Each surveyed turbine should have a search area that has a 50 m radius;

Within this 50 metre radius, the search area should be examined using transects 5.0 – 6.0 metres apart allowing for a visual search of 2.5 – 3.0 metres on each side. The search area may be rectangular, square or circular depending on turbine locations and arrangements and surrounding terrain

The search area of each turbine will be mapped into visibility classes according to Table 1. It is recommended that those turbines where the majority of the search area would not be searchable due to vegetation cover or other impediments (e.g. Visibility Class 4) should not be included in the sub-sample of monitored turbines

Table 1. Determination of Visibility Class

% Vegetation Cover	Vegetation Height	Visibility Class
≥90% bare ground	≤ 15 cm tall	Class 1 (Easy)
≥ 25% bare ground	≤ 15 cm tal	Class 2 (Moderate)
≤ 25% bare ground	≤ 25% > 30cm tall	Class 3 (Difficult)
Little or no bare ground	≥ 25% > 30cm tall	Class 4 (Very difficult)

Where possible, ground cover around turbines should be maintained at a low level in order to facilitate more accurate bat mortality surveys.

Application of additional tools and methods of search in complex habitats (dense or high vegetation, forest, reservoirs) are probable. All carcasses found should be photographed and recorded/labelled with species, sex, date, time, location (UTM coordinate), carcass condition, searcher, injuries, ground cover, and distance and direction to nearest turbine. Collected data (for each individual research) must be presented in individual report (card) and contain data about state of each collected carcasses of bats. in particular:

1) whole carcass, without signs of damage from predators, but may have signs of damage from collision with a wind turbine;
2) carcasses with signs of damage from predators, or parts (wings, skeletal remains, limbs) found in several places. All data sheet sample should be provided in the mortality report.

The estimated number of days since death, and condition of each carcass collected should be recorded in one of the following categories:

– fresh;
– early decomposition;
– moderate decomposition;
– advanced decomposition;
– complete decomposition;
– scavenged.

Researches of natural factors (impacts of environment, climatic conditions, impacts of predators) and their impact on results of dead bats searches.

The main factors that appear to contribute to bat mortality at wind power projects are time of year, species, habitat or landscape features in the area, and weather conditions, including wind speed. Bat mortality at wind power sites occurs primarily in the late summer and early fall. Long-distance migratory bats (i.e. hoary bat, eastern red bat, silver-haired bat) typically comprise the majority of bat fatalities. Weather conditions may influence the level of bat activity and consequent mortality at wind power sites. Warm clear nights with low wind have been associated with higher bat activity.

This factor can have an impact on the underestimation of the death rate of bats caused by wind turbines. Research of bats dead because of collision with eind turbines is carried out by "spreading" a certain number of dead animals (for example 10-20) within the studied area (on test areas), and subsequent daily checks to understand the speed of their "disappearance" (decomposition or picking up by predators, etc.). These works should be carried out according to the seasonal characteristics of the territory and populations of the animals that live here and can have an impact on the results. Below are some important considerations for researching of natural factors and their impact on results of dead bats searches:

Spreading of dead animals (bats) should be conducted at least once a season (spring, summer, fall), during the same period as the bird mortality surveys. Trials should be conducted once per month if vegetation changes occur during the season (e.g. crops grow, harvest, etc.).

A minimum of 10 carcasses should be used for each trial:

- Carcasses should be placed before dusk using gloves and boots to avoid imparting human smellthat might bias trial results (e.g. attract scavengers, etc.)
- Carcasses should be monitored every 3-4 days in conjunction with carcass searches.
- Carcass removal trials should be conducted in a variety of weather conditions.
- Weather conditions should be recorded.
- Carcasses should be placed before dusk using gloves and boots to avoid imparting human smellthat might bias trial results (e.g. attract scavengers, etc.)
- Trials should continue until all carcasses are removed or have completely decomposed (generally for 2 weeks)
- To avoid confusion with turbine-related fatalities, trial carcasses should be discreetly marked (e.g.clipping of ear, wing leg, fur; hole-punching ear; etc.) with a unique identification, so they can beidentified as trial carcasses
- Carcasses used for researches should be as fresh as possible since frozen or decomposed carcasses are less attractive to scavengers. If frozen carcasses are used, they should be thawed prior to beginning carcass removal trials.

Schedule of dead bats search

Recommended schedule of dead bats search is develop in accordance to the recommendations of BATS AND BAT HABITATS Guidelines for Wind Power Projects, OMNR, 2011:

- Period of spring migration (April / May - mid June). Searches of dead animals performs twice per week;
- The breeding season (June – August). Searches of dead animals performs one time per week;
- Period of autumn migration (August – October). Searches of dead animals performs twice per week.

At the condition of small number of bats mortality, the term two years is sufficient for conducting of post-construction monitoring in order to study the degree of impact of wind turbines on the death of bats. In the opposite case, the monitoring term may be extended.

During carrying out these works it is necessary to use gloves. For collection and accumulation of dead bats the special thermo bags are use.After collection and accumulation, the dead animals should be moved to a freezer.

After collection, it is necessary to wash hands, and put gloves in the garbage can.

Researches of habitats and forage areas

Researches of habitats and forage areas must performs 1-2 times during the season of reproduction: search of natural repositories of bats (July), passive acoustic review (July-August), search and definition of migration routes (August-September).

Reporting

According to the results of the conducted studies at the end of November, a detailed report in accordance with the above-described content will be presented.Report will be discussed with Customer. In case of necessity, the additions and remarks to the Monitoring Program for the next period will be made.

Management

After submission and discussion of the Reporting documentation, the necessary management measures, in particular measures to mitigate the effects on bats will be determined (in case of necessity).

Future researches will be focuses on identified factors, and development of ways to overcome them, in particular on increasing the number of field studies to accelerate the adoption of necessary decisions.

Potential compensatory measures (in case of necessity) will be relate to periods of the year that are critical to bats, such as migration and reproduction periods. Compensatory measures can include: shutdown of individual problem wind turbines or their reconstruction (such as equipping of turbines by ultrasonic devices to scare animals); variable speed of blades rotation, constant remote monitoring.

Annex P. PHOTOS OF ARCHEOGICAL RESEARCH