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REPORT ON THE IMPACT ON THE ENVIRONMENT FOR THE PROJECT "CONSTRUCTION OF SĘPOPOL WIND FARM" RÓŻYNA AND ŚMIARDOWO PRECINCTS, SĘPOPOL COMMUNE

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1.0 SUMMARY IN NON- SPECIALIST LANGUAGE

This report is an appendix necessary to obtain the decision on environmental conditions of the permit for the implementation of the project "Sępopol Wind Farm" (in Polish: "Farma Wiatrowa Sępopol"). The farm is located in Warmińsko-Mazurskie voivodeship, Bartoszyce poviat, Sępopol commune. The wind farm, with a total capacity of 60 MW, will consist of 30 wind power plants with the GPZ (Główny Punkt Zasilający – transformer station), located in the Sępopol commune, on the following plots:

- In the Różyna precinct, plots: 217/2 , 256/3 , 337/4,
- in the Śmiardowo precinct, plots: 254, 27/10, 30/37, see

(Map 3 – appendix 4).

The project implementation involves the construction of 30 ENERCON E - 82 2000 kW wind power plants and a GPZ transformer station.

In addition, the project also provides for the implementation of the necessary accompanying infrastructure within the scope of:

- technological roads for the time of construction, exits from these roads to public roads and the repair of parts of commune roads intended for the transportation of elements of the power plant – appendix 6,
- exits from voivodeship, county and commune roads to technological roads, for the time of construction and installation of wind turbines,
- repair of part of the commune roads in order to ensure the parameters required for safe transportation of elements of towers and power plants,
- connection of power plant towers with GPZ transformer station through internal MV cable lines and fiber optic network – appendix 7, on the following plots:
- in the Różyna precinct 328, 337/10, 300, 301/1, 301/2, 301/3, 303,
- in the Kinwągi precinct 119, 126/1, 126/2, 127, 143,
- in the Śmiardowo precinct 19/1, 24/42, 28/3, 29, 31,101.

Three options of the planned project were considered, option 0 – no construction, option 1 – implementation of the project with the assumptions proposed by the investor 74 turbines according to the first proposal of the wind power plant layout in the field provided by the investor (Map 1 and 2, appendix 4) and option 2 – implementation of the project according to the second proposal of the wind power plant

layout in the field provided by the investor (Map 3, appendix 4). The assessment of the options is presented in section 7.0 of this report.

The commune does not have a valid local spatial development plan, therefore the investor applied to the Sępopol commune for a decision on the location of the public purpose investment and obtained such a decision.

The project implementation scope of work will include the following elements:

- execution of excavations and construction of foundations,
- construction of temporary necessary access roads with assembly yards,
- installation of the wind power plant by a specialized team,
- execution of excavations and laying of sections of underground power cable,
- construction of power and telecommunication links,
- transportation of construction elements and materials
- construction of the GPZ transformer station.

The report analyzes the impact of the project on the following elements of the environment for the stage of construction, operation and potential decommissioning:

- impact on the state of ambient air quality,
- the impact on acoustic climate,
- impact on the level of vibration in the environment,
- impact on electromagnetic radiation,
- impact on groundwaters and surface waters,
- impact on soil and woodlots condition,
- impact on human health,
- impact on avifauna and natural environment,
- impact on bats,
- waste management,
- extraordinary threats to the environment,
- cross-border impact,
- the use of natural resources
- landscape alterations,
- the interdependence of individual factors,

- monitoring recommendations.

Due to the nature of the proposed project, it was determined that the main elements of negative environmental impacts during the operational phase could be:

- threat to the acoustic climate,
- electromagnetic radiation,
- impact on avifauna and natural environment,
- impact on bats.

As a result of calculations and acoustic analysis for the assumed number and location of wind power plants, it is forecast that the construction of the analyzed wind farm will not affect the acoustic climate in a manner posing a threat to the surrounding acoustically protected areas, provided that during the phase of technical project development the assumptions and data accepted for calculations in this report are met, according to Table 2, point 5.2.2 of the report

– analyzed option 2 of the project. This refers primarily to the use of turbines with acoustic power levels not exceeding the values from the cited Table 2 for the maximum wind speed and maintaining the location adopted for the analysis (option 2) – Noise Map 3, appendix 4 and tower height not less than 108 m.

A noise hazard analysis was conducted in point 5.1.2 (construction phase), point 5.2.2 (operations phase), and in point 5.3.2 (decommissioning phase).

It is forecast that in the area of the investment and its surroundings there will be no electromagnetic fields with intensity higher than acceptable, which could pose a threat to humans and the environment. Thus, no threat due to exposure to electromagnetic fields is anticipated.

Electromagnetic field threats are discussed in point 5.2.4.

It has also been shown that construction of the wind power plant will not affect the character of use of the adjacent area. With the exception of sections of access roads to the wind power plant and the area occupied by foundations, the remaining area will be used in a similar manner as before – agricultural crops.

The report also shows that the project of wind power plant construction will have no negative impact on all other elements of the environment, less important for the analyzed investment, both at the stage of construction, operation and potential decommissioning.

It should be emphasized that construction of each new wind farm brings with it a measurable environmental effect (clean energy) and meets the current environmental protection policy. The creation of new renewable energy sources is also

in line with the recommendations and policies for renewable energy generation in the Member States of the European Union.

Wind power plants are specific objects that change the landscape, and their location is always perceived subjectively. Therefore, the authors of the report do not exclude the possibility of local social conflicts associated with the planned project – see point 13 of the report. All ambiguities and inquiries of interested parties regarding the implementation of the investment should be clarified in accordance with current regulations at the public consultation stage.

It is also important to note that the implementation of the project will bring positive economic effects for the Sępopol commune, and thus also for its residents.

The implementation of the project will require good organization of heavy traffic associated with the construction period, transport of concrete during the pouring out of foundations and transport of structural elements of wind power plants.

The analysis of threats for avifauna and Natura 2000 protected areas performed by Prof. Przemysław Busse, chap. 5.2.10.2 has shown as follows:

1. The presented results of monitoring indicate that the discussed farm is characterized by average avifauna values in general.
2. In the area covered by the analysis, bird collision rates, estimated considering local conditions, are at average level. The farm at this location will not pose a significant collision hazard to birds. Both fields received an average (Spurgle) or good (Różyny) qualification.
3. The farm does not pose a threat to the species which the Natura 2000 Ostoja Warminska region was designed for, as well as to other protection areas in the distant surroundings.
4. No cumulative impact or barrier effect issues are anticipated.

The analysis of the impact of the farm on bats, chap. 5.2.11 has shown as follows:

1. The results of the screening allow the exclusion of the location of the "Sępopol" – Różyna/Pasławki wind farm project as an investment, where the risk of a significant negative impact on key species listed in appendix no. 1 to the Regulation of the Minister of Environment of 28 September 2004 *on the species of wild animals under protection* (Journal of Laws, No. 220, item 2237) could be very high.
2. Based on the recordings already made, only the species of bats from the vesper group *(Vespertilionidae*) were found.

In conclusion it is stated that the location of the analyzed wind farm, due to its impact on the widely understood environment, receives a positive opinion.

2.0 INTRODUCTION

2.1 Subject of the report

The subject of the report is the environmental impact report for the project “Sępopol Wind Farm”. The farm is located in Warmińsko-Mazurskie voivodeship, Bartoszyce county, Sępopol commune, in Różyna and Śmiardowo precincts. The investment assumptions provide for the construction of 30 wind power plants on plots with the registration numbers:

- Różyna precinct – plot 217/2 – 11 units, power plant no. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and GPZ transformer stations, plot 256/3 – 3 units, wind power plant no. 12, 13, 14, plot 337/4 – 1 unit, wind power plant no. 15,
- Śmiardowo precinct – plot 254 – 7 units, wind power plant no. 16, 17, 19, 23, 24, 25, 26, plot 27/10 – 4 units, wind power plant no. 30, 31, 32, 33, plot no. 30/37 – 4 units, wind power plant no. 34, 35, 36, 52.

2.2 Purpose and scope of the report

The purpose of this environmental impact report is to analyze the threat to individual elements of the environment and to determine the environmental impact findings in connection with the planned scope of implementation of the assumed investment program.

The scope of the report includes an analysis of potential environmental nuisances, taking into account the basic technical and technological data of the wind power plants to be installed.

This assessment presents, among other things:

- determination of the impact on the basic elements of the environment at the stage of construction, exploitation and possible decommissioning of the investment in question,
- the analysis of the effectiveness of the proposed ways to minimize the negative impact on the environment for the technical, technological and location solutions planned by the investor,
- the impact of the project or structures on people and basic elements of the environment and on land development,
- the risks and benefits of the project for other users of the environment and the effects on the environment in the area of the anticipated impact,
- the analysis of potential social conflicts.

The prepared environmental impact report is an attachment necessary to obtain the decision on environmental conditions of the permit for the construction of the wind farm.

2.3 Formal and legal basis for the report

The formal and legal basis for the execution of this report is provided by the following main legal acts:

- Act dated 27.07.2001 on introduction of the act – Environmental Protection Law, Act on Waste and on amending certain acts (Journal of Laws 2001, No. 100, item 1085),
- Proclamation of the Marshal of the Polish Sejm of 20.01.2008 on announcement of the consolidated text of the act – Environmental Protection Law (Journal of Laws 2008 No. 25, item 150),
- Act dated 3.10.2008 on making available of information on environment and its protection, public participation in environmental protection and environmental impact assessments (Journal of Laws 2008 no. 199 item 1227),
- Act dated 3.06.2005 – on amendment of the Water Law Act and certain other acts (Journal of Laws 2005, No. 130 item 1087),
- Proclamation of the Marshal of the Polish Sejm dated 18.11.2005 on

announcement of the consolidated text – Water Law Act (Journal of Laws 2005, No. 239, item 2019 as amended),

- Regulation of the Council of Ministers dated 9.11.2004 on determining types of projects which could have a significant impact on environment and on detailed criteria connected with classifying the project to develop the environmental impact report (Journal of Laws 2004, No. 257, item 2573),
- Regulation of the Council of Ministers dated 10.05.2005 amending the regulation on determining types of projects which could have a significant impact on the environment and on detailed criteria connected with classifying the project to develop the environmental impact report (Journal of Laws 2005, No. 92, item 769),
- Regulation of the Council of Ministers dated 21.08.2007 amending the regulation on determining types of projects which could have a significant impact on the environment and on detailed criteria connected with classifying the project to develop the environmental impact report (Journal of Laws 2007, No. 158, item 1105),
- Act dated 27.03.2003 on planning and spatial development (Journal of Laws 2003 no. 80 item 717 as amended),
- Act dated 7.07.1994 Construction Law (Journal of Laws 1994 no. 89, item 414 as amended),
- Proclamation of the Marshal of the Polish Sejm of 17.08.2006 on announcement of the consolidated text of the Act – Construction Law (Journal of Laws 2006, No. 156, item 1118),
- Act dated 16.04. 2004 on environmental protection, consolidated text (Journal of Laws 2004, No. 92, item 880, as amended),
- Act dated 27.04.2001 on waste (Journal of Laws 2001, No. 62, item 628, as amended),
- Act of 10.03.2006 amending the Act on amending the Act on waste and on amending certain acts (Journal of Laws 2006, No. 63, item 441),
- Regulation of the Minister of Environment dated 24.07.2006 on the conditions which must be met when introducing sewage to water or soil as regards substances particularly hazardous to the aquatic environment (Journal of Laws 2006, no. 137, item 984),
- Regulation of the Minister of Environment dated June 14, 2007 on permissible noise levels in the environment, Journal of Laws No. 120, item 826,

- Regulation of the Minister of Environment dated 6.06.2002 on admissible levels of some substances in the air, alarm levels of some substances in the air and margin of tolerance for admissible levels of some substances (Laws Journal 2002, No. 87, item 796),
- Regulation of the Minister of Environment dated 5.12.2002 on reference values for certain substances in the air (Journal of Laws 2003, No. 1, item 12),
- Regulation of the Minister of Environment on acceptable levels of electromagnetic fields in the environment and methods for verification of meeting these levels, dated October 30, 2003 – Journal of Laws no. 192 item 1883.
- Regulation of the Council of Ministers dated May 16, 2005 on the types of natural habitats and plant and animal species requiring protection in the form of designation of Natura 2000 areas (Journal of Laws No. 94 item 795).
- Regulation of the Minister of Environment dated September 5, 2007 amending the regulation on Natura 2000 special protection areas for birds (Journal of Laws No. 179 item 1275).
- Directive 85/337 EEC dated 27.06.1985 on the assessment of the effects of certain public and private projects on the environment,
- European Commission Directive 97/11/EC dated March 3, 1997 amending Directive 85/337 EEC,
- Directive of the European Parliament and of the Council 2001/77/EC dated September 27, 2001 on the promotion of electricity produced from renewable energy sources in the internal energy market.
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) (Journal of Laws of 1996, No. 58 items 263, 264),

2.4 Classification of the investment

The planned construction of the wind farm is an investment classified as a project that may have a significant impact on the environment, for which a report may be required, according to § 3.1. item 6 of the Regulation of the Minister of Environment dated 9 November 2004 on determining types of projects which could have a significant impact on the environment and on detailed conditions connected with classifying the project to develop the environmental impact report (Journal of Laws No. 257, item 2573, as amended).

In view of the above, the Mayor of Sępopol in decision GI. III. 7627/12/08, dated August 26, 2008, stated the necessity to prepare an environmental impact report for the investment project in question (appendix 1).

2.5 Non-technical description of the project

The location of the wind farm is illustrated in appendix 2 – location of the wind farm. At this stage of the analysis, the following initial assumptions were adopted for the wind farm construction project, which must be maintained at the stage of performing the final technical design:

- location of individual power plants (plot numbers with specific foundation points adopted for the analysis), according to the cadastral map provided by the investor, constituting an appendix to the application for issuing the decision on environmental conditions of the permit for the implementation of the project,
- wind turbine type ENERCON E-82 2000 kW,
- tower height H_w = 108.0 m,
- acoustic power level 104,0 dBA – appendix 3.

In addition, the project provides for the implementation of the necessary accompanying infrastructure within the scope of:

- technological roads for the time of construction, exits from these roads to public roads and the repair of parts of commune roads intended for the transportation of elements of the power plant,
- exits from voivodeship, county and commune roads to technological roads, for the time of construction and installation of wind turbines,

- repair of part of the commune roads in order to ensure the parameters required for safe transportation of elements of towers and power plants,
- connection of power plant towers with GPZ transformer station through an internal MV cable lines and fiber optic network.

3.0 CURRENT TRENDS IN RENEWABLE ENERGY PRODUCTION

Following the entry into force of Directive No. 2001/77/E, on the promotion of electricity produced from renewable energy sources, negotiations were carried out in the internal electricity market in the area of energy.

As a result of preliminary negotiations, so-called indicative targets for renewable energy development were set for each accession country. For Poland, this target was set at 7.5% of electricity from RES, in the national balance of electricity consumption in 2010. Currently there are talks about obliging the EU Member States to produce 20% of energy from renewable sources by 2020, the target proposed by the European Commission for Poland is 15%. *Therefore, the analyzed project is in line with the assumptions of the increase of energy generation from renewable sources of all EU Member States.*

4.0 ENVIRONMENTAL CONDITIONS AND SPATIAL ARRANGEMENTS

The commune does not have a current local spatial development plan. In connection with the above, the investor applied to the commune for a decision on the location of the public purpose investment and obtained the relevant decision.

4.1 Description of the existing condition of the site

The wind farm site is an area of approximately 400 ha, which is currently used for agricultural purposes. After the construction and commissioning of the wind farm facilities and the GPZ transformer station, the remaining area of the farm site will continue to be used for agricultural purposes, as previously intended.

The wind power plant will be located in undeveloped areas, outside of the dense and scattered surrounding development.

4.2 Technical description of the project

The following are the basic selected technical parameters of the wind power plant agreed with the investor, based on factory data and preliminary design assumptions, which are relevant for the execution of this report:

- maximum rated power 2.0 MW,
- tower height to rotor axis 108.0 m,
- propeller length 41 m,
- expected wind speed for activation 3 m/s,
- expected wind speed for automatic stop 28 m/s,
- self-aligning of the rotor to the wind,
- lightning protection system,
- electric shock protection,
- anti-corrosion protection of the tower and the housing,
- maximum acoustic power level of the power plant 104.0 dBA – appendix 3.

The towers will be placed on reinforced concrete foundations made according to the foundation design being developed.

In addition, the project provides for the implementation of the necessary accompanying infrastructure within the scope of:

- technological roads for the time of construction, exits from these roads to public roads and the repair of parts of commune roads intended for the transportation of elements of the power plant – appendix 6,
- exits from voivodeship, county and commune roads to technological roads, for the time of construction and installation of wind turbines,
- repair of part of the commune roads in order to ensure the parameters required for safe transportation of elements of towers and power plants,
- connection of power plant towers with GPZ transformer station with internal MV cable lines and fiber optic network – appendix 7, on the following plots:
- in the Różyna precinct, plots: 328, 337/10, 300, 301/1, 301/2, 301/3, 303
- in the Kinwągi precinct, plots: – 119, 126/1, 126/2, 127, 143,

- in the Śmiardowo precinct, plots: 19/1, 24/42, 28/3, 29, 31,101.

Implementation of the scope of the project outlined above will require the following work:

- execution of excavations and construction of foundations,
- construction of temporary necessary access roads with assembly yards,
- installation of the wind power plant by a specialized team,
- execution of excavations and laying of sections of underground power cable,
- construction of power and telecommunication connection,
- transportation of construction elements and materials,
- construction of the GPZ transformer station.

Technological roads and exits, as well as reinforcement of commune road surfaces, will be made using cellular geosynthetics filled with gravel in the base and gravel as the surface, according to the following solution:

- stone rockfill layer,
- textured and perforated cellular geogrid filled with aggregate,
- aggregate “mattress” made of sandy gravel wrapped with a flat geogrid.

The exits and technological roads will be made up to 5 m wide with turning radii as for passenger vehicles, and for the transport of extra-size elements, widening arcs with radii from R=15m to R=50m will be performed. At exits and ditch crossings, under the pavement structure, galvanized steel spiral corrugated pipe culverts will be placed.

The farm's cable lines will consist of:

- bundles of MV aluminum cables of the YHAKX type with cross sections of 120 mm^2 and 240 mm^2, fastened with cable ties made of plastic,
- cable ducting systems for teletechnical optical fiber networks, made of RHDPE 40/3.7 pipes.

Cables will be laid in cable trenches at a depth of 1 m, tele-technical network cable ducting systems, which are an integral part of the cable lines, will be laid in a cable trench before the cables are laid, at a depth of 1.15 m.

In places where the cable route crosses roads, the cable lines will be laid under the body of the road using the jacking technology, at least 1.5 m from the grade line of the road, in pipes made of high density polyethylene (Arot type casing pipes), in accordance with the conditions specified by the road manager. The cable route crossing of the Bajdycka Młynówka river will be made by jacking under the river bottom with smooth-wall, thick-wall HDPE casing pipes connected by butt welding. The casing

pipes will be laid with a distance of not less than 150 cm between the river bottom and the casing pipes.

The crossing with the underground cable ducting system of the tracks of railway line no. 38, Białystok – Głomno, is to be made using the jacking technology, with smooth-wall, thick-wall casing pipes made of HDPE, connected by butt welding. The foundation of 75 m long casing pipes will be made with a distance of not less than 200 cm between the foot of the rail and the casing pipes.

Implementation of the project will require good organization of heavy traffic, which is dictated by the need for continuous delivery of concrete when pouring out the foundations. The number of trucks delivering the concrete is estimated to be about 50 per foundation, depending on the final design conditioned by soil properties.

5.0 CHARACTERISTICS OF THE IMPACTS OF THE PROJECT ON THE ENVIRONMENT

5.1 During the construction phase

During the project implementation, the nuisance will focus mainly on noise, accompanying the operation of machines, excavators, cranes, mechanical tools etc. Noise will also be caused by heavy transport vehicles and transportation of loose materials. Another factor will be the atmosphere pollution, caused by transport vehicle traffic. Local dusting and fumes emission to the environment will occur. It should be emphasized that all these phenomena are of periodic nature and will cease at the time of closing the construction site. All construction and assembly work will be spread out over time.

5.1.1 Impact on the state of ambient air quality

During implementation of the analyzed project, the threats for the air quality will result from the operation of construction equipment during excavation for foundations and cabling as well as from means of transport causing emission of dust and diesel oil combustion products. Unorganized emission of pollutions will appear during the execution of works related to construction of access road sections and maneuvering yards for the time of construction. Suspended dust and falling dust will be emitted. In cases of welding works, CO, NO_2 and suspended dust will be emitted. In addition, during finishing work, C type gasoline, falling dust, xylene and toluene may be emitted. During the performance of works this emission will constitute a short-term insignificant nuisance only.

The impact of pollutant emissions from the project will be practically limited to the immediate vicinity of the area of construction and assembly works and will not pose a threat to the environment.

These emissions will be incidental and will not adversely affect ambient air condition in the vicinity of the construction site.

5.1.2 Impact on the ambient acoustic climate

The construction of the wind farm will require the arrangement of the construction site. The anticipated scope of civil, installation and assembly works will cause the emergence of periodic local sources of noise, such as:

- operation of construction machinery with noise level of 85 – 105 dBA,
- heavy vehicle transport with noise level of 90 – 110 dB.

Due to the fact that the construction-installation-assembly works will be conducted mainly at daytime and the fact of the distance of construction sites from the nearest residential development areas, it can be assumed that the equivalent level of noise beyond the area of works, caused by the operation of construction machinery and auxiliary technical equipment, as well as by increased self-propelled and motor vehicle traffic, will not exceed the permissible level. An average of approximately 50 courses of heavy vehicles are anticipated for the continuous delivery of concrete for the pouring of one foundation. Heavy transport trips delivering elements of the power plant structure will be spread out over time, which will not significantly affect the level of traffic noise; however, short-term local traffic nuisance may occur.

Having in mind that this nuisance will be of periodic nature, typical for

construction works, will only regard the period of investment execution and will cease on completion of works, it is stated that the periodic adverse effect on the acoustic climate around the conducted works will be acceptable, as a temporary phenomenon common for any construction site and posing no threat to environment.

It is recommended that the construction-assembly works, causing high level of noise, are conducted at daytime. The operation of machines and equipment should be protected in accordance with the OSH provisions. For example - the obligation to use individual ear protections.

5.1.3 Impact on vibrations

Operation of heavy construction equipment may cause vibrations that will be located in the work area and will cease when the work is completed. *Due to the distances between residential buildings and the construction site, no vibration hazards to the nearest buildings and their occupants are expected. Hazards to workers performing construction, installation and assembly work are also not expected.* Where heavy construction equipment as well as machinery and equipment with a percussive nature of work are used, the operation of such machinery and equipment should be protected in accordance with applicable OHS rules for workplaces, such as anti-vibration gloves.

5.1.4 Impact on electromagnetic radiation

Having in mind the scope and nature of the conducted works during the execution of the project, it is stated that no sources of electromagnetic fields that could pose a threat to people or environment will occur at the construction phase.

No adverse impact of electromagnetic radiation on the environment is expected during the construction phase.

5.1.5 Impact on groundwaters and surface waters

During the implementation phase, the impact of earthworks as well as assembly and installation works on groundwater and surface water will be negligible. Groundwater, where the water table is at shallow depths below ground level, could possibly be contaminated with oil-derivative substances leaking from machinery and technical equipment. However, this situation can be effectively eliminated by properly supervising the operation of these devices and keeping them in impeccable working condition.

The project is not expected to have an adverse impact on groundwater or surface water during the construction phase.

5.1.6 Impact on soil and woodlots condition

Impact on soil and vegetation during the construction phase will be practically limited to areas designated for access roads, excavations for foundations, maneuvering yards, places for storing structural elements, and excavations for power cables. Therefore, topsoil should be deposited in a separate location, while the soil from the foundation excavations should be used for road embankments and landscaping after the construction phase is completed. In cases of excess soil, it should be planted, or transported to established locations, with the possibility of use.

There are no trees in the areas of the wind power plant location and in the areas in the immediate vicinity of the wind power plant, and all of the land is of agricultural use. Therefore there is no need to cut down trees. In cases where damage is caused to neighboring agricultural land, it must be compensated to those affected, which is the responsibility of the developer. It should be emphasized that areas several meters away from the excavation and storage of structural elements will remain undisturbed, regardless of the intensity of the work. Upon completion of the work, the land (except areas intended for foundation and any necessary emergency access roads) will be returned to a condition that allows for agricultural development.

5.1.7 Protection of cultural heritage, historical monuments and modern cultural objects

At the design stage it should be checked if there are no local archaeological sites in the vicinity of wind turbines, because then the project requires arrangements with the Voivodeship Monument Conservator, and conducting earthworks requires archaeological supervision. There are no modern cultural objects in the area of power plant location or in its immediate vicinity.

Implementation of the project will not adversely affect this element, provided the above comments are followed.

5.1.8 Impact on human health

Taking into account the considered scope of works we can eliminate negative influence of the construction phase on health of the local residents. Noise, dust and fumes of toxic substances (paints, varnishes, anti-corrosive coatings, etc.) may be harmful or cause a nuisance only to the employees of companies performing construction, assembly, installation and painting work in the immediate vicinity of the construction site. This nuisance should be maximally reduced by usage of appropriate protections specified in OHS regulations and proper organization of works.

5.1.9 Waste management

Waste generated within the project area will be soil including stones (from excavations for foundations) – code 17 05 04. Most of it will be used for access road base and for covering the foundations, and in case of surplus, it will be transported to appropriate locations indicated by farmers for planting.
In addition, small amounts of the following waste will be generated:

- used synthetic gear and lubricating engine oils – code 13 02 06 (hazardous waste),
- used oil-soaked rags and clothes – code 15 02 02 (hazardous waste),
- ferrous metals code – 16 01 17,
- construction waste – code 17 01 07,
- wood – code 17 02 01,

- unsorted mixed municipal waste – code 20 03 01.

The waste generated will be stored in designated, secured areas and the hazardous waste mentioned will be stored in sealed containers.

The waste generated during the construction phase will be managed by the contractor in a manner consistent with the principles of waste management and environmental protection requirements as of the date of the project implementation, and the transport of waste from the temporary storage sites will be carried out based on the means of transport of waste recipients.

5.1.10 Impact on flora

A minor, temporary destruction of agricultural crops in the area of the power plant tower foundation may occur during construction activities. The adverse impact on flora will be limited to the area of the assembly yard and access road and, due to their small area, should not cause great damage to the agrocenosis. There will also be a temporary exclusion of some land from agricultural activities.

5.1.11 Impact on fauna

The main impact on animals, including birds and bats, will be related to noise generated by construction machinery. The exhaust fumes generated or the movement of the heavy construction machinery itself is of a lesser significance. There may be temporary abandonment of areas around the wind turbine installation sites by birds. The observations of Prof. Busse (2006), Zakrzeski (2006) and data from wind farms already in operation indicate that this impact on birds is temporary and that most of them return to their old habitats after construction is complete and noise has ceased.

5.1.12 Impact on tangible property

At this stage, the impact of the project on tangible property will be minor. There may be temporary damage to existing field roads due to transportation of construction materials, structural elements and people for the purpose of assembly of the power plant. Once the construction is complete, any local damage will be repaired. In the case of damage caused to field crops, compensation for causing the damage is the

responsibility of the investor.

5.1.13 Impact on the landscape

At this stage, the impact of the wind power plant will be minor. The project's impact on landscape disharmony will increase as the height of the towers increases during installation.

5.2 Project operation phase

The main nuisances and possible threats to the environment that may occur at the phase of operation of the analyzed project are as follows:

- threat to the acoustic climate,
- electromagnetic radiation,
- impact on avifauna and natural environment,
- impact on bats.

This report analyzes the above mentioned elements and also refers to all other less important elements of the natural environment, despite the marginal impact of the analyzed project on these elements.

5.2.1 Impact on the state of ambient air quality

The wind power plants are unmanned installations, which do not contain any sources of dust, gas or aromatic substances emissions.

Therefore, the planned investment does not cause any air pollution in the form of exceeding the levels of harmful substances in the air and emission of aromatic substances.

5.2.2 Impact on the ambient acoustic climate

The assessment of the acoustic climate for the area around the planned wind farm was conducted using the HPZ – 2001 Windows ITB May 2007 software and the instruction 338/96 "Methods of determining the emission and immission of industrial noise in the environment".

Description of the project in terms of acoustic analysis

The areas of the wind power plant location are situated in Różany and Śmiardowo precincts. After the on-site inspection of the wind farm site and analysis of the provided maps, it was found that the differences in the levels of the individual wind turbines are insignificant due to the requirements of the acoustic analysis, which was taken into account in the numerical calculations.

Methodology of acoustic analysis

The location of turbine towers' foundations was assumed according to the cadastral maps with the location of the wind power plant provided by the investor. Two location options were considered. Option 1 – implementation of the project with the assumptions proposed by the investor, construction of 74 turbines and the GPZ transformer station according to the first proposal of the wind power plant layout in the field provided by the investor (Map 1 and 2, appendix 4) and option 2 – implementation of the project, construction of 30 power plants plus the GPZ transformer station, according to the second proposal of the wind power plant layout in the field provided by the investor (Map 3, appendix 4).

The coordinates of the location of individual substitute omni-directional point sources for each power plant and the location of selected noise immission monitoring points were established in the locally adopted coordinate system provided on the maps with the location of the power plants. These coordinates are illustrated by the data for the software and Noise Maps 1 and 2 (appendix 4 – location option 1) and Noise Map 3 (appendix 4, location option 2 recommended for implementation).

The results of the calculations at each observation point correspond to a height of 4.0 m above the actual ground level at that point. The noise map prepared shows a curve of noise immission levels (45 dBA isophone), illustrating the noise range for the night time limit. The isophone of noise immission levels was determined at a height of 4.0 m above ground level.

Variant 1

In option 1, the wind power plant is located in Różyna and Śmiardowo precincts. Due to the distance between the extreme wind power plants being more than 2000 m, which precludes the summation of noise levels for these precincts, calculations and acoustic analysis were performed independently for both precincts. Map 1 illustrates the 45.0 dB noise isophone and noise immission levels at 7 control observation points for 15 power plants and the GPZ transformer station (appendix 4), while Map 2 illustrates the 45.0 dB noise isophone and calculates noise immission levels at 9

control observation points for 59 power plants (appendix 4).

Variant 2

For option 2, Noise Map 3 illustrating the 45.0 dB noise isophone was prepared and noise immission levels were calculated at 14 control observation points, seven in the northern part, designation of P1n to P7n, and seven in the southern part, designation of P1s to P7s, for 30 power plants and the GPZ transformer station (appendix 4).

Note: All observation points were located at the boundary of the nearest currently existing rural buildings, used primarily for residential and agricultural purposes, and thus the existing acoustically protected facilities.

The obtained results show the values of equivalent noise emission levels for the nearest acoustically protected areas, which were then compared with the permissible levels that are the indicators applicable to determine and control the conditions of using the environment in relation to one day – $\mathbf{L_{Aeq\ D}}$ and $\mathbf{L_{Aeq\ N}}$.

All calculation results are illustrated graphically on noise maps (appendix 4).

After introduction of new permissible levels of noise in the environment expressed by $\mathbf{L_{DWN}}$ (day-evening-night level) and $\mathbf{L_N}$ (night level) indicators, which are applicable to conducting long-term policy in the field of protection against noise and for which the reference time covers all days of the year and all nights of the year, respectively, the acoustic analysis also includes the above-mentioned indicators.

Determination of these indicators requires knowledge of the average annual wind speed for each turbine, based on which it is possible to determine the average annual acoustic power of individual turbines and then perform numerical calculations, which is practically impossible at the project development stage. Therefore, in order to determine the above-mentioned indicators, the most unfavorable case was adopted, assuming that the wind blows at the same speed throughout the year, at which the level of acoustic power of turbines is the highest. In fact, the average annual wind speed and therefore the average annual acoustic power of the turbines is always lower. For such an assumption, having in mind results of calculation of $\mathbf{L_{Aeq\ D}}$ and $\mathbf{L_{Aeq\ N}}$ for the recommended option 2, in the assumed control observation point P3n with the highest calculated immission level, for maximum acoustic power levels of turbines, $\mathbf{L_{DWN}}$ values were calculated and the condition $\mathbf{L_{Aeq\ N} = L_N}$ was assumed. These values were then compared to the acceptable values. The condition for not exceeding the permissible values of $\mathbf{L_{DWN}}$ and $\mathbf{L_N}$ determined under this assumption makes it possible to state that these values are not exceeded in real conditions.

The maps attached to the report illustrate:

- Maps 1 and 2 – 45.0 dBA noise range and noise immission levels calculated at observation points – option 1 for the first version of the location assumptions, 74 wind power plants and GPZ,
- Map 3 – 45.0 dBA noise range and noise immission levels calculated at observation points – option 2 to be implemented, for the second option of location assumptions, 30 wind power plants and GPZ.

Specificity of acoustic phenomena accompanying the operation of the wind power plant

Construction of wind power plants in Poland is an innovative task and is characterized by specific acoustic phenomena associated with the operation of wind turbines.

When assessing the environmental impact of wind power plants in terms of noise, the following aspects should be kept in mind:

a) restrictions in the form of permissible levels of environmental noise for the surrounding areas, in accordance with their method of development and urban functions of the area,
b) recognition of acoustic phenomena associated with the operation of wind turbines, concerning changes in the parameters of acoustic power levels of turbines and background levels in the environment, depending on wind speed.

The first aspect, in the form of permissible noise immission levels which, as a result, determine the distance from the nearest residential buildings, is regulated by the Regulation of the Minister of Environment dated June 14, 2007 on permissible noise levels in the environment, Journal of Laws No. 120, item 826.

When performing a noise risk assessment one should also take into account the second aspect, i.e. the following acoustic phenomena accompanying the operation of wind turbines:

The level of acoustic power of each turbine type varies and can be factory adjusted (reduced at the expense of reduced efficiency). In addition, it varies according to wind speed, increases as wind speed increases, and is virtually constant after a certain limiting speed.

Environmental background noise levels also change with wind speed – they increase as the wind speed increases.

The results of the conducted studies [8] and [9] show that the gradient of the straight line illustrating the changes in the total noise level of the turbine and the background noise measured in the field is smaller than the gradient of the straight line illustrating the changes in the noise level of the background alone. Thus, as wind speed increases, the contribution of background noise to the measured total noise level will show an upward trend; at greater distances, the background level will be comparable to the level of noise generated by the wind power plant. An additional factor influencing the faster increase in background noise levels at residential buildings for which there are noise level limitations is the greater "roughness" of the area around the buildings due to the frequent presence of trees, shrubs, buildings and other structures.

Adopted criteria for acoustic climate assessment

The analyzed wind farm is located in an agricultural area and it is surrounded by directly adjacent agricultural areas, where the permissible noise immission levels are not specified – areas without acoustic protection. According to the Sępopol Municipality Office's response to the investor's inquiry about the character of development in the vicinity of the planned wind farm – appendix 10, it is stated that in the vicinity of the planned farm the dominant buildings are homestead buildings and multi-family residential buildings, but there are also local single-family residential buildings. In addition, the certificates from the municipality contain a provision that defines the function of the developed land: “The areas of multi-family and single-family residential buildings (including homesteads) in accordance with the provisions of the study are understood as areas with residential buildings with garages and outbuildings designed for the needs of the families living there, and in case of farms also with livestock buildings as well as gardens and orchards accompanying the development, with a small share of basic services”. Therefore, the acceptable noise immission levels for the closest currently existing rural buildings used primarily for residential and agricultural purposes were adopted as the evaluation criterion.

Therefore, according to the Regulation of the Minister of Environment dated

June 14, 2007 on permissible noise levels in the environment, Journal of Laws No. 120, item 826, table 1, item no. 3, the permissible levels for the analyzed areas are as follows:

a) for the day time, equivalent sound level A related to the 8 most unfavorable hours of the day **55 dBA**,

b) for the night time, equivalent sound level A related to the 1 most unfavorable hour of the night **45 dBA**.

The above cited regulation introduces new permissible levels of noise in the environment expressed by $\mathbf{L_{DWN}}$ (day-evening-night level) and $\mathbf{L_N}$ (night level) indicators, which are applicable to conducting long-term policy in the field of protection against noise and for which the reference time covers all days of the year and all nights of the year, respectively. For such assessment criteria, the acceptable noise level at the control points located on the boundary of the nearest acoustically protected areas is $\mathbf{L_{DWN} = 55.0\ dBA}$ during day time and $\mathbf{L_N = 45.0\ dBA}$ during night time.

Analysis of the results of calculation and environmental impact assessment

A summary of the results of calculation at the control observation points is presented in the tables below.

Tables 1 and 1A summarize the results of calculations at the adopted control points for option 1 of the location assumptions.

Table 1 Map 1 – northern part

Point no.	Calculated immission level [dBA]	Permissible level [dBA]	Comments
P1	43.4	45.0	No exceedances
P2	44.4	45.0	No exceedances
P3	45.0	45.0	No exceedances
P4	40.6	45.0	No exceedances
P5	44.6	45.0	No exceedances
P6	41.6	45.0	No exceedances
P7	41.5	45.0	No exceedances

Table 1A Map 2 – southern part

Point no.	Calculated immission level [dBA]	Permissible level [dBA]	Comments
P1	43.4	45.0	No exceedances
P2	43.5	45.0	No exceedances
P3	43.1	45.0	No exceedances
P4	46.0	45.0	Exceedance
P5	47.7	45.0	Exceedance
P6	48.0	45.0	Exceedance
P7	43.8	45.0	No exceedances
P8	46.5	45.0	Exceedance
P9	43.1	45.0	No exceedances

According to the calculations illustrated on Noise Maps 1 and 2 and in table 1 and 1A, it is expected that the permissible level of 45.0 dB(A) at night-time will be exceeded in the areas closest to the acoustically protected buildings – points in table 1A marked in gray. Therefore, the implementation of option 1 (74 wind power plants) is not recommended, due to the failure to meet the required environmental standards.

Table 2 presents the location of wind power plants for option 2 (Map 3, appendix 4), for which calculations of noise immission levels were performed at the adopted control observation points.

Table 2

No.	Power plant symbol	Acoustic power level L_{WA} (dB)	Lot no. *(location)*
1	EW1	104.0	217/2 Różyna precinct
2	EW2		
3	EW3		
4	EW4		
5	EW5		
6	EW6		
7	EW7		
8	EW8		
9	EW9		
10	EW10		
11	EW11		
12	EW12	104.0	256/3 Różyna precinct
13	EW13		
14	EW14		
15	EW15	104.0	337/4 Różyna precinct
16	EW16	104.0	254 Śmiardowo precinct
17	EW17		
18	EW19		
19	EW23		

20	EW24		
21	EW25		
22	EW26		
23	EW30	104.0	27/10 Śmiardowo precinct
24	EW31		
25	EW30		
26	EW32		
27	EW34	104.0	30/37 Śmiardowo precinct
28	EW35		
29	EW36		
30	EW52		
31	GPZ	85.0	217/2 Różyna precinct

Table 3 summarizes the calculation results at the adopted control points P1n to P7n and P1s to P7s for option 2 to be implemented (Map 3 – appendix 4).

Table 3

Point no.	Calculated immission level [dBA]	Permissible level [dBA]	Comments
P1n	43.2	45.0	No exceedances
P2n	44.3	45.0	No exceedances
P3n	45.0	45.0	No exceedances
P4n	40.9	45.0	No exceedances
P5n	44.8	45.0	No exceedances
P6n	41.9	45.0	No exceedances
P7n	41.7	45.0	No exceedances
P1s	39.3	45.0	No exceedances
P2s	41.8	45.0	No exceedances
P3s	41.1	45.0	No exceedances
P4s	41.3	45.0	No exceedances
P5s	42.5	45.0	No exceedances
P6s	41.6	45.0	No exceedances
P7s	38.2	45.0	No exceedances

According to the calculations illustrated in Map 3 and table 3, it is projected that the 45.0 dBA nighttime permissible level will not be exceeded in the areas of the nearest acoustically protected housing development, so the proposed number of 30 power plants can be adopted in the final design while maintaining the power plant location proposed in the analyzed option 2 (Noise Map 3 – appendix 4), as described in table 2 of this chapter.

The conducted acoustic analysis shows that the construction of the analyzed wind farm will not change the acoustic climate in a manner posing a threat to the surrounding protected areas, provided that the assumptions and data adopted for calculations in this report are met, and in particular:

- the height of the tower should not be less than 108.0 m,
- the sound power level of the wind power plants should not exceed 104.0 dBA,
- the number of power plants of the project should not be more than 30 and their location should be in accordance with Noise Map 3 – appendix 4.

Meeting the above conditions is the criterion for not exceeding the permissible night time level of 45.0 dBA and day time level of 55.0 dBA for the nearest acoustically protected areas.

After calculating the L_{DWN} index (day-evening-night level) and assuming $L_N = L_{Aeq\ N}$ (night level), according to the assumptions described earlier and the methodology adopted, the following was obtained:

- for the Sępopol project for the selected point P3s with the highest calculated noise immission level - **L_{DWN} = 51.4 < 55.0 dBA** during daytime and **$L_N = L_{Aeq\ N}$ = 45.0 ≤ 45.0 dBA** during night time.

Therefore, it is forecasted that the construction of the analyzed wind farm will not change the acoustic climate in a manner posing a threat to the surrounding acoustically protected areas, provided that the assumptions and data used for calculations in this report are met.

The final location and numbering of the power plants suggested for option 2 are illustrated in Noise Map 3 – appendix 4 of the report, and table 4.

Table 4

No.	**Symbol of the Designation of the power plant**	**Acoustic power level L_{WA} (dB)**	**Lot no. *(location)***
1.	EW1 to EW11	104.0	217/2 (11 pcs.) Różyna Precinct
2.	EW12 and EW14	104.0	256/3 (3pcs.) Różyna Precinct
3.	EW15	104.0	337/4 (1pc.) Różyna Precinct
4.	EW16, EW17, EW19 and EW23 to EW26	104.0	254 (7 pcs.) Śmiardowo precinct
5.	EW30 to EW33	104.0	27/10 (4 pcs.) Śmiardowo precinct
6.	EW34 to EW36 and EW52	104.0	30/37 (4 pcs.) Śmiardowo precinct
7.	GPZ	85.0	217/2 (1 pc.) Różyna Precinct

5.2.3 Impact on vibrations

Legal considerations in terms of the impact of vibration on the environment

The necessary requirements in terms of vibration and other paraseismic vibrations are contained in the standards:

- PN – 85/B 02170 “Evaluation of the harmfulness of vibrations transmitted through the ground to the buildings”,
- PN – 88/B 02171 “Evaluation of the impact of vibrations on people in buildings”.

During operation there will be no vibration burdensome or harmful to people and surrounding buildings, due to the absence of vibration sources that could create such a threat, and the distance of buildings from the power plant site. Modern wind power plants have devices that dampen the natural vibrations of the system.

Note: Bearing in mind the requirements regarding the minimum distance of wind turbines from power lines in force in the ENERGA SA energy company, the technical strip should be maintained when designing the plant location in accordance with the rules:

- LV lines (up to 1 kV) single/dual track – 20/25m, poles located in the axis of symmetry of the technical strip,
- MV lines (up to 45 kV) single/dual track – 25/30m, poles located in the axis of symmetry of the technical strip,
- Lines above 45 kV – the width of the strip depends on the fact of installing active anti-vibration protection on the line – in the absence of attenuators, the distance of the wind turbine from the outermost conductor should meet the condition s≥3d, in the case of installed attenuators the condition s≥d, where d is the diameter of the circle made by the blades of the wind turbine.

5.2.4 Impact on electromagnetic radiation

Legal conditions regarding the environmental impact of electromagnetic fields

Necessary requirements for levels of electromagnetic fields in the environment are set out in the Regulation of the Minister of Environment on permissible levels of electromagnetic fields in the environment and methods of checking compliance with those levels, dated October 30, 2003 (Journal of Laws No. 192 item 1883 of 2003).

Potential sources and forecasting of the possibility of occurrence of electromagnetic

radiation

Electromagnetic (EM) waves of greater or lesser intensity accompany humans everywhere. This applies to virtually all living spaces, the surrounding environment and the work environment.

General principles of electromagnetic radiation assessment

The first step in conducting an assessment of electromagnetic radiation is to determine the range of radiation frequencies, which in turn depend on the type of sources (installed devices). Depending on the type of sources, and thus the frequency of radiation, permissible levels as well as control and measurement methods are specified in Polish legislation. For radiation sources such as all overhead power lines (including 110 kV) and GPZ transformer stations and equipment mounted in wind power plants, the radiation frequency is the grid frequency of 50 Hz.

Permissible levels of electromagnetic radiation

Permissible levels of electromagnetic radiation, in accordance with the Regulation of the Minister of Environment on permissible levels of electromagnetic fields in the environment and methods of checking compliance with those levels (Journal of Laws from 2003 no. 192 item 1883), for the frequency of 50Hz are:

- for areas designated for residential development, levels of **1kV/m** for the electric component and **60A/m** for the magnetic component, the hazard occurs when higher levels than the permissible levels occur in residential areas,
- for areas accessible to the public, the values are **10 kV/m and 60A/m**, respectively; such areas include all agricultural and arable land, people can stay there and carry out all kinds of field work; residential buildings should not be located there. Facilities for business purposes, farms, allotment gardens, etc. may be located on such land.

In addition, when designing transmission lines and GPZ transformer stations, industry requirements are taken into account and, after taking into account the zoning plan, their location is selected in such a way as to ensure that acceptable levels of electromagnetic radiation are maintained in the nearest protected areas as specified in the plan. Such regulations include the Order of the Minister of Mining and Power Engineering dated 28.01.1985 – Detailed guidelines for the design and operation of electrical power equipment in terms of protecting people and the environment from the effects of electromagnetic fields. It establishes the smallest permissible distances between the edge of a power line or other live part and the edge of a balcony or terrace and a roof or horizontal planes – terraces, balconies, etc.

These distances are:

- 14.5 m for 110 kV voltage line
- 26.0 m for 220 kV voltage line
- 33.0 m for 400 kV voltage line.

Therefore, the protection of people and the environment from 50 Hz electromagnetic field radiation generated by power lines and GPZ transformer stations consists in the designation of protection zones around these facilities.

For power lines, the magnetic component of the electromagnetic field, which is proportional to the current and inversely proportional to the distance of the conductors from the ground, is negligibly small at the ground surface.

For the electrical component, there are two protection zones for power lines and substations:

First degree protection zone – includes areas where the electric field strength exceeds 10 kV/m, in this zone the presence of people is prohibited. This zone occurs only very close to high voltage components. Practically, the only people who may be exposed to such fields are energy workers performing work inside GPZ transformer stations directly at the radiation sources or repairing high voltage lines at heights in the immediate vicinity of the lines.

Second degree protection zone – includes areas where the electric field strength is within 1 – 10 kV/m. In this zone, people are temporarily allowed to stay, however, permanent housing, schools, hospitals, etc. cannot be located there. In this zone, for example, workshops, farms, allotments and agricultural fields may be located, i.e. facilities associated with temporary stay of people.

Staying in areas where the electric field does not exceed 1 kV/m and the magnetic field does not exceed 60 A/m is not subject to any restrictions, so housing and any other permanent residence of people can be located there.

For national power lines, the 2nd degree zones are well known (no calculations required) and are respectively:

- 110 kV – 24m, 12m from the line axis (18m)
- 220 kV – 46m, 23m from the line axis (30m)
- 400 kV – 74m, 37m from the line axis (50m)
- 750 kV – 130m, 65m from the line axis.

In the parentheses there are the widths of protection zones for narrow gauge lines with vertical conductor spacing used for forest crossings.

It should be emphasized that when moving away from transmission lines and other sources of electromagnetic fields, the intensity of the electric and magnetic field component decreases very quickly.

For transformer stations (GPZ), designed in accordance with current requirements, 1st and 2nd degree protection zones occur only in areas inside the station. On the exterior, outside their fences, there are not even 2nd degree protection zones – see J. Kucowski, D. Laudyn, M. Przekwas – "Energetyka a ochrona środowiska", WNT, Warsaw 1993.

The above mentioned data are confirmed by numerous studies conducted in recent years (since 2005) in Poland. Such research is conducted, among others, by Voivodeship Inspectorates for Environmental Protection.

The results of research conducted by the Voivodeship Inspectorates for Environmental Protection, in accordance with the work issued by the Chief Inspectorate for Environmental Protection "Pola elektromagnetyczne w środowisku – opis źródeł i wyniki badań" ("Electromagnetic fields in the environment - description of sources and research results") – Warsaw, August 2007, are as follows:

Magnetic component – citation

"The higher magnetic field strength levels apply primarily to measurements around strong magnetic field sources, which include power lines and transformer stations rated 110 kV and above. The highest value of the magnetic field strength **27.5 A/m**, (which corresponds to **45.8% of** the permissible standards defined for places accessible to the public) was measured in 2005 by the laboratory of the Mazowieckie Voivodeship Inspectorate for Environmental Protection for the power line with rated voltage of **400 kV**, traction Miłosna – Płock. In 2006, the highest value of magnetic field strength of **12.9 A/m** (which corresponds to **21.5%** of the value of the permissible standards set for places accessible to the public), was obtained for **220 kV** and **110 kV** high-voltage traction."

Author's comment: it should be added to the information in brackets on the percentage of permissible values that due to the magnetic field strengths found even residential buildings with permanent residence for which the permissible value is **60 A/m** can be located in the measurement areas.

Electrical Component – Citation

The highest measured value of electric field strength in 2005 was 5.03 kV/m**(50.3%** of the limit values set for places accessible to the public), and in 2006 it was **4.85 kV/m (48.5%** of the limit values set for places accessible to the public). Both measured

highest values of electric field strength were obtained by the laboratory of the Lublin Voivodeship Inspectorate for Environmental Protection for the power line with a rated voltage of **400 kV**.

Author's comment: it should be added to the information in brackets on the percentage of permissible values that due to the detected electric field strength the measurement areas correspond to the protection 2nd zone – the maximum value of this zone is **10 V/m**, in which it is possible to stay temporarily, to conduct business activities and any field work.

The authors of the report also conducted their own as-built measurements of 110 kV power lines and GPZ 30/110kV transformer stations, typical for wind farm projects. For example, in the Pomeranian region for an operating wind farm (24 Vestas 2.0 MW wind power plants), GPZ 30/110kV transformer station, the following was obtained:

- the highest value of the magnetic component at a distance of 1.0 m from the GPZ transformer station fence (outside the fence) was **0.54 A/m**, and the permissible level for permanent residence of people was **60 A/m**,
- the highest value of the electric component was **0.47 kV/m**, the permissible level for permanent occupancy was **1.0 kV/m**,

- the highest value of the magnetic component at a height of 2.0 m above the ground under a 110 kV line, at the highest line slack between successive poles was **0.25 A/m**,
- the highest value of the electric component at a height of 2.0 m above the ground under a 110 kV line, at the highest line slack between consecutive poles was **1.35 kV/m**.

Therefore, the results of measurements carried out by various centers in Poland and our own research clearly show that the established protection zones for overhead power lines and the principles of designing GPZ substations are defined in a way that provides a large margin of safety.

The assessment of the threat to the environment in terms of electromagnetic field emissions is based on determining the extent of electromagnetic radiation, which corresponds to the radiation limit levels for the surrounding nearest protected areas.

As shown above for all types of power lines in Poland, the range of electromagnetic radiation corresponding to admissible levels is clearly defined, which is also documented by numerous studies conducted by independent centers, therefore there are generalized rules for their location. Thus, performing calculations for objects emitting electromagnetic fields with a frequency of 50 Hz, such as 110 kV power lines and GPZ transformer stations is unjustified, since all the data needed to perform the assessment are known and generally available. For these sources, the assessment is based on checking whether their location complies with the recommendations to preserve the protection zones, which ensures compliance with the permissible levels corresponding to the surrounding protected areas, namely compliance with the recommended distances from protected facilities or areas. Such an assessment can therefore be performed in a simple way, having a given type of power line (overhead, underground, 110 kV, etc.), a technical description of the GPZ transformer station and the zoning plan, based on the criterion of compliance with established protection zones and distances from protected sites.

Underground power cable lines from 20 to 110 kV are not counted as investments that require or may require an environmental impact report. In accordance with the Regulation of the Minister of Environment on permissible levels of electromagnetic fields in the environment and methods of checking compliance with those levels (Journal of Laws from 2003 no. 192 item 1883), measurements of the electric component of the electromagnetic field with a frequency of 50 Hz around underground power cable lines shall not be performed.

Thus, in the analyzed case, all underground power cables do not pose a threat to the environment and do not require an environmental impact assessment.

Other sources of electromagnetic fields in the analyzed farm are generators and transformers constituting the equipment of turbines located on top of a tower, and the entire cabling.

Taking into account the distances from the ground (height of the tower: 108 m) and from buildings (nearest residential buildings: over 400 m), the existing spatial development of the area and the measurements taken at the operating wind farms, it is concluded that in the area of the analyzed investment and its surroundings there will not be any 1st and 2nd degree zones, and thus there will be no threat of electromagnetic fields with intensity higher than permissible, constituting a threat to humans and the environment. Thus, no threat due to exposure to electromagnetic fields is anticipated.

5.2.5 Impact on groundwaters and surface waters

The analyzed wind farm is an unmanned installation. The equipment will be monitored by a computerized system for remote monitoring and diagnosis of the power plants. There are no areas that would retain rainwater on the farm and no domestic (sanitary) wastewater is generated. The farm does not generate wastewater from any group.

During the operation phase, the wind power plants are not expected to have a negative impact on groundwater and surface water due to the lack of pollution sources.

5.2.6 Impact on soil

Land not used for the construction of power plant foundations and associated infrastructure (mainly GPZ transformer stations) can still be used for agricultural crops. At the stage of operation, no negative impact on the soil of the designed investment is expected.

5.2.7 Impact on people

Impact on the health and well-being of nearby residents will be minor. The

buildings are located beyond the isolines L_{Aeq} = 45 dB, i.e. beyond the line of permissible level in the night time. Buildings are also located outside the range of electromagnetic fields' influence.

There may be a sense of some discomfort associated with the rotational motion of wind power plant rotors. There may be a shadow effect caused by working power plant blades and towers. However, due to the distance of the tower locations, these factors should be considered minor. Another impact could be glare from the tower, especially the rotor blades. Since the tower and rotor blades will be painted with a special matte paint, the glare effect will not occur.

A danger to people may arise in an emergency situation (overturning of the structure). Since the planned investment is far away from human settlements and will meet all strength and load standards, it is not expected to have any negative impact on human health and safety in this regard.

Therefore, no direct or indirect impact of the investment on the health of the immediate residents is expected.

5.2.8 Waste management

No waste will be generated in a continuous manner during operation. When oil and filters in turbine components need to be changed, hazardous waste, other gear and lubricating engine oils (code 130208), filter materials and wiping cloths (code 150202) may be generated. According to the manufacturer's specifications, it can be assumed that the gear oil is changed once every four years for the turbine type under analysis; the amount of oil in a single turbine is approximately 60 l.

Oil and filter changes will be carried out by a specialized team, as part of a specialized service that secures transportation and disposal. All waste is collected by a specialist company at the time of replacement, and no waste is stored at the farm sites – a practice used by wind power plants manufacturers for maintenance inspections.

5.2.9 Extraordinary threats to the environment

The wind turbines have effective lightning protection systems and multi-layer corrosion protection for the tower and housing with a 20-year warranty. The power plant will be sited at a safe distance from buildings and public roads, so there is no direct threat of a possible construction disaster. At wind speeds greater than 28 m/s, the power plant shuts down automatically with proper propeller blade alignment, eliminating the possibility of excessive structural loads. Power plants have oil interceptor systems and an oil-tight enclosure that acts as a storage tank. All workers performing work during the construction phase should be obliged to fix even the smallest spills of oil substances on an ongoing basis.

With a properly designed foundation and correct installation of the supporting structure, as well as properly conducted construction work and technically efficient machinery, no extraordinary threats to the environment are anticipated.

5.2.10 Impact on avifauna and the natural environment

5.2.10.1 Impact on the natural environment

/created on the basis of existing studies concerning the Sępopol commune:
1. Study of Conditions and Directions of Spatial Development of the Sępopol commune
2. Environmental Protection Program for the Sępopol Commune/

The urban-rural commune of Sępopol is located in northeastern Poland. The northern border of the commune is the state border with the Kaliningrad Oblast (Russia).

The town and commune of Sępopol forms the eastern part of the Bartoszyce Poviat in the Warmińsko-Mazurskie Voivodeship.
The city is located centrally within the commune. To the west and southwest, the commune borders on the Bartoszyce commune (Bartoszyce poviat), to the southeast with the Korsze commune (Kętrzyn poviat) and to the east with the Barciany commune (Kętrzyn poviat)

The area of the Sępopol commune in terms of physico-geographical regionalization lies on the Sępopol Plain, which is part of the Old Prussian Lowland. The characteristic feature of the Old Prussian Lowland is a well-developed system of erosion valleys (the Łyna, the Guber and their tributaries) and a relatively low relief variety. The surface of the commune is on average 40-50 meters above sea level. The area of the commune decreases towards the south. The northern parts of the commune lie at an average altitude of 40-60 m. above sea level and the southern parts at 30-40 m. above sea level.
The surface of the commune was formed during the North-Polish glaciation in its Leszczyny and Pomorze (Pleistocene) phases and also during the Holocene, when the river valleys were finally formed.
Glacial and fluvio-glacial accumulation formations from the period of the Baltic (North-Polish) glaciation are mainly flat moraine upland, which is the most typical form of terrain relief in the area of the commune.

Climate

The climate of the Sępopol commune should be classified as lakeland climate, which is characterized by relatively cold and snowy winters, late spring frosts and also a relatively short vegetation period amounting to about 170 days. The average annual temperature is 6.5° C, and the average temperature of the growing season is about 12° C. Total annual precipitation ranges from 600 to 700 mm.

Soils

In the area of the Sępopol commune, soils formed from glacial and water-glacial deposits (mainly tills and sands) predominate. These soils are mainly brown soils with crude soils, brown alkaline soils and luvisols, as well as black soils proper, black degraded soils and alluvial soils.

The land use structure is dominated by agricultural land, which accounts for 76% of the commune's area.

Forests

Forests and wooded areas cover about 19.5% of the commune's area.
Forest areas in the commune consist of ten-odd forest complexes, the area of which does not exceed 500 ha.
It should be noted that the original forest communities here have been heavily transformed by human activity.
The diversity of soil conditions in forested areas is mainly characterized by the forest habitat type.
The community is dominated by fresh forest, moist forest and fresh mixed forest habitats.
On the territory of the Sępopol commune, in the forest areas, the occurrence of numerous species under strict and partial protection was recorded. Protected species are associated mainly with the habitats of fresh and moist forest as well as mixed, moist and swamp coniferous forests.

The strictly protected vascular plants found in the municipality are mainly:
- The lesser periwinkle *(Vinca minor*);
- The common ivy *(Hedera helix*);
- The round-leaved sundew *(Drosera rotundifolia*);
- The common snowdrop (*Galanthus nivalis*);
- The stiff clubmoss *(Lycopodium annotinum*);

partially protected plants are:
- The marsh Labrador tea *(Ledum Palustre*);
- The lily of the Valley *(Convalaria majalis*);
- The European wild ginger *(Asarum europaeum*);
- The alder buckthorn *(Frangula alnus*);
- The sweetscented bedstraw (*Asperula odorata*);
- The common cowslip (*Primula officinalis*).

The animal world of the Sępopol commune

The structure of land use in the commune, primarily the dominance of agricultural land, which is a mosaic of fields and meadows with the accompanying mid-field and waterside woodlots, means that the animal world is represented mainly by avifauna associated with open agricultural areas and human settlements.
The exceptionally numerous population of the white stork *(Ciconia ciconia*) in the Sępopol commune deserves special attention. The largest colonies of these birds are located in Szczurkowo and Lwowiec. These are also some of the largest white stork colonies in Poland. Other bird species associated with agricultural lands and forest edges found in the commune include:
The most valuable bird species observed in the forest areas of the commune are: the black stork *(Ciconia nigra*) and lesser spotted eagle *(Aquila pomarina*). However, according to the Bartoszyce Forest District, only the lesser spotted eagle nests in the commune. Its nesting sites have been given zonal protection.

In the Sępopol commune area, apart from numerous bird species, the population of the European beaver (*Castor fiber*) is also of note. Seven beaver habitat sites were located in the commune, mainly on the Łyna river (northeast of Miedna and near the state border) and on the Guber river (west and south of Prętławki).
Apart from the species mentioned above, there are also numerous game animals in the commune: roe deer (*Capreolus capreolus*), wild boars (*Sus scrofa*), foxes (*Vulpes vulpes*), grey hares (*Lepus europeus pallas*)
The cited data indicate that the area in question has a diverse fauna, among which protected species dominate. This significantly enhances the natural values of the area and, in the case of nesting sites of protected species, provides constraints to the management of forest resources in these areas.

Forms of nature protection in the Sępopol commune

Protected Landscape Areas

1. OChK “Dolina Dolnej Łyny”
2. OChK “Dolina Rzeki Guber”

Altogether, the aforementioned areas cover about 2930 hectares, which is about 12% of the commune's area

There are 17 natural monuments in the commune.

These are primarily single trees and one group of trees. Single protected trees

are mainly oaks (15 pieces).

A group of trees under protection are beeches.

A significant part of the commune's area has been protected under the

SPA NATURA 2000 “OSTOJA WARMIŃSKA”

"Ostoja Warmińska" was proposed as a Natura 2000 area primarily for the protection of one species – the white stork, which reaches its highest numbers here and the highest density in the country. However, it is also a very important refuge for many other species of birds, since as many as

93 bird species valorizing Natura 2000 sites (including 81 breeding and likely breeding species) can be found here. These include 46 species from appendix I of the Birds Directive, including 41 breeding and likely breeding species.

The location of the planned investment Construction of the Sępopol Wind Farm is in the southern part of the Sępopol commune, in an area comprising agricultural land located within the boundaries of the NATURA 2000 SPA “OSTOJA WARMIŃSKA,” **within the Różyna precinct and outside the boundaries of the Natura 2000 area within the Śmiardowo precinct.**

There are no ecological grounds or natural monuments in the area of the planned investment location, the area is not a protected landscape area either, the area is used for large-scale agricultural cultivation.

5.2.10.2 Impact on avifauna

Location and description of the site

The elements of description and location of the wind farm in the area which are discussed below cover only the features of the area which are significant from the point of view of analysis of potential impact of the wind farm on birds.

The location of the planned complex of 30 turbines with a capacity of 2 MW is south of Sępopol, north of Różyna (15 turbines) and near Spurgle – Śmiardowo – Pasławki (15 turbines). Due to the distance and some environmental variation (including distance from forests), the site was considered and studied as two fields - the northern one (Różyna – ROZ: Map 1, Appendix 8.1) – south (combined name Spurgle – SPU, although this field consists of two planned turbine groupings) – (Map 1, Appendix 8.1). The Różyna field is mostly open, flat terrain (Photo A-B, Appendix 8.2), with small areas of tree buffers, in low age classes (Fig. D). There are also wet depressions in the fields that are waterlogged during wet periods of the year (Photo C). The southern field -– consists mainly of “bare” areas similar to the northern field (Photo E). The river flowing there (Photo F) is very narrow and not an attraction for birds – Map 1 and photographs.

Agricultural use of these and surrounding areas is based mainly on typical crop rotation, including mainly winter cereals and oilseed rape grown in large-scale technology (these are mainly vast post-State Agricultural Farm fields, currently intensively cultivated). Grassland areas are rare here. **This area is not distinguished from other agricultural areas in the broad vicinity.**

An important element of considering the potential impact of wind farms on birds is the analysis of the location of the farm in relation to existing or planned forms of area protection. However, what matters most here is not whether the area in question is within or outside the precinct, but whether it lies near a protected area.

This is because protected areas with very large acreages contain both important areas for birds and completely marginal areas – it was not possible to take into account the mosaic nature of the terrain when these areas were created. The stage of planning specific investments is the right time to establish the real value of particular fragments of the area and to determine the possibility or impossibility of locating a particular investment there.

The site in question is located on the border of an area protected under the Natura 2000 project (PLB 280015 - Ostoja Warminska - identical in terms of territory to the area called “Bociany Warmińskie”) – a fragment of the land (a field) around the village of Różyna is located within the protected area, while the Spurgle field is situated outside it.

Impact of wind power plants on birds

Wind turbines have the potential to affect three important elements of environmental quality: nuisance for inhabitants, landscape architecture, and threats to birds.

This study only addresses the risks to birds that could result from the construction of wind power plants at the proposed site.

Wind power plants, like all tall structures, can potentially pose a threat to birds. An additional element of risk here is the movement of the power plant rotor blades. Both birds breeding near the power plant and non-local birds stopping for moulting or during migration, as well as birds in active flight, could be potentially threatened. Operating wind turbines repel birds, which on the one hand reduces the risk of collision with the power plant, but on the other hand causes exclusion of a certain area from use by birds. In the case of breeding birds, the deterrent effect has little effect on bird occurrence, being limited to the immediate vicinity – breeding birds quickly become accustomed to operating power plants and adapt their behavior to the new environmental feature.

Passing birds do not have time to learn about local hazards and are more likely to collide with operating turbines. However, this occurs mainly under specific conditions of low visibility and during night flight.

Under normal conditions, flying birds respond to spotted power plants by changing their flight path – avoiding the obstacle horizontally or by raising their flight ceiling above operating power plants.

There are two parameters of the wind farm that are crucial to the safety of birds during flights: the location of the wind farm in relation to the local flight path preferred by the birds and the distance between the turbines. In the case of a flight path strongly determined by local conditions (layout of leading lines, e.g. coastline, reservoirs and watercourses, distribution of wooded areas or location of very attractive feeding areas) there is a risk that a strong internal impulse to maintain the flight path will cause the birds to “disregard” the threat and fly into the area of the

wind farm. In such a case, the arrangement of turbines and the technical parameters of their operation: distances between turbines and rotor speed begin to play a huge role.

In general, slow-speed turbines spaced at least about 400 m apart (2 x the typical avoidance distance of an operating turbine) allow birds to effectively avoid the hazard. However, care must be taken to ensure that farms do not cover large, uniform areas in places that are important for migrating or foraging birds.

RESULTS OF ANNUAL ORNITHOLOGICAL MONITORING

A complete discussion of the results of the ornithological monitoring is an evaluation of the results obtained for the pre-execution monitoring, covering the entire year – all phenological periods. Detailed discussion is included in Appendix 9 (***"Final assessment of potential threats to birds resulting from the planned construction of the "SĘPOPOL wind farm"*** – Przemysław Busse, ***November 22, 2009***) **and details of the issues raised here should be sought there**.

Detailed results are discussed separately for both observation fields

- "Różyny" (table and figure designations – ROZ) and
- "Spurgle" (designations – SPU) and then commented together.

Assumptions for ornithological monitoring of the wind farm

1. Full monitoring of the wind farm includes **pre-execution** monitoring and operational monitoring, once the investment is operational.
2. The monitoring scheme should be established as a framework – following the principles adopted at other sites – to enable future comparisons and the creation of coherent subject knowledge for further practical applications.
3. Despite the common scheme, monitoring in a specific location must be adapted in detail to the specific conditions of each area.
4. Adoption of a flexible methodological system – adaptation of methodological solutions to the situation found in the first observation cycle, covering all phenological periods (pre-execution monitoring) and application of periodic evaluation of results after each phenological period.

5. Starting monitoring as early as possible in the project planning process and conducting it continuously until the turbines are erected (further continuation in the form of operational monitoring).

Monitoring field observations methodology:

Autumn migration period *(September 1 – November 15)*

1. Stationary visual observations of active passage and residence/feeding of birds with a focus on potentially sensitive and site specific species.

Detailed observations from a fixed point on the site – in the central part of the envisaged wind field.

Observations from no later than 1 hour after sunrise until about 12:00.

During the first 3 hours, special attention should be paid to the passage of passerines, then to birds of prey. Time noted down every 15 minutes.

2. Meteorological data noted down with time of change (if any): temperature, cloud cover, visibility, precipitation, wind (strength and direction).

3. All observed species, their numbers and behavioral details (**flight direction, altitude, flight purpose,** e.g. "flying to feeding grounds"), “active wandering,” “foraging,” “resting”; **distance from the observer**) should be recorded. Making notes in observation notebooks, in appropriate columns and using standard abbreviations.

4. For birds of prey, the duration of stay at the site should be determined (the unit of stay is one hour).

5. Graphical documentation of passage routes by location on base maps *if repeat passage is observed*.

Winter period (*mid-November – early March)*

□ □Observations with free choice of observation routes (transects) as a result of accumulated experience. Scope and documentation of observations as in fall inspections.

Spring-breeding-post-breeding period *(early March to late August)*

□□ Inspection of the use of land for turbine locations by birds.

During spring migration (until the end of April), stationary observations with the addition of transect observations, then transect passes as in winter. It was necessary to perform an inventory of stork nests and gather information on “zoned” birds nests.

Table of number of observations in seasons

Season	Number of days/week	Frequency of days		Frequency of weeks		
		5	10	1	2	3
Autumn (Sep. 1 – Nov. 15)	75/10	15	**14**	10	5	-
Winter (Nov. 16 – Feb. 28)	105/14	-	10	14	7	**6**
Spring (March 1 – April 30)	60/8	12	6	8	**8**	-
Breeding (May 1 – June 30)	60/8	-	**12**	8	4	-
Post-breeding season (July 1 – August 31)	60/8	12	6	8	**8**	-
TOTAL	**48**		**26**		**16**	**6**

The statement of the number of observations applies to the entire site, with alternating visits to the fields according to a schedule determined by the results of the detailed site reconnaissance.

Collision rate estimation methodology – general remarks

The entire course of the collision rate estimation process was conducted in accordance with the standard adopted for risk assessment at many wind farm locations in Poland, which allows for a relative assessment of each successive location, in relation to other places where wind farms are planned or built (see "*Parameters characteristic of the location*").

Methodological details are provided in the separate Appendix 10 "Methodology for estimating bird collision rate at land wind farm sites (v. 2009-11-20)".
The description of the methodology has been revised and simplified – a careful reading of this appendix is NECESSARY to properly perceive and understand the monitoring results given below.

Results of monitoring in observation fields

(1) The number, duration, and dates of observations conducted are provided in Appendix 8.3 (Table 1),

□□**(2)** a complete list of all species observed, **including species listed in Appendix I to the EU Birds Directive, the Polish Red Book of Animals and in general all protected species** is provided in Appendix 8.3 (Tables 2 and 3); the list also includes **numbers of individuals of each species observed** and estimates of potential collision per year and per

turbine,

(3) the characteristics of site use by each species during all seasons of the year are given in Appendix 8.4 (Fig. 1),

(4) the characteristics of bird movement directions by season are given in Appendix 8.4 (Fig. 1),

(5) the airspace utilization characteristics (below the range of the planned turbine rotor, within the range of the planned turbine, and outside the range of the planned turbine) are given in Appendix 8.4 (Fig. 1),

(6) discussion of site characteristics in terms of 6 parameters (number of species, total count, total estimated collision rate, collision rate of birds of prey, Directive Appendix I species and Red Book species:

For the Różyna observation field –

Almost all values of the main parameters are average: the number of species observed, total bird abundance, estimated total collision rate, estimated collision rate of birds of prey and Directive Appendix I species are average, comparing the results to the data from 51 sites surveyed so far. The collision rate for Red Book birds is virtually nil. The overall location score is **+8** points, which is within the range of **RECOMMENDED (good)** locations **–** (see *"Estimation Methodology", Appendix 10*).

For the Spurgle observation field –

The number of species observed and total bird count are average, comparing the results to data from 51 sites surveyed so far. The estimated overall collision is slightly elevated, near the top quartile of the distribution, and the estimated collision rate of birds of prey is average. However, for Directive Annex I species it is clearly above the third quartile, but this is due to single sightings of a large flock of cranes and golden plovers in passing. The collision rate for Red Book birds is average. The overall location score is **+1 point**, which is within the range of **ACCEPTED (average)** locations – (see *"Estimation Methodology"*). Considering the aforementioned two herd observations as incidental, the score would change to **"good"**.

(7) Discussion of the occurrence and threats to birds listed in Appendix I to the EU Directive:

For the Różyna observation field –

White stork, *Ciconia ciconia* – a total of 215 individuals were observed, including 108 and 79 birds in two observations in late July, during the pre-migration gatherings. Potential threats to nesting storks are discussed below. The **common crane, *Grus grus*** – 87 individuals were observed in small numbers, including 30 on a single day during spring passage. The estimated collision rate is once every 83 years or so, which is scant.

The **woodlark, *Lullula arborea* –** a total of 37 individuals were observed, mostly in passage. Estimated collision rate: approximately once every 330 years.

The **western marsh harrier, *Circus aeruginosus*** – observed 20 times, during autumn passage and breeding season. No nesting was observed in the studied area, only feeding and patrol flights, only below the range of the rotor. Estimated collision rate: indeterminately low.

The **red-backed shrike, *Lanius collurio*** – observed only 18 times. This species has never been observed at a height of collision with a turbine rotor.

The **lesser spotted eagle, *Aquila pomarina*** – observed only 6 times.

The others appear sporadically (maximum 8 times). **The farm poses no threat to these species.**

For the Spurgle observation field –

The **common crane, *Grus grus,*** was observed in great numbers only on one day during the autumn passage – 506 out of 661 observed in total. The estimated collision rate of once every 1.1 years or so is **unrealistically high**, given the incidental nature of the appearance of a large number. According to data from Europe (Hötker *et al*. 2006) up to 2004, there was not a single collision for this species.

The **Golden plover, *Pluvialis apricaria* –** a total of 600 individuals were observed, but similar to the crane, 516 individuals on one day in autumn. Hence, the estimated **collision rate** of once every 2 years or so is as **unrealistically inflated** as that of the crane. Both species are observed in at least equal numbers at all locations covered in northern Poland. According to data from Europe (Hötker *et al*. 2006) up to 2004, only 4 collisions of this species were found.

The **white stork, *Ciconia*** – a total of 30 individuals were observed, just after arrival in spring, summer and at the beginning of the autumn passage. Potential threats to storks are discussed below.

The **lesser spotted eagle, *Aquila pomarina* –** observed 13 times, during the whole breeding season. Known nests of this species are located between 1.5 and 8 km from this observation field (Map 2). The infrequent occurrence and altitude distribution of flights indicate that the area in question is not an important feeding area. The eagles' distrust towards wind turbines, which is well known from the literature, allows us to assume that the farm will be avoided by these birds, and at the same time it will not deplete their feeding opportunities.

The western marsh harrier**, *Circus aeruginosus* –** a total of 22 individuals were observed, during the breeding season and during the autumn passage. Collision magnitude approximately once every 419 years. The species is observed at all locations in Poland.

The **black woodpecker, *Dryocopus martius*** – found 14 times. A forest species, at the same time very easy to spot already from a considerable distance (loud voice). The farm is irrelevant to it.

The **red-backed shrike, *Lanius collurio*** – observed only 12 times. This species has never been observed at a height of collision with a turbine rotor.

Others appear sporadically. **The farm poses no threat to these species.**

(8) The issue of direct cumulative impacts for this location does not occur because there are no similar facilities in the vicinity. The cumulative impacts of the Górowo and Sepopol farms are discussed below.

(9) Due to the poor passage found in this area, the barrier problem is not present (no discernible effect).

Ornithological characteristics of the
location vs. Natura 2000 Protected Areas

The non-breeding period, i.e. post-breeding roosting/breeding dispersal – autumn passage – wintering – spring passage is characterized by the fact that the vast majority of birds are not tied to a specific area and can move freely, changing feeding and resting areas to suit current food abundance, existing threats and weather conditions.

At this time, the impact of investments located outside protected areas on the protected areas themselves is none or minimal.

Exceptions to this may be wind farms built around migratory corridors, roosting and feeding routes, or unique feeding areas for which there are no suitable alternatives nearby. Similar problems can be created by extensive wind fields with several hundred turbines limiting freedom of flight or forcing long distance feeding flights. In these relationships, much depends on the characteristics of the protected area – the paradigm of species for the conservation of which the area was established and for the protection of which stage of the life cycle of birds it was established.

Areas established to protect breeding grounds may be completely lacking in protective value during non-breeding periods – and vice versa.

During the ***breeding season,*** the location of a site within a protected area requires a meticulous assessment of both the potential for collision and the potential for loss of feeding grounds or displacement of the pair from the occupied area. Locations outside of protected areas but exhibiting frequent appearance of birds with extensive hunting territories may be subject to evaluation as to whether they result in an irreplaceable loss of feeding habitat, in addition to the real possibility of collision.

Areas established for bird conservation have a very different level of significance when assessing potential threats to birds than habitat areas.

The site in question is located within a protected area as part of the Natura 2000 project (PLB 280015 – Ostoja Warmińska – an area identical to the area called “Bociany Warmińskie”).

Other areas protected due to their avifauna are far beyond the possible range of influence of this farm.

The analysis of the significance of threats took into account the broad characteristics (Standard Data Form) for PLB 280015, which is an area designated primarily for the protection of storks, as well as several species of birds of prey. A number of species from Appendix I to the EU Council Directive 92/43 EEC were found in the area and 15 of them were given a “B” level of area importance. These species belong to very different systematic and ecological groups (e.g. there are typical forest species), which results in a very diverse use of the area and the biotopes occurring there.

This results in the fact that investment risks in some areas may be significant, while in neighboring areas they may be marginal.

The conservation problems characteristic for this area are well presented by the discussion included in the Natura 2000 Standard Data Form:
"One of the most important threats for the valuable bird species and their habitats occurring in the area of Ostoja Warmińska, as well as for the biodiversity in the area of the refuge in general, is the abandonment of extensive farming, leading to the abandonment of agricultural land use and overgrowing of unused meadows, peat bogs and other open and valuable natural areas. ***Also threatening is the development of intensive agriculture****,* ***in some areas, associated with far-reaching unification of the agricultural landscape*** *(cutting down mid-field tree buffers, backfilling small water bodies and peat bogs),* ***causing the loss of many habitats, especially wetlands****."* ***Changing cultivation patterns****,* ***farm restructuring, and afforestation*** were listed as factors threatening refuge values at rank A in the Form. ***It should be emphasized here that the areas planned for the location of the wind farm in question are located in areas which, due to intensification of agricultural production, have already to a large extent lost their value as areas extensively used by birds and it cannot be expected that they will regain that value in the foreseeable future.***
The SPA area is very extensive territorially and covers as much as 142,016 ha (an area about 115 km long and 10-20 km wide), which results in its great diversity. - within its boundaries are areas of high value to birds, as well as areas of secondary importance due to land cover and/or farming. The vastness of the site means that although the numbers of important species reported in the Site Form may seem significant, local densities may in fact be low and at a particular location these birds may not occur at all or may appear sporadically, leading to low collision hazards and little to no impact on the feeding grounds of the nearest nesting pairs.
For the **lesser spotted eagle**, the most important species for Ostoja Warmińska, in the case of two observation fields at the Sępopol farm – Różyny and Spurgle – the **collision risks are very low** – 0.04 and 0.19 individuals respectively, **totaling 0.23 individuals per whole farm per year** (with a **very conservative assessment** according to calculations using our own avoidance index – see "***Methodology.***.."), or even 0.02 and 0.07, **totaling 0.09,** using the avoidance index provided in the latest work by Fernley (2009). **Such potential losses cannot affect the eagle population in Ostoja Warmińska in any significant way (even taking into account the cumulative losses from the Górowo wind farm)**. The potential loss of stork populations, relative to their population in the entire protected area, is only **0.05%** per

year, and **thus virtually imperceptible, with losses of several tens of percent during the first migration to wintering grounds in South Africa.**

Threat minimization recommendations

Threats at the Sępopol wind farm are assessed as insignificant for Ostoja Warmińska. Nevertheless,

- as these threats, although low, are higher for the lesser spotted eagle in the Piasek field of the Górowo wind farm than in other examined fields (considering both farms), it is proposed to reduce the number of turbines in this field. This will result in a reduction in potential losses across the protected area. This is illustrated in tables 1 and 2

Table 1

Estimates of the number of casualties per year per field of the Górowo and Sepopol farms. Collision rate calculated using WindFarm Risk software with avoidance rates according to Busse and Fernley. Bold - Nature 2000 areas.

			Busse		Fernley	
	Turbines	Obs. specim.	Collision rate	Casualties	Collision rate	Casualties
Piasek						
Option 1	**27**	**14**	**0.01748**	**0.47**	**0.00699**	**0.19**
Option 2	**16**			**0.28**		**0.11**
Wiewiórki	**13**	**12**	**0.00756**	**0.10**	**0.00301**	**0.04**
Sępopol						
Różyny	**15**	**6**	**0.00299**	**0.04**	**0.00119**	**0.02**
Spurgle	15	13	0.01263	0.19	0.00505	0.07
Option 1 NATURE	**55**			**0.61**		**0.25**
Total	70			0.80		0.32
Option 2 NATURE	**44**			**0.42**		**0.17**
Total	59			0.61		0.24

Table 2

Effects of removing 11 turbines from the Piasek field of the Górowo farm. Decrease in the estimated mortality of lesser spotted eagles in percentage.

	Turbine	Casualties	
		Busse	Fernley
NATURE option 1	**55**	**0.61**	**0.25**
Total	70	0.80	0.32
NATURE option 2	**44**	**0.42**	**0.17**
Total	59	0.61	0.24
Difference NATURE		**-28%**	**-32%**

The predicted collision rates of other species, including storks, will also decrease proportionally.

- As the development of techniques to deter birds from turbines or to automate turbine shutdowns in the periods of increased threats is foreseen (e.g. works carried out in Poland within the framework of the Technological Initiative I grant), it is proposed to oblige the investor to install the most state-of-the-art devices of this kind that will be available at the moment of commissioning the farm and to modernize them as the technology develops.
- Conducting special observations of the behavior of white storks as part of post-construction monitoring in order to relocate the artificial nest platforms to a safer place should dangerous behavior of certain pairs occur.
- It is proposed to carry out the wind power installation works before the arrival of the lesser spotted eagle, i.e. until the end of April and/or after their departure – from September.

Post-construction monitoring

- It is recommended to conduct ornithological monitoring during the initial period of constructing the wind turbines (first 3-4 turbines) and to comply with any recommendations which may arise from these observations.
- The basic 3-year as-built monitoring should cover the first two years of the wind farm operation and one year, which may be the third, fourth or fifth year of the wind farm functioning. The decision on the third year of observation can be made only after the analysis of data from the initial period.

- The post-construction monitoring methodology should employ the standards of the pre-construction monitoring with the addition of inspections aimed at finding possible casualties of collisions. If possible, automated methods should be applied if available by that time.

CONCLUSIONS

1. **The presented results of monitoring indicate that the discussed farm is characterized by average avifauna values in general. In the area covered by the analysis, bird collision rates, estimated considering local conditions, are at average level. The farm at this location will not pose a significant collision hazard to birds. Both fields received an average (Spurgle) or good (Różyny) rating.**
2. **The farm does not pose a significant threat to the species, especially the lesser spotted eagle and the stork, which the Natura 2000 Ostoja Warmińska was designed for, as well as to other bird species. It also does not affect the integrity of the system or protection areas located further away, which are far beyond the possible range of impact.**

5.2.11 Impact on chiropterofauna

Location and description of the site

The elements of description and location of the wind farm in the area which are discussed below cover only the features of the area which are significant from the point of view of analysis of potential impact of the wind farm on bats.

The location of the *"Sępopol" – Różyna/Pasławki* wind power complex is planned south of Sępopol, north of Różyna (15 turbines) and around the village of Pasławki (15 turbines). In total there will be 30 turbines with a capacity of 2 MW. Following the screening conducted in 2009 it is suggested that these sites should be analyzed both as three separate fields and as a cumulative impact. The northern part of the site (the field near Różyna) is situated on a flat land, partly adjacent to a young forest stand (young and therefore lacking natural hiding places; there are artificial shelters such as boxes). The southern part (2 fields near Pasławki and Chełmiec) is also located on flat, not diversified terrain, and the only element distinguishing the fields from each other is a narrow river flowing along the boundary of the farm planned near the village of Chełmiec. So far no data have been collected on its attractiveness for bats. The field

in the vicinity of the village of Pasławki is similar to the one in the northern part of the site, except that it is crossed by an asphalt road with a line of trees, while in Różyna the road is only a section of the farm's border.
When analyzing the area from the agricultural point of view, it should be classified as a typical large-area crop rotation farming. Within the fields there are no clumps of trees, and small ponds periodically disappear, which is why they are not an attractive feeding area. Probably the most attractive feeding ground is in the very village of Pasławki, which is situated outside the farm area but should be included in the buffer zone. *The area selected for the investment does not differ from the surrounding agricultural areas.*

Impact of wind power plants on bats

Renewable power industry is a rapidly growing field both on a global and local scale – in our country. Its most dynamic branch is wind power industry, which in Poland in the coming years (until 2013) will have "a dominant impact on the increase of the share of RES energy in the country's total energy balance, and thus on the degree of compliance with the obligations arising from Directive 2001/77/EC". Thanks to the support for wind farm projects from the Cohesion Fund under Priority Axis 10.4 of the Infrastructure and Environment Operational Programme, the development of wind power in Poland is gaining momentum.
On the other hand, uncontrolled construction of wind farms poses a number of ecological threats. Scientific research proves that areas with wind conditions favorable for the production of electricity are at the same time valuable sites for bird and bat populations (this applies especially to areas already protected under the Natura 2000 network).
Poland is home to 25 species of bats, of which 20 species regularly breed here. Many valuable sites with bat breeding colonies, hibernacula, feeding grounds, and habitat corridors have already been identified in the country. However, there is still a large number of locations that have not yet been explored by specialists. None of the European countries has a complete knowledge of the migration routes and important refuges for avi- and chiropterofauna, so research for such large investments as wind farms is necessary.
The monitoring plan on which this study was based was determined mainly following the *"Interim Guidelines for the Assessment of the Impact of Wind Power Plants on Bats (for 2009)" (Kepel et al., 2008).* This document is recommended by the Alliance for the Conservation of Bats (in Polish: *Porozumienie dla Ochrony Nietoperzy*), the

State Council for Nature Conservation (in Polish: *Państwowa Rada Ochrony Przyrody*), and organizations involved in bat research and conservation. Wind power plants may potentially affect three important components of environmental quality: nuisance to residents, landscape architecture, and threats to fauna (especially birds and bats).

This study only addresses the risks to bats that could result from the construction of wind turbines at the proposed site.

The main danger to bats is not the power plant as a tall structure, but the negative pressure generated by the movement of the rotor blades, which causes their alveoli (which in bats are built differently from those in birds) to explode, causing internal bleeding and death of the animal. Cases of collision with a rotor are much rarer.

Both local bat populations and migratory animals may be under potential threat. Migrations, as in the case of birds, occur in spring and fall. The studies conducted to date suggest that migratory bats are at higher risk because their feeding and short-distance flights between shelters, feeding grounds or waterholes are at lower altitudes (20-30m on average).

There are two parameters of the wind farm that are crucial to the safety of bats during flights: the location of the wind farm in relation to the local flight path preferred by the bats and the distance between the turbines. The negative impact of the construction of a given facility on bats can be manifested in one of two ways: either the bats change their migration routes, abandon certain feeding grounds, leave their long-time shelters, etc., or they may die "in collision" as described above. In the case of presence of larger numbers of bats in the area of a wind farm, the placement of turbines and technical parameters of their operation, i.e. distances between turbines and rotor speed, play an important role.

So far no uniform scheme of placement of turbines taking into account the needs of bats has been prepared, therefore each of the potential wind farms is analyzed individually. In general, it is only known that farms in locations that are important for bats during migration or relocation to feeding grounds should not cover large, uniform areas, and turbines should be located at least 150-200m from forest walls, tree or shrub buffers (similarly from reservoirs and larger watercourses).

Location of the farm in relation to protected areas

The investment is located on the border of a protected Natura 2000 area (PLB 280015 - Ostoja Warminska - identical in terms of territory to the area called "Bociany Warmińskie") - a fragment of the land (a field) around the village of Różyna is located within the protected area, while the Śmiardowo field is situated outside it. This area is precious for avifauna, but of lesser importance for chiropterofauna. ***There are no bat protected areas within the impact range of this farm.***

Monitoring

A screening, i.e. an assessment of the potential impact of the planned project on chiropterofauna, which is used as a basis for the preparation of the research methodology, was undertaken in September 2009.

The purpose of the screening is to assess the sensitivity of the location from the point of view of possible significant negative impact of the planned investment on locally present populations of bats, migrating bats and elements of the environment attractive for bats which are situated in the area of the farm or in its immediate vicinity, the so-called buffer zone. As a result of this initial assessment, the location was identified and the risk of significant impact on chiropterofauna was assessed based on available data.

The results obtained in the first phase of the screening were used to issue this opinion. This assessment is a study and was carried out by a specialist – chiropterologist.

Methodology of pre-investment chiropterological monitoring

Due to the substantial cost of the investment, the pre-investment monitoring in the area planned for the wind farm "must be conducted using objective methods that exclude human error and allow for further verification of the collected data by another expert. It is necessary to use devices, which enable automatic registration of the birds and bats flying over the area. The recorded data should be reviewed by experienced naturalists" .

The monitoring methodology for the site for the planned wind farm in the vicinity of Sępopol – Różyna/Pasławki was developed individually, based on the screening taking into account phenological changes in the local environment. The discussed area (along with the adjacent buffer zone of approx. 1.5 km width) is to be subject to annual research from March to November, as shown below.

Frequency of inspections

(based on the Guidelines with own modifications adjusted to the individual environmental conditions for the area of Sępopol - Różyna/Pasławki)

LISTENING PERIOD	FREQUENCY AND SPECIFICITY OF INSPECTIONS	THE MAIN TYPE OF BAT ACTIVITY INVESTIGATED
March 15 – April 30 and May	inspections at least three times a month; one all-night inspection in May, the remaining inspections – 4-hours beginning at sunset	leaving winter habitats; spring migration, formation of breeding colonies
June 1 – July 15	at least 4 all-night inspections	reproduction; peak activity of local populations

August 1–31	inspections at least three times a month; two all-night inspections, the remaining inspections – 4-hours beginning at sunset	disintegration of breeding colonies and beginning of fall migrations, swarming
September 1 – October 31	inspections at least three times a month; two all-night inspections, the remaining inspections – 4-hours beginning at sunset; in the areas of expected migration of the common noctule it is recommended to conduct additional listening in the evening (even up to 4 hours before sunset)	fall migrations, swarming
November 1–15	inspections at least once a week, each for 2 hours, beginning 30 minutes before sunset	last flights between shelters, beginning of hibernation

For the farm discussed in this study (in the area of Sępopol - Różyna/Pasławki) it is planned to conduct about 27/30 inspections per year, taking into account various periods of bat activity (spring and fall migration, feeding, forming breeding colonies, swarming, mating). Limiting the research in any of the above recommended periods may result in an inadequate assessment of bat activity at the investment site.

In addition, prior to the commencement of the annual bat control cycle, the site was subjected to a screening, carried out in the first half of September 2009, which aimed, among other things, at locating potential bat shelters and feeding grounds, as well as their migration routes. A buffer zone with a radius of approx. 1.5km around the borders of the area was also defined during the site inspection.

It is also planned to control potential shelters of breeding colonies and hibernacula of bats, which will be conducted in the second half of the summer season and in winter, depending on weather conditions.

During the inspections, simultaneous listening and recording of bat sounds is carried out, which are then analyzed on the basis of review of the recorded sonograms. The analysis of sonograms allows for identification of species and determination of bat activity indices Listening and recording of sounds is carried out on pedestrian/car transects (passed at the speed of max. 25 - 30km/h) and at the most crucial posts (on

average, about 10 minutes per point). The transect routes and listening post locations were determined in such a way as to cover as many different landscape elements and habitat types as possible and as close as possible to the planned turbines.

The inspections are conducted only "from the ground" (ground level). They last one night, begin cyclically from different posts and continue in different directions. Subsequent inspections shall follow at intervals of no less than one week.

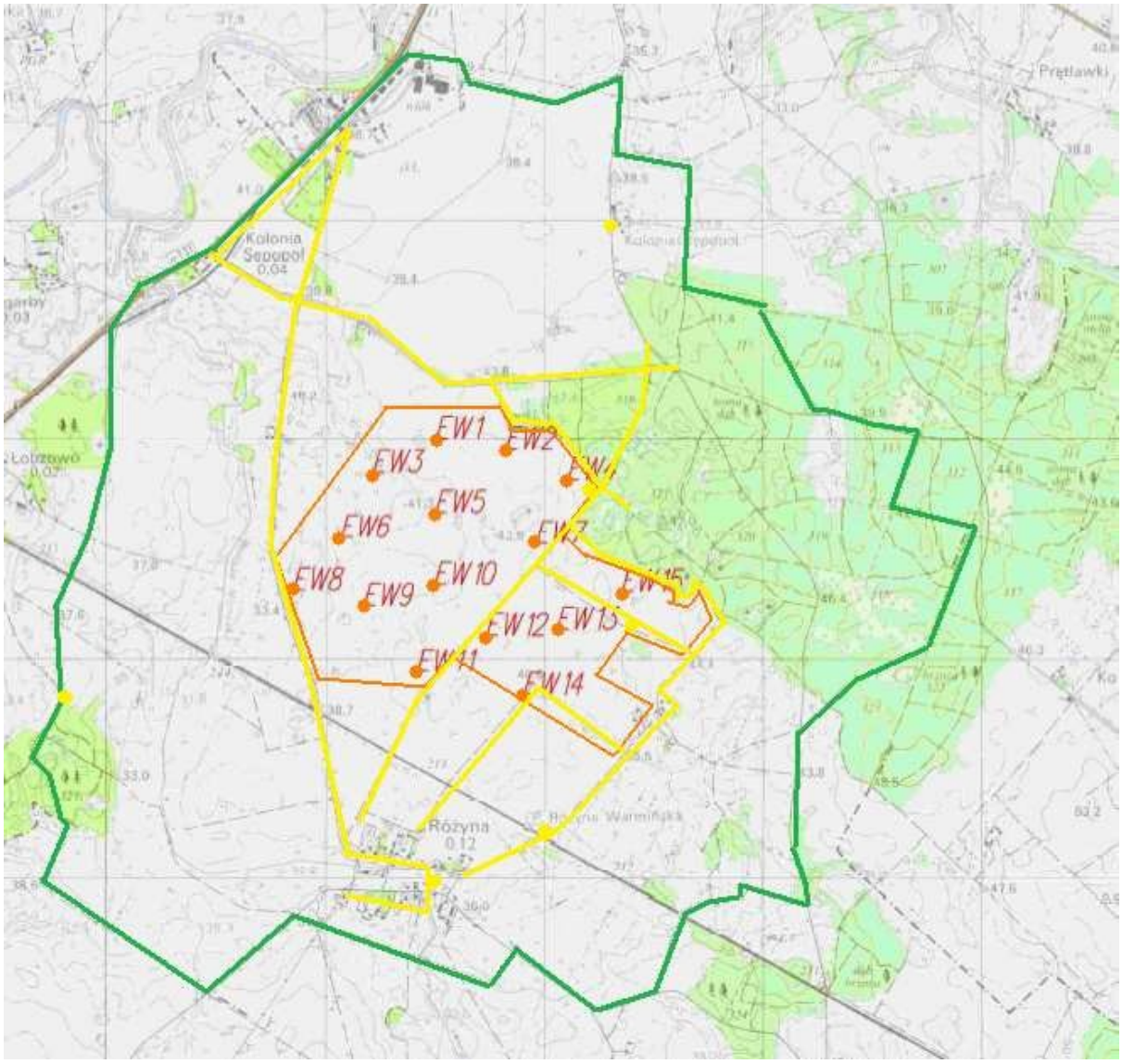
Minor deviations from the above methodology are permissible but must not affect the final results and conclusions drawn.

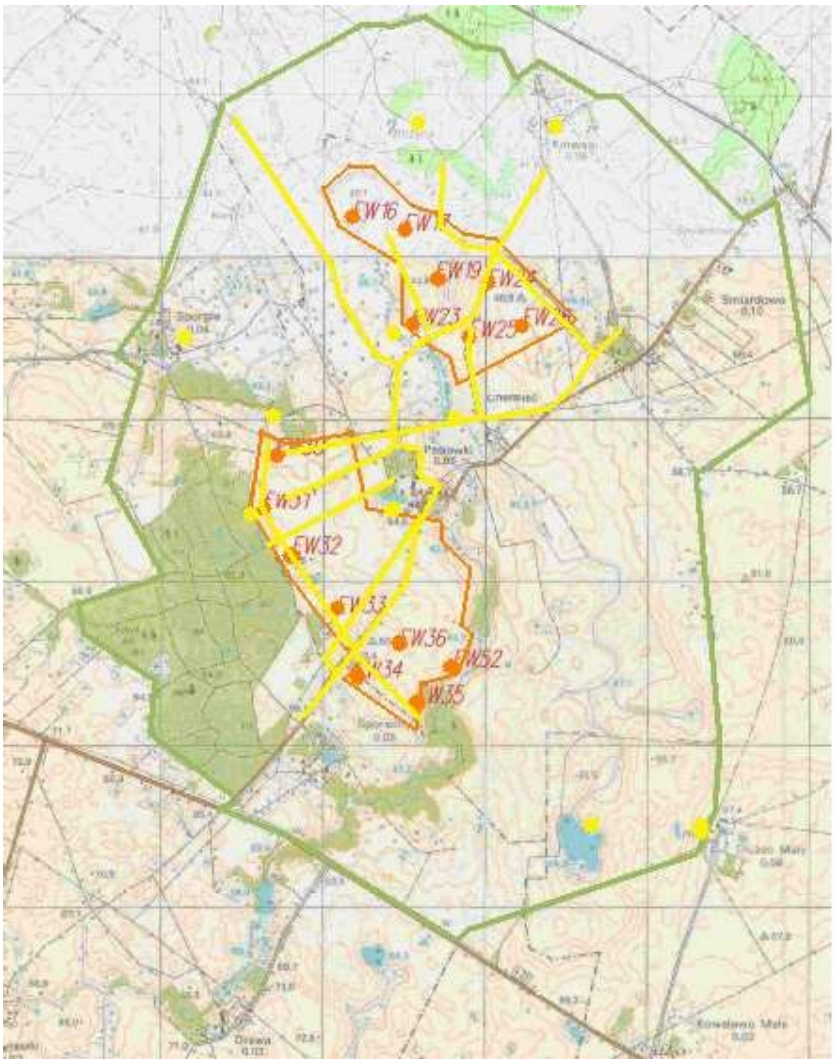
Equipment

The AnaBat SD1 ultrasound detector (serial number 04789), which is a broadband ("zero-crossing frequency divider") device, was used to listen to and record the sounds. This device allows for a zero crossing analysis.

The analysis of the sonograms is performed in the compatible AnaLook software.

Location of transects and listening posts on the map





Explanations to the map:

- green line – buffer zone boundary
- red line – wind farm area boundary
- red points – locations of wind power plants
- yellow line – transect routes
- yellow points – locations of listening posts

Final remarks

- The results of the screening allow excluding the location of the "Sępopol" - Różyna/Pasławki wind farm project as an investment, which might pose a high risk of a significant negative impact on key species listed in appendices no. 1 to the Regulation of the Minister of Environment of 28 September 2004 on protected species of wild animals (Journal of Laws No. 220, item 2237).

- On the basis of the recordings already made, from among the bat species listed below, only the species of the Vespertilionidae were found – the remaining species:

SPECIES OF WILD ANIMALS UNDER STRICT PROTECTION WITH LISTING OF SPECIES REQUIRING ACTIVE PROTECTION*

1) **APPENDIX No, 1**

No.	English name	Latin name
	BATS	CHIROPTERA
	horseshoe bats	**Rhinolophidae**
293	greater horseshoe bat	Rhinolopus ferrumequinum
294	lesser horseshoe bat (1) (2)	Rhinolopus hipposideros
	vesper bats	**Vespertilionidae**
295	pond bat (1) (2)	Myotis dasycneme
296	Geoffroy's bat (1) (2)	Myotis emarginatus
	vesper bats - other	**Vespertilionidae**
297	species (2)	

Explanations:

* Animal species were grouped into higher systematic units in the following way:

- the names of **CLASSES** are in capital letters, in bold font style,
- the names of ORDERS are in capital letters, in regular font style,
- the names of **families** are in small letters, in bold font style.

Latin names of species, families, orders and classes are additionally marked in italics.

(1) - species for which the derogations from the prohibitions set out in § 8 of the Regulation do not apply,

(2) - animal species requiring active protection.

** No Polish name.

However, this assessment does not give a detailed answer as to how high the risk of negative impact is. Lack of information on the presence of key species can be a consequence of both actual non-existence of the mentioned species in the studied area and failure to perform annual chiropterological monitoring. Based on the data already obtained from the screening, a methodology for pre-investment chiropterological monitoring was designed. It was developed based on and in accordance with the *"Interim Guidelines for the Assessment of the Impact of Wind Power Plants on Bats* (for 2009)" (Kepel et al. 2008). *The "Interim Guidelines..."* were in turn based on Annex 1 of Resolution 5.6 of the EUROBATS Agreement on the Conservation of Populations of European Bats entitled *"Wind Turbines and Bats: Guidelines for the planning process and impact assessments"* (Rodrigues et al. 2008).

Furthermore, even though the farm is located in the immediate vicinity of a Natura 2000 site (PLB 280015 – Ostoja Warmińska, the so-called "Bociany Warmińskie"), the site does not appear to be valuable for bats. The area intended for the investment consists of fields cultivated in large-scale technology. There are occasional fragments of wooded areas on the boundary of the investment site, however the architectural plans indicate that the location of the turbines is designed to maintain a distance of at least 150-200m from the tree buffers. Similarly, the issue of maintaining at least 500-600m distance from buildings has also been taken into account. This is important information to the advantage of this wind power plant complex, as the site inspection has shown that summer and winter shelters are to be expected in the surrounding settlements, which are probably the only suitable places in the area - due to the lack of alternative natural shelters. High bat activity is not expected above intensively farmed areas (not diversified with tree buffers, rows of trees, water bodies, rivers etc.), but may occur at the boundary of the tree buffers, which is supposed to be free from turbines.

The studied locations are analyzed both as 3 separate fields and as 1 cumulative impact. The opinion issued is based on site inspection, interviews with residents, discussions with the investor and the planner, but primarily based on the recordings of bats' sounds made with the Anabat SD1 ultrasound detector (SA recordings attached to the Opinion). This Opinion was issued to document that specialist research on chiropterofauna resources is already being conducted in the area of the proposed investment: "Sępopol" - Różyna/Pasławki wind power plant complex. At the same time it is stated that the screening is continued and will be completed on the night of 14/15 September 2009.

5.2.12 Cross-border environmental impact

Taking into account the nature and location of the analyzed project, no cross-border environmental impact is expected.

It is possible, however, that the project will positively impact the environment on a global scale when implemented. The implementation of the project will result in a decrease in the greenhouse effect as a result of replacing fossil fuels, thus reducing the emission of CO_2 into the air.

5.2.13 Interdependence of individual factors

There is no interdependence between the analyzed elements of the environment.

5.2.14 Use of natural resources

There is no impact on this element of the environment, no natural resources are used.

5.3 <u>Decommissioning phase</u>

On average, wind power plant investments are designed for 20 years plus of operation and are then usually replaced by newer ones and further operated. They should therefore be classified as fixed investments.

Nevertheless, in accordance with the statutory requirement, the environmental impact of the decommissioning phase was analyzed with regard to:

- the impact on air quality
- the impact on acoustic climate,
- the impact on the level of vibration,
- the impact on the ground surface and soil,
- waste.

5.3.1 Impact on air quality

The threat to the air quality will result from the operation of construction equipment and means of transport. Fugitive emissions will occur. Suspended dust and falling dust will be emitted. During decommissioning there will be similar issues as during construction, as discussed in point 5.1.1.

No adverse impact on the air quality is anticipated during in the decommissioning phase.

5.3.2 Impact on acoustic climate

Noise will be generated during the decommissioning of the investment as a result of operation of construction and transport equipment, with sound levels of 85 – 110 dBA. It can be assumed that the scope of works will be similar as in the construction phase. Therefore, the threat of excessive noise during the decommissioning phase will be comparable to the construction phase discussed in point 5.1.2.

No threat to the acoustic climate is expected during the decommissioning phase.

5.3.3 Impact on the level of vibration

No excessive adverse vibration levels are expected during the decommissioning phase. The vibration levels will be similar as during the construction phase, as discussed in point 5.1.3. Workers operating impact machinery for breaking foundations will be at risk of on-site vibration. The operators of this equipment should be equipped with anti-vibration gloves.

No threat to the environment is expected during the decommissioning phase.

5.3.4 Impact on the ground surface and soil

The demolition works will remove the power plant facilities and concrete from the foundations and access roads from the land and soil surface. The land can be restored to crop production, following reclamation.

No threat to the environment is expected during the decommissioning phase.

5.3.5 Waste

Waste will be generated during decommissioning works. Construction elements, as waste, ferrous metals (code 16 01 17) and concrete rubble (code 17 01 01), should be transported to appropriate landfills.

Additionally, the following waste will be generated:

- used synthetic gear and lubricating engine oils – code 13 02 06 (hazardous waste) in the amount of about 0.5 Mg per turbine,
- used oil-soaked rags and clothes – code 15 02 02 (hazardous waste) in an amount of approximately 0.1 Mg,
- construction waste – code 17 01 07,
- wood – code 17 02 01,
- unsorted mixed municipal waste – code 20 03 01.

The waste generated will be stored in designated, secured areas and the hazardous waste mentioned will be stored in sealed containers. Due to the complexity of the decommissioning work, the dismantling of the structure will be carried out by a specialist company that will also secure the transport and disposal of hazardous waste.

Before commencing the decommissioning works, it is necessary to thoroughly analyze the issue of waste with respect to the current regulations in force for the date of decommissioning, due to the possibility of amendments being made to the waste legislation. Transport means will be comparable in number to the construction phase. There will be a periodic increase in exhaust and noise emissions associated with the operation of construction and transport equipment.

No threat to the environment is expected during the decommissioning phase.

6.0 ANALYSIS OF CHANGES IN LAND USE AND LANDSCAPE

The impact of operating wind power plants on the surrounding landscape results from the visual specificity of the structures themselves, the physiography of the investment area and the settlement structure of the region.

The visual impact of the structure depends on:

- height of the power plant tower,
- total height of the power plant (from the base to the highest extreme position of the propeller tip),
- spatial structure of the planned investment (single power plants or complexes),
- contrast painting of the power plant,
- rotor movement and number of blades,
- construction illumination.

The topography influences the impact of the power plant through:

- locations of individual power plant towers in the landscape,
- land use,
- exposure of the power plant in relation to surrounding areas.

The settlement structure of the region is shaped by the spatial distribution of human settlements, technical infrastructure (industrial plants, mobile phone towers, power grids), communication routes, etc.

The impact of the turbine depends mainly on its height parameters. The planned investment envisages the use of structures with a total height of up to 150 m. Therefore, the analyzed wind power plant facilities will constitute a strange, technical element of the natural landscape. Due to the height it is difficult to incorporate and "mask" the turbines in the landscape as they are towering over the tree buffers – appendix no. 5, photos 5 and 6.

The planned location of the wind farm should not significantly reduce the aesthetic value of the landscape. The wind power stations will be seen from traffic routes as follows:

Różyna Precinct

- from the access route to the GPZ station against the background of the P1 buildings - photo 1,
- from the GPZ station against the background of the P5 buildings - photo 2,

- from the P3 point in the direction of the GPZ station - photo 3,

Śmiardowo Precinct

- from the road against the buildings of the former Pasławki State Agricultural Farm P6 - photo 4.

Therefore, there are no objects of significant landscape and architectural value in the scenic background of the wind power plants - see photographs in appendix 5.

One of the factors that affect the perception of wind turbines is the movement of the rotor, the number of blades and the painting of the blades. The movement of the rotor itself can cause "fatigue" to the observer, especially from close distances. However, it should be noted that this is a very subjective sensation and depends on the individual person. The painting of the propellers should be matt in order to reduce the effect of sun reflections on the rotating blades of the power plant. Polish regulations require the tips of the blades to be painted in red and white stripes as obstacle marking of the structure. This is an element that disturbs the harmony of the landscape.

The construction of the wind power plant will not affect the character of use of the adjacent land. With the exception of the area for the GPZ station and the area occupied by foundations, the remaining area can be used similarly as it has been used so far – for agricultural development.

It should be emphasized that the issue of landscape changes associated with the location of wind power plants is subjective, which leads to varied opinions on the topic.

7.0 ANALYSIS AND EVALUATION OF THE OPTIONS OF THE PLANNED PROJECT

Option 0 – not undertaking the investment

Abandoning the investment will not have any direct impact on the natural environment of the area in question, it will remain unchanged. The area of the planned investment will continue to be used as agricultural land, as it has been used so far. Not continuing with the project means resigning from the possibility of producing renewable energy. No positive impact of the power plant, which contributes to reducing emissions of pollutants into the atmosphere, including the greenhouse gas CO_2, will occur. Abandoning the construction of wind power plants runs counter to the global policy of reducing air pollution and limiting the greenhouse effect. No steps will therefore be taken to fulfil Poland's commitments to increase the use of energy from renewable

sources and reduce CO_2 emissions. It should be borne in mind that following the entry into force of Directive No. 2001/77/ EC, on the promotion of electricity produced from renewable energy sources, negotiations were carried out in the internal electricity market in the area of energy. As a result of the negotiations, so-called indicative targets for renewable energy development were set for each accession country. For Poland, this target was set at 7.5% of electricity from RES, in the national balance of electricity consumption in 2010. Currently there are talks about obliging the EU Member States to produce 20% of energy from renewable sources by 2020, the target proposed by the European Commission for Poland is 15%. Moreover, not undertaking the project will result in no new jobs, both at the stage of construction and operation, and will not bring any financial benefits, in the form of taxes, to the commune.

The abandonment of the project due to its environmental, social and economic benefits should be treated as an unfavorable option.

Option 1 – undertaking the investment with the first option of location of the power plant assumed by the investor

The analyzed location option does not meet the requirements of environmental protection standards with respect to emitted noise – Map 2 appendix 4. Therefore, steps should be taken to reduce the number of wind turbines or adjust the power plant layout in the area.

This option should not be implemented due to the exceeding of permissible environment noise levels in acoustically protected areas – see table 1A in chapter 5.2.2 of the report.

Option 2 – undertaking the investment with the second option of location of the power plant assumed by the investor

The analyzed location option does meet the requirements of environmental protection standards with respect to emitted noise – Map 3 appendix 4. When considering the layout of the wind power plant towers, the location of the towers was planned so as not to exceed the permissible noise levels.

As a party to the United Nations Framework Convention on Climate Change, Poland is obliged to reduce emissions of greenhouse gases and other gases resulting from combustion, primarily coal. From the 19th century until today, the average global temperature has risen by 0.7° C , and exceeding the limit by 2° C could cause Greenland's glaciers to melt. Greenhouse gases, mainly carbon dioxide, are believed to be the main culprit of these changes. According to WWF, as much as 37% of these emissions come from fossil fuel energy production.

The International Energy Agency (IEA) estimates that global electricity consumption will double by 2020. Globally, it is estimated that 20% of electricity will be generated from renewable energy sources (WWF). Upon joining the European Union, Poland was obliged to generate 10.4% of electricity from renewable energy sources in the years 2010-2014[1]. We can observe a gradual increase in the number of both single power plants and entire wind farms in the country. However, the potential for generating "clean" electricity is still not widely exploited.

The energy obtained from wind power plants is called an environmentally clean form of energy. A 1 kWh of electricity generated during the operation of a wind power plant can replace a 1kWh of energy generated by coal-fired power plants. Thus, it eliminates the emission of pollutants associated with this process.

It can be assumed that the emission of compounds to the atmosphere during the production of 1MWh of electricity in conventional power plants amounts to:

- 7.8 kg of SO_2,
- 3.2 kg of NO_2,
- 937 kg of CO_2,
- 0.2 kg of CO,
- 1.1 kg of dust.

The data given above prove the great advantages of replacing energy from coal combustion with energy from renewable sources. Therefore, it is advisable to strive for replacing fossil fuels with energy sources that are less harmful to the environment.

[1] Regulation of the Minister of Economy dated 3 November 2006 amending the regulation on the detailed scope of obligations for the obtainment and presentation for remission of certificates of origin, payment of the substitute fee and purchase of electricity and heat generated from renewable energy sources (Journal of Laws No. 205 item 1510).

In accordance with the recommendations of, inter alia, the conventions in Montreal (1988), Sundsvall in Sweden (1990) and in Nairobi in Kenya (1991), devoted to the expected effects of climate change as a result of the greenhouse effect caused by excessive emissions of CO_2, it was assumed that carbon dioxide emissions should be reduced by approximately 20% by 2005. Therefore, it is necessary to develop the use of environmentally safe sources of energy to replace fossil fuels and wind energy belongs to these sources. Building wind power plants brings measurable environmental effect and is consistent with the environmental protection policy (in particular regarding air and climate protection), as well as with the energy policy of both Poland and the European Union.

The results of the analyses of acoustic climate for this option did not reveal any exceeding of permissible values in the vicinity of human settlements (Noise map 3 appendix 4). The power plant will operate unmanned, with human intervention limited only to periodic maintenance and possible repairs. The constructions will not release any pollutants into the atmosphere. The selected option of the project is optimally located in space and situated in agricultural crop areas.

The above data allow to conclude that the option 2 of the investment selected for implementation is beneficial for the environment and taking into account the energy security of Poland additionally proves the advisability of its execution.

8.0 DESCRIPTION OF POTENTIALLY SIGNIFICANT IMPACTS OF THE PLANNED PROJECT ON THE ENVIRONMENT

8.1 Resulting from the existence of the project

The project under analysis is a pro-ecological investment, which generates electricity from renewable sources of energy without emission of pollutants into the environment. As mentioned before, wind power plants impact the environment mainly through noise emissions. They directly affect the areas surrounding their locations. The acoustic effect decreases with distance.

The planned project being the subject of the report together with other facilities causing emission may have a cumulative impact. There are no major industrial plants in the Sępopol commune. However, in case of planned construction of other wind farms, the cumulative impact of the new wind farms and the wind farm in question will be minor, due to their location at a certain distance from each other. In case of

expansion of existing farms or building new wind power plants in the immediate vicinity of the existing ones, an acoustic analysis taking into account the cumulative level of noise emissions should be carried out in the future. The farms will be separated by strips of arable land, communal and field roads with rows of trees and forest complexes, which will reduce the possibility of cumulative impact.

On a time scale, the planned wind farm project will have positive temporary, permanent, short-, medium- and long-term ecological impact on the environment.
Any potential threats to the environment are outlined in the table below :

No.	Type of Impact	Construction period	Operation period
1	2	3	4
1.	Positive	None	Generation of clean energy
2.	Negative	Transformation of part of the land surface, emission of dust and other pollutants into the atmosphere and sound emission	Sound emission, radiation
3.	Direct	Emission of dust and other pollutants into the atmosphere, sound emission	Sound emission, radiation
4.	Indirect	Impact of means of transport and construction machinery	None
5.	Short-term	Sound and pollutant emissions into the atmosphere	None
6.	Long-term	Transformation of part of the land surface	Sound emission, radiation
7.	Reversible	Air pollution	None
8.	Irreversible (cumulative)	None	None
9.	Volume	None	Sound emission, radiation
10.	Periodic	Emissions into atmosphere and noise from machinery and equipment	Sound emission

8.2 Resulting from the use of natural resources

No non-renewable natural resources will be used as a result of this investment.

8.3 Resulting from pollution

No air, ground or groundwater or surface water pollution will occur as a result of the implementation of this investment and its operation.

9. 0 DESCRIPTION OF THE MEASURES ENVISAGED TO PREVENT, REDUCE OR COMPENSATE FOR ADVERSE IMPACTS

In order to minimize the impact of wind power plants on the natural environment in the phase of implementation and operation of the investment, measures will be applied to limit and minimize these phenomena.

Implementation phase:

- construction works will be carried out between 6:00 a.m. and 10:00 p.m. in order to limit the temporary increase of noise generated by the operating construction machinery and the transport of construction materials,
- the construction of the power plant will be carried out with ready-to-use elements assembled together at the assembly yard,
- during construction and installation works the stripped soil must be properly stockpiled in a designated area for reuse to restore the original condition upon completion of construction,
- disposal of the resulting construction waste to designated disposal sites or to an operating landfill,
- after completion of the construction and assembly works the area around the tower should be restored to its original condition.

Operation phase:

- the power plant tower is located at a distance of not less than 400 m from residential buildings, in order to meet the conditions resulting from the acceptable noise standards,
- the tower construction uses tubular structure, which has less impact on birds than lattice structure,
- to eliminate light reflections, the tower and rotor blades will be painted in a light pastel matte color,
- no advertising should be placed on the tower and nacelle, the logo of the power plant manufacturer or energy producer harmonizing with the color of the tower and nacelle itself is acceptable, obstruction lighting will be used in the tower,
- in case of a possible wind turbine tower failure or collapse, the investor is obliged to repair any damage caused to the environment.

Decommissioning phase:

- the works should be carried out outside the night time between 6 a.m. and 10 p.m. in order to eliminate the noise associated with the operation of construction machinery and means of transport,
- any waste must be transported to a designated disposal site or an operating landfill.

10.0 COMPARISON OF THE PROPOSED TECHNOLOGICAL SOLUTIONS WITH OTHER AVAILABLE SOLUTIONS USED IN DOMESTIC AND FOREIGN PRACTICE

The investor will ensure correct technological and technical solutions at the stage of developing technical designs. The ENERCON E-82 2000 kW wind power plants planned for use meet the requirements for this type of investment, both in domestic and world practice.

11.0 THE AREA OF LIMITED USE

The analyzed project of constructing a wind farm in an agricultural area will not cause any changes in the use of this land and of the adjacent areas of agricultural character; these areas will continue to be used for agricultural purposes. The analyzed investment does not require the establishment of a limited use area. However, the construction of the wind farm must be considered in future spatial planning. The ranges and levels of noise emissions of the wind farm must be taken into account, with regard to the permissible levels in force at the date of implementation of the spatial development plans being prepared. The scope of restrictions for location of newly created acoustically protected areas should take into account the permissible noise levels in force as of the date of implementation and possible changes to the spatial development plans.

12.0 PRESENTATION OF ISSUES IN A GRAPHICAL FORM

The analyzed issues of the environmental impact of the investment in terms of acoustic climate are presented graphically on noise maps - appendix 4.

13.0 ANALYSIS OF POTENTIAL SOCIAL CONFLICTS RELATED TO THE PLANNED PROJECT

The construction, and, in particular, operation of the wind farm may give rise to conflicts of social nature. This study demonstrates that there are no significant adverse impacts of the investment on particular components of the natural environment. Concerns about the deterioration of landscape values may result from subjective feelings of individual residents of the surrounding areas. Any protests may be rather emotional, which is understandable due to different attitudes of people towards wind power plants.

Given:

- the lack of impact on the buildings in the surrounding settlements, such as kindergartens, schools and hospitals,
- the use of modern technical and ecological solutions preventing and limiting the impact on the environment,
- the lack of significant impact on environment, including acoustic climate, electromagnetic field emissions,
- the increased energy demand of consumers and the development of the region's infrastructure,
- the positive impact of the investment on the economic situation of the commune and thus its residents, few such initiatives can be expected in the future.

In order to eliminate any possible conflicts it is necessary to carry out educational activities by meeting with interested parties in order to present the assessment of risks and measures taken to eliminate them. During the public consultations it is important to present the economic benefits and environmental advantages of the investment for the commune, and therefore for the local community, resulting from the operation of the wind turbines.

14.0 METHODICAL ASSUMPTIONS, PROBLEMS, ISSUES THAT MUST BE FURTHER INVESTIGATED OR MONITORED

14.1 Proposals for monitoring during the construction phase

Due to the substantial cost of the investment, the annual pre-investment chiropterological monitoring in the area planned for the wind farm must be conducted using objective methods that exclude human error and allow for further verification of the collected data by another expert. It is necessary to use devices, which enable automatic registration of the birds and bats flying over the area. The recorded data should be reviewed by experienced naturalists.

The following should be inspected during the construction phase:

- the course of construction and assembly works,
- amount of noise emissions.

14.2 Proposals for monitoring during the operation phase

Due to formal reasons (a Natura 2000 area), the scope of the annual ornithological monitoring has to be set at a level higher than usually, which is provided for in the recommended methodology of monitoring, and the results have to be presented to the relevant environmental protection authorities.

The acoustic power levels quoted by the manufacturer always have a certain accuracy specified in the technical data – most often this accuracy is ± 2 dBA, in a few cases ± 1 dBA.

Following the implementation of the project it is recommended to conduct control measurements of noise immission at the observation points P1n to P7n and P1s to P7s for the Różyna and Sępopol precincts, under various wind conditions.

14.3 Proposals for monitoring during the decommissioning phase

During this phase, the investment area should be restored to its original condition, prior to the start of construction. The following should be inspected during the decommissioning phase:

- the course of construction and assembly works,
- amount of noise emissions.

15.0 FINAL CONCLUSIONS

The subject of the report is an investment concerning the construction of a wind power plant complex, roads and assembly yards, power and telecommunication connections, GPZ station, under the "Sępopol Wind Farm" investment task. The farm is located in Warmińsko-Mazurskie voivodeship, Bartoszyce county, Sępopol commune. The wind farm, with a total capacity of 60 MW, will consist of 30 wind power plants with the GPZ (Główny Punkt Zasilający – transformer station), located in Sępopol commune, on the following plots:

- in Różyna precinct, plots: 217/2 , 256/3 , 337/4,
- in Śmiardowo precinct, plots: 254, 27/10, 30/37,

1. On the basis of the conducted analyses it is expected that there will be no threats in the form of noise emission and electromagnetic radiation to the nearest protected areas, provided that the implemented option is option 2 described in the table below and illustrated in Map 3 – appendix 4.

No.	**Power plant symbol**	**Acoustic power level L_{WA} (dB)**	**Lot no. *(location)***
1.	EW1 to EW11	104.0	217/2 (11 pcs.) Różyna Precinct
2.	EW12 and EW14	104.0	256/3 (3pcs.) Różyna Precinct
3.	EW15	104.0	337/4 (1 pc.) Różyna Precinct
4.	EW16, EW17, EW19 and EW23 to EW26	104.0	254 (7 pcs.) Śmiardowo precinct
5.	EW30 to EW33	104.0	27/10 (4 pcs.) Śmiardowo precinct
6.	EW34 to EW36 and EW52	104.0	30/37 (4 pcs.) Śmiardowo precinct
7.	GPZ	85.0	217/2 (1 pc.) Różyna Precinct

2. Minimization of the impact of the analyzed investment on landscape values will occur through:
   - the use of a single type of power plant and the same height of the tower, which will not cause differentiation of the internal structure of the entire farm and will reduce the impact on the landscape,
   - not placing advertisements on power plant structures,
   - all wind turbine structures will be painted the same matte gray color, not contrasting with the surroundings,
   - it is permitted to place the manufacturer's name and power plant symbol on the turbine nacelle,

3. Wind turbines should be illuminated for warning purposes for all flying objects.
4. In case of natural losses in the course of construction, assembly and transport works, the investor is obliged to compensate the natural environment.
5. At the design stage it should be checked if there are no local archaeological sites in the vicinity of wind turbines, because then the project requires arrangements with the Voivodeship Monument Conservator, and conducting earthworks requires archaeological supervision.
6. Cases of construction during the growing season should be avoided, and in case of crop destruction, the investor is obliged to compensate the affected party.
7. The analysis of threats for avifauna and Natura 2000 protected areas performed by Prof. Przemysław Busse, chap. 5.2.11 has shown as follows:
    - The presented results of monitoring indicate that the discussed farm is characterized by average avifauna values in general.
    - In the area covered by the analysis, bird collision rates, estimated considering local conditions, are at average level. The farm at this location will not pose a significant collision hazard to birds. Both fields received an average (Spurgle) or good (Różyny) qualification.
    - The farm does not pose a threat to the species which the Natura 2000 Ostoja Warmińska region was designed for, as well as to other protection areas in the distant surroundings.
    - No cumulative impact or barrier effect issues are anticipated.
8. The analysis of the impact of the farm on bats, chap. 5.2.11 has shown as follows:
    - The results of the screening allow the exclusion of the location of the "Sępopol" – Różyna/Pasławki wind farm project as an investment, where the risk of a significant negative impact on key species listed in appendix no. 1 to the Regulation of the Minister of Environment of 28 September 2004 *on the species of wild animals under protection* (Journal of Laws No. 220, item 2237).

- Based on the recordings already made, only the species of bats from the vesper group *(Vespertilionidae*) were found.

9. At the stage of execution of executive designs and during implementation of the project, all recommendations and comments contained in this report should be complied with.

16.0SUPPORTING MATERIALS USED TO PREPARE THE REPORT

This report was prepared using the following materials:

1) Arrangements with the investor during the preparation of the report.
2) Site inspection.
3) Metody określania emisji i imisji hałasu przemysłowego w środowisku, Instrukcja 338/96, ITB – Warsaw 1996.
4) Letter from the Commune Office about the areas surrounding the Power Plant site.
5) Site map with the location of the power plant at a scale of 1 : 5000 and 1: 10000, provided by the investor.
6) Topographic maps of the location of the site areas provided by the investor.
7) Regulation of the Minister of Environment dated June 14, 2007 on permissible noise levels in the environment, Journal of Laws No. 120, item 826.
8) General Specification 660 kW Variable Slip Wind Turbines, Item no.: 943111.R2.
9) Ingenieurbüro für akustik BUSCH GmbH – Summary of an acoustical report, Westensee, Dec. 30. 1998.
10) Ingielewicz R., Zagubień A. “Problemy hałasu środowiskowego związane z pracą siłowni wiatrowych” International Scientific and Technical Conference on Wind Power Plants, Kołobrzeg, May 2000.
11) Ingielewicz R., Zagubień A. “Hałas elektrowni wiatrowych a ochrona środowiska”, Environmental Protection Conference, Wrocław 2004.
12) Tymczasowe wytyczne dotyczące oceny oddziaływania elektrowni wiatrowych na nietoperze (na rok 2009). Kepel A. and co-authors.
13) Projekt wytycznych w sprawie przyrodniczych analiz przed realizacyjnych i monitoringu farm wiatrowych realizowanych w ramach procedury oceny oddziaływania na środowisko.

14) Guidelines for consideration of bats in wind farm projects (EUROBATS). Rodrigues L. and co-authors.
15) Best Practice Guides for Wind Energy Development. The British Wind Energy Association.
16) Nietoperze Polski. Ciechanowski M., Sachanowicz K..
17) Nietoperze. Volume 1 Issue 1. Szkudlarek R. and co-authors.
18) Wpływ antropogenicznych przekształceń krajobrazu na strukturę i funkcjonowanie zespołów nietoperzy w Polsce. Lesinski G.,

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