proeko ECOLOGICAL DESIGN AND IMPLEMENTATION OFFICE
80-280 Gdańsk, ul. Szymanowskiego 2 tel./fax (058) 558-40-10 e-mail: proeko@proeko.gda.pl www.proeko.gda.pl

Study **ENVIRONMENTAL IMPACT REPORT FOR THE WIELISZEWO WIND FARM TOGETHER WITH TECHNICAL INFRASTRUCTURE (Słupsk County, Pomorskie Province)**		
Contracting Authority	EWG Słupsk Sp. z o.o.	
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Team of Authors	Tomasz Andrzejewski, PhD, Eng acoustics	
	Łukasz Kowalski, MSc. cartographic documents	
	Marcin Kulik, MSc. biotic environment	
Study leader	Maciej Przewoźniak, PhD (doctor habilitatus) environmental and landscape protection, synthesis	
	Ewa Sawon, MSc. physiography	
	Andrzej Winiarski, MSc. sozology	
	Kinga Ziętek, MSc. Eng cultural heritage	
Environmental monitoring		
Ornithological monitoring	Jacek Antczak, PhD	

Chiropterological survey	Robert Kościów, MSc.	

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Table of contents:

1. LEGAL BASES AND SCOPE OF THE STUDY 6
2. DESCRIPTION OF THE PLANNED INVESTMENT 10
   2.1. Planned investment – baseline scenario 10
   2.2. Investment scenarios 14
   2.3. Environmental impact assessment of the investment scenarios 16
   2.4. The solutions protecting the environment in the investment scenario selected for implementation – the most advantageous scenario for the environment 17
   2.5. Land use conditions at the investment construction and exploitation stages 18
3. STRUCTURE AND ANTHROPIZATION OF NATURAL ENVIRONMENT IN THE LOCATION OF THE INVESTMENT 20
   3.1. Location in the region 20
   3.2. Structure of natural environment of the location of the Wieliszewo wind farm and its immediate surroundings 20
      3.2.1. Abiotic environment 20
      3.2.2. Biotic environment 22
         3.2.2.1. Vegetation cover 22
         3.2.2.3. Fauna – general specification 23
         3.2.2.4. Ornithological monitoring 24
         3.2.2.5. Chiropterological survey 27
      3.2.3. Environmental processes and interrelationships of the location of the investments with surrounding areas 27
   3.3. Diagnosis of environmental anthropization status 28
4. NATURE PROTECTION FORMS IN THE LOCATION OF THE INVESTMENT 32
   4.1. Location of the investment 32
   4.2. Regional surroundings of the location of the investment 32
5. DESCRIPTION OF MONUMENTS PROTECTED UNDER THE REGULATIONS ON MONUMENT PROTECTION AND CARE AND ON THE PROTECTION OF THE OTHER CULTURAL HERITAGE IN THE LOCATION OF THE POWER PLANT 41
6. ENVIRONMENTAL IMPACT ASSESSMENT OF THE INVESTMENT SCENARIO SELECTED FOR IMPLEMENTATION 43
   6.1. Construction stage 43
      6.1.1. Abiotic environment 43
      6.1.2. Biotic environment 49
      6.1.3. Waste 50
      6.1.4. Tangible and cultural assets 52
      6.1.5. Human health 53
   6.2. Investment exploitation stage 54

6.2.1. Impact on abiotic environment 54
6.2.2. Impact on flora 55
6.2.3. Impact on fauna 55
6.2.3.1. Introduction 55
6.2.3.2. Birds 55
6.2.3.3. Bats 57
6.2.3.4. Other fauna 58
6.2.4. Waste 58
6.2.5. Impact on acoustic conditions 60
6.2.6. Impact of wind farms in the scope of infrasound emission 65
6.2.7. Impact of wind farms and associated infrastructure in the scope of electromagnetic radiation emission 66
6.2.8. Impact on landscape 70
6.2.9. Tangible and cultural assets 75
6.2.10. Human health 76
6.3. Investment decommissioning stage 77
7. INVESTMENT IMPACT ASSESSMENT ON FORMS OF NATURE CONSERVATION AND LANDSCAPE PROTECTION 79
7.1. Territorial and individual forms of nature protection 79
7.2. Flora and fauna species protection 89
7.3. Protection of green areas and tree stands 89
8. DIAGNOSIS OF THE POTENTIALLY SIGNIFICANT ENVIRONMENTAL IMPACTS OF THE PLANNED INVESTMENT, INCLUDING CROSS-BORDER IMPACTS AND DESCRIPTION OF THE APPLIED PROJECTION METHODS 91
8.1. Impacts resulting from presence of the investment 91
8.2. Impacts resulting from the use of natural resources 92
8.3. Impacts related to decommissioning or limited access to natural environment resources 92
8.4. Impacts related to the potential environmental pollution 93
8.5. Limited use areas 93
8.6. Cross-border environmental impact 93
8.7. Risk of severe failures 94
8.8. Environmental impact classification 94
8.9. Cumulative impact assessment 97
8.9.1. Cumulative effect of environmental impacts of the Wieliszewo wind farm 97
8.9.2. Cumulative environmental impact assessment of the Wieliszewo wind farm and wind farms in its vicinity and the high-voltage line 98
8.10. Description of the projection methods 100

9. PROPOSED ACTIONS AIMED AT PREVENTING OR MITIGATING ADVERSE ENVIRONMENTAL IMPACT AND ENVIRONMENTAL COMPENSATION 101
10. ANALYSIS OF POSSIBLE SOCIAL CONFLICTS ASSOCIATED WITH THE PLANNED INVESTMENT AND CURRENT PUBLIC CONSULTATIONS RELATED TO THE PROJECT 104
11. PROPOSED MONITORING OF ENVIRONMENTAL IMPACT OF THE PLANNED INVESTMENT 106
12. LIST OF DIFFICULTIES RESULTING FROM TECHNOLOGICAL OR KNOWLEDGE GAPS AND IDENTIFIED AT THE REPORT PREPARATION STAGE 108
13. SOURCES OF INFORMATION FORMING A BASIS FOR PREPARATION OF THE REPORT 109
14. NON-TECHNICAL REPORT SUMMARY 114
List of figures 130
List of photos 130

Text appendices:

1. Decision of the Regional Director of Environmental Protection in Gdańsk on the need for carrying out an environmental impact assessment and on the scope of the environmental impact report for the planned project with a potential significant environmental impact consisting in the “Construction of the Wieliszewo wind farm comprising 17 wind turbines with a maximum capacity of 3 MW each, together with access roads, assembly yards and electricity infrastructure: MV/110 kV substation, MV cable lines with a fibre optic cable and a 110 kV cable line with a fibre optic cable”
2. Resolution No. XIX/130/2008 of the Council of the Potęgowo Commune of 29 February 2008 on the local zoning plan for the Wieliszewo wind farm;
3. Report on the monitoring of avifauna at the Wieliszewo Wind Farm, November 2010 (J. Antczak);
4. Report and assessment of the potential impact of the planned location of the Wieliszewo wind farm on bats, 30 December 2010 (author: R. Kościów).
5. Extract from the entry in the land register – appendix to the Report **in a separate volume**.

Cartographic appendices:

Appendix 1. Wieliszewo wind farm in the Potęgowo commune – wind farm impact assessment (1:10,000).

Appendix 2. Wieliszewo wind farm in the Potęgowo commune – range of acoustic impact of the planned wind turbines on a land cadastral map (1:10,000)

Appendix 3: Route of the planned 110 kV cable line against the background of forms of nature conservation (1:10,000).

1. LEGAL BASES AND SCOPE OF THE STUDY

This report describes the environmental impact of the project consisting in the construction of:

- the Wieliszewo wind farm comprising 17 wind turbines with a maximum capacity of 3 MW each;
- access roads;
- assembly yards;
- electricity infrastructure:
  - MV/110 kV substation (the Nowa Dąbrowa grid connection point);
  - MV cable lines together with a fibre optic cable (connecting the turbines with the grid connection point);
  - 110 kV cable line with a fibre optic cable (connecting the Nowa Dąbrowa grid connection point with the Bięcino grid connection point in the Damnica commune).

The report was drawn-up as an appendix to application for issuing of the environmental permit for implementation of the investment.

Pursuant to the Act on Disclosure of Information on the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessments, dated 3 October 2008 (Journal of Laws of 2008 No. 199, item 1227 as amended) and the Regulation of the Council of Ministers of 9 November 2010 on the investments of potentially significant environmental impact (Journal of Laws No. 213, item 1397), the investment entitled Wieliszewo Wind Farm with technical infrastructure, including: installations using wind power to produce electricity of total height of at least 30 m (Par. 3.1.6), and power stations of rated voltage of at least 110 kV (Par. 3.1.7); is included into the category of establishments of potentially significant environmental impact. With regard to the above, the project requires the environmental permit for its implementation.

The decision on the obligatory environmental impact assessment and on the scope of environmental impact report for the construction of the Wieliszewo Wind Farm with the technical infrastructure in the Potęgowo Commune was issued by the Regional Director of Environmental Protection in Gdańsk (**Appendix 1**) after obtaining the opinion of the State Provincial Sanitary Inspector in Słupsk.

Pursuant to Art. 66 of the Act on Disclosure of Information on the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessments, dated 3 October 2008 (Journal of Laws of 2008 No. 199, item 1227 as amended):

1. *the environmental impact report should include:*
   1) *description of the planned investment, including in particular:*
      a) *specification of the investment as a whole and land use conditions at the stage of construction and operation or use,*
      b) *key specific features of the production processes,*
      c) *expected types and volumes of pollution produced in effect of operation of the planned investment;*

2) *description of elements of the environment affected by the expected environmental impact of the investment, including elements of the environment protected under the Nature Conservation Act of 16 April 2004;*
3) *description of the historical monuments protected under the legislation on the protection and care of historical monuments existing in direct vicinity or range of impact of the planned investment;*
4) *description of the expected environmental effects in the case of abandonment of the investment;*
5) *description of the analysed scenarios, including:*
   a) *scenario proposed by the application and reasonable alternative scenario,*
   b) *scenario that is most beneficial for the environment with statement of reasons for their selection;*
6) *determination of the expected environmental impact of the analysed scenarios, including also in the case of major industrial accident as well as possible cross-border environmental impact;*
7) *statement of reasons for the scenario proposed by the applicant, with specification of its environmental impact, including in particular on:*
   a) *humans, plants, animals, fungi and natural habitats, water and air,*
   b) *land surface, with consideration to ground mass movements, climate and landscape,*
   c) *tangible assets,*
   d) *historical monuments and cultural landscape, covered by the existing documentation, including in particular with historical monuments record or register,*
   e) *interactions between the elements, referred to in items a-d;*
8) *description of projection methods applied by the applicant and the description of expected significant environmental impacts of the planned investment, covering direct, indirect, secondary, accumulated, short-, medium- and long-term, permanent and temporary environmental impacts, resulting from:*
   a) *implementation of the project,*
   b) *use of environmental resources,*
   c) *emissions;*
9) *description of the expected activities aiming at ensuring prevention, mitigation or environmental compensation of negative environmental impacts, in particular on the purposes and objects of protection of the Natura 2000 site and its integrity;*
10) *for roads which are projects that can always have a significant environmental impact:*
   a) *development of the assumptions for:*
      – *rescue research of the identified historical monuments located in the area of the planned investment, discovered during the construction works,*
      – *programme of protection of the existing historical monuments against the negative impact of the planned investment and protection of cultural landscape,*
   b) *analysis and assessment of possible threats and damage to historical monuments protected under the legislation on the protection and care of historical monuments, in particular archaeological monuments, in direct vicinity or range of impact of the planned investment;*
11) *if the planned investment is related to the use of installations, comparison of the proposed technology with the technology meeting the requirements, referred to in Art. 143 of the Environmental Protection Law of 27 April 2001;*

12) *determination, whether the planned investment requires the establishment of the limited use area in the meaning of the Environmental Protection Law of 27 April 2001, and determination for the borders of such area, limitations in the scope of intended use of the area, technical requirements for the construction objects and their use; this does not apply to the investments consisting in construction of national road;*
13) *presentation of discussed issues in graphical form;*
14) *presentation of the discussed issues in cartographic form in the scale corresponding to the object and level of detail of the issues analysed in the report and enabling comprehensive presentation of the performed analyses of environmental impact of the investment;*
15) *analysis of possible social conflicts associated with the planned investment;*
16) *presentation of the proposed monitoring of the planned investment impact at the construction and operation or use stages, in particular on the objectives and object of protection of the Natura 2000 site and its integrity;*
17) *determination of difficulties resulting from technological or knowledge gaps identified at the report preparation stage;*
18) *non-technical summary of information contained in the report for each component of the report;*
19) *full name of person or persons preparing the report;*
20) *sources of information forming a basis for preparation of the report.*

2. *Information, referred to in paragraph 1, points 4-8, should consider the expected impact of the analysed scenarios on the purposes and object of protection of the Natura 2000 site and its integrity.*
3. *In the case of potential cross-border environmental impact, information, referred to in paragraph 1, points 1-16, should consider determination of impact of the planned investment outside the territory of the Republic of Poland.*
4. *If the planned investment requires the establishment of the limited use area, the report should be enclosed with a copy of cadastral map certified by the competent authority with the delineated borders of the area requiring the establishment of the limited use area. This does not apply to the investments consisting in construction of national road.*
5. *If the planned investment is related to the use of installation requiring an obligatory integrated permit, the environmental impact report should contain the comparison of the proposed technique with the best available techniques.*
6. *The environmental impact report should consider the impact of investment at the stages of its implementation, operation or use and decommissioning.*

The environmental impact report for the Wieliszewo Wind Farm together with technical infrastructure covers the issues laid down in the aforementioned Art. 66 of the Act on Disclosure of Information on the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessments, dated 3 October 2008 (Journal of Laws of 2008 No. 199, item 1227 as amended) with consideration to the requirements of the decision of the Regional Director of Environmental Protection in Gdańsk (**Appendix 1**).

The Report has been prepared based on:

- design materials provided by the Contracting Authority – EWG Słupsk of Legnica
- environmental monitoring – "Report on the monitoring of avifauna of the Wieliszewo Wind Farm," November 2010 (J. Antczak) and "Report and assessment of potential impact of the planned location of the Wieliszewo Wind Farm on bats," 30 December 2010 (R. Kościów);

- archive materials of the PROEKO Ecological Design and Implementation Office (EDIO) in Gdańsk;
- published materials concerning the methodological aspects of environmental impact assessments;
- published materials concerning the project site and its regional surroundings;
- acts of common and local law pertaining to environmental protection.
- landscape inspection conducted in February 2011.

Complete list of information sources, in the form of published and archive materials and legal acts forming a basis for preparation of the Report is provided in Section 13.

2. DESCRIPTION OF THE PLANNED INVESTMENT

2.1. Planned investment – baseline scenario

The project consists in the construction of the Wieliszewo wind farm with technical infrastructure in the Potęgowo commune, which will comprise the following basic elements (cartographic appendix):

- the Wieliszewo wind farm comprising 17 wind turbines with a maximum capacity of 3 MW each;
- access roads;
- assembly yards;
- electricity infrastructure:
  - MV/110 kV substation (the Nowa Dąbrowa grid connection point);
  - MV cable lines together with a fibre optic cable (connecting the turbines with the grid connection point);
  - 110 kV cable line with a fibre optic cable (connecting the Nowa Dąbrowa grid connection point with the Bięcino grid connection point in the Damnica commune)

Within the planned investment, turbines meeting the following parameters are anticipated:

1) maximum capacity of 3 MW (each),
2) tower height up to 100 m, rotor diameter up to 90 m,
3) maximum sound power at the level not exceeding the maximum permissible noise level as laid down in the environmental protection law, at the borderline of the residential housing areas or any other development intended for permanent stay of inhabitants and at the borderline of such areas delineated in the local spatial development plans.

In addition, all turbines will meet the following requirements:

- marking of aviation obstacle (external ends of rotor blades painted in 5 stripes of equal width, perpendicular to the rotor axis and covering 1/3 of the rotor length – 3 red or orange stripes and 2 white),
- turbine structure in white or grey colour (harmonised colour palette for the entire wind farm),
- prohibition of installing advertising billboards, excluding the signs (logos) of manufacturer or investor or equipment owner.

The Wieliszewo wind farm will be located in the Potęgowo commune, and the 110 kV power line will be situated in the Potęgowo and Damnica communes, in the geodesic precincts and on the land plots listed below:

Location of wind turbines:
Potęgowo commune:

- Nowa Dąbrowa geodetic precinct – land plots No.: 199/5, 109/3, 210/3, 199/2;
- Karżnica geodetic precinct – land plots No.: 38/3, 38/1;
- Wieliszewo geodetic precinct – land plots No.: 26, 22/1, 6/4, 46, 6/3, 1;

Location of access roads and assembly yards:
Potęgowo commune:

- Nowa Dąbrowa geodetic precinct – land plots No.: 145/1, 58, 160/1, 165, 199/2, 199/5, 109/3, 210/3, 162,
- 158/3,213/8;
- Karżnica geodetic precinct – land plots No.: 39, 38/1, 38/3, 37;
- Wieliszewo geodetic precinct – land plots No.: 45, 46, l, 41/2, 24, 26, 22/1, 6/4, 6/3, 2;

Location of MV cable lines together with a fibre optic cable:
Potęgowo commune:

- Nowa Dąbrowa geodetic precinct – land plots No.: 199/5, 109/3, 210/3, 199/2, 159/2, 158/3, 213/8;
- Karżnica geodetic precinct – land plots No.: 38/1; 38/2; 38/3;
- Wieliszewo geodetic precinct – land plots No.: 46, 45, 26, 24, 22/1, 41/1, 2, l, 6/4, 6/3;

Location of the MV/110 substation (grid connection point):
Potęgowo commune: Nowa Dąbrowa geodetic precinct – land plot No.: 213/8;

Location of the 110 kV cable line together with a fibre optic cable:
Potęgowo commune:

- Nowa Dąbrowa geodetic precinct – land plot No.: 213/8;

Damnica commune:

- Stara Dąbrowa geodetic precinct – land plots No.: 159/3, 207/2, 161/1, 203/1, 183/3, 176, 175/1, 173/4,173/1,291/8,1;
- Domaradz geodetic precinct – land plots No.: 3/8, 3/4 3/9, 3/10, 21;
- Damnica Leśnictwo geodetic precinct – land plot No.: 279/3;
- Zagórzyca geodetic precinct – land plots No.: 240, 229, 219, 164/6, 105/2, 154, 60, 58, 49/1, 48, 31;
- Karżniczka geodetic precinct – land plots No.: 42, 48/2, 46, 38/18, 37, 36, 29, 28/5, 25, 22/3, 30 (closed area), 16;
- Bięcino geodetic precinct – land plots No.: 204, 256, 203, 189, 187, 255, 163, 55, 36/1;

It is planned that each turbine will occupy an area of up to 1,200 m^2. Access roads with a width of up to 5 m will be led from the nearest hardened local, commune, county or provincial roads.

The area of the site intended for the location of the substation is approximately 0.9 ha.

In accordance with the “Local zoning plan for the Wieliszewo wind farm” (2008), the total area of the site intended for wind turbines, assembly yards, transformer station, underground cable lines and access roads will be up to 20.85 ha.

Within the assembly yards intended for power station installation work as well as power and MV cable laying, target maintenance of the agricultural use of land is expected.

The 110 kV cable line together with a fibre optic cable, with a length of approximately 11.4 km, will run through the Potęgowo and Damnica communes, mainly along communal roads and agricultural land – avoiding tree and shrub clusters. The cable route crosses, among other things, the S6 expressway (land plot No. 159/3, Stara Dąbrowa geodetic precinct) and a closed area (land plot No. 30, Karżniczka geodetic precinct). Once the lines are laid, the land will be restored to its original condition. Humic layers at the site will be removed, preserved and used after the completion of the work in areas intended for turfing. The planned excavation will be 0.9 m wide and approximately 1.5 m deep.

Type of technology

It is planned that 17 turbines with a maximum capacity of up to 3 MW, with tower height of up to 100 m and rotor diameter of up to 90 m will be used. Each wind turbine will be connected with underground MV power cables to a MV/110 kV substation, which will raise voltage to 110 kV. From the MV/110 kV substation an underground 110 kV power line will run to a substation of the Bięcino grid connection point.

Wind power plant consists of steel tower of pipe structure and a head - nacelle equipped with power generator, a motor positioning the rotor against the wind, own vibration reducer and electronic protectors. The hub with rotor blades is made of plastics used in aviation structures. Each blade of the power plant rotor is assembled individually in a way to maintain optimal operating conditions considering current wind pressure. Structural elements of turbines will be mounted on reinforced concrete foundations. Control of the power plant operation is automatic. The control system programmes the parameters resulting in switching off the power plant depending on, among others, the time in which the defined wind speed threshold is exceeded, in the case of a short circuit as well as in the case of electric discharges, disturbances on transmission lines or other failures. The technology of electricity generation using wind turbines and feeding such electricity to the grid is based on the following types of conversion and phenomena: aerodynamic, i.e. the conversion of energy carried by the wind into rotational motion of the rotor (blades), electromagnetic, i.e. the conversion of mechanical energy (rotational motion of the rotor) into electricity (generator), electrical, i.e. the conversion and electrical adjustment (voltage, frequency and phase) to the receiving grid (e.g. substation of the grid connection point) and electricity transmission through a connection line to the grid. The envisaged wind turbines are the latest generation turbines of low rotary speed of the rotors and therefore of the lowest noise ratios.

The areas where wind turbines, access roads and assembly yards are located will be subject to soil geotechnical surveys.

Turbines are installed at the sites of their placement and using finished elements (sections of the tower, blades, nacelle) with the use of a crane. The turbines will be placed on monolithic, reinforced-concrete foundations.

The planned 110 kV power line will be laid in a trench which will be approximately 90 cm wide. Excavated soil masses are used on site. Any potential surplus will be disposed. Excavation will be done without drainage and without the use of aggregate. Crossings of the line under hardened roads, utilities and the Charstnica watercourse will be made using the directional drilling method.

The wind farm life is expected to be approximately 25 years. Wind turbines are maintenance-free installations. To ensure proper functioning and operation supervision, the wind turbines are equipped with telecommunications infrastructure (a network of

ground optical telecom cables laid in parallel to the power cables). For the purposes of data sharing between the individual turbines, the grid connection point and power dispatch systems, an ITC network enabling data transmission (optic fibre) will be installed.

The MV/110 kV transformer station, to be constructed as part of the investment, will be surrounded with a zone excluded from use - fenced area.

The planned internal works, connected with local public roads, will enable access of the technical and maintenance services to the individual wind turbines and transformer station. Roads will have a hardened surface, covering a strip with a width of approximately 5 m, with local broadenings in the areas of curves and intersections, and will be led from the nearest hardened local, commune, county or provincial roads.

The wind farm will operate in maintenance-free mode, with the use of remote control and supervision system.

Estimated volume of consumed water and other raw materials, materials, fuels and energy

In the period of its operation, the Wieliszewo Wind Farm will use mostly wind kinetic energy and minor volumes of power for the purposes of obstacle lighting of wind turbines. The wind farm will not use other raw materials and consumables and fuels during its operation.

The expected maximum quantities of materials and consumables for the construction of foundations of the 17 wind turbines are as follows:
- reinforcement steel – approximately 1,249.5 /t/
- C45/55 concrete – approximately 15,283 /m^3/
- C16/20 concrete – approximately 1,955 /m^3/
- backfilling and foundation embankment – approximately 17,799 /m^3/

Construction of access roads and assembly yards will consist of:
- wearing course of crushed-stone aggregate – 10 cm thick,
- base course stabilised with cement – 30 cm thick,
- levelling sand ballast – 10 cm thick (see Section 7.2.).

Type and estimated volumes of substances or energy released to the environment with the use of environmental protection solutions

Wind turbines operate on maintenance-free basis and require no construction of a social background facilities and water supply and sewage infrastructure (no water intake and sewage disposal).

The amount of sanitary waste generated in the area of the designed grid connection point will be small, comparable to the amount of water used for sanitary purposes (in the range of several dozen litres per week). Sanitary waste will be discharged to a septic tank or Toi Toi-type portable toilets will be used.

The land plot intended for the construction of the grid connection point is situated on the area with no stormwater sewage system. Drainage system of the transformer station includes:
- inspection chamber made of reinforced-concrete shaft units
- sedimentation tank made of reinforced-concrete shaft units
- coalescing separator
- sampling well

- disposal to dry well.

Water from precipitations and thaws, accumulated in tight sumps under the transformers will flow to the separation well and to the absorbent well.

To separate water and oil and discharge it, the station will be equipped in the monitoring and separation system meeting the requirements of the Polish legislation on the protection of water environment against oil pollution.

The Wieliszewo wind farm will be the source of:

- noise emitted to the environment - emission of acoustic energy to the environment caused by rotor operation and rotation of blades of the turbines: planned wind turbines are the sources of high sound power that will cause periodic changes of acoustic environment at the vast area however not exceeding the permissible standards in the surroundings of places of permanent residence of people (see Section 6.2.5.);
- low level infrasound below the values that could affect human health (see Section 6.2.6.);
- electromagnetic radiation from MV/HV transformer stations – it will cover fenced areas, in safe distance from developed areas (the closest developed areas are located at a distance of approximately 680 m in the village of Nowa Dąbrowa), which will ensure compliance with the applicable legal standards;
- waste production (see Section 6.2.4.).

Moreover, apart from the delivery of substances (waste) and emission of energy (noise, infrasound), the Wieliszewo wind farm together with the technical infrastructure and the 110 kV power cable line will cause:

- liquidation of soil cover and vegetation of agrocenoses at the construction stage (see Sections 6.1.1. and 6.1.2.);
- local reduction of stormwater infiltration to soil – water will flow down on the surface of foundations and road surface and be absorbed by soil in their direct vicinity; stormwater from transformer station will be disposed directly to soil after initial treatment (see Section 6.2.1.)
- potential impact on birds and bats (see Section 6.2.3.);
- impact on physiognomic values of landscape of the investment area and its surroundings (see Section 6.2.8.).

2.2. Investment scenarios

Apart from the baseline scenario described in Section 2.1., the following scenarios were analysed:

- scenario of abandonment of the investment (zero scenario);
- scenarios differing from the baseline scenario with the number and distribution of the planned turbines (Fig. 2a and 2b).
- different types of wind turbines.
- various routes of the 110 kV line and its construction as an (underground) or overhead cable line.

Scenario of abandonment of the investment - zero scenario;

This scenario would be the most advantageous for the environment of the investment area and its surroundings, however also unadvantageous in terms of global emission of

energy pollutions to air and counteracting climate change (a conventional energy source would have to be built in the other location instead of a source of so called clean energy).

Withdrawal of the investment would have no impact on the local environment – it would remain intact. At the same time, no positive effects of wind turbines would take place, use of which contributes to reduced emission of pollutions to air, including greenhouse gases, and enables saving the restricted fossil fuels.

A conventional power plant fired with hard coal releases to air 2.142 kg of sulphur dioxide (SO_2), 1.584 kg of nitrogen oxides (NO_X) and 0.19 kg of particulate matter[1], when producing 1 MWh of energy. It releases also large volumes of carbon dioxide (CO_2) responsible for global warming – approximately 907.02 kg.

A wind turbine with a nominal capacity of 3 MW, assuming an industry average efficiency, can reduce daily emissions of:

- sulphur dioxide by approximately 30.84 kg;
- nitrogen oxides by approximately 22.81 kg;
- particulate matter by approximately 2.79 kg;
- carbon dioxide by approximately 13 tonnes.

The planned investment of the total nominal power up to 60 MW for estimated efficiency of approximately 20%, is the source of approximately 106,000 MWh of power per annum, which means annual reduction of emission[2]:

- sulphur dioxide by approximately 227 tonnes;
- nitrogen oxides by approximately 168 tonnes;
- particulate matter by approximately 20 tonnes;
- carbon dioxide by approximately 9,637 tonnes.

Abandonment of construction of the planned wind farm would be in contrary to the policy of air protection and counteracting climate change in global scale and energy policy of Poland (see Section 2.3.), including the postulate of diversification of energy sources in Poland and increased consumption of renewable energy.

Alternative scenarios

The location of 28 wind turbines has been initially considered in the Potęgowo commune (Fig. 2a). Implementation of this scenario would require acquisition of the new areas for the investment (including for placement of turbines, assembly yards and construction of the new access road sections).

At later design stages, for environmental and technical reasons, the location of 11 turbines was abandoned, reducing their number to 17 in the final scenario (Fig. 2b).

The solution alternative to the baseline scenario, allowing location of 17 wind turbines, would be further reduction of the number of turbines or withdrawal from their location in the Potęgowo commune.

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[1] ENERGA S.A.: Information on the impact of power production on the environment in terms of emission volume for individual fuels used for production of electricity sold by ENERGA – OBRÓT SA in 2009 (website: www.energa.pl)

[2] Values estimated on the basis of data published by ENERGA SA.

Different types of wind turbines were also considered. A total of 8 types of turbines were analysed in terms of their impact on the acoustic environment and wildlife (mainly birds and bats).

As part of the optional scenarios, the use of wind turbines of various manufacturers with similar parameters was considered, including:

- Nordex N90/2500 LS turbines with a nominal capacity of 2.5 MW; 104.5 dB;
- Nordex N100/2500 LS turbines with a nominal capacity of 2.5 MW;
- GE 2.5 xl turbines with a nominal capacity of 2.5 MW; 105 dB;
- Goldwind PMDD 2.5 turbines with a nominal capacity of 2.5 MW;
- Siemens SWT-2.3-101 turbines with a nominal capacity of 2.3 MW;
- Vestas V90 2.0 turbines with a nominal capacity of 2 MW; 104 dB.

The final decision on the turbine selection has not been made yet, however for the purpose of the environmental impact assessment this report uses the parameters of the turbine which is most likely to be used in the planned Wieliszewo wind farm – Nordex N90/2500 LS with a nominal capacity of 2.5 MW.

In addition, 2 optional routes of the 110 kV line were analysed, including an overhead variant.

2.3. Environmental impact assessment of the investment scenarios

As it was shown in Section 2.2., different scenarios were considered for the planned project, which differed mainly in the number of wind turbines, type of turbines and their location.

In context of local environmental protection, location of lower number of turbines is more advantageous. In terms of environmental impact, construction of a larger number of wind turbines (scenario of 28 wind turbines) would result in:

- larger area subject to transformation (new excavations for foundations, arrangement of assembly yards and access roads, excavation for MV cables);
- higher noise emissions (higher number of emission sources);
- greater impact on landscape;
- potential higher impact on birds and bats.

The project scenario with the smallest number of wind turbines considered (17) was selected for implementation.

In different optional scenarios, the arrangement of the turbines was also diverse. In the option adopted for implementation, the arrangement of the turbines was adjusted as much as possible to the areas with the lowest nature value, at the same time ensuring that the maximum possible economic benefits are obtained.

The scenario selected for implementation was prepared on the basis of preliminary agreements made with property owners and comprehensive analyses, feasibility and other studies, such as the local zoning plan adopted by way of Resolution No. XIX/130/2008 of the Council of the Potęgowo Commune of 29 February 2008 on the local zoning plan for the Wieliszewo wind farm.

As part of scenario consideration, the final project concept adopted takes into account:

- maintenance of proper distances between turbines and residential housing – ensuring compliance with permissible noise standards for residential housing;

- keeping a distance of at least 200 m from the borders of forest complexes with the protection of birds and bats in mind;
- location of turbines at a distance from trees indicated in environmental studies;
- use of modern, technologically advanced turbines, enabling, inter alia, the reduction of noise emissions.

The evaluation of scenarios for the 110 kV line showed a definite advantage of using an underground cable instead of an overhead line. An overhead line, as opposed to an underground (cable) line is a constant source of electromagnetic radiation, devaluates the landscape, may pose a threat to flying animals and its construction causes much greater consumption of construction materials – raw materials (steel or concrete pylons and their foundations).

2.4. The solutions protecting the environment in the investment scenario selected for implementation – the most advantageous scenario for the environment

Wind turbines are a source of so called clean energy. Their use, thanks to replacing the conventional energy sources, contributes to reduced emission of CO_2, SO_2, NO_x and particulate matter to atmosphere, which brings advantageous environmental effects in local (reduced air pollution, better aero-sanitary conditions for human life) and global (reduced the climate and derivative effects of the greenhouse effect). The use of renewable energy sources complies with the sustainable development principles in force in Poland by way of Constitution and required by the international obligations of the country, primarily these resulting from its membership in the European Union and from ratification of the United Nations Framework Convention on Climate Change and so called the Kyoto Protocol by Poland.

During the previous planning and design works of the Wieliszewo wind farm, the following solutions protecting the environment were applied, among others:

1) selection of a newer type of wind turbines, which guarantees reduced noise emissions thanks to low tip speed;
2) location of wind turbines:
   – in a distance from residential facilities enabling elimination of impact of excessive noise level emitted by wind turbines on humans;
   – on agricultural lands with no significant environmental values, in line with the results of the ornithological (Antczak 2010) and chiropterological survey (Kościów 2010);
3) applying uniform and non-contrasting with the surroundings colour palette of the power plant structure in order to reduce impact on landscape,
4) location of the MV/110 kV transformer station at the distance from developed areas (approximately 680 m) and surrounded by fencing marking the range of excessive electromagnetic radiation;
5) equipping the transformer station in oil sumps and systems of monitoring and separation of oil from storm waters in order to minimise the risk of leakage of transformer oil to the environment, as well as fire and oil leakage alarm system;
6) use of underground MV cables between the individual turbines, which will contribute to mitigated landscape impact; underground laying of the cable lines will have no impact on the current use of the real estates, since the cable lines will be

laid below the depth of use of arable fields for agricultural purposes; this will also mitigate the risk of bird collisions, for which power energy lines pose a threat,

7) use of an underground cable for the 110 kV power line, which will minimise its impact on the environment in terms of electromagnetic radiation, devaluation of the landscape and potential impact on flying animals;
8) use of directional drilling in places where the 110 kV cable line passes under hardened roads. This method should also be used under the Charstnica watercourse not to affect the technical condition of roads and banks of the watercourse, which could change its hydrological regime;
9) designation of the route of the 110 kV cable line mainly along commune roads;
10) reception and utilisation of waste classified as hazardous waste (e.g. gear oils) by specialist services, in compliance with the conditions provided for in the Act on Waste,
11) placement of turbines on cylindrical solid walls, which in contrary to the truss towers (or frame-strut towers) provide the birds with no nesting options and therefore do not attract them additionally in the vicinity of wind turbines;
12) humic layers at the site will be removed, preserved and used after the completion of the work in areas intended for turfing or in the case of excavations for the cable line – they will be used for backfilling.

2.5. Land use conditions at the investment construction and exploitation stages

Under the planned investment, the construction stage will be initiated with construction roads to the individual turbines (i.e. levelling, supply of material and forming the road profile). This process can partially apply to the existing roads that will be temporarily withdrawn from exploitation. Upon completion of road constructions, these will be permitted for general use.

This will be followed by levelling of the areas for locations of the turbines and assembly yards as well as excavations for foundations of the wind turbines. The next stage of works will consists in placing the foundations and, upon their setting (hardening), installation of the core power plant structure.

The areas covered with earthworks and assembly works will be withdrawn from agricultural use for the period of performance of these works.

Upon completion of the assembly works, the areas around the power plant will be recultivated and restored for agricultural use. Only the areas of placement of foundations of the power plant and corresponding access roads will be excluded from agricultural use on permanent basis.

The initial use will be restored also for all areas of location of MV and HV (110 kV) power cables and optical telecom cables.

In the operation stage, in the range of excessive noise emitted by the power plant, location of residential housing, homestead and protected service development will be excluded – this complies with the provisions of the “Local zoning plan for the Wieliszewo wind farm” **(Appendix 2).**

This plan designates, among other things (Appendix 2):

- 17 areas of permitted location of wind turbines – the location of turbines is permitted only within the boundaries of 1-17 EW/RP areas;

- areas of permitted location of transformer stations, power lines and internal access roads.

3. STRUCTURE AND ANTHROPIZATION OF NATURAL ENVIRONMENT IN THE LOCATION OF THE INVESTMENT

3.1. Location in the region

In terms of division into physical and geographical regions (according to J. Kondracki, 1998), the Potęgowo commune is mostly located in the south Baltic Sea coastal sub-province, in the southern part of the Koszalin coastal macroregion. Almost all of its area belongs to the Damnicka Upland mesoregion, which also covers the area where the project will be located.

The **Damnicka Upland**, with an area of approximately 830 km^2, is situated between the valleys of the Słupia and Łeba rivers, rising 20-30 m higher than the Sławieńska Plain to the west, i.e. up to 60-80 m above sea level, and in some places even up to 100 m above sea level. Thanks to its higher elevation and steep slopes of the valleys determining its boundaries, the Damnicka Upland clearly stands out from the surrounding regions. To the north, on the border of the Słowiński Coast, there are moraine slopes of the Gardno Phase, accompanied by outwash plain in the south. The soils are predominantly podzolic on sands and brown earth on clays. The Łupawa river flows through the central part of the Damnicka Upland.

3.2. Structure of natural environment of the location of the Wieliszewo wind farm and its immediate surroundings

3.2.1. Abiotic environment

Topography

In the area of the site of the Wieliszewo wind farm and in its surroundings there are the following morphogenetic units:

- moraine upland;
- upland slope zone;
- the valley of the Rębowa watercourse (approximately 400 m to the east of the project location).

The whole location area of the investment is situated within the moraine upland. The terrain of the moraine upland plateau is diversified with small melt-out forms.

The elevation levels range approximately between 73 to 103 m above sea level. The main level of the upland plateau is predominantly situated at an elevation of 80-90 m above sea level. The surface of the project site declines towards the south, towards the valley of the Rębowa watercourse, the bottom of which is at an elevation of 70-75 m above sea level.

Geological structure

The moraine upland is underlain by boulder clay with thin patches of ablation sands, and in the depressions there are marshy deposits.

Below the Quaternary layers, there are Tertiary sediments, most often represented by lignite formations developed mainly as sands, silts and silty clays with admixtures of or interbedded with carbonised organic matter.

The **soil cover** at the project site on the surface is dominated by lixiviated and acid brown soils of III-VI soil quality.

Hydrographically, the project site is located in the catchment basin of the Łupawa river, which flows into the Baltic Sea in the town of Rowy (approximately 28 km to the north of the project site).

The Łupawa river flows some 4.5 km east of the project site. The width of its valley at the closest point to the project site is 100-200 m. The narrow valley, cutting deep into the upland, runs approximately in the north-south direction. It is characterised by significant drops, similar to submountain rivers. These features were used for building weirs for hydropower purposes in Łupawa and Poganice. Within the boundaries of the Potęgowo commune, the river has a right-bank tributary of the Darżyńska Struga river and a small stream from Grąbkowo. The Darżyńska Struga river, with a length of 14.3 km, flows out of marshy land between Darżyno and Potęgowo, and its typically agricultural catchment area is located entirely within the Potęgowo commune. On its left bank, the Łupawa river has a tributary of a short stream from Malczkowo and the Rębowa river (flowing about 400 m to the east of the nearest planned wind turbine), also known as Ciek spod Dobrej. Upstream, the watercourse is fed from marshy and peat bog areas near Wieliszewo.

The project site is located within the Słupsk hydrogeological subregion, which covers the central and southern part of the Potęgowo commune. In the Słupsk subregion, the main useful aquifer is related to Quaternary formations. The depth of the aquifer is variable, depending on terrain configuration it ranges from 20 to 100 m below ground level. It is usually well isolated from the ground surface. The capacity of wells ranges from 10 to 100 m^3/h.

The south-eastern part of the project site is located in the designed protection area of the Bytów Main Groundwater Reservoir No. 117 – two wind farms with the auxiliary infrastructure (roads, MV lines) are planned to be located within its area. Within the range of the Main Groundwater Reservoir No. 117 the age of the water-bearing formations is Quaternary, and the average depth of water intakes is 10-50 m. The hydrogeological documentation for the Main Groundwater Reservoir No. 117 was prepared in 2002. The Main Groundwater Reservoir No. 117 is an intermoraine reservoir with a fossil valley and has diversified resistance to pollution. The estimated disposable resources are about 140,000 m^3 per day, the area of the reservoir is approximately 514 km^2 and the area of its designed protected areas is 754 km^2.

In addition, there are two main groundwater reservoirs in the Potęgowo commune: No. 115 Łupawa, and No. 107 Pradolina Łeby.

The Main Groundwater Reservoir No. 115 Łupawa is an intermoraine reservoir with a total area of 118 km^2. Its main useful aquifer is located in Quaternary intermoraine water-bearing sands. The disposable resources of the reservoir amount to 28,631 m^3/day (i.e. 1,193 m^3/h), reserves of intakes in the area of the reservoir – 1,064.1 m^3/h.

The Main Groundwater Reservoir No. 107 Pradolina Łeby has a total area of 195 km^2 and disposable resources of 6,700 m^3/h. The top of the water-bearing layer formed by sands and gravels is shallow, 0.5–5.0 m below ground level, and in the area of upland edge it is found much deeper – approximately 80 m below ground level.

Climate conditions

The Potęgowo commune, where the project site is located, is situated in the East Pomeranian Region according to the climatic regionalisation of Poland (Wosia 1999), developed based on an analysis of the frequency of occurrence of different types of weather. The region includes the eastern section of Słowiński Coast and part of the

Kaszuby Coast. The specificity of the area's climatic relations results from, among other things, the fact that days with cool weather, including days with heavy clouding, and days with cool weather with precipitation, are recorded here relatively most frequently. On average in a year there are almost 53 days with cool weather, nearly 30 cool days with heavy clouding, and 32 cool days with precipitation. Days with moderately cold weather with frost, without precipitation and with moderate to heavy clouding are also relatively rare.

According to the "Study on the spatial development conditions and directions of the Potęgowo Commune" (2010), in the area of Potęgowo the warmest months are July and August, and the coldest – January and February. The average annual temperature is +7.6^{o}C (Słupsk station). The growing season lasts from 185 to 200 days on average. The characteristic features are short winter with late onset, as well as the relatively high number of hot days – 2,512. The average length of winter in the multi-year period from 1950 to 1994 was 61 days in the area of Słupsk, therefore also in Potęgowo. It is a region of relatively high annual precipitation (771 mm in Słupsk, 740 mm in Malczkowo, with the national average of about 600 mm). The month with the highest precipitation is July. On an annual basis, in the area of Słupsk, where the meteorological station is located, which is also meaningful for the Potęgowo area – the prevailing winds are from W, S, SW and N directions, while in the summer from the western direction. The average wind speed in the multi-year period from 1975 to 1994 was 3.6 m/s. The highest wind speeds – above 4 m/s – were recorded mostly in December, January and March.

3.2.2. Biotic environment

3.2.2.1. Vegetation cover

In accordance with the "Environmental protection programme for the Potęgowo commune" (2003), forest areas in the commune occupy a total of approximately 5,950 ha, with a forest cover ratio of 26.8% (the lowest in the Słupsk county). The forests are managed by four Forestry Districts: Łupawa (3,396 ha), Cewice (1,166 ha), Damnica (992 ha) and Lębork (283 ha). Agencja Nieruchomości Rolnych (Agricultural Property Agency) manages 65 ha of forests, while 48 ha are non-state forests.

Forests are concentrated mainly along the southern and eastern borders of the commune, its northern and western parts are practically completely devoid of them. Forest habitats are dominated by fresh coniferous forest (approximately 30%) and fresh mixed coniferous forest (approximately 45%). Habitats with higher fertility – fresh mixed forest occupy about 20% of habitat areas. The remaining area is made up of wet and bog habitats, mainly mixed bog coniferous forest and alder carr forest, associated with the valleys of the Łupawa river and its tributaries, and the valley of the Łeba river.

The dominant species in the commune's forest stands is pine (approximately 80% of forest stands), spread across all habitats, except for alder carr forests. It forms pure and mixed forest stands with the participation of birch, spruce, beech and oak. The second most frequently occurring species in forest stands is birch (5.3%). Beech (4.6%), spruce (4%) and oak (3%) are less frequent.

The project site from the west, south and north-east is adjacent to forest complexes (mainly pine and pine-spruce forests).

To the northeast of the project site, at a distance of approximately 2 km from the closest planned wind turbine, a Natura 2000 site of Community importance – Dolina Łupawy PLH220036 is located (see Section 4).

The areas of the planned location of wind turbines, access roads, MV cables and transformer station are covered only with agrocenoses of arable lands with periodic segetal vegetation (Cartographic Appendix 1).

In the surroundings of the Wieliszewo wind farm site, vegetation is represented mainly by:

- pine and pine-spruce forests;
- field shrubs with hydrogenic vegetation;
- roadside and field shrubs and trees;
- meadow and pasture complexes used for agricultural purposes;
- agrocenoses (arable land and fallow land);
- orchards, gardens, outdoor house plants;
- ruderal vegetation growing near the existing buildings.

The 110 kV power cable connecting the Nowa Dąbrowa grid connection point with the Bięcino grid connection point will run mainly along roads and through areas used for agricultural purposes. In addition, on a short section the cable line will run under the Charstnica watercourse, where the directional drilling method will be used.

Near the roads along which the cable is to be laid there are (Cartographic Appendix 3):

- agrocenoses;
- forests, shrubs and trees;
- meadows;
- orchards, gardens;

3.2.2.3. Fauna – general specification

In accordance with the “Study...” (2010), in the Potęgowo commune there are many fauna species representing different animal groups.

In the larger forest complexes in the eastern part of the commune, there are populations of deer, wild boar, roe deer, 2 species of martens, badger, fox, raccoon, few hares in the fields, hedgehogs frequently occurring in scrub and gardens.

In the preserved wet depressions, ponds, wooded areas and moist edges of small watercourses and drainage ditches amphibian species are abundant, such as common water frog, pool frog, moor frog, common toad, common spadefoot, smooth newt and northern crested newt. The forest sections of the Łupawa river, which in the commune shows a submountain nature, are the breeding grounds of the kingfisher, grey wagtail, common sandpiper and common merganser.

In the commune’s rivers we can find salmonidae fish – brown trout, rainbow trout, sea trout, stickleback, perch, gudgeon, lamprey, roach and bleak.

The forest sections of the Łupawa river, which in the commune shows a submountain nature, are the breeding grounds of the kingfisher, grey wagtail, common sandpiper and common merganser.

Extensive field complexes between Głuszynek and Rzechcino in the northern part of the commune are important for breeding and migrating groups of cranes composed of more than 1,000 individuals.

The general ornithological and chiropterological characteristics of the project site are presented in Section 3.2.2.4 and Section 3.2.2.5, respectively, and the detailed characteristics are specified in Appendix 3 and 4, which are an integral part of this Report.

3.2.2.4. Ornithological monitoring

An annual monitoring of avifauna for the Wieliszewo wind farm was conducted at the project site in the period from the beginning of September 2009 to the end of August 2010 – pre-implementation stage (Antczak 2010).

Five survey modules were conducted as part of the field study:

- counting from observation points;
- counting at transects;
- inventory of breeding sites of large birds within a given area and its surroundings;
- night counting;
- counting on the roosting ground of crane.

At the site of the planned Wieliszewo wind farm (area of approximately 7.5 km² – Fig. 3), four observation points were established, located in places where the entire area can be seen. In addition, transect lines of the total length of 8,400 m were delineated.

During the studies performed in the area of the planned wind farm and in its immediate surroundings, a total of 101 bird species (44 – Nonpasseriformes, non-passerine, and 57 – Passeriformes, passerine) were identified. In addition, due to the distance or bad weather conditions, the presence of birds from a higher taxon was observed (goose – Anser sp., corvidae – Corvus sp., small passerines – Passeriformes).
Among all species, in annual scale 59 species were recorded rarely (1–4 observations; attendance below 15%), 21 species were observed irregularly (5–10 observations; attendance of 15–34%) and the remaining 21 species were recorded regularly (more than 10 observations; attendance – above 35%) – Appendix.

Vast majority of the regularly recorded bird species included common and non-endangered birds. The most frequently recorded species included: buzzard, ringdove, bunting, lark, raven, fieldfar, meadowlark, meadow pip, blackbird, crane and linnet (with attendance over 70%). Among the species observed irregularly the following should be mentioned: pewit, marsh harrier, woodlark, red kite and golden plover, while species observed rarely the following should be listed: white-tailed eagle, whooper swan, Bewick's swan, hen harrier, Montagu's harrier, Eurasian curlew, great egret and merlin – these were, however, mostly single observations during seasonal migrations or individuals sporadically flying through the site of the planned wind farm.

Table 1 Species composition, status at the site and protection status.

Explanations: Status at the site: B – breeding within the site boundaries; BX – breeding in the surrounding area; M – migrating or flying through; Protection status: SPP – strict species protection; PARTP – partial protection; HUNTP – hunting protection; PRLA – species from the Polish Red List of Animals: level of threat to species in accordance with the Red List of Dying or Threatened Animals in Poland (Głowaciński 2001): EXP – species that have disappeared or are likely to have disappeared in Poland; EN – species at very high risk, strongly endangered; VU – species at high risk, vulnerable to extinction; NT – species at lower risk, but near threatened; LC – species not endangered

No.	SPECIES	LATIN NAME	STATUS	PROTECTION	ANNEX I to the BIRDS DIRECTIVE	PRLA
1	mute swan	*Cygnus olor*	*M*	SPP		
2	Bewick's swan	*Cygnus columbianus*	*M*	SPP	+	
3	whooper swan	*Cygnus cygnus*	*M*	SPP	+	
4	bean goose	*Anser fabalis*	*M*	PARTP		
5	white-fronted goose	*Anser albifrons*	*M*	PARTP		
6	widgeon	*Anas penelope*	*M*	SPP		CR
7	teal	*Anas crecca*	*M*	PARTP		
8	mallard	*Anas platyrhynchos*	*B*	PARTP		
9	goldeneye	*Bucephala clangula*	*M*	SPP		
10	goosander	*Mergus merganser*	*M*	SPP		
11	partridge	*Perdix perdix*	*B*	SPP		
12	quail	*Coturnix coturnix*	*B*	SPP		
13	cormorant	*Phalacrocorax carbo*	*M*	PARTP		
14	great egret	*Ardea alba*	*M*	SPP	+	
15	grey heron	*(Ardea cinerea*	*M*	PARTP		
16	white stork	*Ciconia ciconia*	*BX*	SPP	+	
17	red kite	*Milvus milvus*	*BX*	SPP	+	NT
18	white-tailed eagle	*Haliaeetus albicilla*	*BX*	SPP	+	LC
19	marsh harrier	*Circus aeruginosus*	*BX*	SPP	+	
20	hen harrier	*Circus cyaneus*	*M*	SPP	+	VU
21	Montagu's harrier	*Circus pygargus*	*M*	SPP	+	
22	sparrowhawk	*Accipiter nisus*	*M*	SPP		
23	buzzard	*Buteo buteo*	*BX*	SPP		
24	rough-legged buzzard	*(Buteo lagopus*	*M*	SPP		
25	kestrel	*Falco tinnunculus*	*M*	SPP		
26	merlin	*Falco columbarius*	*M*	SPP	+	
27	crane	*(Falco columbarius*	*BX*	SPP	+	
28	golden plover	*Pluvialis apricaria*	*M*	SPP	+	EXP
29	pewit	*Vanellus vanellus*	*M*	SPP		
30	common snipe	*Gallinago gallinago*	*M*	SPP		
31	Eurasian curlew	*Numenius arquata*	*M*	SPP		VU
32	wood sandpiper	*Tringa glareola*	*M*	SPP	+	CR
33	black-headed gull	*Chroicocephalus ridibundus*	*M*	SPP		
34	common gull	*Larus canus*	*M*	SPP		
35	herring gull	*Larus argentatus*	*M*	PARTP		
36	stock dove	*Columba oenas*	*BX*	SPP		
37	ringdove	*Columba palumbus*	*B*	PARTP		
38	Eurasian Collared Dove	*Streptopelia decaocto*	*BX*	SPP		
39	turtledove	*Streptopelia turtur*	*BX*	SPP		
40	cuckoo	*Cuculus canorus*	*B*	SPP		
41	swift	*Apus apus*	*M*	SPP		
42	kingfisher	*Alcedo atthis*	*M*	SPP	+	
43	black woodpecker	*Dryocopus martius*	*B*	SPP	+	

44	great spotted woodpecker	*Dendrocopos major*	*B*	SPP		
45	woodlark	*Lullula arborea*	*B*	SPP	+	
46	lark	*Alauda arvensis*	*M*	SPP		
47	periwinkle	*Riparia riparia)*	*BX*	SPP		
48	barn swallow	*(Hirundo rustica*	*BX*	SPP		
49	house martin	*Delichon urbica*	*B*	SPP		
50	tree pipit	*Anthus trivialis*	*B*	SPP		
51	meadow pipit	*Anthus pratensis*	*B*	SPP		
52	yellow wagtail	*Motacilla flava*	*B*	SPP		
53	white wagtail	*Motacilla alba*	*M*	SPP		
54	bohemian waxwing	*Bombycilla garrulus*	*B*	SPP		
55	wren	*Troglodytes troglodytes*	*B*	SPP		
56	redbreast	*Erithacus rubecula*	*B*	SPP		
57	black redstart	*hoenicurus ochruros*	*BX*	SPP		
58	whinchat	*Saxicola rubetra*	*B*	SPP		
59	blackbird	*Turdus merula*	*B*	SPP		
60	missel thrush	*Turdus viscivorus*	*B*	SPP		
61	fieldfare	*Turdus pilaris*	*B*	SPP		
62	song thrush	*Turdus philomelos*	*B*	SPP		
63	redwing	*Turdus iliacus*	*M*	SPP		
64	marsh warbler	*Acrocephalus palustris*	*B*	SPP		
65	icterine warbler	*Hippolais icterina*	*B*	SPP		
66	lesser whitethroat	*Sylvia curruca*	*B*	SPP		
67	whitethroat	*Sylvia communis*	*B*	SPP		
68	blackcap	*Sylvia atricapilla*	*B*	SPP		
69	wood warbler	*Phylloscopus sibilatrix*	*B*	SPP		
70	chiffchaff	*Phylloscopus collybita*	*B*	SPP		
71	willow warbler	*Phylloscopus trochilus*	*B*	SPP		
72	goldcrest	*Regulus regulus*	*B*	SPP		
73	marsh tit	*Parus palustrlis*	*B*	SPP		
74	willow tit	*Poecile montana syn. Parus montanus*	*B*	SPP		
75	coal tit	*Parus ater*	*B*	SPP		
76	great titmouse	*Parus major*	*B*	SPP		
77	blue tit	*Cyanistes caeruleus syn. Parus caeruleus*	*B*	SPP		
78	nuthatch	*Sitta europaea*	*B*	SPP		
79	oriole	*Oriolidae*	*B*	SPP		
80	red-backed shrike	*Lanius collurio)*	*B*	SPP	+	
81	great grey shrike	*Lanius excubitor*	*B*	SPP		
82	jay	*Garrulus glandarius*	*B*	SPP		
83	magpie	*Pica pica*	*B*	PARTP		
84	daw	*Coloeus monedula syn. Corvus monedula*	*BX*	SPP		
85	rook	*Corvus frugilegus*	*M*	PARTP		
86	hooded crow	*Corvus cornix*	*M*	PARTP		
87	raven	*Corvus corax*	*BX*	PARTP		
88	starling	*Sturnus vulgaris*	*B*	SPP		
89	sparrow	*Passer domesticus*	*BX*	SPP		
90	tree sparrow	*Passer montanus*	*BX*	SPP		
91	finch	*Fringilla coelebs*	*B*	SPP		
92	brambling	*Fringilla montifringilla*	*M*	SPP		
93	greenfinch	*Carduelis chloris*	*B*	SPP		
94	goldfinch	*Carduelis carduelis*	*B*	SPP		
95	siskin	*Carduelis spinus*	*M*	SPP		
96	linnet	*Carduelis cannabina*	*B*	SPP		

97	bullfinch	*(Pyrrhula pyrrhula*	*M*	SPP		
98	grosbeak	*Coccothraustes coccothraustes*	*M*	SPP		
99	bunting	*Emberiza citrinella*	*B*	SPP		
100	common reed bunting	*Emberiza schoeniclus*	*B*	SPP		
101	meadowlark	*Emberiza calandra syn. Miliaria calandra*	*B*	SPP		

Source: Report from avifauna monitoring for the Wieliszewo Wind Farm (Antczak 2010).

Complete text of ornithological monitoring by Antczak (2010) is provided in Appendix 3 constituting an integral part of this Report.

3.2.2.5. Chiropterological survey

The "Report and assessment of potential impact of the planned location of the Wieliszewo Wind Farm on bats" was also prepared for the project site (Kościów, 2010 – Appendix 4), which presents the results of field studies conducted between 1 September 2009 and 1 September 2010. Only three bat species were observed within the monitored area:

- (common pipistrelle *Pipistrellus pipistrellus*;
- Nathusius's pipistrelle *Pipistrellus nathusii*;
- brown long-eared bat *Plecotus auritus*).

Bats were found only in the surroundings of the planned Wieliszewo wind farm (Fig. 4).

In Poland, all observed bat species are protected by law (Regulation of the Minister of Environment of 28 September 2004 on the protected species of protected wild animals – Journal of Laws of 2004, No. 220, item 2237).

Pursuant to this study:

1. *Bats were not observed within the proposed wind farm site.*
2. *The species composition of bats and their number indicate that the diversity of bat species in the area covered by the study is very low.*
3. *The composition of bats was dominated by forest and synurbic species, which, as such, are strongly associated with rural development.*
4. *Results of the monitoring indicate that areas important for bats are located outside the project site and their significance is local.*

Complete text of chiropterological monitoring (Kościów 2010) is provided in Appendix 4 constituting an integral part of this Report.

3.2.3. Environmental processes and interrelationships of the location of the investments with surrounding areas

Geodynamic, hydrological and environmental processes are of essential importance in the area of the location of the Wieliszewo wind farm.

The geodynamic processes within the small parts of upland slopes of steep inclination and on the anthropogenic embankments include potential presence of minor surface mass movements. Surface and linear water erosion is also possible.

Natural interrelationships are established primarily through surface and underground water runoff. Water is the main carrier of matter, which causes the migration of chemical elements in the environment. It results in a unidirectional process

of geochemical coupling of autonomous (top), transit (slope) and subordinated (depressions, valley bottoms) surfaces. In autonomous units there is a loss of matter, in transit units its flow is predominant with various degree of accumulation or loss (denudation), and in subordinated units accumulation of matter prevails. Due to the topography of the project site, surface runoff occurs from the top of the upland to the north towards the Rębowa river valley.

There are no hydrographic objects that may pose flood threat at the location of the power plant and in its vicinity.

Natural interrelationships are also established through air circulation. The core of atmospheric connections consists in physical (temperature, humidity) and chemical (air composition, wind as element carrier) transformation of air properties depending on flow over the specific area. Considering the advantage of winds from the western sector in the area of the project location, these include primarily the west - east interrelations. Forest and mixed agricultural and forest areas are located towards north, south and west from the area of the project location, which encourages purity of inflowing air masses.

Local vegetation succession is observed. At the areas not used for agricultural purposes, in particular at the border of forest areas and tree groups as well as at the hydrogenic areas, secondary succession of forest and waterside vegetation. Introduction of natural vegetation was spontaneous, as the factors limiting its development opportunities ceased to operate. On the remaining areas, vegetation succession is prevented primarily by agrotechnical practices.

Ecological interrelationships (migration of plants and animals) are stimulated primarily by the biological matrix of the area, namely the system of naturally active areas – biological patches and corridors which enable natural functional interrelationships in a horizontal plane. The area of the planned project site has a typical agricultural character, with impoverished biological structure.

The basic elements of the biological matrix in the surroundings of the project site are (pine and spruce) forest complexes. On the moraine upland, apart from forest complexes, there are depressions with hydrogenic vegetation. Ecological connections between the local ecological areas in the upland are strengthened by agricultural use of land.

Approximately 400 m to the east is the sub-regional biological corridor of the valley of the Rębowa river. The valley of the Rębowa river enables and stimulates animal migration (primarily fish, birds related to water environment and wetlands) and movement of plant diaspores. It is also a place of transport of abiotic matter (river water, bedload and transported sediments) whereas the valley form modifies local air circulation.

3.3. Diagnosis of environmental anthropization status

The main signs of the environmental anthropization of the project site and its direct surroundings include:

- domination of agricultural land use, resulting in, among others, synanthropization of vegetation, degradation of ecological structure of the area and specifics of landscape displaying the features of cultural agricultural landscape;
- rural settlements: dense homestead development with backyard gardens in villages: Wieliszewo, Nowa Dąbrowa, and utility development in Owczarnia –

sources of pollution emission to atmosphere, of municipal and utility sewage and waste;

- network of hardened and dirt roads (motor traffic as a source of air and noise emissions), mainly including national road No. 6 Kołbaskowo – Łęgowo and provincial road No. 211 Żukowo – Nowa Dąbrowa
- medium-voltage power line network;

In further surroundings, there is a concentration of anthropogenic transformation of the natural environment in the village of Potęgowo (approximately 10 km to the east from the project site) and in the city of Słupsk (approximately 15 km to the west from the project site).

Aerosanitary conditions

The potential sources of air pollution within the area of the investment include:

- national road No. 6 and provincial road No. 211;
- household heating appliances, sources of heat and technological emission from utility facilities in the area of the investment and in its surroundings;
- emission of transport pollution from local roads;
- fugitive emissions of particulate matter from non-vegetated areas (e.g. dirt roads).

Transport pollution of atmosphere can cause in adverse changes of production capacity of soils and affect negatively on near-road vegetation (trees, shrubs and herbaceous vegetation) as well as on health on the nearby inhabitants. This adverse effect is caused by emission of exhaust fumes containing among others heavy metals, sulphur dioxide and nitrogen oxides as well as particulate matter.

In accordance with the “Report on the state of the environment in Pomorskie Province in 2009" (WIOŚ 2010), the air in the entire Potęgowo commune, which is located in the Lębork and Słupsk zone, is of class A purity (in all categories).

In accordance with the "Environmental protection programme for the Potęgowo commune" (2003) a significant and onerous source of atmospheric air pollution in the heating season is medium and low emission from combustion of low-calorific coal in the households and small local boiler houses.

The largest source of air pollution (apart from transport) is the boiler house of an agricultural establishment in Malczkowo (3.5 km east of the closest planned wind turbine).

In accordance with “Environmental protection programme for the Potęgowo commune" (2003), in the area of the Potęgowo commune the only valid decision permitting air emissions issued by the County Governor’s Office is held by a company named Star-Meble of Łupawa (approximately 6.5 km to the south-east from the closes wind turbine), which uses polyurethane foam for production. However, the main source of air pollution is – as in the whole area of the Słupsk county – combustion of coal and low-quality fuels in households.

There are no air pollution measurement points in the area of the project site. The nearest measuring station is located in Słupsk (approximately 15 km to the west of the project site), however, due to the distance and differences in land use, the results from this station are not representative for the project site.

Noise

No industrial plants and onerous facilities in terms of noise emission to the environment are situated within the area of the investment. The most important source of noise emission is motor traffic on national road No. 6 Kołbaskowo – Łęgowo which runs approximately 850 m from the closest planned wind turbine.

In the area of the Potęgowo commune the sources of "organised" noise mainly include means of road transport along national road No. 6 and provincial road No. 211.

There are no results of acoustic measurements for roads and a railway line on their course through the Potęgowo commune, no noise survey was conducted here. In recent years, no noise nuisance control measures have been applied for in the Potęgowo commune.

In the area of the project site, the facilities and areas of functions protected due to acoustic nuisance include rural development on the outskirts. There are mainly farm buildings here.

Electromagnetic radiation

A medium-voltage power line runs through the project site. At a distance of approximately 8.6 km from the project site to the north there is a 400 kV power line. In addition, at a distance of 2 km from the project site (to the north-west), near the village of Domaradz, a mobile phone base station is located.

Water pollution and changes to water circulation system

Surface waters

The quality of water in the Łupawa river is monitored by the Provincial Environmental Protection Inspectorate in Gdańsk. The waters of the Łupawa river were tested at the monitoring point in the village of Damnica (approximately 6.8 km to the north-west from the project site). The results of the tests are presented in Table 2.

Table 2. Concentrations of key water eutrophication indicators in the Łupawa river in 2009

Station number	Name of river	Name of station	Distance from the	Biological status	Key indicators	Physicochemical	Key indicators	Subst. specific. harmful to	Biological condition/ potential	Chemical status	Key	Groundwater body
15	Łupawa	Damnica	42.2	good	fb	good	BZT 5, ChZT-Mn, NK	N	good	good	Cd, Pb, Ni	good

Source: “Report on the state of the environment in Pomorskie Province in 2009” (2010)

Groundwater

In accordance with the “Study on the spatial development conditions and directions of the Potęgowo Commune” (2010), groundwater in the Potęgowo commune (including in the area of the Main Groundwater Reservoir No. 115 Łupawa and within the boundaries of the Main Groundwater Reservoir No. 107 Pradolina Łeby and its designed protection zones) is of good quality. In accordance with the hydrographic documentation of the Main Groundwater Reservoir No. 117, the quality of its waters is average, with a typical excessive content of iron and manganese.

Lithospheric transformations

The essential lithospheric transformations in the area of the project site include:

- transformations of physical and chemical properties of soils in areas of agricultural use and potential commencement of erosion processes related primarily to the agrotechnical activities;
- transformations related to transport infrastructure, including embankments, excavations and levelling;
- the areas of geomechanical transformation, related to adaptation of the area for investment, including in particular excavations and embankments, related to foundation of buildings, location of technical infrastructure, etc.

Synanthropization and degradation of vegetation

Due to the dominance of agricultural land in land use, the vegetation of the project site is almost entirely synanthropic. It comprises mostly by arable land agrocenoses. Deforestation and agricultural use of the areas have largely transformed the habitats, which were impoverished. Transformation covered soils, including primarily the upper parts of their profiles, in which natural strata layout, including humus strata, were damaged by plough layer formation. Changes related to aeration, which is different than in forest ground, water retention or other composition of soil organisms, were intensified nowadays by the use of mineral fertilisers, in particular by contamination of all kinds of pesticides.

Synanthropization of meadows and pastures plant communities is related to drainage and excessive grazing as well as introduction of "noble grasses".

The most synanthropized vegetation occurs in the case of damaged areas of technical infrastructure, e.g. communication infrastructure, where the ruderal species are growing.

4. NATURE PROTECTION FORMS IN THE LOCATION OF THE INVESTMENT

4.1. Location of the investment

The area of the planned location of the Wieliszewo Wind Farm together with the auxiliary infrastructure, including a 110 kV power line, is situated outside the spatial forms of nature conservation in the meaning of the Nature Conservation Act (consolidated text in Journal of Laws of 2009, No. 151, item 1220 as amended).

Species protection of flora, fungi and fauna

At the project site (in the places of planned location of wind turbines, HV power line and transformer station) no plant and fungi species covered with species protection in Poland were identified. The areas intended for direct locations of wind turbines, the servicing transformer station and HV power line, are overgrown mainly with segetal vegetation accompanying the crops and roadside vegetation, chiefly ruderal.

During the ornithological monitoring in the area of the planned investment, the presence of a total of 101 bird species, vast majority of which is strictly protected or partially protected, was identified[3]. In addition, 7 from the identified species are included in Annex I to the Birds Directive (see Table 1 and **Appendix 3**).

In the scope of chiropterofauna, 3 bat species identified during the monitoring (see Section 3.2.2.5 and **Appendix 4**) are strictly protected (Regulation of the Minister of Environment of 28 September 2004 on the protected species of protected wild animals - Journal of Laws of 2004, No. 220, item 2237). None of the identified species is listed neither the Polish Red Book of Animals nor in Annex II to the Council Directive 92/43/EEC.

4.2. Regional surroundings of the location of the investment

In the surroundings of the location of the investment, within a distance of up to approximately 20 km from the planned Wieliszewo wind farm together with the auxiliary infrastructure, including the 110 kV cable line, the following forms of nature protection are established (Fig. 5):

- **Słowiński Park Narodowy** (at a distance of approximately 13.5 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned wind turbine);
- **nature reserves**, including:
  - Ź**ródliskowe Torfowisko** (approximately 12 km to the south-west from the closest planned wind turbine and approximately 15 km from the planned 110 kV cable line);
  - **Grodzisko Runowo** (approximately 14.2 km to the east from the closest planned wind turbine and approximately 16.7 km from the planned 110 kV cable line)
  - **Dolina Huczka** (approximately 15.6 km to the south from the closest planned wind turbine and approximately 18 km from the planned 110 kV cable line);

[3] In Poland, practically all species are protected (Regulation of the Minister of Environment of 28 September 2004 on the protected species of protected wild animals - Journal of Laws of 2004, No. 220, item 2237).

  - **Łebskie Bagno** (approximately 19.6 km to the north-east from the closest planned wind turbine and more than 20 km from the planned 110 kV cable line);
  - **Jałowce** (approximately 14 km from the planned cable line and at least approximately 20 km to the north from the nearest planned location of a wind turbine**);**
- **Dolina Słupi Landscape Park and its buffer zone** – at a minimum distance of approximately 7.5 km to the west from the closest planned wind turbine (and approximately 80 m to the south in the case of the buffer zone) and approximately 10 km to the south-west from the planned 110 kV cable line (and approximately 2 km to the south in the case of the buffer zone)**;**
- **Fragment Pradoliny Łeby ze Wzgórzami Morenowymi na Południe od Lęborka (Fragment of the Łeba Marginal Stream Valley with the Moraine Hills South of Lębork) Landscape Protection Area** – at a minimum distance of approximately 14 km to the east from the closest planned wind turbine and at a distance of approximately 16.5 km to the east from the planned 110 kV cable line;
- **Pas Pobrzeża na Wschód od Ustki (Coastline East from Ustka) Landscape Protection Area** at a minimum distance of approximately 16.7 km to the north-west from the planned 110 kV cable line and at a distance of over 20 km to the north-west from the closest planned wind turbine
- **Natura 2000 sites**, including:
  - special bird protection areas:
    - **Dolina Słupi** PLB220002 (approximately 7.2 km to the west from the closest planned wind turbine and approximately 9.6 km from the planned 110 kV cable line);
    - **Ostoja Słowińska** PLB220003 (approximately 15 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned turbine);
  - Sites of Community Importance:
    - **Dolina Łupawy** PLH220036 (approximately 2.2 km to the north from the nearest planned location of a wind turbine and approximately 2.2 km to the east from the planned 110 kV cable line);
    - **Ostoja Słowińska** PLH220023 (approximately 15 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned turbine);
    - **Łebskie Bagno** PLH220040 (approximately 19.6 km to the north-east from the closest planned wind turbine and more than 20 km from the planned 110 kV cable line)
    - **Bagna Izbickie** PLH220001 (approximately 18.5 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned wind turbine);
    - Shadow List 2010 Area **Dolina rzeki Słupi** approximately 7.7 km to the south-west from the planned 110 kV cable line and approximately 7 km from the closest planned wind turbine);
- **natural monuments** – the nearest of which is located at a distance of approximately 880 m from the planned 110 kV cable line. In relation to the planned wind turbines,

the closest monument is located at a distance of approximately 5.5 km from the planned wind turbine locations).

- **documentation sites** – the closest of which is located approximately 1.3 km to the east from the closest planned wind turbine and approximately 3.8 km from the planned 110 kV cable line.
- **ecological sites** – the closest of which are located approximately 77 km from the planned 110 kV cable line and at least approximately 3.1 km from the nearest planned location of wind turbines;

Słowiński National Park

Pursuant to the Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, No. 92, item 880, as amended), a national park comprises an area of outstanding natural, scientific, social, cultural and educational values, with an area of not less than 1,000 ha, where all nature and landscape values are protected.

The Słowiński National Park (SNP) was established on 1 January 1967 under the Regulation of the Council of Ministers of 23 September 1996 (Journal of Laws No. 42, item 254). The currently effective legal act is the Regulation of the Council of Ministers on the Słowiński National Park of 2 March 2004 (Journal of Laws No. 43, item 390), which defines its area, boundaries and rules of management as well as the boundaries of the buffer zone.

The area of the SNP is 32,744.03 ha, including 21,572.89 ha in the Pomorskie Province and 11,171.14 ha in the coastal waters of the Baltic Sea. The land area of the Park covers the Łebsko Spit and the area of coastal lakes: Gardno, Dołgie Małe, Dołgie Wielkie, Łebsko, as well as forest and open areas, located south of the Baltic Sea coastal strip with a length of approximately 35 km, from 184.75 to 217.30 km of the sea coast, i.e. from Rowy to Łeba.

The park was entered in the world list of national parks by the International Union for Conservation of Nature (with category II). Due to its dune and marsh areas, its natural values are unique in Europe and in the Baltic Sea region. In 1977, the Park was the first in Poland to be recognised by UNESCO as a World Biosphere Reserve.

In 1995, the Park was included in the list of objects of the Ramsar Convention – "The Convention on Wetlands of International Importance especially as Waterfowl Habitat" – ratified by Poland on 22 March 1978 (Journal of Laws of 29 March 1978).

In order to protect the park against the external risks, the SNP has an established buffer zone. Its boundary runs at a minimum distance of some 8 km to the north of the planned 110 kV cable line and approximately 17.5 km from the closest planned wind turbine.

Nature reserves

Źródliskowe Torfowisko, a peat bog reserve established in 2008 for active protection of an area of 8.17 ha located in the Podwilczyn Forestry, in the Krzynia geodesic precinct. The purpose of nature protection in the reserve is to preserve the spring area with its natural vegetation specific for spring peat bogs, and beech forests surrounding the area. To protect the reserve against external threats, a buffer zone of 35.59 ha was established.

Grodzisko Runowo – Forest and archaeological reserve with an area of 29.66 ha in the Potęgowo commune, established in 1981 to protect the stands of beech and oak trees

with perimeters in excess of 3 meters, as well as the remains of a Slavic burgwall, together with a settlement and a kurgan cemetery near the Pogorzelica river (dating back to the second half of the 9th century). The archaeological site is entered in the register of cultural objects and is subject to strict conservation protection. The nearest localities are Runowo and Warcimino.

Dolina Huczka – forest reserve with an area of 6.71 ha. The reserve comprises fragments of the branch 20 of the Gałęźnia forestry, the geodetic precinct of Borzytuchom, and the Bytów Forestry District. The reserve is a fragment of an eastern slope of the Słupia river valley, featuring a number of erosion cuts, of which the largest one is the trough of the river's right-bank tributary, the Huczek stream. Also, in the central part, on the hill between the valley of the Słupia river and the Huczek stream, there is a Lusatian culture settlement (650-400 BC). In the reserve, apart from landscape values, it is worth highlighting the occurrence of many rare and endangered vascular plants, including under full protection. Due to special natural and cultural values of the reserve, an educational eco-route was set along the Huczek stream valley (Utracka-Minko, Miller 2000).

Łebskie Bagno – the reserve of with an area of 111.32 ha, located in the Łeba marginal stream valley, in the Janowice Forestry, provides protection to populations of five species of flowering plants, populations of four species of mosses included in the Polish Red List. The protection covers bryophyte phytocenoses, bog coniferous forest phytocenosis and bog birch forest phytocenoses. It is important to protect degraded raised bog habitat which is capable of regeneration. Łebskie Bagno is a Baltic Sea-type raised bog, whose biological balance is disturbed as a result of improper use. Regenerating peat-forming bryophyte phytocoenoses are observed, i.e. the reconstruction of the peat bog is underway.

Jałowce – partial forest reserve with an area of 1.29 ha, established in 1984. It features many specimens of the juniper (*Juniperus communis*) in different forms in pine forests between moraine hills. The purpose of protection is to preserve numerous juniper trees concentrated in a small area and to monitor the process of its growth in the existing habitat conditions and plant complexes. In the reserve, there are specimens of juniper trees in various shapes, reaching the height of 4–8 m.

Dolina Słupi Landscape Park – (as per the Park's website – www.dolinaslupi.pl) The Dolina Słupi Landscape Park was established in 1981. Its area is 37,040 ha and together with the buffer zone (83,170 ha) it covers the area of middle section of the Słupia river and its basin from Soszyca to the Krępa-Łosino route. The Dolina Słupi Landscape Park is distinguished by the abundance of landscape forms and considerable variations in land elevation. The specific feature of Park is its afforestation rate - as many as 72% of its area is covered by forests. The most common forest communities are fresh and mixed pine forests, with much less common bog forests. Deciduous forests of the Park are represented by several types of communities, from which the largest areas are covered by beechwoods: acidic and fertile, river valleys are associated with wood stitchwort alluvial forests, poplar and willow forests, and grey willow shrubs. Very interesting flora formations include mires with particularly valuable parts associated with raised bogs. Lakes of different size, shape and origin, including the largest lake in the Park – Jasień Lake (590 ha), are the important component of the landscape. The most valuable nature elements are lobelia lakes with their relict vegetation. There are 748 species of vascular plants in the Park, many of which are protected, threatened and endangered. The area of the Park with its lakes, numerous streams and rivers is a advantageous habitat for many species of fish, including the

valuable migratory fish: salmon and sea trout. In the wetlands, 10 species of amphibians found excellent conditions for growth. There area also four species of reptiles in the Park. There is an abundance of avifauna. Particularly noteworthy are nests of the goldeneye, hen harrier, red kite, white-tailed eagle, lesser spotted eagle and eagle owl – endangered birds entered in the "Polish Red List of Animals". Due to the diversity and abundance of avifauna, the entire Park has been recognized as one of 118 bird habitats in Poland. In 2004, the entire Park was included in the Natura 2000 network as a special bird protection area – Dolina Słupi – PLB 220002. There are also 41 species of mammals in the Park. To protect the most valuable fragments of nature, four nature reserves and 57 natural monuments were established in the Park.

Fragment Pradoliny Łeby ze Wzgórzami Morenowymi na Południe od Lęborka (Fragment of the Łeba Marginal Stream Valley with the Moraine Hills South of Lębork) Landscape Protection Area – with an area of 16,731 ha is located in the Łeba-Reda marginal stream valley and Kashubian Lake District mesoregions. The area is characterised by a clear late-moraine till with numerous lakes found in depressions. The diversity of the landscape is emphasised by the broad Łeba marginal stream valley in the north and gorges of rivers flowing from the south. The moraine hills are covered by forests with diverse tree species and age structure. The forest-forming species of trees occurring here are pine, beech, oak, spruce, alder and birch.

Pas Pobrzeża na Wschód od Ustki (Coastline East from Ustka) Landscape Protection Area covers the area east of the Słupia river mouth, along the coast, to Lake Gardno, totalling 3,336 ha. It is located between the towns of Ustka and Rowy. The most prominent sightseeing attraction in the area is the dune and cliff coast. Cliff denudations show black paleosols dated at approximately 1,000 to 10,000 years old. In Poddąbie and Dębina, the height of the cliffs ranges from 14 to 35 metres. In Poddąbie, several dozen years ago a landslide occurred at a length of 150 m of the coast and 70 m inland. At present, the site is overgrown with young coastal beech.

Natura 2000 sites

The special bird protection area Dolina Słupi PLB220002 covers an area of 37,471.8 ha and is located in the Pomorskie Province.

The area covers the river basin of the central part of the Słupia river and its tributaries: Bytowa, Jutrzenka and Skotawa. It features diversified post-glacial landscape with typical forms: ribbon and kettle lakes, outwash plains and end moraine hills. Part of numerous lakes are the oligotrophic lobelia lakes. The largest lakes include: Jasień, Skotowskie and Głębokie Lake. The forests, aged 40-100, are primarily the coniferous forests with pine and mixed and deciduous forests with beech and oak. The creek valleys are overgrown with alder-ash forests. The landscape of the habitat is diversified, with numerous ravines and hills up to 160 m above sea level.

There are at least 22 bird species listed in Annex I to the Birds Directive, 6 species from the Polish Red Book (PRB). In the breeding period, the area is inhabited by at least 1% of domestic population (C3 and C6) of the following bird species: red kite (PRB), poorwill, osprey (PRB), common sandpiper, goldeneye, goosander are present; the following species are present in high abundance and relatively high density (C7): white stork, black stork, crane, green sandpiper, woodlark and red-back shrike. Numerous valuable and well preserved habitats listed in Annex I to the Habitats

Directive create a mosaic. Different types of mires and alluvial forests are particularly valuable. The area is inhabited by six species of animals listed in Annex II, including otters. The largest threats to the area include water pollution with municipal and agricultural wastewater, uncontrolled tourist and recreational influx, including development of settlements.

The special bird protection area Ostoja Słowińska PLB220003 is located approximately 15 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned turbine; it covers an area of 19,326.7 ha, located in the Pomorskie Province in the communes of Łeba (357 ha), Wicko (2,350.5 ha), Główczyce (2,121.4 ha), Smołdzino (14,276.9 ha) and Ustka (222 ha).

The area protects the landscape and diversity of morphological forms observed within the Gardeńsko-Łebska Peninsula, including unique coastal barchan dunes (up to 40 m above sea level wandering with the rate of 3-10 m per annum), two largest coastal brackish lakes: Łebsko (7140 ha, maximum depth of 6.3 m) and Gardno (2468 ha, maximum depth of 2.6 m) with adjoining meadows, mires, forests and bog coniferous forests. In total, the area is composed of: main complex of the Słowiński NP (with sea waters included to the park area in 2004), complex Rowokół and the Łupawa River bed connecting Rowokół with the main complex. The inter-dune basins, so called, deflation fields, a primary flora succession is observed from the initial psammophylic communities to crowberry coniferous forest. The area is covered with well preserved, typically formed and present on large areas habitats specific for coastal areas, including 26 types of habitats listed in Annex I to the Council Directive 92/43/EEC. In this area, the habitats of multiple rare and endangered species were identified, including 23 from Annex II to the Council Directive 92/43/EEC (including 8 fish species and one of more extensive populations of Linaria odora in Poland (also the species listed in Annex II to this Directive) and many protected
vascular species. This area inhabits also interesting non-vertebrates, including among others leeches Hirudinae: Haementria costata, Haemopsis sanguisuga, Piscicola geometra and arachnids Arachnidae: Arctosa sp., Dolomedes fimbriatus. The unique nature of wandering dunes is protected. The offshore part of the area is the habitat of European porpoise. This is an important bird area of European range E 09 (Słowiński NP). The area is entered into the list of Ramsar sites; it is also included in the Słowiński Biosphere Reserve. There are at least 28 bird species listed in Annex I to the Birds Directive, 11 species from the Polish Red Book (PRB). In the breeding period, the area is inhabited by at least 1% of domestic population (C3 and C6) of the following bird species: white-tailed eagle (PRB),
golden eagle (PRB), osprey (PRB), eagle owl (PRB), dunlin (schinzii) (PRB), ringed plover (PRB); Montagu's harrier and black cormorant are present in a relatively high density (C7). In the migration period, at least 1% of population of the migration route (C2 and C3) of the following bird species is observed: smew
(approximately 2%), crane (>3%), bean goose (>4%) and goosander; greater white-fronted goose and widgeon are present in a relatively high density (C7).

Area of Community importance – Dolina Łupawy PLH220036 comprises the valleys of the Łupawa and Bukowina rivers from their outflow from the Jasień Lake. The following are present within the area:

- natural, deep riverbeds of Łupawa and Bukowina Rivers;
- springs and small creeks (tributaries);

- extensive alluvial areas of sub-mountainous nature *Carici remotae-Fraxinetum* at the valley slopes as well as oak and hornbeam forests *Stellario-Carpinetum* in many gorges and beechwoods *Luzulo-Fagetum* and *Asperulo-Fagetum;*
- wet meadows, transition and raised bogs and dystrophic lakes in drainless areas.

In addition to protected habitats, animal and plant species, the following make up the natural value of the area:

- mountainous and sub-mountainous nature of the river;
- one of the largest concentrations of springs in the Pomerania;
- large complexes of alluvial forests of sub-mountainous nature;
- numerous rare and endangered plant species from the Polish Red Book
- highly numerous population of freshwater alga *Hildenbrandtia rivularis* confirming water purity;
- valuable salmonidae species;
- predatory bird habitats and habitats of wetland and meadow bird species;
- picturesque landscape with extensive forest complexes.

The site of Community importance Ostoja Słowińska PLH220023 protects the landscape and diversity of morphological forms observed within the Gardeńsko-Łebska Peninsula, including unique coastal barchan dunes (up to 40 m above sea level wandering with the rate of 3-10 m per annum), two largest coastal brackish lakes: Łebsko (7140 ha, maximum depth of 6.3 m) and Gardno (2468 ha, maximum depth of 2.6 m) with adjoning meadows, mires, forests and bog coniferous forests. In total, the area is composed of: main complex of the Słowiński NP (with sea waters included to the park area in 2004), complex Rowokół and the Łupawa River bed connecting Rowokół with the main complex. The inter-dune basins, so called, deflation fields, a primary flora succession is observed from the initial psammophylic communities to crowberry coniferous forest.

The area is covered with well preserved, typically formed and present on large areas habitats specific for coastal areas, including 26 types of habitats listed in Annex I to the Council Directive 92/43/EEC. In this area, the habitats of multiple rare and endangered species were identified, including 23 from Annex II to the Council Directive 92/43/EEC (including 8 fish species and one of more extensive populations of Linaria odora in Poland (also the species listed in Annex II to this Directive) and many protected vascular species. This area inhabits also interesting non-vertebrates, including among others leeches *Hirudinae*: *Haementria costata, Haemopsis sanguisuga, Piscicola geometra* and arachnids *Arachnidae: Arctosa sp.*, *Dolomedes fimbriatus*. The unique nature of wandering dunes is protected. The offshore part of the area is an important habitat of European porpoise population in the Baltic Sea. This is an important bird area of European range E 09 (Słowiński NP). The area is entered into the list of Ramsar sites; it is also included in the Słowiński Biosphere Reserve. There are at least 28 bird species listed in Annex I to the Birds Directive, 11 species from the Polish Red Book (PRB). In the breeding period, the area is inhabited by at least 1% of domestic population of the following bird species: white-tailed eagle, golden eagle, osprey, eagle owl, dunlin (schinzii), ringed plover; Montagu's harrier and black cormorant are present in a relatively high density. In the migration period, at least 1% of population of the migration route of the following bird species is observed: smew, crane, bean goose and goosander; greater white-fronted goose and widgeon are present in a relatively high density.

The site of Community importance Łebskie Bagna PLH220040comprises two Baltic peat bogs (Czarne Bagno and Łebskie Bagno) located in the Łeba valley, in a complex of reclaimed lowland bogs. Each of the peat bogs is partially, but to a different extent, degraded as a result of years of drainage, peat use, fire and afforestation. Partially open peat bog tops: in Łebskie Bagno fragments of a live raised bog in stagnation and very well regenerating bryophyte complexes in well-irrigated post-mining excavations. In Czarne Bagno there are no intact raised bog bryophytes. The slopes of the domes of both bogs overgrown with bog forests with spontaneously-growing or planted trees.

The area was established to protect the following habitat types:

- natural dystrophic water reservoirs;
- active raised bogs;
- degraded raised bogs, but capable of natural and stimulated regeneration;
- bog woodland (*Vaccinio uliginosi-Betuletum pubescentis, Vaccinio uliginosi-Pinetum, Pino).*

Planned special habitat protection area Dolina rzeki Słupi in accordance with Shadow List 2010

According to the standard data form prepared in May 2004 (updated in April 2009), the area covers 6,997.2 ha and comprises the valley of the Słupia river from the town of Sulęczyn to the river's mouth, together with its tributaries. The topography of this region was formed in the period of North-Atlantic continental glacier melting, which contributed to the diversity of landscape forms and differentiation of altitudes. A significant part of the area is overgrown with forests (approximately 10% of the area comprises forest habitat types). The most common forest communities are fresh and mixed pine forests, with much less common bog forests. Deciduous forests are represented by several types of communities, from which the largest areas are covered by beechwoods: acidic and fertile, river valleys are associated with wood stitchwort alluvial forests, poplar and willow forests, and grey willow shrubs. Very interesting flora formations include mires with particularly valuable parts associated with raised bogs. Lakes of different size, shape and origin are the important component of the landscape. The most valuable nature elements are lobelia lakes with their relict vegetation. Thanks to the presence of lakes, numerous streams and rivers, it is an advantageous habitat for many species of fish, including the valuable migratory fish: salmon and sea trout. In the wetlands, 10 species of amphibians and four species of reptiles found excellent conditions for growth. There is also an abundance of avifauna.

Nature monuments

15 natural monuments have been set up in the commune – single specimens of grand trees and groups of trees. Three of the monuments (register No. 153, 154, 155) were established under Decisions of the Governor of Słupsk of 26 October 1978 No. 153/20, 154/21, 155/22 (Official Journal WRN in Słupsk No. 1, item 2), others under Governor's Decision No. 51/95 of 28 August 1998. The trees registered as monuments include a group of holm oaks and one beech near a forester's lodge in Darżewo, common oak and Douglas fir in a park in Runowo, common oak and beech near the

Czarne Lake, common oak in the locality of Warcimino and 2 Norway maples, common beech and a small-leaved lime in a park in Łupawa.

There are no natural monuments in the area surrounding the project site. The nearest monument (approximately 880 m from the planned kV line) is a common oak located in a park in the village of Karżniczka. Also, the monuments closest to the planned wind turbines are a common oak and a common beech located at least approximately 4.5 km near the Czarne Lake (southern part of the Potęgowo commune).

Documentation sites

In the Potęgowo commune there are two documentation sites, none of which is located within the project site. The nearest one is Wyrobisko Wieliszewo, which protects an area after peat extraction (the site was established on 10 October 1997 under Decision of the Governor of Słupsk No. 13/97 [Official Journal of the Słupsk Governor of 1997, No. 18, item 99] – located at least approximately 1.3 km to the east from the closest planned wind turbine and approximately 3.8 km to the south from the planned 110 kV cable line.

Ecological sites

No ecological sites are situated within the area of the investment. The nearest ecological sites are two peat bogs located in the geodetic precinct of Wieliszewo – Torfowisko Wieliszewo 1 and Torfowisko Wieliszewo 2. They are located at a minimum distance of approximately 1.8 km from the closest planned wind turbine and were established under by the Potęgowo Commune Council's Resolution No. 117/XVIII/2008 of 3 March 2008. They are raised bogs preserved in a very good condition, overgrown with initial form of bog coniferous forest. They constitute a part of a large raised bog named Wieliszewskie bagna, overgrown with bog coniferous forest and bog birch forest. They have a hummock and flark structure.

In addition, the following ecological sites are found along the planned 110 kV power line, which is an integral part of the project, at a distance of up to 500 m (Table 13 and Cartographic Appendix 3):

Table 3 Ecological sites along the route of the planned 110 kV cable line

No.	Type of ecological site	Plot No.	Distance from the line [m]
1	Bog	284/3	273
2	Bog, water pond	284/3	475
3	Peat bog	279/10	95
4	Meadow	291/5	369
5	Water pond	304/1	303
6	Water pond	304/2	77

Source: own study.

5. DESCRIPTION OF MONUMENTS PROTECTED UNDER THE REGULATIONS ON MONUMENT PROTECTION AND CARE AND ON THE PROTECTION OF THE OTHER CULTURAL HERITAGE IN THE LOCATION OF THE POWER PLANT

Within the location of the Wieliszewo wind farm there area no facilities listed to the register of monuments on the basis of the provisions on the protection and care of historic monuments.

The closest object entered in the register of historic monuments of Pomorskie Province is a park in the Malczkowo village (Pomorskie Province reg. No. 1612 of 11 December 1996), located approximately 2 km to the east of the nearest planned wind turbine.

With respect to the planned 110 kV cable line, the nearest monument entered in the register of the Pomorskie Province (No. 341 of 28 April 1964) is the palace and park complex in the village of Karżniczka, located approximately 550 m away from the planned 110 kV cable line.

Moreover, an object entered in the register of the Provincial Conservation Officer in the vicinity of the planned wind farm is a palace and park complex located in the village of Karżniczka (Pomorskie Province reg. No. 1174 of 1 July 1987).

In the Potęgowo commune, at the distance of more than 5 km from the project site, there are numerous examples of unrestored historical cultivated greenery. The exception is the renovated park around the reconstructed manor house in Łupawa, as well as parks next to the palace in Runowo. Apart from them, there are remnants of historical parks in Czerwieniec, Darżyno, Grąbkowo, Głuszynek, Głuszyn, Grapice, Poganice, Rzechcino and Skórowo. These are 18th and 19th century landscape parks, which are parts or remains of palace and park complexes.

22 inventoried post-evangelical cemeteries, entered in the conservator's records, have been preserved to a small extent. Their remains mostly include a historical tree stand, sometimes the composition structure and a few tombs and tombstones. Due to the significant degree of devastation and mostly significant distance from settlements, at present the historic cemeteries do not have a significant impact on the image of the cultivated greenery in the commune.

A very characteristic and well preserved element in the landscape of the commune are country roads and alleys leading to land estates planted with rows of deciduous trees. The plantings are dominated by maples, sycamores, lime trees and ash trees, but there are also fragments of oak, beech, acacia or willow avenues. Given the current low traffic on most of these roads (cobbled and dirt roads), the plantings are mostly well preserved.

In the area of the location of the Wieliszewo wind farm there are archaeological sites catalogued on the basis of conducted archaeological research or historical sources (“Zoning plan for the Wieliszewo geodetic precinct” 2008).

The Wieliszewo wind farm is located in the zone of partial archaeological and conservation protection set out in the zoning plan (2008) (see Cartographic Appendix 1). In accordance with the zoning plan

in the zone of partial archaeological and conservation protection, within the boundaries of 13 archaeological sites marked on the drawing of the plan and included in the provincial register of monuments, it has been established that archaeological rescue

research must be first conducted for all earthworks associated with the implementation of the project involving the construction of wind turbines, after the completion of which the area can be permanently designated for investment purposes;

Moreover, the area of the wind farm site is located in the zone of limited conservation and archaeological protection (see Cartographic Appendix 1). In accordance with the zoning plan

in zones of limited archaeological and conservation protection, within the area of occurrence of archaeological sites marked on the drawing of the plan and included in the provincial register of monuments, it has been established that archaeological intervention research in the form of archaeological supervision of earthworks carried out as part of project implementation must be first conducted for all earthworks associated with the implementation of the project involving the construction of wind turbines, after the completion of which the area can be permanently designated for investment purposes;

6. ENVIRONMENTAL IMPACT ASSESSMENT OF THE INVESTMENT SCENARIO SELECTED FOR IMPLEMENTATION

6.1. Construction stage

6.1.1. Abiotic environment

Surface lithospheric layer

Impact of the planned Wieliszewo wind farm and associated infrastructure on abiotic environment will take place primarily at the investment stage lasting usually several months. Access roads and excavations for the foundations of the power plant towers and for cables will be built in this period. Excavations for foundation purposes will liquidate the soil cover and transformations in the sub-surface geological structures in effect of earthworks and result in waste production in the form of soil excavated for the purposes of foundations and road construction (see Section 6.1.3.).

Turbine foundations at the depth down to approximately 3 m below ground level are assumed, which for the planned foundation parameters (base of 30 x 30 m) will result in necessary disposal - for each turbine - of approximately 2700 m^3 of soil (sands and clays), which translates into approximately 45,900 m^3 of soil for the array of 17 wind turbines. In addition, significant amounts of soil and earth will be generated as a result of construction of access roads. Soil from the excavations can be used for levelling of road areas and whole land management upon completion of the construction works or used in any other way

In accordance with “Zoning plan for the Wieliszewo geodetic precinct” (2008) at the site where the turbines will be built, on their assembly yards, in the area of the transformer station, on new access roads and in the area of excavations for installation of cables, the soil cover will be removed (including: arable land of class IVa, IVb, V and VI, pastures and mineral wastelands). In accordance with the zoning plan, this will apply to a total area of approximately 20.83 ha.

During the construction of the wind farm, due to the use of heavy machinery, storage of construction materials and elements, physical transformations of the soil cover in the vicinity of the areas of direct location of the wind farm can occur. These include:

- changes to lithological structure of bedrock (sub-soil);
- soil profile damage;
- change of physical structure of soil in effect of pressing with heavy construction machinery and stored material.

The planned 110 kV power line will be laid in an excavation which will be 90 cm wide. Crossings with hardened roads, utilities and watercourses will be made using the directional drilling method. Excavated soil masses are used on site. Any potential surplus will be disposed. No trench drainage is planned. No aggregate is planned to be used.

During earthworks related to the execution of the above activities the following transformations of the environment will take place:

- soil cover removal (soil cover removed and overburden deposited for later use, once the earthworks are completed) – only on sections other than roads. The section of cable line not installed within roads lanes amounts to about 16% of the line length;

- transformation of near-surface geological structures (removal of approximately 10,260 m^3 of soil layer and its temporary deposition on the ground surface until the cables are installed; on sections where the cable line crosses county roads with hardened surface (asphalt), the directional drilling method will be used;
- in the section where the power line passes under the Charstnica watercourse, directional drilling method will be used, which will prevent changes of morphodynamics of the watercourse;
- air pollution and noise emissions (operation of construction equipment, transport of materials) – operation of construction equipment (excavation), transport of ballast and elements of the cable network; impact of emissions of pollutants generated during the construction of the cable lines will be virtually limited to the area of the immediate vicinity of the works and will not pose a threat to the environment; due to the fact that the installation works will be carried out during the day and due to the distance of construction sites from the nearest residential development, it is expected that the equivalent noise level outside the area of performed works, caused by operation of machinery as well as increased traffic of self-propelled vehicles and cars will cause no nuisance for the residents (periodic noise level during construction works is not regulated by the Polish legislation);
- waste production, mainly soil (excess soil from excavations – see Section 6.1.3.).

Upon completion of works, the cable excavations will be filled and reclaimed.

The passage of cable lines under the Charstnica watercourse and under hardened roads will be carried out using the directional drilling method. This method is trenchless and minimises the impact of the project on the surface lithospheric layer.

Surface and ground waters

No surface water are present in the area of direct locations of the wind turbines and the planned transformer station. Construction of the wind turbine and the associated infrastructure, including excavations for the power line, will have no impact on the hydrographic objects nearby.

Foundation works of the wind farm and transformer station will be preceded by geotechnical surveys of soil. With regard to shallow foundations of the planned turbines (approximately 3 m below ground level), no damage to the first groundwater level is expected. In the case of local and shallow ground waters, foundations should be placed without drainage of excavations.

Construction of transformer station can potentially cause local reduction of storm water infiltration to soil. The ground will be duly secured to prevent leakage of petroleum substances to soil and ground waters during the implementation of the investment in the event of any incidents of leakage.

The directional drilling method used for installing the HV 110 kV cable under the Charstnica watercourse will not disturb its hydrological regime.

To summarise: implementation of the planned investment will have no impact on surface and groundwater. In particular, it will not pose any threat to water resources of the Main Groundwater Reservoir No. 115 Łupawa and No. 107 Pradolina Łeby, as well as the planned protection area of the Main Groundwater Reservoir No. 117.

Atmospheric air

Impact on air pollution will result primarily from the operation of construction equipment (excavations, construction of road sections and manoeuvre yards) and transport of construction materials and soil from the output and of the construction elements of the power plant.

Vehicle traffic, excavations and storage of soil from the output and potentially of bulk construction materials will cause periodic emission of particulate matter to air. It will be of fugitive nature, of limited range, primarily to the construction site area. With a view to good airing conditions, it will have no significant impact on the aerosanitary conditions in the area of the investment implementation.

Computations of transport pollution emission volumes

Minor sources of air pollution associated with the construction phase and operation of the project will include vehicle engine exhaust. Several thousand substances are identified in emissions from internal combustion engines. Only relevant chemical substances specific to transport are taken into account. These are:

- on a local scale – nitrogen oxides, hydrocarbons, carbon monoxide
- on a macro scale – carbon dioxide (greenhouse gas)

The assessments do not consider sulphur dioxide and lead (due to elimination of sulphur and lead content from fuels). Therefore, the most important analysed pollutants include **nitrogen oxides, carbon oxide and hydrocarbons** and due to traffic of heavy-duty vehicles also particulate matter emission was analysed.

Vehicle traffic – construction stage

For calculations of the impact of the project on air pollution during the construction stage, the following data on truck-traffic intensity was assumed:

- maximum traffic intensity – approximately 100 vehicles / 12 hours (during the day); up to 10 vehicles/hour was assumed for the calculations;
- minimum traffic intensity – approximately 10 vehicles / 12 hours (during the day); approximately 1 vehicle/hour;
- average traffic intensity – approximately 30 vehicles / 12 hours (during the day);

The construction stage will last approximately nine months – it was assumed that during the entire construction stage (approximately 200 days) there will be approximately 6,000 truck passages through the analysed area.

Car traffic – operation stage

During the operational phase, vehicle traffic will be minimal:

- 2 passenger cars / 8 hours
- 1 truck / month

Vehicle traffic volume at the exploitation stage is marginal (negligible).

Calculation methodology

Road traffic is a specific source of air pollution which is difficult to analyse because it is not possible to measure emissions directly and emitters are mobile and very close to the ground surface. Emissions in the analysed area were estimated using COPERT

4 software for calculating emissions of pollutants from road transport. The key factors that determine the amount of emissions from the road include:

- type of vehicles – engine size and type, type of toxicity standard effective at the time when the vehicle was admitted to road traffic,
- vehicle traffic parameters – traffic intensity, types of vehicles, speed of individual vehicle classes,
- emission type – from a warm or warming up engine from a given ambient temperature;

The maximum traffic intensity specified on the previous page was used to calculate emissions from the area under analysis.

Using COPERT 4 software, baseline specific emissions were calculated. The calculations were made for several types of trucks. Emissions calculated using COPERT 4 software were entered into the transport pollution distribution modelling software, which made it possible to determine maximum and average annual concentrations of pollutants.

Due to the fact that significantly different vehicles make up the traffic, it is necessary that the calculations take into account traffic structure in terms of type and manufacturing year (age) of vehicles. These factors are taken into account by averaging the specific emissions with weighting factors resulting from the share of a given group of vehicles in their total traffic. Below is presented the annual share of vehicles from different manufacturing periods (that meet individual standards) adopted for the purpose of the calculation:

Conventional	**0%**
Euro 1 - 91/441/EEC	**0%**
PC Euro 2 - 94/12/EEC	**0%**
PC Euro 3 - 98/69/EC Stage2000	**0%**
PC Euro 4 - 98/69/EC Stage2005	**50%**
PC Euro 5 (post2005)	**50%**
PC Euro 6	**0%**

The stream of vehicles travelling through the analysed area was divided into several groups of vehicles specified in Tables 4 through 7. The tables show the average specific emissions for various types of trucks calculated with COPERT 4 software (and in-house spreadsheet EMISJA). Average specific emissions were calculated for the most significant traffic pollutants – nitrogen oxides, carbon monoxide, hydrocarbons and particulate matter. Speed of 10-30 km/h was assumed for the calculations.

Table 4 Specific emission – nitrogen oxides (NO_x)

heavy-duty vehicles	<7.5t	7.5-12t	12-14t	14-20t	20-26t	28-32t	>32t
Conventional	5.21	8.92	10.26	13.32	16.03	17.74	18.57
HD Euro I - 91/542/EEC Stage I	5.68	9.68	10.90	14.54	17.63	20.24	21.04
HD Euro II - 91/542/EEC Stage II	5.42	8.77	9.98	13.99	16.18	18.70	19.09
HD Euro III - 2000 Standards	2.83	4.73	5.32	7.16	8.58	10.19	9.95
HD Euro IV - 2005 Standards	1.61	2.69	3.03	4.08	4.89	5.81	5.67
HD Euro V - 2008 Standards	0.31	0.52	0.59	0.79	0.94	1.12	1.09
HD Euro VI	0.31	0.52	0.59	0.79	0.94	1.12	1.09

Share	**0.00%**	**0.00%**	**0.00%**	**33.33%**	**33.33%**	**33.33%**	**0.00%**
average specific emission 2.94 g/km							

Table 5 Specific emission – hydrocarbons (C_xH_y)

heavy-duty vehicles	<7.5t	7.5-12t	12-14t	14-20t	20-26t	28-32t	>32t
Conventional	3.66	3.24	3.57	5.22	2.96	2.93	3.25
HD Euro I - 91/542/EEC Stage I	0.66	1.23	1.36	1.96	2.44	2.40	2.72
HD Euro II - 91/542/EEC Stage II	0.43	0.79	0.87	1.26	1.56	1.54	1.73
HD Euro III - 2000 Standards	0.40	0.75	0.83	1.22	1.50	1.44	1.65
HD Euro IV - 2005 Standards	0.02	0.04	0.05	0.07	0.08	0.08	0.09
HD Euro V - 2008 Standards	0.02	0.04	0.05	0.07	0.08	0.08	0.09
HD Euro VI	0.02	0.04	0.05	0.07	0.08	0.08	0.09
Share	**0.00%**	**0.00%**	**0.00%**	**33.33%**	**33.33%**	**33.33%**	**0.00%**
average specific emission 0.08 g/km							

Table 6 Specific emission – carbon monoxide (CO)

heavy-duty vehicles	<7.5t	7.5-12t	12-14t	14-20t	20-26t	28-32t	>32t
Conventional	4.70	6.56	7.12	10.16	7.29	7.83	8.18
HD Euro I - 91/542/EEC Stage I	1.71	2.94	3.19	4.47	5.63	5.77	6.41
HD Euro II - 91/542/EEC Stage II	1.30	2.21	2.41	3.26	4.09	4.57	4.80
HD Euro III - 2000 Standards	1.62	3.02	3.34	4.72	5.90	6.07	6.81
HD Euro IV - 2005 Standards	0.13	0.24	0.25	0.36	0.43	0.44	0.47
HD Euro V - 2008 Standards	0.13	0.24	0.25	0.36	0.43	0.44	0.47
HD Euro VI	0.13	0.24	0.25	0.36	0.43	0.44	0.47
Share	**0.00%**	**0.00%**	**0.00%**	**33.33%**	**33.33%**	**33.33%**	**0.00%**
average specific emission 0.41 g/km							

Table 7 Specific emission – particulate matter (PM10)

heavy-duty vehicles	<7.5t	7.5-12t	12-14t	14-20t	20-26t	28-32t	>32t
Conventional	0.97	1.12	1.18	1.67	1.51	1.56	1.70
HD Euro I - 91/542/EEC Stage I	0.42	0.71	0.76	1.10	1.39	1.37	1.54
HD Euro II - 91/542/EEC Stage II	0.18	0.27	0.29	0.35	0.46	0.48	0.53
HD Euro III - 2000 Standards	0.21	0.35	0.38	0.52	0.65	0.60	0.69
HD Euro IV - 2005 Standards	0.11	0.14	0.14	0.17	0.20	0.21	0.21
HD Euro V - 2008 Standards	0.11	0.14	0.14	0.17	0.20	0.21	0.21
HD Euro VI	0.07	0.08	0.08	0.08	0.09	0.09	0.09
Share	**0.00%**	**0.00%**	**0.00%**	**33.33%**	**33.33%**	**33.33%**	**0.00%**
average specific emission 0.19 g/km							

The calculations were made for the construction stage. The maximum (instantaneous) emissions were calculated for the maximum traffic intensity of 10 vehicles/hour and the average annual emissions for the average traffic intensity of 3 vehicles/hour. It has been assumed that the distance to be covered by 1 vehicle at the project site is approximately 3 km. The calculated emissions are shown in Table 8.

Table 8 Emissions from the project site during the construction stage

	Maximum emission [kg/h]	Average emission [kg/h]	Total emission throughout the entire construction stage [Mg / 9 months]
Nitrogen oxides NOx	0.09	0.02	0.05
Hydrocarbons CxHy	0.002	0.0004	0.001
Carbon monoxide CO	0.012	0.003	0.007
PM10 particulate matter	0.006	0.001	0.003

The emissions calculated above represent minimum values and will not worsen the aerosanitary conditions at the project site.

Impact of traffic pollutants emitted from the wind farm construction site on air pollution

The calculations of maximum one-hour concentrations were made for maximum one-hour emissions.

The highest maximum concentrations

The emissions calculated above are from the entire construction site. To present the distribution of maximum (one-hour) concentrations, calculations were made for a selected line section of the emission source (excluding the 5th and 6th state of vertical equilibrium of the atmosphere, as these states occur only at night, while the maximum traffic intensity occurs during the day). Calculations of maximum concentrations were performed for the maximum emission, grouping all emission sources in the area of a single line source, which overstates the results of pollutant concentration calculations (because in reality these sources will be dispersed over a larger area).

Table 9 Calculated maximum concentration:

Type of pollutant	Distance from emission source [m]	S_{mm} ($\mu g/m^3$)	D_1 ($\mu g/m^3$)
NOx	road axis road edge 10 m from the road edge	7 5 2	200
CO	10 m from the road edge	0.04	30,000
CxHy	10 m from the road edge	0.3	2000*
PM10	10 m from the road edge	0.07	280

* average reference value D_1 = 2,000 $\mu g/m^3$ (aliphatic hydrocarbons D_1 = 3,000 $\mu g/m^3$; aromatic hydrocarbons D_1 = 1,000 $\mu g/m^3$)

From this follows that:

- maximum concentration of nitrogen oxides in the axis of the road (in the place of location of the emission source) is below 10% of permissible level
- maximum concentration of nitrogen oxides in a distance of 10 m from the edge of the road decreases to trace values (1% of permissible level)

Maximum concentrations of the remaining pollutants (CO, C_xH_y and PM10) are negligible (far below 1% of the reference value).

The calculations also show that annual average concentrations from the area under analysis for all traffic pollutants will be negligent.

To summarise, calculations of all transport pollutants emitted at the construction stage from the area of the designed wind farm will be of trace nature (negligible).

Other atmospheric pollutions

Welding works will emit CO, NO_2 and particulate matter. In addition, finishing works will potentially emit C petrol, downfalling particulate matter, xylene and toluene. Impact of emission of pollutions produced during the assembly and finishing works will be practically limited to the direct vicinity of these works and will pose no threat to the environment.

Transport of output with trucks, supply of concrete for foundation laying and transport of construction elements will periodically worsen the aerosanitary conditions (fumes and dust) near the transport routes, which should be therefore routed in a possibly greatest distance from settlements.

Acoustic environment

Vehicle transport and operation of heavy equipment within the investment area will be associated with noise emission (see Section 6.1.5.).

Due to the fact that the construction, installation and assembly works will be carried out during the day and due to the distance of construction sites from the nearest residential development, it is expected that the equivalent noise level outside the area of performed works, caused by operation of construction machinery and accompanying technical equipment as well as increased traffic of self-propelled vehicles and cars will cause no nuisance for the residents (periodic noise level during construction works is not regulated by the Polish legislation).

Vibrations

Operation of heavy construction machinery (excavators, bulldozers, concrete nodes) can cause vibrations that will be located in the area of the conducted works and discontinued upon their completion. These can have adverse effect for the structure of the buildings and humans living therein. Their presence is however of short-term nature and applies to the area of maximum range up to several dozens of metres from the operating area of the machines. In the case of planned investment, such vibrations will be present only in the period of construction of power plant tower foundations.

Due to distances between the residential housing development and the construction sites (above 500 m) no risk of vibrations for the nearest buildings and humans living therein are expected.

6.1.2. Biotic environment

Vegetation cover

Impact of wind power plant complex and associated infrastructure on flora will take place only at the construction stage. In the areas of direct location of the turbines and on the assembly yards around them (approximately 1,200 m^2 each) and in the area of the location of power station and of the new access roads, current vegetation, represented primarily by agrocenoses.

During the construction of the turbines, with regard to the use of heavy machinery and storage of construction elements, physical transformations of vegetation and its

liquidation in the vicinity of the areas of direct location of the turbines (temporary assembly yards) and on the routes of excavations for cable laying. This will include only the arable lands.

Upon completion of investment works, the area occupied temporarily for the construction purposes (e.g. excavations for cables, storage areas) will be reclaimed (including restoration of the agricultural function).

The areas of the planned location of wind turbines and transformer station are covered only with agrocenoses of arable lands with periodic segetal vegetation. There is no threat to trees and shrubs in areas of the planned construction works.

Trenches for power cables will be made primarily along existing roads and will pass through areas used for agricultural purposes. The cable line will also run under the bed of the Charstnica river. The line will run through a forest area (along the existing road).

With regard to the course of excavation for the cable line on the routes of roads and via agricultural lands, laying of cables will have no negative impact on the tree and shrub species in the surroundings of the project site. In the case of single specimens of trees or shrubs next to the road strip, the works should be performed manually so as not to damage their root system. In addition, the cable line under watercourses will be installed using the directional drilling method, which is a trenchless method. Therefore, the installation of the line will not affect the hydrology of the watercourse, the vegetation present on the watercourse banks and their morphodynamics.

Fauna

In the period of construction of the wind turbines and excavations for the power line, in effect of nuisance related to operation of the construction machinery (noise, exhaust fumes, vibrations, physical threat) and accesses to the construction sites, fauna will most probably migrate on temporary basis on the adjoining areas, excluding the areas easily subject to synanthropization, of high adaptation skills to changing environmental conditions (primarily certain rodent and bird species).

Field monitoring demonstrates that deterring of fauna during construction works has a range of several hundred meters from the construction sites. This is a typical periodic impact.

At the areas of direct location of the turbines and of the new access roads, also liquidation of soil fauna will take place due to decommissioning of soil cover.

6.1.3. Waste

In the course of construction of the planned investment (roads, power grid, telecom grid, foundations of turbines, power plant assembly) the construction waste, classified into group 17 according to the Regulation of the Minister of Environment of 27 September 2001 on the catalogue of waste - Journal of Laws No. 112, item 1206 (table 10) will be produced. Volumes of waste were estimated using the analogy method to already delivered wind farms.

Table 10 Types of waste at the construction stage of wind turbines

Waste group code	**Waste type**	**Number** (for the array of 17 wind turbines)

15	**WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**	
15 01	**packaging (including separately collected municipal packaging waste)**	
15 01 01	paper and cardboard packaging	18.53 m^3
15 01 02	plastic packaging	51.6 m^3
15 01 03	wooden packaging	8.5 m^3
15 01 04	metal packaging	0.015 t
15 01 05	composite packaging	0.69 m^3
15 01 06	mixed packaging waste	2.5 m^3
15 02	**absorbents, filter materials, wiping cloths and protective clothing**	
15 02 03	absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02	0.5 m^3
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**	
17 01	**Construction material and element waste and road infrastructure waste (e.g. concrete, bricks, tiles and ceramics)**	
17 01 01	Concrete waste and debris from demolition and renovation works	23 m^3
17 01 03	Tiles and ceramics waste	1.85 m^3
17 01 07	Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	3.5 m^3
17 01 82	wastes not otherwise specified	2.9 m^3
17 02	**Wood, glass and plastic waste**	
17 02 01	Wood	3 m^3
17 02 03	Plastic	2.5 m^3
17 03	**bituminous mixtures, coal tar and tarred product waste**	
17 03 80	Asphalt felt waste	2.5 m^3
17 04	**Metals and scrap (including their alloys) waste**	
17 04 05	Iron and steel	3 tonnes
17 04 11	Cables other than those mentioned in 17 04 10	396 running metres
17 05	**Soil (including excavated soil from contaminated sites), stones and dredging spoil**	
17 05 04	Soil and stones other than those mentioned in 17 05 03	31,400 m^3
17 06	**Insulation materials and asbestos-containing construction materials**	
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03	3 m^3

Source: own study, waste classification according to the Regulation of the Minister of Environment of 27 September 2001 on the catalogue of waste

Vast majority of the aforementioned waste (excluding soil and ground) will be temporarily stored in the dedicated containers/tanks which will minimise the risk of penetration of pollutants into the soil and water environment. Vast majority of waste included into group 17 listed in table 7, excluding waste from 17 01 81, 17 02 03, 17 04 11 and 17 06 04, can be transferred by their holder (investor), pursuant to the Regulation of the Minister of Environment of 21 April 2006 on the list of types of waste that can be transferred by waste holder to any natural persons or organisational units being no entrepreneurs and permissible methods of their recycling (Journal of Laws No. 75, item 527, as amended, Journal of Laws of 2008 No. 235, item 1614), to any natural persons or organisational units being no entrepreneurs for use for their own purposes (pursuant to the rules laid down in the aforementioned Regulation).

Waste that will not be transferred to any natural persons or organisational units being no entrepreneurs for use for their own purposes, must be disposed at the cost of the Investor, to the legally operating waste landfill. Disposal must be performed by the entity holding an applicable decision of a Governor of the Słupsk County or any other county.

Rules for waste handling are regulated by the Act on Waste (consolidated text: Journal of Laws of 2007 No. 39, item 251, as amended) and implementing legislation thereto.

6.1.4. Tangible and cultural assets

Tangible assets

Tangible assets in the area of the location of the planned investment are represented by the network of hardened roads (commune roads) and dirt roads, LV power lines, and in the surroundings by rural development of diversified architectural nature and technical condition.

When constructing the Wieliszewo wind turbine complex, it will be necessary to reconstruct and modernise part of the commune roads and other local dirt roads and to construct the new assembly roads according to the draft local spatial development plans.

The location of trenches for power cables along roads will not deteriorate their technical condition. Vast majority of the roads within the location of the turbines have no hardened surface and are in poor technical condition. These roads will be renovated and modernised in order to secure safe access to vehicles servicing the wind farms during construction and exploitation. Modernisation will consist primarily in the construction of the new road surface, analogically to the one planned for assembly roads. Modernised roads will remain public roads Road modernisation will be performed when the general contractor of the investment considers it necessary due to technical and safety reasons.

Operational roads on private lands will form accessed to the planned wind turbines of minimum width of approximately 5 m (width of hardened surface). For the purposes of construction works, temporary access roads can be built apart from operational roads.

Upon completion of the wind farm construction, exploitation roads and assembly yards will remain, whereas the areas taken for storage yards, manoeuvre yards and

passings will be reclaimed by placement of the previously removed soil layer (restoration of agricultural function).

Apart from road infrastructure, the power plant construction will have no impact on any other tangible assets. In particular, the construction of the Wieliszewo wind farm will result in no adverse impact on investment of the village in the surrounding areas.

The 110 kV cable line will be installed under hardened roads using the directional drilling method. This method is trenchless, therefore the installation of the cable line will not worsen the technical condition of hardened roads under which it will be laid.

Cultural assets

Construction of the Wieliszewo wind farm with associated infrastructure will have no physical impact on cultural assets at the construction stage.

No objects entered into the register of monuments are found at the location of the planned investment. The closest object entered in the register of historic monuments of Pomorskie Province under the law on the protection and care of historical monuments is a park in the Malczkowo village (reg. No. 1612 of 11 December 1996), located approximately 2 km to the east of the nearest planned wind turbine (see Section 5). With respect to the planned 110 kV cable line, the nearest monument entered in the register of the Pomorskie Province (No. 341 of 28 April 1964) is the palace and park complex in the village of Karżniczka, located approximately 550 m away from the planned 110 kV cable line.

The project site is located in the zone of limited archaeological and conservation protection set out in the zoning plan (2008) and adjacent to zones of partial archaeological and conservation protection. All investment activities within these zones require archaeological intervention research (in the case of zones of limited archaeological and conservation protection – in the form of supervision).

In accordance with the zoning plan (2008) all investment activities within such zones require consultations with the Provincial Conservation Officer in Gdańsk.

In addition, the HV 110 kV line will be installed outside the protection areas of archaeological sites and at a safe distance (approximately 550 m) from other objects of cultural value (palace and park or manor and park complexes).

6.1.5. Human health

At the construction stage the impact of the planned investment on human health will take place in effect of vehicle transport of:

- output from excavations for foundations of the wind turbines;
- construction materials to construction sites and to the route of power line;
- people to the construction sites and back.

Nuisance related to vehicle transport impact, i.e. air pollution (exhaust fumes and road dust), noise, surface vibrations and risk of accidents will be limited in space (road surroundings) and time (construction period is planned for 6–9 months).

Periodic nuisance related to the investment processes are not regulated by the environmental protection legislation.

6.2. Investment exploitation stage

6.2.1. Impact on abiotic environment

Surface lithospheric layer

At the operation stage of the Wieliszewo wind farm, no impact on surface lithospheric layer, including soils, will take place.

Water conditions

At the exploitation stage, impact of the planned Wieliszewo wind farm on water conditions will consist in local reduction of storm water infiltration to soils. This water will flow down on the surface of foundations and soak into soil in direct vicinity of the wind farm. Also discharge of storm water from the transport areas will be surface discharge to soil. Due to the nature and volume of vehicle traffic on these roads (only agricultural vehicles heading towards fields and maintenance service of the wind farm), no risk to groundwater will be present.

The designed transformer station will be equipped in the storm water sewage system. Rainwater flowing from the roof will be collected in a gutter and then discharged to the nearby green areas. Water from precipitations and thaws, accumulated in tight sumps under the transformers will flow to the separation well and to the absorbent well. To separate water and oil and discharge it, the station will be equipped in the monitoring and separation system meeting the requirements of the Polish legislation on the protection of water environment against oil pollution.

The transformer station will also be the source of sanitary waste from the social facilities. As it is not possible to connect to the external sewage system, at the transformer station a septic tank for sanitary waste will be used. The estimated water consumption for the sanitary system is approximately 1 m^3/month.

In conclusion, the operation of the Wieliszewo wind farm together with its technical infrastructure, including the 110 kV cable line, using the technology referred to above, will not pose any threat to surface water and groundwater, including to water resources of the Main Groundwater Reservoir No. 115 Łupawa and No. 107 Pradolina Łeby, as well as the Main Groundwater Reservoir No. 117 Bytów.

Atmospheric air pollution

At the stage of exploitation (operation) of the planned investment, no impact on atmospheric air pollution with gases, particulate matter or odours will take place.

With farms are as such the pro-environmental devices, which in general reduce emission of energy pollution to air.

Exploitation of access roads will be associated with emission of transport pollution. Due to the nature and marginal volume of vehicle traffic on these roads (only agricultural vehicles accessing the fields and power plant service), share of this type of pollution in general pollution balance in the location of the wind farm will be negligible.

Climate

Impact of wind farm on the local climate conditions will consist primarily in reducing the wind power. Kinetic energy of wind will be transformed into mechanical energy of power-generating devices and finally into power (the core of wind power plant operation).

These changes will include for the most the area of blade rotation (55–145 m above ground level).

Minor anemometric changes will take place in the vicinity of the power plant pillar, including at ground surface level.

The structures of wind farm will cause also minor drop of direct solar radiation reaching the ground surface (shading). These changes will be marginal to living organisms.

6.2.2. Impact on flora

At the operation stage, the Wieliszewo wind farm and associated infrastructure will have no impact on flora.

6.2.3. Impact on fauna

6.2.3.1. Introduction

Impact on fauna, including in particular avifauna, is the potential key natural effect of the wind power plant operation. Impact on birds and bats (impact on invertebrates is unknown) can manifest by:

- mortality in effect of collision with power plant constructional elements;
- changes to fauna distribution in effect of loss of habitats or feeding areas in the area of the power plant location and in its surroundings;
- changes of flight routes (wind turbines as an ecological barrier).

6.2.3.2. Birds

In general, number of birds collisions with turbines is a function of abundance of birds using a given area. The highest mortality of birds was recorded for wind turbines located in the areas (Gromadzki 2002)[4]:

- attractive for birds as feeding areas;
- constituting the routes of regular migration flights;
- constituting the routes of regular flights to the feeding area or roost site.

Also the impact of species composition of birds on their mortality was evidenced, which results from inter-species differences of flight heights and daily distribution of migration activity.

The following have also a significant impact on increased risk of bird collisions with power plant constructional elements:

- parameters of the power plant construction: height, rotor diameter and rotary speed, night illumination;

[4] Gromadzki M., 2002, Uwarunkowania faunistyczne - ornitologiczne (Fauna and ornithological conditions), in: Gromadzki M., Przewoźniak M., Ekspertyza nt. ekologiczno-krajobrazowych uwarunkowań lokalizacji elektrowni wiatrowych w północnej (Pobrzeże Bałtyku) i w centralnej części woj. pomorskiego (Expert report on ecological and landscape conditions for location of wind farm in the northern (Baltic Coastal Region) and central part of the Pomorskie Province), BPiWP "Proeko", Gdańsk.

- size of power plant complex and its mutual distribution;
- meteorological conditions (primarily visibility);
- day time: dawn, day, dusk and night (different bird activity and visibility);
- year season: spring migrations, breeding, autumn migrations, wintering.

Deterring effect of wind turbines on birds (including related with their acoustic impact) was observed to the distance of up to 800 m, averagely 200-500 m (Gromadzki 2002). The areas of the power plant location and its surroundings are less used as feeding, resting and nesting sites of birds, also the changes of bird flights have been noticed. Deterring effect of wind turbines on birds constitutes at the same time the factor decreasing their mortality.

First results of post-implementation ornithological survey for wind farms in Poland are known. For example, according to the results of post-implementation monitoring for wind farms located near Puck (in coastal area) i.e. in the area of numerous spring and autumn migration, also of birds considered collisional (falconiformes) and potentially collisional (anseriformes, cranes, charadriiformes), mortality for the migration and breeding seasons (in 2007–2008 the mortality was surveyed for 4 months in annual scale, in 2009 by 8 months) is 0.1–0.15 victim/turbine/month, and the estimated annual mortality of birds with such intense use of air space is 13–34 victim/year for this location (1.2–1.8 victim/turbine/year) (Zieliński et al. 2007, 2008 and 2009).

Conclusions from the ornithological survey at the location of the Wieliszewo wind farm (Antczak 2010 – Appendix 3)

- *During the survey conducted from September 2009 to August 2010 in the area designated for the construction of the Wieliszewo wind farm and in the immediate vicinity at least 101 bird species associated with the project site were identified.*
- *No concentrations of birds of above-average importance for the Pomerania region were found in any of the analysed phenological periods.*
- *46 species of breeding avifauna were found. In addition, further 13 species were identified in adjacent areas.*
- *Valuable species nesting within the radius of 2–5 km from the planned wind farm site included the red kite, which was observed during its breeding season and migration, but using the area of the wind farm irregularly, which indicates the existence of alternative, more attractive feeding grounds nearby.*
- *Moreover, white-tailed eagle nested 7 km from the wind farm and occasionally flew to the roosting area of crane in sector 6*(see Fig. 3).
- *During the spring migration period, 993 individuals of 22 species making directional flights (to the east and north-east) were recorded. The most abundant species were geese.*
- *The average intensity of directional flights in spring was 33.1 individuals/hour (3.6-173 individuals/hour).*
- *In the post-breeding dispersal and autumn migration period, 4,734 individuals representing 27 species making directional flights (to the south-west and west) were recorded. Larks, corvidae (mixed flocks of rooks, jackdaws and hooded crows) and starlings were observed in the largest number.*

- *The average intensity of directional flights in summer and autumn, depending on the assumptions made, was 55.7–94.7 individuals/hour (2–532 individuals/hour in individual counts).*
- *In sector 6, there was a local roost site of cranes with 54 to 235 individuals and a feeding ground of up to 120 individuals.*
- *In sector 6, there was a flocking of golden plover with up to 1,500 individuals.*
- *The flocking of crane and golden plover has been active for at least 20 years, so it is permanent and deserves protection, or at least the construction of wind turbines in the area should be prohibited.*

– *No significant threats were recorded for avifauna nesting in valuable protected areas within a 10 km radius from the planned project* (including for the special birds protection area Dolina Słupi PLB220002, site of Community importance Dolina Łupawy PLH220036 and special habitat protection area Dolina rzeki Słupi – according to Shadow List 2010).

- *Measures were proposed to minimize potential a adverse impact on avifauna, mainly focusing on securing the roosting and feeding ground of cranes and the flocking of golden plover.*
- *Methodological assumptions for monitoring once the construction of the wind farm is completed were proposed.*
- *Taking into account all the recommendations, it was concluded that the planned wind farm will not have a significant adverse impact on avifauna.*

Complete text of ornithological monitoring by Antczak (2010) is provided in Appendix 3 constituting the integral part of this Report.

6.2.3.3. Bats

The key feeding areas of bats in agricultural landscape include usually water reservoirs (Downs and Racey 2006), while the basic flight routes between the shelters and feeding grounds – linear landscape elements, in particular tree lanes (Verboom and Huitema 1997). The key areas of bat feeding can also include groups of deciduous tree stands and their edges (Walsh and Harris 1996, Russ and Montgomery 2002). On the open areas, *Pipistrellus* bat activity decreases to zero already in a distance of 70 m from river or water reservoir and reaches minimum values in approximately 40 m from tree line (Downs and Racey 2006).

Vast majority of bats avoids tree-less and extensive arable lands (Lesiński et al. 2000). In the light of these data, turbines located in a distance greater than 100-200 m from the linear tree stands and water reservoirs should pose only a minor risk to bats.

Conclusions from the chiropterological survey at the location of the Wieliszewo wind farm (Kościów 2010 – Appendix 4)

1. *Bats were not observed within the proposed wind farm site.* (However, they were found in the surroundings of the Wieliszewo wind farm – see Fig. 4)
2. *The species composition of bats and their number indicate that the diversity of bat species in the area covered by the study is very low.*
3. *The composition of bats was dominated by forest and synurbic species, which, as such, are strongly associated with rural development.*
4. *Results of the monitoring indicate that areas important for bats are located outside the project site and their significance is local.*

5. *Considering the above, it is estimated that the project consisting in the construction and operation of the Wieliszewo wind farm will not have a significant adverse impact on the populations of bats identified in the area of Nowa Dąbrowa, Wieliszewo and the forest near Domaradz.*
6. *It is recommended that post-implementation monitoring be performed in one year, two years and threes year after the date of commissioning of the wind farm.*

None of the bat species (i.e. common pipistrelle, Nathusius's pipistrelle and brown long-eared bat) identified in the vicinity of the planned Wieliszewo wind farm is a species listed in the standard data forms of the closest Natura 2000 sites, i.e. the special birds protection area Dolina Słupi PLB220002, the site of Community importance Dolina Łupawy PLH220036, and the special habitat protection area Dolina rzeki Słupi entered in Shadow List 2010.

Complete text of monitoring of impact of the location of Wieliszewo wind farm on bats (Kościów 2010) is contained in Appendix 4, constituting an integral part of this Report.

6.2.3.4. Other fauna

The large mammal species (see Section 3.2.2.3) present in the region of the project site are primarily associated with forest and shrub environment. Their presence on agricultural areas is of short-term nature. Impact of wind farms (operating in areas of agricultural use) on these animals will not differ significantly from the functioning of the other infrastructural and utility facilities.

Wind farms pose no obstacles for animals moving on land.

Sound wave impact (in full spectrum, including infra- and ultrasounds), vibrations and movement of rotor on terrestrial and aquatic vertebrates and on invertebrates is possible however was not studied (Goc, Meissner, 2007). Any potential mortality of birds can change distribution of scavengers, for which the areas of wind farm can become a potential feeding ground.

According to the experiences of wind farms operating in the Western Europe, the wind farms cause no changes to the "surface" fauna of a given area.

Scientific literature on impact of wind farms on animals provides no information on the impact on animals moving on surface – such impact was determined only for flying animals, primarily birds, that can collide with the power plant structures.

The issue of infrasound impact on animals is also negligible. Infrasound noise levels measured near the wind turbines are very low, undetected by human and cause no proven negative effects for humans. Thus, it can be stated that these are also safe for animals.

Polish legislation does not govern the issue of noise and infrasound impact on animals. The Regulation of the Minister of Environment of 14 June 2007 on the permissible noise levels in the environment (Journal of Laws of 2007, No. 120, item 826) in force, contains the standards of permissible noise for humans only.

6.2.4. Waste

At the operation stage of the Wieliszewo wind farm and associated infrastructure, no solid waste will be produced, excluding waste related to maintenance works of technical equipment.

For different types of turbines, according to the manufacturer's data, one can assume replacement of gear oil with frequency between once a year to once per several years (specific even for the individual wind turbines within the farm - whether the oil should be replaced should be agreed usually on the basis of analyses in the semi-annual cycle for gear oil and in the annual cycle for hydraulic oil). Volume of oil in a single turbine, depending on type, ranges between 60 - 90 l.

In the cases of necessary oil and filter replacement in sub-modules of turbines, hazardous waste can be produced (table 11).

Table 11 Possible types and volumes of hazardous waste for the planned Wieliszewo wind farm

No.	Waste type	Code	Waste volume per annum 1/	Waste handling
1	mineral based non-chlorinated hydraulic oils	13 01 10*	approximately 2 [m^3] 2/	transferred to waste collecting entity
2	mineral-based non-chlorinated engine, gear and lubricating oils	13 02 05*	approximately 12 [m^3]	transferred to waste collecting entity
3	other engine, gear and lubricating oils	13 02 08*	approximately 3.6 [m^3] 3/	transferred to waste collecting entity
4	packaging containing residues of or contaminated by dangerous substances	15 01 10*	approximately 3.14 [m^3]	used for interim storage of waste and/or transferred to waste collecting entity
5	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	15 02 02*	approximately 121 [kg]	transferred to waste collecting entity
6	discarded equipment containing hazardous components other than those mentioned in 16 02 09 to 16 02 12	16 02 13*	approximately 60 [kg]	transferred to waste collecting entity

Source: own study, waste classification according to the Regulation of the Minister of Environment of 27 September 2001 on the catalogue of waste

1/ Estimate on the basis of information from the operating wind farms.

2/ Used hydraulic oils are considered waste upon performance (usually every 5 years) of the general overhaul of the hydraulic oil installation – the potential minor leakages between the overhauls are eliminated by means of wiping cloths.

3/ Consumed gear oils can be considered waste only in the case of unexpected loss of their properties (in standard exploitation no replacement of this oil is assumed) - WF. Minor leakages are eliminated by means of wiping cloths.

Waste handling

Used oil (no. 1, 2 in table 8) in the case of necessary draining off from the installation, will be stored in tight containers (no. 4 in table 8) in closed wind power plant tower, in a manner preventing spilling on paved and impermeable surface,

pursuant to the Regulation of the Minister of Economy and Labour of 4 August 2004 on detailed method of waste oil handling (Journal of Laws No. 192, item 1968).

Pursuant to this Regulation:

"Waste oils are collected and stored selectively according to the requirements specified by their industrial use or treatment (...)

Waste oils are collected to tight containers made of non-combustible materials, resistant to waste oils, electrostatically discharging, equipped in tight closing and protected against breaking (...)

Waste collection containers can be used in rotation between the waste producer and their subsequent holder, place of recycling or treatment"

Filter materials and wiping cloths (no. 5 in table 11) will be collected in special containers at the wind generator service levels and, when filled, handed over to the waste collector.

Collection and disposal of consumed oils and oiled cloths requires an agreement with a licensed company.

Used fluorescent lamps (no. 6 in table 11) will be collected in metal packaging of manufacturer in dedicated space in the intermediate storage in a manner preventing breakage. Collection and disposal of consumed light sources requires an agreement with a licensed company.

Rules for waste handling are regulated by the Act on Waste (consolidated text: Journal of Laws of 2007 No. 39, item 251, as amended) and implementing legislation thereto.

6.2.5. Impact on acoustic conditions

Bases of analysis

- Regulation of the Minister of Environment of 14 June 2007 on the permissible noise levels in the environment (Journal of Laws No. 120, item 826 + annex),
- Polish Standard PN-ISO 9613-2 Acoustics. Attenuation of sound during propagation outdoors. General computation method,
- LEQ Professional 6.0 software for Windows compliant with the a/m standard;
- Programme and spatial concept of the investment – planned location of wind turbines – the Wieliszewo Wind Farm – Grapice commune,
- Technical data of wind turbines of Nordex N90/2500 type planned in the concept for construction in this location.

Purpose of analysis

The purpose of this analysis is expected determination of the value and range of noise emitted to the environment from the area of planned wind power plant complex, enabling the **impact assessment of the planned location on the acoustic environment.**

Specification of the noise source

The investment programme specified in the design of the Wieliszewo wind farm assumes the construction of 17 turbines. The source of noise emitted from wind power plant to the environment is rotor and blade operation causing emission of acoustic

energy to the environment. This sources have significant acoustic power causing changes to acoustic environment at large parts of the area. The factor increasing the range of impact is placing the movable parts of turbines on significant altitude reaching from several dozen to one hundred several dozen meters.

As the basis to calculate and determine the range of impact of the designed wind farm, the data provided by Investor was adopted. The Nordex N90/2500 turbine planned to be used in the analysed location has a nominal acoustic power L_{AW} = 104.5 dB. In the analysis, turbine height of h = 100 m was assumed.

Table 12. Data adopted for acoustic analysis for day- and night-time (locations and assumed settings of wind turbines).

Computation data:

Point sources

No.	X[m]	Y[m]	z [m]	Pma	Symbol
1	1,549.0	1,076.0	100.0	104.5	1
2	1,561.0	1,399.0	100.0	104.5	2
3	2,385.0	2,057.0	100.0	104.5	3
4	3,180.0	2,117.0	100.0	104.5	4
5	1,970.0	1,967.0	100.0	104.5	5
6	2,029.0	2,406.0	100.0	104.5	6
7	1,665.0	2,576.0	100.0	104.5	7
8	1,430.0	3,096.0	100.0	104.5	8
9	1,814.0	2,956.0	100.0	104.5	9
10	2,238.0	2,798.0	100.0	104.5	10
11	2,614.0	2,366.0	100.0	104.5	11
12	2,655.0	3,003.0	100.0	104.5	12
13	2,971.0	3,287.0	100.0	104.5	13
14	3,122.0	2,943.0	100.0	104.5	14
15	3,540.0	2,879.0	100.0	104.5	15
16	3,884.0	2,634.0	100.0	104.5	16
17	3,727.0	1,957.0	100.0	104.5	17

Source: LEQ Professional v. 6 software

The acoustic data presented above were used for the "LEQ Professional 6.0" software to determine the range of propagation of noise emitted from the analysed wind farm in the environment. Calculations were performed for A level of acoustic power without consideration of distribution of acoustic power of the source in octave centre frequencies. Air temperature of 10°C, relative humidity of 70%. Soil attenuation was calculated for soil rate of G=1.

The expected strength and range of noise emitted to the environment from the planned Wieliszewo wind farm was developed adopting the most disadvantageous in terms of air temperature and relative humidity (air temperature: 10°C, relative humidity:

70%) attenuation indices by atmosphere, contained in the Polish Standard PN-ISO 9613-2 > Acoustics. Attenuation of sound during propagation outdoors. General computation method<. In addition, the computation model considers also noise propagation in a way as in line with the wind direction. With regard to the above, acoustic computations were performed for meteorological conditions (thermal, humidity and anemometric) which are the most disadvantageous in terms of strength and range of noise propagation.

Determination of the criterion for noise impact assessment of the environment.

Criterion of permissible noise level in the environment for the protected functions are specified on the basis of the Regulation of the Minister of Environment of 14 June 2007 on the permissible noise levels in the environment (Journal of Laws No. 120, item 826 + annex).

According to the presented concept, the designed wind farm is located in areas of arable land or wasteland and none of the plots, at which the designed turbines are to be constructed, adjoins directly the areas of protected function.

With regard to the above, at the moment, following the legislation currently in force, i.e. the above-mentioned Regulation, there are no legal grounds to specify the permissible noise level in the environment at the meeting point of plots intended for turbine construction and surroundings.

Due to the expected ranges of impact of the wind power plant complex, noise level that can be emitted in the environment at the border of the existing homestead development and single-family developed both at the analysed area and adjoining areas, should be checked. This level cannot exceed the values specified in points 2a and 3b of Table 1 of the annex to the a/m Regulation.

At the same time, one should remember that launching of the analysed wind farm will permanently change the acoustic environment in this area. This fact will have a significant impact on the ability to change the urban planning functions and introduce restrictions related to the use of areas adjoining the planned investment.

When analysing the current land use and the potential future types of land use, one should consider the potential occurrence in the vicinity of the planned wind farm of the new areas of single-family residential development, residential and service areas or homestead development areas.

In the first case, the permissible noise level in the environment at the border of single-family residential development should amount to:

from the remaining objects and activities being the source of noise

L_{AeqD} = 50 dB at 6 a.m. – 10 p.m. (daytime),

L_{AeqN} = 40 dB at 10 p.m. – 6 a.m. (nighttime).

In the second and third case, at the border of residential and service or homestead development areas:

from the remaining objects and activities being the source of noise

L_{AeqD} = 55 dB at 6 a.m. – 10 p.m. (daytime),

L_{AeqN} = 45 dB at 10 p.m. – 6 a.m. (nighttime).

According to the data above, the range of impact of the analysed wind power plant complex on the environment should be assessed according to isoline L_{Aeq} = 50 or L_{Aeq} = 55 dB during the day and according to isoline L_{Aeq} = 40 dB or L_{Aeq} = 45 dB at night, depending on the existing and potentially planned provisions of the local plans concerning the protected development.

Analysis results

Calculations were performed for the a/m baseline scenario i.e. for nominal acoustic power of 104.5 dB. One version was analysed: maximum range – all wind turbines planned in this area operate at maximum acoustic power – L_{AW} = 104.5 dB.

The permissible noise level at night in the analysed area is determined by the value L_{Aeq} = 45 dB, which cannot be exceeded within the areas of the existing and planned residential buildings in the homestead development.

The results of calculations in the observation point network are presented in a form of a site plan with marked noise sources (17 points corresponding to the individual turbines in the wind farm), observation points (9 points distributed at the borders of the homestead development areas and individual housing settlements in this area). Range of noise impact is presented with the use of isolines (lines of equal sound level).

Table 13. Results of acoustic analysis for day- and night-time

LEQ Professional v. 6 software

Printout of calculation results

Project: WIELISZEWO Wind Farm

x [m]	Y [m]	Leq [dB(A)]
2,184.0	1,462.0	43.9
1,942.0	3,568.0	42.6
2,216.0	3,504.0	43.3
1,638.0	3,990.0	38.6
2,442.0	3,486.0	44.1
4,206.0	2,202.0	42.4
2,676.0	1,456.0	42.3
3,184.0	1,542.0	42.4
4,898.0	2,198.0	36.1

Source: LEQ Professional v. 6 software

The obtained results are presented in graphic form. Fig. 6 presents the image of sound field obtained in effect of operation of 17 planned wind turbines at acoustic power L_{AW} = 104.5 dB. For this scenario (maximum noise range) the expected noise levels in the residential development areas are L_{Aeq} = 36–44 dB.

These results indicated that in the case of sound power L_{AW} = 104.5 dB, operation of the whole wind farm (17 turbines) would be possible both during the day and at night with no restrictions.

The performed analysis enabled delineation of the area, in which the noise level at night can exceed L_{Aeq} = 45 dB. The borders of this area are at the same time the

borders of the area to be covered with development ban /ban of locating the new residential building in homestead development/. At the same time, the area, at which noise level at night exceeds L_{Aeq} = 40 dB should be covered with the bank of locating the new single-family residential buildings.

Table 14. Minimum distance of the designed turbines at the Wieliszewo wind farm from farm buildings

Turbine No.	Distance [m]	Direction	Comments
Wieliszewo wind farm			
EW1	733	west	dispersed development in the village of Wieliszewo
EW2	630	west	dispersed development in the village of Wieliszewo
EW3	576	south	dispersed development in the village of Wieliszewo
EW4	585	south	development in the village of Wieliszewo
EW5	555	south	dispersed development in the village of Wieliszewo
EW6	948	south	dispersed development in the village of Wieliszewo
EW7	1036	north	development in the village of Nowa Dąbrowa
EW8	700	west	development in the village of Nowa Dąbrowa
EW9	640	north	development in the village of Nowa Dąbrowa
EW10	715	north	development in the village of Nowa Dąbrowa
EW11	919	south	dispersed development in the village of Wieliszewo
EW12	603	north	development in the village of Nowa Dąbrowa
EW13	611	north-west	development in the village of Nowa Dąbrowa
EW14	967	north-west	development in the village of Nowa Dąbrowa
EW15	1254	north-west	development in the village of Nowa Dąbrowa
EW16	1300	south-west	development in the village of Wieliszewo
EW17	700	south-west	development in the village of Wieliszewo

Source: In-house.

Conclusions

The performed analysis demonstrated that from the perspective of acoustic environment shaping, it is possible to implement the analysed investment in its planned form. The planned wind farm can operate with no limitations both during the day and at night at full acoustic power of each turbine, i.e. at L_{AW} = 104.5 dB.

The conditions and conclusions presented in the study are correct as long as the acoustic power of the planned turbines does not exceed L_{AW} = 104.5 dB. For turbines with a higher acoustic power, the acoustic analysis should be reviewed.

When conducting the proceeding on this investment, one should remember that the above-mentioned results and conclusions are based on a forecast resulting from

computer analysis of the design. The aforementioned projection should be verified on the basis of actual condition of the investment determined upon its delivery on the basis of measurements performed under the post-implementation analysis.

6.2.6. Impact of wind farms in the scope of infrasound emission

According to Polish Standard PN-86/N-01338 infrasound is sound or noise, frequency range of which is between 2 Hz and 16 Hz. According to ISO 7196 infrasound is sound or noise, frequency range of which is between 1 Hz and 20 Hz.

With regard to infrasound of artificial origin, the term of infrasound noise and low frequency noise is in use and covers the frequency range from approximately 10 Hz to 250 Hz.

The infrasound included in infrasound noise are received by the body with specific sound reception route (primarily via hearing organ). Hearing capacity depends on the sound pressure level. High individual variability in hearing perception of ultrasounds was stated, in particular for the lowest frequencies. Infrasound reception thresholds are the higher the lower is their frequency and amount to, for example: for frequencies of 2 Hz approximately 120-140 dB, for frequencies of 6 ÷ 8 Hz approximately 100 dB, and for frequencies of 12 ÷ 16 Hz approximately 90 dB.

Apart from specific sound reception route, infrasound is received by vibration receptors. The perception thresholds are by 20 ÷ 30 dB higher comparing to the hearing thresholds. When the sound pressure level exceeds 140 dB, infrasound can cause permanent and adverse changes to the body. The phenomenon of structure and internal organ resonance can occur, perceived already from 100 dB as an unpleasant feeling of internal vibrating. Apart from pressure in ears, it is one of the most common symptoms stated by the persons exposed to infrasound. However a prevailing effect of infrasound impact on the body is their nuisance, occurring already when the hearing threshold is exceeded at minor level. This phenomenon is specified with subjectively determined excessive tiredness, discomfort, sleepiness, disturbances of balance, psychomotor capacity and physiological functions. Objective confirmation of these conditions are lesions to central nervous systems, specific for activity disorders (according to information published on the official website of the Central Institute for Labour Protection - www.ciop.pl.).

In the case of wind farms, infrasound is generated in the case of improper profile of turbine blade and poorly selected rotary speed. In the initial stage of development of wind turbines, these were actually onerous to the environment. Legal restrictions and rapid development in this area led however to obtaining the structures that hardly emit infrasound.

On the basis of numerous studies (Ingielewicz, Zagubień 2004, Leventhall 2005, Rogers 2005 and Chouard 2006) it can be stated that:

- infrasound noise levels measured in direct vicinity of the wind turbines are very low;
- sound G level of infrasound generated by wind turbines measured in a distance of 500 m is practically at the background noise level and imperceptible by humans. For example, according to the measurement results (Ingielewicz, Zagubień 2004) for the Jankowice Wielkie WF, the level of sound G of infrasound generated by turbines along with noise background fell within the range of 56.4 dB for 2 Hz to 78.4 dB for 16Hz, whereas the level of G sound of background noise after shut-down of all turbines was between 55.8 for 2 Hz and 76.1 dB for 16 Hz;

- infrasound of G, LG sound level below 90 dB causes no proven adverse effects for human body;
- infrasound of sound pressure level below the hearing threshold specified above causes no hearing sensation and are not perceptible to humans.

In conclusion, wind turbines emit infrasound at very low level, definitely below the values that can affect human health.

6.2.7. Impact of wind farms and associated infrastructure in the scope of electromagnetic radiation emission

Legal standards regulating environmental impact of electromagnetic radiation

The list of physical quantities recommended for use when assessing the impact of electric fields on humans is provided in the Council Recommendation of 12 July 1999. This recommendation specifies among others restrictions for human exposure in electric, magnetic and electromagnetic fields variable in time. The basis to establish these restrictions were numerous studies on impact of fields on living organisms. The essential quantities for which the basic restrictions were described include:

- magnetic flux density - B;
- current density - J;
- specific energy absorption rate - SAR;
- power density - S.

All quantities depend on frequency of emitted fields.

To enable practical assessment of the risk of exceeding the basic restrictions, so called "reference levels" were used derived directly from basic restrictions. The reference levels were derived on the basis of analytical scientific methods as well as numerous sensory studies.

The reference levels include:

- electric field strength - E;
- magnetic field strength - H;
- magnetic flux density - B;
- power density - S;
- limb current - IL.

The Council Recommendation, for field frequency of 50 Hz, provides for the following reference level values:

- electric field strength level – **5kV/m**;
- magnetic field strength level – **80 A/m;**
- magnetic flux density – **100μT**.

In the case of no exceeding of the reference levels is stated, no exceeding of basic restriction is also stated. When the values of electric, magnetic field strength or flux density measured in the environment exceed the reference levels, it does not have to mean exceeding of basic restrictions. In such case, following the Recommendation, one should check for each case, whether the basic restrictions are exceeded whether not.

In Poland, the permissible levels of electromagnetic fields in the environment and the methods of controlling their compliance are specified by the Regulation of the Minister of Environment of 30 October 2003 on the permissible levels of electromagnetic fields in the environment and the methods of controlling their compliance (Journal of Laws No. 192, item 1883). The Regulation provides the following limit values:

- permissible value of electric field of 50 Hz for public areas – 10 kV/m;
- permissible value of electric field for residential housing areas – 1 kV/m;
- permissible value of electric field of 50 Hz in the environment – 60 A/m.

These values are provided for the height of 2 m above the ground level or above any other surfaces on which people can be present.

The limit values specified in the Regulation of the Minister of Environment are presented in the tables (table 17 and 18).

Table 15 Permissible levels of electromagnetic non-ionising radiation specified by the limit values of physical quantities for public areas.

No.	Range of radiation frequency	Electric component	Magnetic component	Power density
1	0 Hz	10 [kV/m]	2500 [A/m]	-
2	from 0 Hz to 0.5 Hz	-	2500 [A/m]	-
3	from 0.5 Hz to 50 Hz	10 [kV/m]	60 [A/m]	
4	from 0.05 kHz to 1 kHz	-	3/f [A/m]	-
5	from 0.001 MHz to 3 MHz	20 [V/m]	3 [A/m]	-
6	from 3 MHz to 300 MHz	7 [V/m]	-	-
7	from 300 MHz to 3 GHz	7 [V/m]	-	0.1 [W/m^2]

Source: Regulation of the Minister of Environment of 30 October 2003 on the permissible levels of electromagnetic fields in the environment and the methods of controlling their compliance (Journal of Laws No. 192, item 1883)

Table 16 Permissible levels of electromagnetic non-ionising radiation specified by the limit values of physical quantities for residential housing areas.

No.	Range of radiation frequency	Electric component	Magnetic component	Power density
1	50 Hz	1 [kV/m]	60 [A/m]	-

Source: Regulation of the Minister of Environment of 30 October 2003 on the permissible levels of electromagnetic fields in the environment and the methods of controlling their compliance (Journal of Laws No. 192, item 1883)

The provisions above form the basis to perform a specific analysis in the scope of presence or absence, in the surroundings of the object being a source of electromagnetic radiation, of the areas, in which the values of electric and magnetic fields intensity exceed the provided standards. n the case of absence of such phenomena, there are no grounds to state a negative impact of fields emitted by this object on human health and natural environment.

Sources of electromagnetic radiation of the planned investment

The planned investment is composed of the following potential sources of electromagnetic radiation:

- MV/110 kV transformer station;
- HV 110 kV cable line;
- wind turbines;
- MV cable lines, connecting the wind farm with the planned MV/110 kV transformer station.

The SN/110 kV transformer station will be part of the technical infrastructure of the planned Wieliszewo wind farm. MV cable connections will be used to connect the wind power plant complex with the planned switching station in the transformer station.

The planned 110 kV power cable line, connecting the Nowa Dąbrowa grid connection point with the Bięcino grid connection point, is not a source of electromagnetic radiation due to the use of special shields on the cables and their installation underground.

In accordance with the Regulation of the Council of Ministers of 9 November 2010 on the investments of potentially significant environmental impact (Journal of Laws No. 213, item 1397), the construction of 110 kV cable lines is not listed as a project with a potential significant impact on the environment.

In accordance with the Regulation referred to above, MV cable connections (connecting the wind farm with transformer station) and the wind turbines (generators) are not sources of electromagnetic [5]radiation. The technology of construction of such power devices assumes application of adequate screens preventing release of electromagnetic energy to the environment.

A significant source of electromagnetic radiation in the area of the Wieliszewo wind farm can be only the MV/110 kV transformer station.

Distribution of electromagnetic field

According to tables 17 and 18, for the areas intended for residential housing the level of electric component of electromagnetic field of industrial frequency (50 Hz – frequency of power grids) cannot exceed **1 kV/m**. For the public areas, permissible level of electric component of electromagnetic field of 50 Hz frequency cannot exceed **10 kV/m**.

Pursuant to the Regulation of the Minister of Environment of 30 October 2003, 10 kV/m is the limit value of electric field for public areas. For the residential housing areas this value cannot exceed 1 kV/m. These values cannot be present at the height below 2 m above the ground level or above any other surfaces on which people can be present.

The Regulation of the Minister of Labour and Social Policy of 29 November 2002 on the highest permissible concentrations and rates of factors of adverse effect to health in the working environment (Journal of Laws No. 217, item 1833), four special protection zones are specified for the electric field E of 50 Hz frequency:

- *danger zone, in which* $E > 20$ kV/m;
- *risk zone, in which* $10 \text{ kV/m} < E < 20 \text{ kV/m}$;
- *transitional zone, in which* $5 \text{ kV/m} < E < 10 \text{ kV/m}$;

[5] projects with a potential significant impact on the environment

- *secure zone, in which* $E < 5$ *kV/m.*

In the secure zone, the employees can stay without any time limits.

In the transitional zone only the employees working with sources during the whole time shift are allowed.

In the risk zone, time of stay of the employees working with field sources during the shift depends on the value of electric field strength present in this zone.

Stay of employees in the danger zone is prohibited.

At the area in which electric field strength is below 1 kV/m, there are no restrictions and this area is considered perfectly safe for people.

The area, in which the technical equipment of transformer station (emission sources) will be located, will be fenced with a net of 2 m height in a manner effectively preventing access of any third persons. The described area will be accessible only to the areas after specialist professional training or potentially persons accompanying them.

The core of environmental impact assessment of the investment for the construction of MV/HV transformer station is determination of theoretical distribution of power density of electromagnetic radiation in the areas of potential stay of people. With regard to Art. 135 of the Environmental Protection Law of 27 April 2001, determination of distribution of electromagnetic field in the areas inaccessible to people is not grounded, which is proved by clause 34 of the Regulation of the Minister of Environment of 30 October 2003 on the permissible levels of electromagnetic fields in the environment and the methods of controlling their compliance, governing their measurement outside the fenced area of the station.

Due to the fact that the area of transformer station will be closed, any potential generation of electromagnetic fields – their areas will remain inaccessible to people.

The aim of analysis of electromagnetic radiation is to estimate the values of such possible pollution and - on the basis thereof - determination of the need to delineate the areas of limited use. According to the applicable environmental law provisions (Art. 135 of the Environmental Protection Law), the areas of limited use are not delineated on fenced areas at which the installations are located. Thus determination – estimation of the areas of electromagnetic fields on the inaccessible area is not grounded from the perspective of standards resulting from individual provisions of the Environmental Protection Law.

On the basis of general land development concept of the transformer station area and experiences in the scope of issues related to projecting the distribution of electromagnetic fields it is stated that location of the components of the said facility excludes the possibility of exceeding of both electric and magnetic component values in the places accessible to people i.e. outside the fencing of the station. At the same time, basing on the experience in constructing such facilities it is stated that electric field strength outside the fencing of the station will not exceed 1 kV.

The discussed MV/110 kV transformer station will pose no risk to the environment and people and will meet the requirements included in the Regulation of the Minister of Environment of 30 October 2003 on the permissible levels of electromagnetic fields in the environment and the methods of controlling their compliance.

Also on the basis of current experiences i.e. empirical measurements of electromagnetic fields on similar, existing facilities (110 kV switchboard areas) it is state, that in the area of the planned station, upon its development, in the places

accessible to personnel, electric field strength will not exceed the limit value of transitional zone (10 kV/m).

Distribution of magnetic field

According to tables 11 and 12, for the areas intended for residential housing and public areas the level of electric component of magnetic field of frequency (50 Hz) cannot exceed **60 A/m**.

Similarly as in the case of electric field, the magnetic field is governed by the Regulation of the Minister of Environment of 30 October 2003 on the permissible levels of electromagnetic fields in the environment and the methods of controlling their compliance. This provision provides the limit value of magnetic field for public areas of 60 A/m. These values are provided for the height of 2 m above the ground level or above any other surfaces on which people can be present.

With regard to the area of the planned transformer station being also the working environment, the Regulation of the Minister of Labour and Social Policy of 29 November 2002 on the highest permissible concentrations and rates of factors having adverse effect to health in working environment. This provision specifies four impact zones of magnetic fields and provides the limit values for them.

The Regulation of the Minister of Labour and Social Policy of 29 November 2002 concerning the working environment, specifies four protection zones of 50 Hz frequency for magnetic field H:

- danger zone, in which $H > 2000$ A/m;
- risk zone, in which $200 \text{ A/m} < H < 2000$ A/m;
- transitional zone, in which $66.6 \text{ A/m} < H < 200$ A/m;
- secure zone, in which $H < 66.6$ A/m.

Basing on the experiences in the construction of such type of facilities followed by actual measurements of electromagnetic fields it is stated that the area of the station, upon its development, will generate magnetic field of the strength at maximum load of a values not exceeding 60 A/m (limit value for secure zone). In such case it should be also stated that magnetic field strength outside the fenced area of the station will not exceed the permissible value for the public areas. As already mentioned, this area will be completely inaccessible to third persons, therefore impact of magnetic components of electromagnetic fields generated at its area, will have no impact on humans and animals moving on land. This phenomenon can potentially apply to flying single birds, however staying in a given area for a limited period of time. Therefore, this phenomenon should be considered negligible.

6.2.8. Impact on landscape

Landscape specifics of the wind turbines

Visual specifics of wind turbines assumes that (Przewoźniak 2007):

- these are high objects, even up to 200 m at elevated wing;
- in the groups, due to distances between the individual turbines of 300-450 m, form a landscape barrier at different levels;
- the towers are placed in groups according to the two basic schemes:

  - regularly – on linear basis in the triangle top system, which involves spatial order however has a strong geometric effect on landscape
  - irregularly, adapting to landscape topography and other conditions, which introduces physiognomic disorder however is closer to "wry" nature[6];
- the blades move for vast majority of the year, which attracts the attention, sight and can cause stroboscopic effect and the shadow flicker effect (see Section 6.2.10);
- moving rotors can periodically induce light reflections, at specific sun and blade position at sunny weather;
- the power station structures cast periodically a permanent and movable shadow, depending on sun height;
- the turbines are not visible at night (excluding night barrier marking - red lamp at the top of the tower).

Apart from parameters of wind turbines and their complexes, the basic impact on their exposition in the landscape have:

- landscape features, including in particular:
  - topography (plain, rolling, hummocky, hilly, mountainous, valley);
  - land use (primarily presence of forests, as well as tree stands, alleys and lanes as well as construction objects);
  - presence of water reservoirs forming extensive exposition planes;
- human concentrations as power plant observers, including in particular:
  - settlements (cities, villages, recreation complexes);
  - transport routes (roads and railway lines);
  - tourist routes (land and water).

Field reconnaissance in the areas of already operating wind turbines demonstrated among others that (Przewoźniak 2007):

- from a close distance, the wind power plant is an alien element in the landscape due to clearly technical nature and no masking opportunity due to height;
- along with an increasing distance of viewing the wind power plant its landscape dissonance decreases, which results primarily from its narrow structure – a significant drop of power plant perception in rolling moraine landscape of diversified topography is recorded in a distance of approximately 6 km;
- concentration in groups is one of the key features influencing the power plant perception – the larger group of turbines the higher landscape dissonance;
- a crucial feature of wind turbines influencing their perception in the landscape is colour palette of the structure – vast majority of the viewed turbines was white or light grey – white colour is more contrastive in all weather conditions and, when glossy, produces additional light effects;
- installation of advertising boards, which should be well visible by default, has a negative impact on perception of turbines;

[6] Przewoźniak M., 2007, Ochrona przyrody w planowaniu przestrzennym, czyli o tym, że przyroda jest krzywa, a jej ochrona w planowaniu przestrzennym nie jest prosta, (Nature conservation in spatial planning i.e. the nature is not straight and its conservation in landscape planning is not simple), Urbanista 1(49).

- wind turbines considered as aviation obstacles have the ends of blades painted red[7] - this provides the intended effect of better visibility and therefore contract of power plant against the landscape;
- topography in extensive area and landscape coverage with trees, in particular forests, have a crucial impact on perception of turbines;
- weather conditions, in particular cloudiness rate, including colour of clouds and direction of illumination of the power plant to the observer, constitute an important and differing in time condition of perception of the turbines;
- landscape exposition of the turbines and their perception are strongly affected by location within the range of visibility from the roads, in particular where they are close to the roads and form a landscape dominant, and where they remain visible for a long time to the observers on the road or in train;
- the locations in direct vicinity of settlements are the most exposed in terms of landscape, in particular where the turbines are perceived at the background of development as dominants in terms of size.

Aesthetic assessments of wind farms are subjective, dependent on individual feelings and inclinations and in effect extremely differentiated – from negative due to the nature of large technical structures, forming a foreign component in landscape, to positive, reflecting their sophisticated, simple and state-of-the art form. In fact it does not matter whether these are ugly or nice. The fact whether they cause significant landscape transformation matters. Significant means:

- in what territorial scale: local, subregional or interregional;
- what landscape is transformed – natural, cultural (settlement, industrial and infrastructural, etc.) and whether it is protected;
- how many people will permanently and temporarily (transport areas) stay in transformed landscape.

Wind turbines, due to constructional height, are the technical elements visible from great distances. At the terrestrial areas, the ranges of visibility of high structures are limited due to differentiated landscape barriers and presence of landscape background (e.g. raised land, forests, development) at the background of the objects. The wind farms have always local impact on landscape (the location and its surroundings within the range of several km) and might have subregional and inter-regional impact, within the range of several or several dozen km, depending on topographic specifics and weather conditions. These impacts apply to the period of operation of wind farms i.e. approximately 25–30 years.

Disturbance of natural or cultural landscape values can result in decreased tourist and recreational attractiveness of the wind turbines area, however opinions in this issue are diversified (some say that wind turbines are the element contributing to tourist attractiveness of the area).

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[7] Wind turbines considered as aviation obstacles, pursuant to the Regulation of the Minister of Transport and Construction of 14 January 2006 amending the regulation on the manner of reporting and marking of aviation obstacles (Journal of Laws No. 9, item 53), (...) *should have external blade ends painted in 5 stripes of equal width, perpendicular to the longer dimension of rotor blade, covering 1/3 of length of the rotor blade (3 red or orange and 2 white). Extreme stripes cannot be white.*

General landscape conditions of the assessment of the Wieliszewo wind farm

- planned grouping of turbines in an array of 17 turbines;
- the predicted height of individual wind turbines is 145 m (tower height up to 100 m, rotor diameter up to 90 m);
- structure of facilities in the form of solid load-bearing pillar;
- light, uniform colour palette of the whole power plant structure (red blade tops - obstacle marking)
- morphological diversity of the wind farm site – from moraine upland, where wind turbines will be located, through the upland slope zone, to the valley of the Rębowa river (adjacent to the project site);
- concentrations of settlement in the villages of Wieliszewo and Nowa Dąbrowa (approximately 570 m south of the closest planned wind turbine);
- network of hardened and dirt roads, mainly including national road No. 6 Kołbaskowo – Łęgowo and provincial road No. 211 Żukowo – Nowa Dąbrowa;
- low and medium voltage power line network;
- location at a minimum distance of about 7.5 km from the Dolina Słupi Landscape Park and the nearest turbine, some 80 m from the buffer zone of the Park.

Detailed analysis of landscape conditions

The planned wind turbines, as large technical facilities, will significantly change the previous, typical agricultural landscape and cause its anthropization in the area of the project site and in its surroundings. Field mapping and analysis of topographic maps in scales of 1:10,000 and 1:50,000 (Cartographic Appendix 1, 2 and 3, photo 1–8) demonstrated that the wind farm will be visible primarily from:

1) arable lands – from the direct vicinity of the location of the wind turbines,
2) from rural settlement units located in the vicinity of the project site, in particular from the villages of Nowa Dąbrowa, Wieliszewo and to a smaller extent from villages farther from the site, including: Stara Dąbrowa, Malczkowo, Karżnica, Domaradz and Łabiszewo;
3) from the roads adjacent to the location of the investment and its surroundings, including state road No. 6 Kołbaskowo – Łęgowo and provincial road No. 211 Żukowo – Nowa Dąbrowa;
4) from nature protection forms, especially from the Natura 2000 site of Community importance Dolina Łupawy PLH220036 and from the Dolina Słupi Landscape Park.

Ad. 1)

The planned wind turbines, as large technical facilities up to 17 items, will significantly change the previous, typical agricultural landscape and cause its anthropization in the area of the project site and in its surroundings. At the location of the investment, where the distances from the planned turbines are the smallest (several hundred meters) and in effect their landscape exposure will be the greatest, no structural objects are present and people are present only periodically during the agricultural works. Due to the above, impact of planned turbines on the observers will be limited.

Ad. 2)

The impact of the wind farm on the landscape viewed from settlement units will take place from the villages located in its immediate surroundings, in particular from the following villages:

- Nowa Dąbrowa (view to the south-west to south-east from a distance of approximately 603 m – 2.5 km);
- Wieliszewo (view to the west to north-east from a distance of 570 m – 2.1 km);
- Stara Dąbrowa (view to the south and south-east from a distance of 1.6 km – 3.7 km);
- Malczówko (view to the west from a distance of 1.1 km – 3.6 km);

To a smaller extent, the turbines will be seen from villages around the area (partial obscuration), including:

- Domaradz (view to the east from a distance of approximately 1.5 km – 4 km);
- Karżnica (view to the south-west and west from a distance of approximately 1.5 km – 4.3 km);
- Malczkowo (view to the east from a distance of approximately 2.8 km – 5.5 km);
- Rębowa (view to the south-west from a distance of approximately 3.1 km – 5.6 km);
- Boguszyce (view to the south-east from a distance of approximately 1.6 km – 4.3 km);
- Łabiszewo (view to the north-west from a distance of 2.6 km – 5.2 km).

In addition, the turbines will be visible against the arable lands, mid-field dirt roads, state road No. 6 and provincial road No. 211 present in this area – which will result in devaluation of cultural landscape of rural development areas.

Ad. 3)

Impact of the turbines on landscape viewed from the transport routes will take place primarily from:

- national road No. 6 Kołbaskowo – Łęgowo, on a section from Poganice to Mianowice, from a distance of approximately 900 m – 6.2 km, the visibility of the planned turbines will be partially limited by trees and roadside rows of trees;
- provincial road No. 211 Żukowo – Nowa Dąbrowa, on a section from Malczkowo to Nowa Dąbrowa, from a distance of approximately 0.2 km – 3.8 km, the visibility of the planned turbines will be partially limited by trees and roadside rows of trees;
- other local roads in the area of the project site, from the distance of several dozen metres to several kilometres;

In many cases, the presence of small trees and shrubs and roadside rows of trees will reduce the visibility of the wind turbines. Nonetheless,

Ad. 4)

Due to the distance (7.5 km) and large forest complexes obscuring the landscape, the planned turbines will be hardly or not at all visible from the Dolina Słupi Landscape Park.

Also, the planned wind turbines will be visible from the Natura 2000 site Dolina Łupawy PLH220036 from a distance of approximately 2 km. This area was established

for the protection of natural habitats, which are not threatened by any change in the landscape physiognomy.

Conclusion

According to landscape analysis, the planned array of 17 wind turbines (Wieliszewo wind farm) will be a new specific element of landscape anthropization in the Potęgowo commune:

- its landscape exposition will take place from:
  - villages located in the vicinity of the project site, i.e.: Nowa Dąbrowa, Stara Dąbrowa, Wieliszewo, Owczarnia and Malczkowo (from a distance of several hundred meters to over 3.6 km);
  - transport routes in the area of the location of the investment, including state road No. 6 Kołbaskowo – Łęgowo and provincial road No. 211 Nowa Dąbrowa – Żukowo (from a distance from approximately 0.2 km to approximately 6.2 km) and local hardened and dirt roads, crossing the area of the location and its surroundings;
- in many cases visibility of the planned wind turbines will limit or even eliminate forest complexes, road tree lanes, tree stands, bushes and structures;
- Location of the wind farm planned for operation for 25–30 years (periodic landscape impact) within the agricultural areas, will contribute to protection of landscape against introduction of devaluating permanent settlement projects;
- decommissioning of wind farm will cause restoration of landscape to the initial state (provided that the agricultural use will be continued).

6.2.9. Tangible and cultural assets

At the operation stage no impact of the planned Wieliszewo wind farm and associated infrastructure on cultural assets will be present (see Section 6.1.5.).

Wind turbines will be a new element of the cultural landscape of the location of the investment and its surroundings. Their impact on cultural landscape (agricultural and settlement landscape) will be significant in effect of large and specific technical facilities (see Section 6.2.8.).

Impact on tangible assets will refer to the scope of land use in the scope of excessive impact of wind farm on acoustic environment. The areas of the turbines and their excessive noise impact (see Section 6.2.5.) are and will remain in agricultural use. The owners of these area will be unable to change the land use from agricultural to development lands associated with permanent stay of people (settlements, single family houses, etc.). Operation of the turbines will not affect agricultural activity, with regard to which the lands as arable lands will not lose its value.

Value of plots of the power plant location will increase due to incomes from area lease (direct economic benefits).

The local self-government of the Potęgowo commune will obtain indirect economic benefits due to an increase in property tax.

6.2.10. Human health

The planned Wieliszewo wind farm and associated infrastructure may potentially impact human health by:

- **noise emission** by the turbines – the Report specified the operation conditions of the power plant, meeting of which ensures that their impact on acoustic environment will meet the standards in force (see Section 6.2.5.) and won't act as the source of deterioration of human life quality;
- **infrasound emission** – wind turbines emit infrasound at very low level, definitely below the values that can affect human health. (see Section 6.2.6.);
- **electromagnetic radiation emission** – power generator of the turbines emit radiation of very low strength, posing no threat to humans and disappearing in a distance of 30-40 m from the source (placed at height of more than 100 m), also the cable (underground) power lines and medium voltage transformer station are not the sources of electromagnetic radiation of excessive values (see Section 6.2.7.);
- **in the emergencies (** construction disaster) by collapse of the power plant structure – the situation of extraordinary emergency is theoretically excluded, since the structure of power plant meets all standards in the scope of bearing capacity and strength; any possible collapse of the planned wind farms will pose no threat to the human settlement, which will be located in a distance of at least 470–500 m;
- **stroboscopic effect** – optic effect caused by periodic light reflections associated with reflecting of sunlight from the rotating blades – negligible impact due to significant distance to the buildings (more than 500 m). In addition, this effect has been practically eliminated in the modern turbines by applying matt coatings and paints preventing sun reflections (Michałowska-Knap 2006);
- **shadow flicker effect** – optic effect related to shadowing of the surrounding areas by rotating wind turbine rotor blade (frequently mistaken with stroboscopic effect); this effect occurs primarily in short periods of the day, at morning and afternoon hours, when low position of the sun makes it shine from behind the turbine and when the shadows of rotor blades are elongated. It is especially noticeable in the winter period, when the sunlight angle of incidence is relatively low.
  Pursuant to the performed surveys, flickering of frequency above 2.5 Hz can pose a nuisance to humans (in vast majority of people, the body reaction occurs at significantly higher frequencies of 16 - 25 Hz). Maximum frequencies of flickering caused by modern wind turbines do not exceed 1 Hz, i.e. are far below the threshold value of 2.5 Hz and should not be perceived as causing adverse effect.
- **effect of changed landscape perception** – impact highly differentiated due to individual and subjective feelings of humans (see Section 6.2.8.).

Operation of the Wieliszewo wind farm will cause no negative impact on human health. It may however such as any other wind farm affect the quality of life of the local inhabitants, primarily in the emotional and psychical aspects. This may result from no acceptance for change of living environment (for the most landscape change) and subjective fears that the environmental protection standards in the scope of noise, infrasound and electromagnetic radiation are not kept.

6.3. Investment decommissioning stage

The estimated operation period of modern wind farms is approximately 25–30 years. It is unknown now whether after that period the Wieliszewo wind farm together with the 110 kV cable line and the remaining auxiliary infrastructure will be decommissioned or modernised. Assuming the scenario of decommissioning of the investment, one should focus on the following issues:

- risk to atmospheric air condition will result from operation of construction equipment and transport means - fugitive emission of pollution to air (suspended and particulate matter) and noise; during decommissioning, similar issues of concern as in the construction phase will occur; no significant negative impact on air and acoustic environment at the decommissioning stage is expected;
- decommissioning of the HV 110 kV, MV and fibre optic lines will require excavation of the cables, which would involve breaking ground and all related consequences (similarly as on the construction stage – see Section 6.1.1.). It seems that the best solution would be to leave the cables in the ground (see Section 10);
- decommissioning of the power plant will result in immediate restoration of the landscape to the initial state (provided that the surrounding will not change significantly in the operation phase), noise emission and potentially impact on birds will also cease;
- turbine structures will require scrapping (up to 17 wind turbines x approximately 350 tonnes = 5,950 tonnes), similarly to power cables;
- decommissioning of wind turbine foundations includes cracking and disposal of debris on landfill or transfer for use to natural persons (pursuant to the Act on Waste currently in force – it is unknown what provisions will be in force in 25–30 years); volume of concrete debris will be approximately 45,900 m^3;
- other waste, including synthetic engine, gear and lubricating oils, code 13 02 06 (hazardous waste), wiping cloths, protective clothing contaminated by oils, code 15 02 02 (hazardous waste), non-segregated mixed municipal waste, code 20 03 01, will be stored in designated and secured sites (hazardous waste will be stored in tight containers) until collection (by specialist companies) or transferred to the nearest sites for recycling or utilisation;
- soil surface will be relieved from the power plant structures and concrete from the foundations and access roads, post-foundation excavations will require rehabilitation (filling with clay sand and soil substrate). Upon rehabilitation, the area can be restored to plant production.

The obligation to rehabilitate the area after project decommissioning will rest on the owner of wind farm.

In effect of replacement of the planned turbines to new ones, an issue of scrapping of the structure of the previous turbines will appear. For now, it cannot be stated whether the foundations will be able for further use.

Table 17 Types of waste at the decommissioning stage of wind turbines

Waste group code	**Waste type**	**Number** (for the array of 17 wind turbines)
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**	

17 01	**Construction material and element waste and road infrastructure waste (e.g. concrete, bricks, tiles and ceramics)**	
17 01 01	Concrete waste and debris from demolition and renovation works	approximately 45,900 m^3
17 01 03	Tiles and ceramics waste	approximately 13 m^3
17 01 07	Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	approximately 13 m^3
17 01 81	Waste from renovations and reconstruction of roads	approximately 1,600 m^3
17 01 82	wastes not otherwise specified	approximately 13 m^3
17 02	**Wood, glass and plastic waste**	
17 02 03	Plastics (rotor blades)	approximately 217 t
17 04	**Metals and scrap (including their alloys) waste**	
17 04 05	Iron and steel (nacelle, hub, turbine tower – one wind turbine approximately 350 t)	approximately 6,900 t
17 04 11	Cables other than those mentioned in 17 04 10	approximately 17,700 running metres
17 06	**Insulation materials and asbestos-containing construction materials**	
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03	approximately 15 m^3

Source: own study, waste classification according to the Regulation of the Minister of Environment of 27 September 2001 on the catalogue of waste

7. INVESTMENT IMPACT ASSESSMENT ON FORMS OF NATURE CONSERVATION AND LANDSCAPE PROTECTION

7.1. Territorial and individual forms of nature protection

The area of the Wieliszewo wind farm site and the HV 110 kV cable line, which is an integral part of the project, is located outside of the territorial forms of nature protection.

In the surroundings of the location of the investment, within a distance of up to approximately 20 km from the planned Wieliszewo wind farm, the following forms of nature protection are established (Fig. 5):

- **Słowiński Park Narodowy** (at a distance of approximately 13.5 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned wind turbine);
- **nature reserves**, including:
  - Ź**ródliskowe Torfowisko** (approximately 12 km to the south-west from the closest planned wind turbine and approximately 15 km from the planned 110 kV cable line);
  - **Grodzisko Runowo** (approximately 14.2 km to the east from the closest planned wind turbine and approximately 16.7 km from the planned 110 kV cable line)
  - **Dolina Huczka** (approximately 15.6 km to the south from the closest planned wind turbine and approximately 18 km from the planned 110 kV cable line);
  - **Łebskie Bagno** (approximately 19.6 km to the north-east from the closest planned wind turbine and more than 20 km from the planned 110 kV cable line);
  - **Jałowce** (approximately 14 km from the planned 110 kV cable line and at least approximately 20 km to the north from the nearest planned location of a wind turbine**);**
- **Dolina Słupi Landscape Park and its buffer zone** – at a minimum distance of approximately 7.5 km to the west from the closest planned wind turbine (and approximately 80 m to the south in the case of the buffer zone) and approximately 10 km to the south-west from the planned 110 kV cable line (and approximately 2 km to the south in the case of the buffer zone)**;**
- **Fragment Pradoliny Łeby ze Wzgórzami Morenowymi na Południe od Lęborka (Fragment of the Łeba Marginal Stream Valley with the Moraine Hills South of Lębork) Landscape Protection Area** – at a minimum distance of approximately 14 km to the east from the closest planned wind turbine and at a distance of approximately 16.5 km to the east from the planned 110 kV cable line;
- **Pas Pobrzeża na Wschód od Ustki (Coastline East from Ustka) Landscape Protection Area** at a minimum distance of approximately 16.7 km to the north-west from the planned 110 kV cable line and at a distance of over 20 km to the north-west from the closest planned wind turbine
- **Natura 2000 sites**, including:
  - special bird protection areas:
    - **Dolina Słupi** PLB220002 (approximately 7.2 km to the west from the closest planned wind turbine and approximately 9.6 km from the planned 110 kV cable line);

  - **Ostoja Słowińska** PLB220003 (approximately 15 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned turbine);
- Sites of Community Importance:
  - **Dolina Łupawy** PLH220036 (approximately 2.2 km to the north from the nearest planned location of a wind turbine and approximately 2.2 km to the east from the planned 110 kV cable line);
  - **Ostoja Słowińska** PLH220023 (approximately 15 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned turbine);
  - **Łebskie Bagno** PLH220040 (approximately 19.6 km to the north-east from the closest planned wind turbine and more than 20 km from the planned 110 kV cable line)
  - **Bagna Izbickie** PLH220001 (approximately 18.5 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned wind turbine);
- Shadow List 2010 Area – PLH **Dolina rzeki Słupi** approximately 7.7 km to the south-west from the planned 110 kV cable line and approximately 7 km from the closest planned wind turbine);

- **natural monuments** – the nearest of which is located at a distance of approximately 880 m from the planned 110 kV cable line. In relation to the planned wind turbines, the closest monument is located at a distance of approximately 5.5 km from the planned wind turbine locations).
- **documentation sites** – the closest of which is located approximately 1.3 km to the east from the closest planned wind turbine and approximately 3.8 km from the planned 110 kV cable line.
- **ecological sites** – the closest of which are located approximately 77 km from the planned 110 kV cable line and at least approximately 3.1 km from the nearest planned location of wind turbines;

Słowiński National Park

Implementation of the project will pose no risk of devaluation of the protected values of the Słowiński National Park (at a minimum distance of approximately 13.5 km from the planned 110 kV line and more than 20 km from the closest wind turbine). Due to the distance and presence of natural obstacles (tree stands, rural settlement and inclines), wind turbines will not be visible from the Park area.

Installation of the planned 110 kV cable line, due to its location underground, will also not affect the landscape values of the SNP.

The project site is located outside the buffer zone of the Słowiński National Park designated for its protection against external threats.

Nature reserves

The construction of the planned Wieliszewo wind farm and the 110 kV cable line will not cause any adverse impact on the nature of the nearest nature reserves Źródliskowe Torfowisko, Jałowce, Dolina Huczka, Łebskie bagna and those located at further away, due to the object of protection (forest reserves) and due to the nature of the environmental impact of the wind turbines (limited primarily to impact on acoustic environment, landscape

and potentially on flying animals). Due to the distance (12 km and more from the closest wind turbine and 14 km and more from the planned 110 kV cable line), the planned project will have no impact on the reserves.

Dolina Słupi Landscape Park and its buffer zone

Implementation of the project will pose no risk of devaluation of the protected values of the Dolina Słupi Landscape Park (at a minimum distance from the closest wind turbine of approximately 7.5 km to the south-west and approximately 10 km from the planned 110 kV cable line). Due to the distance and presence of natural obstacles (tree stands, forest complexes, rural settlement and inclines), wind turbines will be hardly or will not be visible from the Park area. The wind farm will be also located outside the Park buffer zone (in a distance of more than 80 m from its border) established for its protection against the external risks.

As the cable line is installed underground, it will not have any impact on the landscape values of the park.

Fragment Pradoliny Łeby ze Wzgórzami Morenowymi na Południe od Lęborka (Fragment of the Łeba Marginal Stream Valley with the Moraine Hills South of Lębork) Landscape Protection Area

Location of the Wieliszewo wind farm will pose no threat to the protected values of the protected landscape areas and their functions as ecological corridors.

The planned wind turbines will be located at a minimum distance of 14 km from the boundary of the Fragment of the Łeba Marginal Stream Valley with the Moraine Hills South of Lębork Landscape Protection Area and will be hardly or not at all visible from there.

Due to the distance and presence of natural obstacles, wind turbines will not be visible from other protected landscape areas in the vicinity.

The 110 kV cable line will be constructed approximately 16.5 km to the east of the protected landscape area. As the cable line is installed underground, it will not have any impact on the landscape values of the Fragment of the Łeba Marginal Stream Valley with the Moraine Hills South of Lębork Landscape Protection Area.

Pas Pobrzeża na Wschód od Ustki (Coastline East from Ustka) Landscape Protection Area

Location of the Wieliszewo wind farm will pose no threat to the protected values of the protected landscape areas and their functions as ecological corridors.

The 110 kV cable line will be constructed approximately 16.7 km to the east of the protected landscape area. As the cable line is installed underground, it will not have any impact on the landscape values of the Pas Pobrzeża na Wschód od Ustki (Coastline East from Ustka) Landscape Protection Area.

The planned wind turbines will be located in a minimum distance of more than 20 km from the border of the Pas Pobrzeża na Wschód od Ustki (Coastline East from Ustka) Landscape Protection Area and will not be visible from the boundary of this area.

Natura 2000 sites

The nearest special birds protection area Dolina Słupi PLB220002 is located at the distance of about 7.2 km from the project site (the closest planned turbine).

The nearest habitat protection areas are: site of Community importance Dolina Łupawy PLH220036 (at least some 2.2 km from the closest planned wind turbine and approximately 2.2 km from the planned 110 kV cable line) and the site of Community importance Łebskie Bagno PLH220040 located at least some 19.6 km from the closest planned wind turbine and more than 20 km from the planned 110 kV cable line.

In the Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, No. 92, item 880 as amended) it was stated for Natura 2000 sites that:

(...)

Art. 33. 1. It is prohibited, subject to Art. 34, to undertake any activities that might, alone or in combination with any other activities, have significant negative impact on the objectives of Natura 2000 site protection, including in particular:

1) deteriorate the condition of natural habitats or habitats of flora and fauna species, for the protection of which the Natura 2000 site was established or

2) have a negative impact on the species, for the protection of which the Natura 2000 site was established or

3) deteriorate the integrity of the Natura 200 site or its associations with the other areas.

2. The provision of paragraph 1 will be applied respectively to the proposed areas of community importance included on the list, referred to in Art. 27.3.1, until the European Commission approves them as the areas of Community importance and establish them as special areas of conservation.

3. Draft policies, strategies, plans and programmes and amendments to such documents as well as any planned initiatives, that may have a significant impact on Natura 2000 site and which are not directly associated with the protection of Natura 2000 site or the areas, referred to in paragraph 2, or do not result from that protection, require the proceeding on the environmental impact assessment under the rules laid down in the Act on Disclosure of Information on the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessments, dated 3 October 2008.

(...)

Art. 34. 1. If the necessary requirements of superior public interests, including social or economic requirements, dictate so, and in the case of no alternative solutions, the locally competent regional director of environmental protection and on maritime areas the director of the competent maritime office, may permit the implementation of plan or activities that might have a negative impact on the objectives of Natura 2000 site or the areas included on the list, referred to in Art. 27.3.1, ensuring the performance of environmental compensation necessary to guarantee integrity and proper functioning of the Natura 2000 network.

2. When a significant negative impact refers to priority habitats and species, the permit, referred to in paragraph 1, can be granted only for the purposes of:

1) protection of human health and life;

2) ensuring common safety;

3) obtaining advantageous effects of primary importance for natural environment;

4) resulting from the necessary requirements of the superior public interest, upon obtaining the opinion of the European Commission.)

(…)

Art. 35a. In the case of activities intended for implementation under the planned investments, the permit, referred to in Art. 34.1, will be replaced by an environmental permit or consultations with the regional director of environmental protection, in the meaning of the Act on Disclosure of Information on the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessments, dated 3 October 2008. (...).

Art. 36. 1. On the Natura 2000 sites, subject to paragraph 2, the activity related to maintenance of equipment and facilities ensuring flood safety and business, agricultural, hunting and fishing activity as well as amateur fishing is not prohibited, provided that it has no negative impact on the objectives of the protection of Natura 2000 sites. (...)

In addition, the provisions of the Regulation of the Minister of Environment on the special protection areas Natura 2000 of 21.07.2004 (Journal of Laws No. 229, item 2313, amended by Journal of Laws of 2007 No. 179, item 1275 and Journal of Laws of 2008 No. 198, items 1226) state that:

(...)

§ 4 The purpose of establishing the areas, referred to in § 2, is to protect the populations of wild birds and maintenance of their habitats in non-deteriorated condition.

§ 5 The object of protection are bird species listed in Annex 2 to the Regulation.

(...)

Supplementary provisions of common law with a view to Natura 2000 site are implemented by the Regulation of the Minister of Environment of 13 April 2010 on natural habitats and species of Community interest as well as on the selection criteria for the areas eligible for recognition or establishment as Natura 2000 sites (Journal of Laws of 2010 No. 77, item 510).

Pursuant to the Nature Conservation Act, the site supervisor will prepare draft plan of protection activities for the period of 10 years for the Natura 2000 site (the draft will be approved by the Regional Director of Environmental Protection by means of an order) and draft protection plan (draft will be approved by the minister competent for environmental by means of an regulation). Such drafts have not been prepared for the Natura 2000 sites in the surroundings for the location of the investment yet.

Regulation of the Minister of Environment on the special protection areas Natura 2000 of 21 July 2004, as amended, contains the provisions that:

§ 4. The objectives of establishing the areas, referred to IN § 2, are: protection of wild bird species populations, maintenance and management of their natural habitats in compliance with the environmental requirements, restoration of damaged biotopes and their formation.

§ 5 The object of protection are bird species listed in Annex 2 to the Regulation and their natural habitats."

At the area of the "Dolina Słupi" PLB220002 special protection area, the presence of at least 22 bird species listed in Annex I to the Birds Directive 79/409/EEC) was observed. From these species, the following are protected, in accordance with the criteria classifying the bird species and their habitats for protection in the form of the Natura 2000 sites (species graded A, B or C according to the standard data form):
Botaurus stellaris Eurasian bittern
Ciconia nigra black stork
Ciconia ciconia white stork
Pernis apivorus European honey-buzzard
Milvus milvus red kite
Haliaeetus albicilla white-tailed eagle
Circus aeruginosus marsh harrier
Aquila pomarina lesser spotted eagle
Crex crex cork crake
Grus grus crane
Sterna hirundo common tern
Bubo bubo eagle owl

Aegolius funereus boreal owl
Caprimulgus europaeus goatsucker
Alcedo atthis common kingfisher
Dryocopus martius black woodpecker
Dendrocopos medius middle spotted woodpecker
Lullula arborea woodlark
Anthus campestris tawny pipit
Sylvia nisoria barred warbler
Ficedula parva red-breasted flycatcher
Lanius collurio red-backed shrike

The main threats to the area include (according to the standard data form available at http://natura2000.gdos.gov.pl/natura2000/dane/pdf/pl/ PLH220036.pdf) water pollution with municipal and agricultural wastewater, uncontrolled tourist and recreational influx, including development of settlements. The location of the wind turbines was not listed as a project posing a threat to the special birds protection area Dolina Słupi PLB220002. During the annual ornithological survey (Antczak 2010 – Appendix 3), 17 breeding species listed in Annex I of the Birds Directive (79/409/EEC) were identified in the area of the project site. These were: whooper swan, Bewick's swan, whooper swan, great egret, white stork, red kite, white-tailed eagle, marsh harrier, hen harrier, Montagu's harrier, merlin, crane, golden plover, wood sandpiper, kingfisher, black woodpecker, woodlark and red-backed shrike.

According to the results of the ornithological monitoring (Antczak 2010):

– *No concentrations of birds of above-average importance for the Pomerania region were found in any of the analysed phenological periods.*
– *No significant threats were recorded for avifauna nesting in valuable protected areas within a 10 km radius from the planned project* (including for the special birds protection area Dolina Słupi (PLB 220002), site of Community importance Dolina Łupawy PLH220036 and PLH Dolina rzeki Słupi (an area recorded in the Shadow List 2010)).
– *Measures were proposed to minimize potential a adverse impact on avifauna, mainly focusing on securing the roosting and feeding ground of cranes and the flocking of golden plover.*
– *Methodological assumptions for monitoring once the construction of the wind farm is completed were proposed.*
– *Taking into account all the recommendations, it was concluded that the planned wind farm will not have a significant adverse impact on avifauna.*

Measures aimed at minimising potential adverse impact of the Wieliszewo wind farm on birds are specified in Section 9.

Complete text of ornithological monitoring by Antczak (2010) is provided in Appendix 4 constituting the integral part of this Report.

The site of Community importance **Dolina Łupawy PLH220036** hosts the following types of habitats listed in Annex I to the Habitats Directive (92/43/EEC) meeting the criteria for establishment of the Natura 2000 site:

- (code 3140) Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. *Charetea*
- (code 3150) Natural eutrophic lakes with Nympheion, *Potamion* type vegetation;

- (code 3260) Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation *Ranunculion fluitantis*
- (code 3270) Rivers with muddy banks
- (code 6410) Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion*)
- (code 6430) Tall herb fringe of the montane to alpine levels (*Adenostylion alliariae*) and riverrine communities (*Convolvuletalia sepium*)
- (code 6510) Lowland and Submontane Meadows (*Arrhenatherion elatioris*)
- (code 7140) Transition mires and quaking bogs (primarily with *Scheuchzerio-Caricetea* vegetation)
- (code 7150) Depressions on peat substrates of the *Rhynchosporion*
- (code 7220) Petrifying springs with tufa formation *Cratoneurion commutati*
- (code 7230) Alkaline fens
- (code 9110) *Luzulo-Fagenion* beech forests
- (code 9130) *Dentario glandulosae-Fagenion, Galio odorati-Fagenion* beech forests
- (code 9160) Sub-Atlantic oak-hornbeam forests (*Stellario-Carpinetum*)
- (code 9190) Acidophilic oak forests (*Betulo-Quercetum*)
- (code 91D0) Bog woodland *(Vaccinio uliginosi-Betuletum pubescentis, Vaccinio uliginosi-Pinetum, Pino)*
- (code 91E0) Alluvial forests with Alnus glutinosa and Fraxinus excelsior (*Salicetum albo-fragilis, Populetum albae, Alnenion)*
- (code 91F0) Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers *(Ulmenion minoris)*

The following bird species from Annex I of Council Directive 79/409/EEC occur in the area Dolina Łupawy PLH220036:
Ciconia nigra (black stork)
Ciconia ciconia (white stork)
Pernis apivorus (European honey buzzard)
Milvus migrans (black kite)
Milvus milvus (red kite)
Haliaeetus albicilla (white-tailed eagle)
Circus aeruginosus (marsh harrier)
Circus cyaneus (hen harrier)
Aquila pomarina (lesser spotted eagle)
*Pandion haliaetus (*osprey)
Crex crex (cork crake)
Grus grus (crane)
Bubo bubo (eagle owl)
Caprimulgus europaeus (goatsucker)
Alcedo atthis (common kingfisher)
Dryocopus martius (black woodpecker)
Dendrocopos medius (middle spotted woodpecker)
Lullula arborea (woodlark)
Anthus campestris (tawny pipit)
Luscinia svecica (bluethroat)
Sylvia nisoria (barred warbler)

Lanius collurio (red-backed shrike).

In addition, the following species listed in Annex II of Council Directive 92/43/EEC are protected within the Natura 2000 area – site of Community importance Dolina Łupawy PLH220036:

mammals:

- Eurasian beaver *(Castor fiber);*
- Eurasian otter (*Lutra lutra);*

amphibians:

- crested newt (*Triturus cristatus)*

fish and lampreys:

- brook lamprey (*Lampetra planeri)*;
- river lamprey (*Lampetra fluviatilis)*,
- Atlantic salmon (*Salmo salar)*;
- goat (*Cobitis taenia)*;
- European bullhead (*Cottus gobio)*.

The threats to this area (in accordance with the standard data form – http://natura2000.gdos.gov.pl/natura2000/dane/pdf/pl/PLH220036.pdf) include:

- hydroengineering works
- discontinued use (e.g. grazing or mowing) of meadows and soligenous mires;
- intensification of forest management, tree logging, in particular at steep valley, gorge and spring area slopes
- locating of the investments causing water pollution within the area and in its vicinity.

The location of the wind turbines was not listed as a project posing a threat to the special habitat protection area Dolina Łupawy PLH220036.

Due to the nature of the impact and difference of the environment, the planned Wieliszewo wind farm together with the transformer station and the 110 kV cable line will have no impact on the habitats and plant and animal species for the protection of which the Natura 2000 site Dolina Łupawy PLH220036 was established.

Shadow List 2010 site – Dolina rzeki Słupi

The following habitat types listed in Annex I of Council Directive 92/43/EEC occur in this area:

Code: 3110 Lobelia lakes

Code: 3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp *Charetea*

Code: 3150 Natural eutrophic lakes with Nympheion, *Potamion* type vegetation

Code: 3160 Natural dystrophic lakes and ponds

Code: 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis and Callitricho-Batrachion* vegetation

Code: 3270 Rivers with muddy banks

Code: 6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion*)

Code: 6430 Tall herb fringe of the montane to alpine levels (*Adenostylion alliariae*) and riverrine communities (*Convolvuletalia sepium*)

Code: 6510 Lowland and Submontane Meadows (*Arrhenatherion elatioris*)

Code: 7110 Active raised bogs (live)

Code:7120 Degraded raised bogs still capable of natural regeneration

Code: 7140 Transition mires and quaking bogs (primarily with *Scheuchzerio-Caricetea vegetation)*

Code: 7150 Depressions on peat substrates of the *Rhynchosporion*

Code: 7220 Petrifying springs with tufa formation *Cratoneurion commutati*

Code: 7230 Alkaline fens

Code: 9110 *Luzulo-Fagenion* beech forests

Code: 9130 Asperulo-Fagetum beech forests *(Dentario glandulosae-Fagenion, Galio odorati-Fagenion)*

Code: 9160) Sub-Atlantic oak-hornbeam forests (*Stellario-Carpinetum*)

Code 9190 Acidophilic oak forests (*Betulo-Quercetum*)

Code: 91D0 Bog woodland *(Vaccinio uliginosi-Betuletum pubescentis, Vaccinio uliginosi-Pinetum, Pino)*

Code: 91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (*Salicetum albo-fragilis, Populetum albae, Alnenion)*

The following mammal species (including one bat species) listed in Annex II of Council Directive 92/43/EEC occur in the area:

Barbastella barbastellus Western barbastelle
Castor fiber Eurasian beaver
Lutra lutra Eurasian otter

Key threats to the area listed in the standard data form include:

- hydroengineering structures on the Słupia river in Słupsk, Skarszów Dolny, Krzynia, Konradowo, Gałęźnia Mała, Soszyca
- abandonment of grazing and mowing of meadows
- salmonidae fish farms
- clearing of forests on slopes and valley edges
- not fully developed water treatment system in the Słupia river drainage basin

The location of the wind turbines was not listed as a project posing a threat to the Shadow List 2010 site – Dolina rzeki Słupi.

Due to the distance (approximately 7.7 km to the south-west from the planned 110 kV cable line and approximately 7 km from the nearest planned wind turbine), nature of the impact and difference of the environment, the planned Wieliszewo wind farm together with the transformer station and the 110 kV cable line will have no impact on the habitats and plant and animal species for the protection of which the Shadow List 2010 site – Dolina rzeki Słupi was established.

Construction of the Wieliszewo wind farm, including the construction and operation of 17 wind turbines and power infrastructure will cause no deterioration of natural habitat status and flora and fauna status and have no adverse impact on the species, for the protection of which the Natura 2000 sites were established. As already mentioned, this results from the following factors:

a) the nearest special birds protection area Dolina Słupi PLB220002 is located 7.2 km to the west from the closest planned wind turbine – in accordance with the findings of the annual ornithological survey (Antczak 2010): *Taking into account all the recommendations, it was concluded that the planned wind farm will not have a significant adverse impact on avifauna*.

b) the closest site of Community importance Dolina Łupawy PLH220036 (approximately 2.2 km to the north from the nearest planned wind turbine) – construction and operation of the turbines will not cause any impact on habitats and plant and animal species protected within the area;

c) construction and operation of the Wieliszewo wind farm will cause no disintegration of any of the Natura 2000 sites (the turbines will be located outside the Natura 2000 areas);

d) construction and operation of the Wieliszewo wind farm in the scenario of the wind farm location taking into account the conclusions from ornithological monitoring (Antczak 2010 – **Appendix 3**), will not affect the integrity of the Natura 2000 network.

e) construction and operation of the Wieliszewo wind farm will cause no disintegration of the Shadow List 2010 Dolina rzeki Słupi area (the turbines will be located outside the area);

To summarise, the planned Wieliszewo wind farm will cause no significant impact on the Natura 2000 and Shadow List 2010 sites.

Nature monuments

Implementation of the planned project will have no impact on natural monuments existing in the vicinity, the nearest of which is located at a distance of approximately 880 m from the planned 110 kV cable line. The nature monuments closest to the planned wind turbines (at a distance of approximately 4.5) are two monuments near the Czarne Lake (southern part of the Potęgowo commune) – common oak and common beech (see Section 4.1.).

Documentation sites

The closest of the documentation sites is Wyrobisko Wieliszewo, whose object of protection is an area after peat extraction, located at a minimum distance of approximately 1.3 km to the east from the closest planned wind turbine and approximately 3.8 km from the planned 110 kV cable line.

Implementation of the planned investment will have no impact on the documentary sites located in its vicinity.

Ecological sites

In accordance with Resolution the Potęgowo Commune Council No. XIX/128/2008 of 29 February 2008, in the area of the above ecological sites it is prohibited to:

1) *destroy, damage or transform the object,*
2) *perform earthworks permanently deforming the terrain, with the exception of objects related to flood prevention,*
3) *damage and contaminate soil,*
4) *litter in the object and the area around it,*

5) *make changes to water courses, if they serve purposes other than nature protection and sustainable use of agricultural and forest land and fishery management,*
6) *dump, bury and discharge waste or other impurities,*
7) *liquidate small water reservoirs, oxbow lakes or wetlands,*
8) *apply slurry, with the exception of spreading on own agricultural land,*
9) *locate summer housing outside area designated in the local zoning plan,*
10) *harvest, destroy or damage plants and fungi in ecological sites established to protect stands or habitats of protected plants and fungi,*
11) *display billboards.*

The nearest ecological site is a water pond located at a distance of approximately 77 m from the planned 110 kV cable line. The power line (see Section 4.1) will be installed along the existing road and will have any impact on the ecological sites in the area.

The closest ecological site with respect to the planned wind turbines is the site located at a distance of 3.1 km from the closest planned wind turbine.

Implementation of the planned investment will have no impact on the ecological sites located in its vicinity.

7.2. Flora and fauna species protection

Construction and operation of the Wieliszewo wind farm will cause no risk to the protected flora and fauna species - all locations of the turbines are planned on the areas of agricultural use and occupied by agrocenoses. The 110 kV cable line connecting the Nowa Dąbrowa grid connection point with the Bięcino grid connection point will run through areas used for agricultural purposes and along roads.

Impact of wind turbines on the protected bird and bat species of individual nature and posing no threat to species population is possible - which results from the performed ornithological (Antczak 2010 – **Appendix 3**) and chiropterological monitoring (Kościów 2010 – **Appendix 4**).

7.3. Protection of green areas and tree stands

The conditions of trees and shrubs protection are specified in the Nature Conservation Act (consolidated text in Journal of Laws of 2009, No. 151, item 1220 as amended):

Art. 83.

1. Trees or shrubs may be removed from the area of real-property subject to paragraph 2 and 2a, upon obtaining of the permit issued by head of commune, mayor or president of the city on request of the property owner. If the holder of a property is not its owner, the consent of the owner will be enclosed with the request.

2. Permit for removal of trees or shrubs from the area of real-property entered into the register of monuments is issued by the provincial conservation officer.

"2a. Permit for removal of trees within the public road lane, excluding foreign species of poplar, is issued upon consultation with the regional director of environmental protection.

2b. Failure to provide a statement of reasons within 30 days from the day of receiving the draft permit, referred to in paragraph 2a, by the regional director of environmental protection will be considered as consultation of the permit.

2c. The authority competent to issue the permit, referred to in paragraph 1, should carry out field inspection in the scope of presence of protected species within tree stands before issuing the permit."

(...)

5. A permit for removal of trees or shrubs in areas under landscape protection within the boundaries of (...) nature reserve shall require the approval of the (...) regional director of nature protection.

6. The provisions of paragraphs 1 and 2 shall not apply to trees or shrubs:

1) in the woods;

2) fruit trees or shrubs, excluding these growing within the real-property entered into the register of monuments and within the national park or nature reserve – in areas not covered with landscape protection;

3) on tree and shrub plantations;

4) below 10 years of age;

5) removed with regard to operation of botanic or zoological gardens;

6) (repealed);

7) removed under the decision of the competent authority from the areas situated between the coastline and flood embankment or naturally high bank, in which the route of flood embankment was embedded, from flood embankments and areas in a distance below 3 m from the embankment foot;

8) which disturb visibility of signalling devices and trains and impede exploitation of railway devices or cause formation of snowdrifts on railway tracks, removed under the decision of the competent authority;

9) being the aviation obstacles, removed under the decision of the competent authority;

10) removed under the decision of the competent authority due to the needs related to maintenance of detailed water drainage equipment.

If it is necessary to remove individual trees and shrubs located within a project site, the law referred to above shall apply.

8. DIAGNOSIS OF THE POTENTIALLY SIGNIFICANT ENVIRONMENTAL IMPACTS OF THE PLANNED INVESTMENT, INCLUDING CROSS-BORDER IMPACTS AND DESCRIPTION OF THE APPLIED PROJECTION METHODS

8.1. Impacts resulting from presence of the investment

1. At the construction stage (the investment does not exist yet), the following will take place:
   a) transformations of surface lithospheric layer (excavations),
   b) liquidation of soil cover,
   c) liquidation of vegetation (mainly agrocenoses),
   d) impact on fauna (primarily soil and deterring of the remaining fauna),
   e) emission of pollution to atmosphere (vehicles and construction machinery),
   f) noise emission (vehicles and construction machinery),
   g) waste production (mainly soil from excavations).

   These impacts will not be significant in the meaning of environmental protection provisions.
2. At the exploitation stage of the investment, with regard to its presence, the following will occur:
   a) reduced emission of pollution to atmosphere from conventional energy sources
   b) noise emission by turbines,
   c) infrasound emission by turbines,
   d) electromagnetic radiation emission by transformer station,
   e) hazardous waste production,
   f) potential impact on avifauna,
   g) potential impact on chiropterofauna,
   h) landscape anthropization,
   i) impact on human living conditions - cumulative impact.

Potentially significant impacts include the ones listed in clauses a, b and h. With a view to noise emission (clause b) it was demonstrated that its permissible levels will not be exceeded (Section 6.2.5.).

3. At the decommissioning stage (end of operation of the investment), the following will take place:
   a) emission of pollution to atmosphere (vehicles and demolition machinery),
   b) noise emission (vehicles and demolition machinery),
   c) construction material waste production.

Classification of environmental impacts of the planned investments, including potentially significant impacts, pursuant to Art. 66 of the Act on Disclosure of Information on the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessments, dated 3 October 2008 (Journal of Laws of 2008 No. 199, item 1227 as amended) is provided in Section 8.8.

8.2. Impacts resulting from the use of natural resources

The planned investment will cause no use of natural resources, apart from the use of renewable, kinetic wind energy (long-term impact, permanent at windy weather conditions).

At the construction stage, the analysed investment will require consumption of raw materials, materials and fuels, including:

- aggregates (sand and gravel) for concrete production for foundations (approximately 17,500 t);
- water for concrete production for foundations and for social and welfare purposes of construction teams (approximately 7,400 m^3);
- fuel for construction equipment and transport service (approximately 130 t).

8.3. Impacts related to decommissioning or limited access to natural environment resources

The issue of legal protection of utility resources of natural environment in the location of the Wieliszewo wind farm applies to soil protection.

Soil protection

Pursuant to the Act on the Protection of Agricultural and Forest Land of 3 February 1995 (consolidated text in Journal of Laws of 2004 No. 121, item 1266 as amended), agricultural lands of higher quality classes and organogenic soils are subject to legal protection. Pursuant to the Act:

Non-agricultural and non-forest use of:

1) *agricultural lands constituting arable lands classes I-III, provided that their dense area designated for such use exceeds 0.5 ha - requires obtaining of the consent of the Minister of Agriculture and Food Economy* [currently the Minister of Agriculture and Rural Development];
2) *forest lands constituting the property of State Treasury - requires the consent of the Minister of Environmental Protection, Natural Resources and Forestry*[currently the Minister of Environment] *or a person authorised by it;*
3) *(deleted)*
4) *(deleted)*
5) *of the other forest lands*

requires the approval of the Province Governor expressed upon obtaining of the opinion of agricultural chamber."

With regard to the planned investment, the need for exclusion from agricultural production of arable lands constituting arable lands class IV, IVa, IVb, V and VI is estimated (this applies to the areas of direct location of wind turbines, assembly sites and power energy station and access roads). Intended use of class III agricultural soils of dense area exceeding 0.5 ha for non-agricultural purposes will require a consent of the Minister of Agriculture and Rural Development. No need for changing the use of forest areas for non-forest purposes will occur.

8.4. Impacts related to the potential environmental pollution

With a view to environmental pollution, the planned investment will cause noise emission (long-term impact, permanent at windy weather conditions) and infrasound and will be the source of waste production.

There is no risk of exceeding the permissible noise levels in areas of current settlement development, multi- and single-family development and residential and service areas. The planned wind farm can operate without any restrictions at full sound power at day and at night.

This projection should be verified on the basis of actual status, which will be stated on the basis of the measurements performed under the post-implementation noise monitoring (see Section 13).

Emission of excessive electromagnetic radiation by the transformer station will be limited to fenced area of the station.

Infrasound emission by the modern wind farms is insignificant and poses no adverse impact on humans.

Waste will be produced at the construction, exploitation and decommissioning stage of the investment. At the construction stage, these will include mostly soil and ground waste and in lesser degree construction material waste, whereas at the exploitation stage hazardous waste (requiring special treatment) can be produced and at the decommissioning stage - primarily construction material waste. Rules for waste handling are regulated by the Act on Waste (Journal of Laws of 2001 No. 62, item 628 as amended) and implementing legislation thereto.

8.5. Limited use areas

The planned Wieliszewo wind farm does not belong to the investments for which the limited use area is established[8].

The adopted technical, technological and organisational solutions will ensure elimination of negative environmental impact, including on human living conditions. Areas within the acoustic impact range of the power plant will remain in current agricultural use.

8.6. Cross-border environmental impact

The Wieliszewo wind farm, due to the scale of investment and location in a distance of approximately 30 km + 12 sea miles from the border of Poland (territorial waters border on the Baltic Sea) will cause no cross-border environmental impact.

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[8] Pursuant to the Environmental Protection Law the limited use area is established for *"sewage treatment plants, municipal waste landfills, composting plants, transport route, airport, power lines and stations and radio communications station, radio-navigation and radio-location station"*.

8.7. Risk of severe failures

The Wieliszewo wind farm, due to no processing, production or storage of hazardous substances is not included into the plants of increased risk or high risk of severe industrial failures.

At the investment stage, the risk of failure may apply only to the potential disturbances in operation of the mechanical equipment used during the construction and assembly woks (e.g. leakage of petroleum products) and pose a threat to water and soil environment. Preventing such failures will be possible by:

- continuous monitoring of equipment used at the wind farm construction and assembly stage with a view to potential leakages and failures;
- carrying-out any potential repairs of mechanical equipment in adjusted sites;
- delivery of the investment by qualified and skilled construction workers.

The investment exploitation state will be associated with the potential theoretical failures consisting in collapsing or damaging the structure of power plant tower. Probability of such situation is very low. Continuous monitoring of operating parameters of individual turbines and of potential damages decreases the probability of such failure. Nevertheless, in the case of the potential occurrence of such failure, no risk to humans will take place due to significant distance from residential development (above 500 m).

8.8. Environmental impact classification

Classification of environmental impacts of the planned investments, including potentially significant impacts, pursuant to Art. 66 of the Act on Disclosure of Information on the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessments, dated 3 October 2008 (Journal of Laws of 2008 No. 199, item 1227 as amended) is provided in table 19.

Table 18 Classification of environmental impacts of the planned investment, including **potentially significant impacts**

Environmental impacts	Impact types			Impact duration			Impact mechanism		
	Direct	indirect	secondary	short-term	medium-term	long-term (25-30 years)	temporary	periodic	permanent
CONSTRUCTION STAGE									
Transformations of surface lithospheric layer (excavations),	X					X	X		
Liquidation of soil cover	X					X	X		
Liquidation of vegetation	X					X	X		
Impact on fauna	X	X		X				X	
Emission of pollution to atmosphere (vehicles and construction machinery)	X			X				X	
Noise emission (vehicles and construction machinery)	X			X				X	
Waste production (mainly soil from excavations)	X			X				X	
EXPLOITATION STAGE									
Reduced emission of pollution to atmosphere from conventional energy sources			**X**			**X**			**X**
Noise emission by turbines (the permissible levels will not be exceeded)	**X**					**X**		**X**	
Electromagnetic radiation emission by transformer station of the grid connection point	X					X			X
Infrasound emission by turbines	X					X		X	

Hazardous waste production	X					X		X	
Impact on avifauna	X	X				X		X	
Impact on chiropterofauna	X	X				X		X	
Landscape anthropization (assessment in terms of personal feelings)	**X**					**X**			**X**
Impact on environmental conditions of human comfort of life (accumulated impact effect)	X	X				X			X
LIQUIDATION STAGE									
Emission of pollution to atmosphere (vehicles and demolition machinery)	X			X				X	
Noise emission (vehicles and demolition machinery)	X			X				X	
Construction material waste production	**X**			**X**				**X**	

Source: own study.

8.9. Cumulative impact assessment

8.9.1. Cumulative effect of environmental impacts of the Wieliszewo wind farm

The planned Wieliszewo wind farm will contribute to increased share of environment-friendly energy sources in the energy production balance. Environment-friendliness of wind farms consists in use by them of renewable energy sources and no energy emissions of particulate matter and gases to the environment. The wind farm causes however environmental impact, in particular in the scope its physical condition (sozologic issues), nature functioning (ecological issues) and landscape physiognomy (aesthetic issues).

Sozologic issues with a view to wind farm cover primarily noise emission (energy impact). Provided that the parameters specified in this report are met, the Wieliszewo wind farm will cause no excessive impact, harmful to humans, in this scope. At the exploitation stage, no material environmental impact will be caused by the turbines (emission of solid, liquid and gas waste) and avoidance of additional emission of gas and particulate matter pollution to air from conventional power industry will be possible. Wind turbines replace the conventional power industry based on coal, oil or gas combustion, or limit its development. Therefore they have ad-hoc or final impact on reducing the emission of combustion products to air, that is primarily of CO_2, SO_2, NO_x and particulate matter. This has a positive impact on atmospheric pollution state and should contribute to reducing the results of greenhouse effect - climatic and derived. The Wieliszewo wind farm will have its part in this process. Cumulative effect of wind farm environmental impact can be considered - in terms of sozology - as positive.

Construction and exploitation of the Wieliszewo wind farm will cause indirect and direct impact on the ecosystems, including:

1) liquidation of natural habitats at the construction stage (assembly yards, power plant foundations, access and assembly roads) - this will apply only to agricultural ecosystems of low environmental value;
2) liquidation of vegetation at the construction stage - this will apply only to agrocenoses and ruderal vegetation of low environmental value;
3) transformation of habitats at the exploitation stage (noise impact) - low importance due to limited spatial range of impact, nature of habitats (arable lands) and adaptation capacity of biotic environment,
4) potential impact on flying animals, primarily birds and bats - as demonstrated in Section 6.2.3., the risk of negative impact is low.

Cumulative effect of the planned Wieliszewo wind farm on ecosystems was assessed as potentially low.

As already stated (Section 6.2.8.), aesthetic assessments of wind farms are subjective, dependent on individual feelings and inclinations and in effect extremely differentiated - from negative due to the nature of large technical structures, forming a foreign component in landscape, to positive, reflecting their sophisticated, simple and state-of-the art form. The Wieliszewo wind farm will cause transformation of the cultural and agricultural landscape in local and sub-regional scale. The range of significant and permanent landscape impact of the Wieliszewo wind farm will cover primarily the inhabitants of villages located in direct vicinity of the investment area i.e.: Nowa Dąbrowa and Wieliszewo.

As already mentioned (Section 6.2.10.), operation of the Wieliszewo wind farm can cause cumulative impact on comfort of human life. The feeling of deteriorated living conditions may result from no acceptance for change of living environment (for the most landscape changes) and subjective fears that the environmental protection standards in the scope of noise, infrasound and electromagnetic radiation are not kept.

In general assessment, cumulative impact of the Wieliszewo wind farm will on one hand, at the side of positive impacts, cause reduced emission of pollution to air, and on the other hand will have differentiated environmental impact, in particular on landscape changes. It should be emphasized that landscape impact will be periodic (approximately 25-30 years) - after decommissioning of wind farm, the landscape will be restored to the near-current condition.

8.9.2. Cumulative environmental impact assessment of the Wieliszewo wind farm and wind farms in its vicinity and the high-voltage line

In the neighbouring communes, investment processes and planning procedures are carried out (of different progresses), aimed at locating other wind farms in this area.

According to information obtained by the authors of the report, the following wind farm locations are planned (Fig. 8):

- in the Potęgowo commune – at a distance of approximately 12 km to the east of the Wieliszewo wind farm, there is a wind farm in the geodetic precinct of Potęgowo. In addition, the construction of the Głuszynko-Grapice wind farm is planned (22 turbines) at a distance of approximately 11 km; for the Głuszynko-Grapice wind farm the “Local zoning plan for the Głuszynko and Grapice wind farm in the Potęgowo commune” was adopted under Resolution of the Potęgowo Commune Council No. XXXIV/242/2009 of 31 August 2009 and the “Environmental impact report for the Głuszynko, Grapice wind farm” was prepared (February 2011).
- In the Główczyce commune, the construction of two wind farms is planned: Drzeżewo I and Drzeżewo III.

  For the Drzeżewo I wind farm (11 turbines) located at a distance of approximately 12 km from the Wieliszewo wind farm the “Local zoning plan for the Główczyce commune in geodesic precincts of Drzeżewo-Lipno, Żoruchowo, Zgojewo, Żelkowo, Przebędowo” was adopted under Resolution of the Główczyce Commune Council No. 58/91/03 of 30 October 2003 and the “Environmental impact report for the Drzeżewo I wind farm” was prepared (February 2011).

  For the Drzeżewo III wind farm (14 turbines) located at a distance of approximately 18.5 km from the Wieliszewo wind farm the “Local zoning plan for the Główczyce commune in the geodesic precincts of Wykosowo” was adopted under Resolution of the Główczyce Commune Council No. 59/92/03 of 30 October 2003 and the “Environmental impact report for the Drzeżewo III wind farm” was prepared (February 2011).
- in the Damnica commune – one wind farm composed of up to 13 turbines is planned at the distance of approximately 9.5 km, in the geodetic precincts of Bięcino and Karżniczka. (the project was included in the local zoning plan and an environmental permit was obtained for it);
- in the Smołdzino commune – the construction of wind turbines is planned at a distance of approximately 20 km to the north in two geodetic precincts in the villages of Siecie,

Wierzchocino and Witkowo. For the purpose of the project, an amendment to the local zoning plan is planned to enable its implementation;

- in the Dębnica Kaszubska commune - pursuant to the "Study on the spatial development conditions and directions of the Dębnica Kaszubska commune" (2010), wind farms in the following geodetic precincts are planned: Skorszów Górny, Starnice, Łabiszewo, Dobieszewo, Dobra, Kotowo, Ochodza, Budowo and Jawory. The closest area designated in the Study is the Łabiszewo geodetic precinct, which is located about 1.5 km away from the Wieliszewo wind farm. At this stage only a draft of a local zoning plan for the Skorszów Górny geodetic precinct has been prepared, but it has not been adopted yet;
- Kobylnica commune – there is one wind farm (24 turbines) at least approximately 19.5 km from the nearest planned turbine of the Wieliszewo wind farm; it is located within the geodetic precincts of Zajączkowo, Łosino, Widzino, Kończewo, and Sierakowo. In addition, in the commune a permit was obtained for the construction a second wind farm (18 turbines) covering the Kłakowo and Płaszewo geodetic precincts.

Cumulative environmental impact of the turbines at the stage of implementation will be as follows:

1. Cumulative impact on landscape – turbines included in the closest wind farms in the Potęgowo, Dębnica Kaszubska and Główczyce communes, will create a sequence of anthropogenic landscape transformations as viewed by persons travelling along transport routes, which mainly applies to national road No. 6 Kołbaskowo-Łęgowo and county road No. 211 Żukowo-Nowa Dąbrowa;
2. The wind farms will be seen at the same time only to a limited extent, mainly due to raised land and forests that obscure the view;
3. Impact on fauna, in particular avifauna, can cover reduced attractiveness of the location of wind farm as feeding sites and potential impact as obstacles in bird migration (barrier effect).
4. Implementation of the Wieliszewo wind farm in cumulative impact with the other planned wind farms will not affect the Natura 2000 sites, including no infringement of the network integrity or disintegration of individual areas – all planned wind turbines are to be located outside the Natura 2000 site borders.
5. Cumulative impact on acoustic environment may occur only in local scale in the case of direct vicinity of the farms. In the case of the Wieliszewo wind farm, the minimum distance from an existing wind farm (in the geodetic precinct of Potęgowo) is approximately 9.6 km, and from the planned wind farms (in the geodetic precinct of Łabiszewo in Dębnica Kaszubska commune) – approximately 1.5 km.

At present (March 2011), it is not possible to predict the cumulative effect of the planned Wieliszewo wind farm with the planned wind farm in the geodetic precinct of Łabiszewo because the final locations and parameters of the wind farms in this area are not known (no local zoning plan has been adopted and no environmental permit has been issued).

The most important cumulative effect of environmental impact of wind farms will be their impact on landscape, that will result in change of the landscape features of the region. Dominating cultural agricultural landscape (arable and settlement) will be replaced with cultural agricultural and infrastructural (industrial landscape) with specific physiognomic dominant in a the form of wind power plant structures, perceived in large

complexes, individually from various distances, in favourable weather conditions even up to approximately 20 km.

Landscape impact will be of periodic nature (approximately 25-30 years) and will secure this area against excessive settlement investment pressure permanently devaluating the landscape.

8.10. Description of the projection methods

Environmental impact assessment of the planned investment was performed in three stages.

Stage 1

Search of archive materials, field eco-physiological and landscape inspection, annual ornithological and chiropterological monitoring of the location of the planned investment and its surroundings.

Stage 2

Performance with the expert method of specialist environmental impact assessments of the planned investment in the scope of impact on noise, electromagnetic radiation, landscape and avifauna and chiropterofauna or in the scope of key impacts associated with operation of wind farms.

Stage 3

Comprehensive environmental impact assessment, with consideration to direct and indirect impacts, secondary, cumulative, short-, medium- and long-term as well as permanent and temporary impacts.

When projecting environmental changes caused by the planned investment, the following methods were applied:

- inductive and descriptive (from detailed analysis to general synthesis);
- environmental analogy (on the basis of assumption on the stability of the laws of nature);
- mathematical modelling (noise);
- diagnosis of environmental condition on the basis of field mapping as the baseline for future extrapolation;
- cartographic analyses (Fig. 1-8 and Cartographic Appendix 1, 2 and 3);
- photo visualisation (landscape).

These methods are described among others in the works of Przewoźniak (1987, 1995, 1997) and in the "Problemy Ocen Środowiskowych” (Aspects of Environmental Assessments) (No. 1–48).

9. PROPOSED ACTIONS AIMED AT PREVENTING OR MITIGATING ADVERSE ENVIRONMENTAL IMPACT AND ENVIRONMENTAL COMPENSATION

Preventing and mitigating the potential negative environmental impacts of the planned Wieliszewo wind farm can be theoretically achieved by the following:

1) applying environment-friendly technologies of construction works;
2) selection of technical parameters of the planned turbines mitigating their environmental impact;
3) mitigation of the potential impact on birds;
4) mitigation of the potential impact on bats;
5) development of scenarios for wind farm location;

Ad 1)

Mitigating the environmental impact of the Wieliszewo wind farm at the construction stage can be achieved by:

- adequate storage of removed soil layer for re-use in order to restore the initial state upon completion of the construction works;
- performance of excavation for the 110 kV cable line in forest areas in road strips and through areas used for agricultural purposes without affecting watercourses in adjacent areas;
- in the case of excavation for the 110 kV cable line near trees, the works should be performed manually so as not to damage the roots;
- disposal of output from the excavations for foundations and transport of construction materials and elements of the turbines should be carried out with circumvention of developed rural areas and, if possible, outside night hours (10 PM - 6 AM);
- utilisation of output from excavations for foundations of the power plant to reclaim post-exploitation pits and other degraded areas in the Potęgowo commune;
- installation of the HV 110 kV cable line on sections crossing watercourses and hardened roads with the use of the directional drilling method;
- upon completion of the construction and assembly works, restoration of the area to the original state.

Ad 2)

Mitigating the environmental impact of the Wieliszewo wind farm in the area of its location by selection of power plant parameters, can be achieved by:

- constructing the similar type of wind turbines to limit the impact of the complex and limit its landscape impact;
- placing no advertisements on the structure of turbines to reduce their landscape impact (excluding the investor or turbine producer logos);
- using for painting of the structure of turbines of matt white to light grey colours in the upper parts of the structure (this colour causes the best effect of camouflaging

the turbines in the landscape in particular during cloudy weather) and possibly the green shades at the foot of the tower (this procedure will reduce contrast of power plant against the vegetation);

- application of paints eliminating the visual stroboscopic effect;
- constructing the turbines of uniform height in order to reduce the area of potential contacts with flying animals;
- reducing acoustic power of individual turbines to limit their impact on the acoustic environment, only where excess noise levels are identified – in accordance with the acoustic analysis (see Section 6.2.5.) all wind turbines can operate at full acoustic power both during the day and at night.

Ad. 3)

According to the recommendations of the ornithological monitoring (Antczak 2010 – **Appendix 3**) the following measures should be taken:

- *leaving the entire sector 6 free from turbines and not locating any wind farm there in the future due to the presence of roosting and feeding ground of crane (up to 235 individuals) and regularly used feeding ground of golden plover (up to 1,500 individuals). Moreover, as there are cranes and ducks in the area, it also periodically attracts white-tailed eagles.*
- *not to allow growing corn within the area of the wind farm. This crop is preferred and actively sought by cranes and geese. Corn may only be grown in sector 6, which may further stop birds from flying away from the roosting ground.*
- *when planning access roads and other infrastructure, field water reservoirs (especially the pond in sector 4), trees and shrubs should be avoided. Construction works should be conducted so as to prevent draining of water reservoirs. Such measures will preserve local water resources and provide a resting place for migrating ducks. In addition, all field ponds constitute field enclaves used as breeding grounds of small passerine birds, including the endangered red-backed shrike. During migration periods, such areas provide resting places for small passerine birds.*
- *individual towers should be moved away from the forest boundary by at least 200 m (Gromadzki Przewoźniak 2002). On the one hand, such measure minimises the possible effect of deterring the species nesting in the ecotone area (in this location, this applies mainly to woodlark nesting on the forest edge), but on the other hand, a sufficient distance of the turbines from the wall of the forest makes it possible for the birds of prey flying out of the forest to correct their flight route to the feeding grounds.*

Ad. 4)

Pursuant to the guidelines drawn-up and published in December 2009 by the Association for Bats Protection (PON) and recommended for use among others by the National Nature Conservation Council, it is recommended to:

1. Do not use artificial lighting of the investment area e.g. lanterns, illumination of turbines and masts (excluding the lighting required by the other provisions of law) - such lights attract the insects ensuring easy feeding site for bats.
2. Do to plant forest on agricultural areas within the planned investment and do not introduce trees and shrubs, in particular of continuous nature (e.g. road tree lanes)

that might become the new migration routes and ecological corridors used by the bats.

3. It is recommended to prevent growing of tree stands and shrubs (e.g. in effect of natural dispersion) in particular of continuous nature (as above) on the lands leased by the investor, including near access roads to the wind turbines.

Water reservoirs should not be created.

In accordance with the chiropterological survey (Kościów 2010 – **Appendix 4**):
It is recommended that post-implementation monitoring be performed in one year, two years and threes year after the date of commissioning of the wind farm.

Ad. 5)

At the design stage of the planned investment, the scenario differing with number and distribution of the planned turbines, and the type of the used turbines, was considered (see Section 2.2.).

The scenario selected for implementation (up to 17 turbines) was prepared on the basis of the following assumptions:

- maintenance of relevant turbine distances from the residential housing - ensuring compliance with permissible noise standards for residential housing;
- wind turbines should be located in accordance with the results of the ornithological and chiropterological survey (Antczak, Kościów 2010 –**Appendix 4**);
- exclusion of environmentally valuable areas from turbine location and keeping safe distances from them.

As presented in the Report, the Wieliszewo wind farm will cause no significant impact on forms of nature protection, including the Natura 2000 sites. With regard to the above, there is no need to take the actions in the field of environmental compensation in the meaning of the Nature Conservation Act (consolidated text in Journal of Laws of 2009, no. 151, item 1220 as amended).

10. ANALYSIS OF POSSIBLE SOCIAL CONFLICTS ASSOCIATED WITH THE PLANNED INVESTMENT AND CURRENT PUBLIC CONSULTATIONS RELATED TO THE PROJECT

The designed Wieliszewo wind farm with associated infrastructure is to be constructed:

- at a distance of approximately 2.2 km from: the Natura 2000 site of Community importance – Dolina Łupawy PLH220036, some 7.2 km from the Natura 2000 site of special birds protection – Dolina Słupi PLB220002, and about 7.5 km to the west from the Dolina Słupi Landscape Park (and approximately 80 m to the south of its buffer zone);
- at a distance of 77 m from the nearest ecological site with respect to the planned 110 kV power cable line;
- at a distance of several hundred metres from the villages of Nowa Dąbrowa and Wieliszewo and further: Stara Dąbrowa, Malczkowo, Karżnica, Domaradz and Łabiszewo;

Following these conditions, with regard to the planned construction of the Wieliszewo wind farm, the following social conflicts may arise due to:

1) protest of ecologists and environmentalists[9] against the location of the wind farm near the nature and landscape protection forms,
2) protests of inhabitants of the surrounding villages, from among of whose some people may protest in fear of deterioration of their living conditions, including against:
   - excessive noise, infrasound and electromagnetic radiation;
   - deterioration of landscape values of the surrounding areas and optic effects;

   and with regard to limited right to dispose their land properties.

Ad. 1)

A protest against the location of the Wieliszewo wind farm at a distance of 2.2 km from the Natura 2000 site of Community importance – Dolina Łupawy PLH220036 may concern primarily landscape anthropisation, however, landscape is not the object of protection in Natura 2000 sites, thus such a protest would have no formal and legal grounds.

Protest against the location of the Wieliszewo wind farm near other territorial forms of nature conservation, including the Dolina Słupi Landscape Park, can be mainly related to anthropisation of landscape of these areas.

Wind turbines will be hardly or not at all visible from fragments of the Dolina Słupi Landscape Park (7.5 km to the west) and from other forms of nature protection and will

[9] Ecologist is the representative of biological science discipline, subject-matter of which are the studies of interrelations and associations between the organisms or their populations and their environments. Pseudo-ecologist is a representative of any other profession, preaching (from different reasons) and in rare cases implementing the pro-ecological beliefs.

not violate any regulations applicable within their boundaries. Impact of wind turbines on landscape of these areas will be negligent (see Section 6.2.8.).

The 110 kV power line will be installed along a route outside the established forms of nature protection. An ecological site is located at least some 77 m from the route of the planned power line. The route of the cable line will closely follow the existing roads and will run in such a way as not to affect the watercourses in the adjacent areas. Therefore, the installation of the cable line will not pose any threat to the ecosystems protected within the ecological ecosystems.

Ad. 2)

There are no objective health prerequisites for occurrence of social conflicts in fear of excessive noise, in the aspects of the permissible noise level standards in force. There are also no objective health prerequisites for occurrence of social conflicts in fear of infrasound (emission from technologically advanced turbines is very low).

The issue of impact of the planned power plant complex on landscape is presented in Section 6.2.8. Since landscape perception is always subjective and dependent on individual feelings, any potential protest in this area will be also subjective and therefore emotionally intensive. As already mentioned, aesthetic assessments of wind farms are extremely differentiated - from negative due to the nature of large technical structures, forming a foreign component in landscape, to positive, reflecting their sophisticated, simple and state-of-the art form.

As the practice demonstrates, the source of conflicts in the case of locations of the turbines are also of financial nature. These results for the most from the fear of drop of land prices. As demonstrated in Section 6.2.9, operation of the turbines will not affect agricultural activity, with regard to which the lands as arable lands will not lose its value.

Another source of conflicts is that the value of plots at which the wind farm will be location will increase due to revenues from land lease. This material gain will apply only to the owners of plots and not their neighbours (there are protests against so called "unfair" distribution of turbines).

Within the proceeding on environmental impact assessment on the planned investment related to issuing of the environmental permit and consent for implementation of the investment, ensuring social participation is required. The rules of social participation in the proceeding on the environmental impact assessment of the investment are laid down in the provisions of the Act on Disclosure of Information on the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessments, dated 3 October 2008 (Journal of Laws No. 199, item 1227 as amended).

11. PROPOSED MONITORING OF ENVIRONMENTAL IMPACT OF THE PLANNED INVESTMENT

The planned Wieliszewo wind farm, upon putting into exploitation, will require monitoring in the scope of:

1) environmental noise level measurements,
2) control of potential impact on bird behaviours and mortality;
3) control of potential impact on bats.

Ad. 1)

To assess acoustic environment changes in the area of the Wieliszewo wind farm, at least two measurement cycles of noise level in the environment should be performed.

The first measurement cycle should be performed upon obtaining a building permit, however before commencement of the construction works or upon implementation of the investment along with the second cycle, with non-operating turbines. These measurements will present the existing condition of acoustic environment and act as the reference point for assessing the changes occurring in effect of construction of the wind farm. Measurement points should be located near the edge residential buildings or homestead development of the nearest localities. Localisation of the points should be selected in a way to avoid impact of household noise from the development on the measured sound level.

The second measurement cycle should be performed upon construction and putting into exploitation of the planned wind farms in the same measurement points. These measurements should be performed in possibly the same conditions (time of the year, vegetation, temperature, wind power) comparing to the conditions of the first measurement cycle.

When any exceeding of the permissible noise level is stated, one should decrease the settings of the nearest turbines to the measurement points, in which the exceeding was stated and perform the control measurements.

Repeated control measurements may become necessary in the case of construction near the Wieliszewo wind farm of the other wind farms in distances that can affect cumulative formation of acoustic environment.

Ad. 2)

On the basis of annual pre-implementation monitoring (Antczak 2010 - **Appendix 3**), it was found that
(...) the planned wind farm will not have a significant adverse impact on avifauna.

Nonetheless, after the construction of the wind farm is completed, it will be advisable to conduct a post-implementation survey (in accordance with the PSEW Guidelines), which will enable verification of mortality and the remaining potential impacts of the wind farm on species using the analysed location.

Following the "Guidelines in the scope of impact assessment of wind turbines on birds) (2008, PSEW Szczecin), post-implementation ornithological monitoring of wind farm should cover an annual cycle and constitute the copy of pre-implementation studies and be repeated three times within 5 years upon putting the farm into operation, in the years selected by an expert - ornithologist (e.g. in years 1, 2, 3 or 1, 3, 5), due

to presence of time-delayed effects. It is recommended to perform impact assessments of farm on the use of airspace by birds in parallel to the studies of mortality due to collisions.

Baseline monitoring principles:

1. Duration: 3 years with consideration to all phenological periods.
2. Object of observations: (1) species composition and (2) abundance and for birds observed in flight also (3) flight height divided into 3 levels (up to lower level of rotor operation, rotor operation zone, above rotor at elevated height) and (4) direction of flight as well as mortality due to collision.
3. Scope of studies: modules 1-4 as above and additionally the mortality monitoring.

Ad. 3)

Pursuant to the "Temporary guidelines for wind farm impact on bats (version II, December 2009)" and the results of the chiropterological survey (Kościów 2010 – **Appendix 4**), it is necessary to perform at least three-year post-investment monitoring consisting in a survey of bat mortality and their activity near the towers at the height of the rotor axis, following the guidelines valid for the period of the farm operation.

12. LIST OF DIFFICULTIES RESULTING FROM TECHNOLOGICAL OR KNOWLEDGE GAPS AND IDENTIFIED AT THE REPORT PREPARATION STAGE

When preparing the "Environmental impact report for the Wieliszewo wind farm in the Potęgowo Commune (Słupsk County, Pomorskie Province)" no difficulties resulting from insufficient technique or knowledge gap, excluding gaps in knowledge on avifauna and bat fauna. In order to fill this gap, the following were performed:

- ornithological survey in the area of the Wieliszewo wind farm in the period from September 2009 to August 2010 (Antczak 2010);
- chiropterological survey in the period from 1 September 2009 to 1 September 2010 (Kościów 2010),

which are an integral part of this Report (**Appendix 3 and 4**).

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14. NON-TECHNICAL REPORT SUMMARY

1. LEGAL BASES AND SCOPE OF THE STUDY

This report concerns the environmental impact of the designed Wieliszewo wind farm in the Potęgowo commune, comprising 17 wind turbines with a maximum capacity of 3 MW each. The turbines will be located in the geodetic precinct of Wieliszewo, Karżnica, and Nowa Dąbrowa.

Moreover, the underground 110 kV power line, which is an integral part of the project, connecting Nowa Dąbrowa grid connection point with the Bięcino grid connection point, will be located in Nowa Dąbrowa in the Potęgowo commune, and Stara Dąbrowa, Domaradz, Damnica Leśnictwo, Zagórzyca, Karżniczka and Bięcino in the Damnica commune.

The Report was drawn-up pursuant to the Act on Disclosure of Information on the Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessments, dated 3 October 2008 (Journal of Laws of 2008 No. 199, item 1227 as amended) and Regulation of the Council of Ministers of 9 November 2010 on investments of potentially significant environmental impact (Journal of Laws No. 213, item 1397), as an appendix to the application for issuing an environmental permit.

2. DESCRIPTION OF THE PLANNED INVESTMENT

Planned investment – baseline scenario

The Wieliszewo wind farm will be composed of, in the baseline scenario selected for implementation, the following essential elements:

- the Wieliszewo wind farm comprising 17 wind turbines with a maximum capacity of 3 MW each;
- access roads;
- assembly yards;
- electricity infrastructure:
  - MV/110 kV substation (the Nowa Dąbrowa grid connection point);
  - MV cable lines together with a fibre optic cable (connecting the turbines with the grid connection point);
  - 110 kV cable line with a fibre optic cable (connecting the Nowa Dąbrowa grid connection point with the Bięcino grid connection point in the Damnica commune)

The individual wind turbines will meet the following parameters:

- maximum capacity of 3 MW (each),
- maximum total height with a blade extended at its highest point is 145 m above ground level, including the tower – 100 m, and with a rotor diameter of 90 m,
- maximum sound power at the level not exceeding the maximum permissible noise level as laid down in the environmental protection law, at the borderline of the residential housing areas or any other development intended for permanent

stay of inhabitants and at the borderline of such areas delineated in the local spatial development plans.

- steel tower structure - pipe and solid structure,

maximum sound power at the level not exceeding the maximum permissible noise level as laid down in the environmental protection law, at the borderline of the residential housing areas or any other development intended for permanent stay of inhabitants and at the borderline of such areas delineated in the local spatial development plans;

- marking of aviation obstacle (external ends of rotor blades painted in 5 stripes of equal width, perpendicular to the rotor axis and covering 1/3 of the rotor length – 3 red or orange stripes and 2 white);
- construction of power plant in a colour not contrasting with the environment (uniform colour palette of the whole wind power plant farm).
- prohibition of installing advertising billboards, excluding the signs (logos) of manufacturer or investor or equipment owner.

It is planned that each turbine will occupy an area of up to 1,200 m^2. Access roads with a width of up to 5 m will be led from the nearest hardened local, commune, county or provincial roads.

The area of the site intended for the location of the substation is approximately 0.9 ha. In addition, the investment will require temporary occupation of part of the areas intended for implementation of the investment (for the construction period). This will apply to assembly yards of the wind farm, routes of MV power cable lines etc. Upon completion of the construction stage within these areas, their function will be restored.

Investment scenarios and their assessment

Apart from the baseline scenario of the investment (presented above) the scenario of no delivery of the investment (zero scenario) and extended scenario were analysed:

1. The zero scenario would be the most advantageous for the environment of the investment area and its surroundings, however also unadvantageous in terms of global emission of energy pollutions to air and counteracting climate change (a conventional energy source would have to be built in the other location instead of a source of so called clean energy).
2. An alternative scenario assumed, inter alia, location of 28 wind turbines (in a different arrangement), which would require occupation of the new areas for investment purposes (including placement of additional wind turbines, their assembly years and construction of the new sections of access roads) and would cause higher noise emission, increased environmental impact and potentially higher impact on birds and bats. In addition, the overhead 110 kV power line considered in the alternative scenario would significantly impact the landscape within a few kilometres.
3. The scenario selected for implementation has been prepared taking into account recommendations included in the annual ornithological (Antczak 2010 – **Appendix 3**) and chiropterological (Kościów 2010 – **Appendix 4**) survey to minimise threats to birds and bats of the area and limit the acoustic nuisance in residential development areas. The scenario is the most beneficial to the environment.

Land use conditions at the investment construction and exploitation stages

Within the investment process, the need for temporary exclusion of the areas of location of the structures, adjoining assembly yards, temporary storage yards and areas of access roads (including the sections of the existing roads) and the cable line routes will occur.

Upon completion of the assembly works, the temporary storage yards around the wind farm and cable line routes will be reclaimed and restored to the agricultural use. Only the areas of placement of foundations of the power plant, assembly yards and their access roads will be excluded from agricultural use on permanent basis. Access roads will be made public.

The solutions protecting the environment in the project scenario selected for implementation - the most advantageous scenario for the environment

Wind turbines are a source of so called clean energy. Their use, thanks to replacing the conventional energy sources, contributes to reduced emission of CO_2, SO_2, NO_x and particulate matter to atmosphere, which brings advantageous environmental effects in local (reduced air pollution, better aero-sanitary conditions for human life) and global (reduced the climate and derivative effects of the greenhouse effect). The use of renewable energy sources complies with the sustainable development principles and is required by the international obligations of Poland, in particular these resulting from our membership in the European Union and accession to the Kyoto Protocol. At the same time, the wind farms are the investments that might have the potentially significant environmental impact, in particular in the field of noise emission, impact on birds and landscape.

At the design stage for the planned wind farm, the following environment protecting solutions were adopted:

- selection of a newer type of wind turbines, which guarantees reduced noise emissions thanks to low tip speed;
- location of wind turbines:
- in a distance from residential facilities enabling elimination of impact of excessive noise level emitted by wind turbines on humans;
- on agricultural lands with no significant environmental values, in line with the results of the ornithological and chiropterological survey;
- applying uniform and non-contrasting with the surroundings colour palette of the power plant structure in order to reduce impact on landscape,
- location of the MV/110 kV transformer station at the distance from developed areas (approximately 680 m) and surrounded by fencing marking the range of excessive electromagnetic radiation;
- use of underground MV cables between the individual turbines, which will contribute to mitigated landscape impact; underground laying of the cable lines will have no impact on the current use of the real estates, since the cable lines will be laid below the depth of use of arable fields for agricultural purposes; this will also mitigate the risk of bird collisions, for which power energy lines pose a threat,
- reception and utilisation of waste classified as hazardous waste (e.g. gear oils) by specialist services, in compliance with the conditions provided for in the Act on Waste,

- equipping the transformer station in oil sumps and systems of monitoring and separation of oil from storm waters in order to minimise the risk of leakage of transformer oil to the environment, as well as fire and oil leakage alarm system;
- use of an underground cable for the 110 kV power line, which will minimise its impact on the environment in terms of electromagnetic radiation, devaluation of the landscape and potential impact on flying animals;
- designation of the route of the 110 kV cable line mainly along commune roads;
- use of directional drilling in places where the 110 kV cable line passes under hardened roads and under the Charstnica watercourse not to affect the technical condition of roads and banks of the watercourse, which could change its hydrological regime;
- placement of turbines on cylindrical solid walls, which in contrary to the truss towers (or frame-strut towers) provide the birds with no nesting options and therefore do not attract them additionally in the vicinity of wind turbines;
- humic layers at the site will be removed, preserved and used after the completion of the work in areas intended for turfing or in the case of excavations for the cable line – they will be used for backfilling.

3. CHARACTERISTICS OF THE NATURAL ENVIRONMENT

In accordance with the classification of physical and geographical regions of Poland by Kondracki (1998), the area of the Wieliszewo wind farm site together with the auxiliary infrastructure and the 110 kV power line in the Potęgowo commune is located in the Damnicka Upland mesoregion, which is a part of the Koszalin coastal macroregion.

The location area of the investment is mostly situated within the plateau of the moraine upland.

Vegetation of the area has no specific features in terms of botany. It is represented primarily by agrocenoses of agricultural lands, meadows and pastures with numerous minor tree stands and shrubs patches and lanes. Larger complexes are found to the north, west and south.

Natural environment of the location of the Wieliszewo wind farm and its surroundings is largely anthropized, primarily in effect of dominating agricultural use of lands. The effect of this is for the most synanthropization of vegetation and impoverishment of ecological structure.

The areas of direct location of wind turbines (places of foundations), manoeuvre yards and planned access roads are located exclusively at agricultural lands (arable fields and grasslands). The route of the 110 kV power cable is locate mainly along existing roads and areas used for agricultural purposes.

In the period from the beginning of September 2009 until the end of August 2010, at the project site an ornithological survey was conducted (Antczak 2010), and in the period from 1 September 2009 to 1 September 2010 a chiropterological survey was carried out (Kościów 2010). The result of these studies was used in the Report.

During the studies, at the site of the designed wind farm and in its immediate vicinity the presence of a total of 101 bird species, vast majority of which is strictly protected

or partially protected, was identified[10]. Moreover, among the recorded species, 17 are listed in Annex I of the Birds Directive (Antczak 2010 – **Appendix 3**). Vast majority of the regularly recorded bird species included common and non-endangered birds. *The most frequently recorded species included: buzzard, ringdove, bunting, lark, raven, fieldfar, meadowlark, meadow pip, blackbird, crane and linnet (with attendance over 70%).*

During the chiropterological monitoring (Kościów 2010 – **Appendix 4**), no bats were found in the area of the planned investment, while in the areas directly adjacent to the project site only three species of bats were identified (common pipistrelle *Pipistrellus pipistrellus*, Nathusius's pipistrelle *Pipistrellus nathusii* and brown long-eared bat *Plecotus auritus*).

In Poland, all observed bat species are subject to strict protection (Regulation of the Minister of Environment of 28 September 2004 on the protected species of protected wild animals – Journal of Laws of 2004, No. 220, item 2237).

4. NATURE PROTECTION FORMS IN THE LOCATION OF THE INVESTMENT

The area of the Wieliszewo wind farm is located outside the spatial forms of nature conservation in the meaning of the Nature Conservation Act of 16 April 2004 (Journal of Laws No. 92, of 30 April 2004, item 880 as amended).

In the surroundings of the location of the investment, within a distance of up to approximately 20 km from the planned Wieliszewo wind farm and the 110 kV cable line, the following forms of nature protection are established (Fig. 5):

- **Słowiński Park Narodowy** (at a distance of approximately 13.5 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned wind turbine);
- **nature reserves**, including:
  - Źródliskowe **Torfowisko** (approximately 12 km to the south-west from the closest planned wind turbine and approximately 15 km from the planned 110 kV cable line);
  - **Grodzisko Runowo** (approximately 14.2 km to the east from the closest planned wind farm and approximately 16.7 km from the planned 110 kV cable line)
  - **Dolina Huczka** (approximately 15.6 km to the south from the closest planned wind farm and approximately 18 km from the planned 110 kV cable line);
  - **Łebskie Bagno** (approximately 19.6 km to the north-east from the closest planned wind turbine and more than 20 km from the planned 110 kV cable line);
  - **Jałowce** (approximately 14 km from the planned cable line and at least approximately 20 km to the north from the nearest planned location of a wind turbine**);**
- **Dolina Słupi Landscape Park and its buffer zone** – at a minimum distance of approximately 7.5 km to the west from the closest planned wind turbine (and approximately 80 m to the south in the case of the buffer zone) and approximately

[10] In Poland, practically all species are protected (Regulation of the Minister of Environment of 28 September 2004 on the protected species of protected wild animals - Journal of Laws of 2004, No. 220, item 2237).

10 km to the south-west from the planned 110 kV cable line (and approximately 2 km to the south in the case of the buffer zone)**;**

- **Fragment Pradoliny Łeby ze Wzgórzami Morenowymi na Południe od Lęborka (Fragment of the Łeba Marginal Stream Valley with the Moraine Hills South of Lębork) Landscape Protection Area** – at a minimum distance of approximately 14 km to the east from the closest planned wind turbine and at a distance of approximately 16.5 km to the east from the planned 110 kV cable line;
- **Pas Pobrzeża na Wschód od Ustki (Coastline East from Ustka) Landscape Protection Area** at a minimum distance of approximately 16.7 km to the north-west from the planned 110 kV cable line and at a distance of over 20 km to the north-west from the closest planned wind turbine
- **Natura 2000 sites**, including:
  - special bird protection areas:
    - **Dolina Słupi** (approximately 7.2 km to the west from the closest planned wind turbine and approximately 9.6 km from the planned 110 kV cable line);
    - **"Ostoja Słowińska** " (approximately 15 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned turbine);
  - Sites of Community Importance:
    - **"Dolina Łupawy"** (approximately 2.2 km to the north from the nearest planned location of a wind turbine and approximately 2.2 km to the east from the planned 110 kV cable line);
    - **"Ostoja Słowińska** " (approximately 15 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned turbine);
    - **"Łebskie Bagno"** (approximately 19.6 km to the north-east from the closest planned wind turbine and more than 20 km from the planned 110 kV cable line)
    - **"Bagna Izbickie"** (approximately 18.5 km to the north from the planned 110 kV cable line and more than 20 km from the closest planned wind turbine);
  - Shadow List 2010 Area[11] **Dolina rzeki Słupi** approximately 7.7 km to the south-west from the planned 110 kV cable line and approximately 7 km from the closest planned wind turbine);
- **natural monuments** – the nearest of which is located at a distance of approximately 880 m from the planned 110 kV cable line. In relation to the planned wind turbines, the closest monument is located at a distance of approximately 5.5 km from the planned wind turbine locations).
- **documentation sites** – the closest of which is located approximately 1.3 km to the east from the closest planned wind turbine and approximately 3.8 km from the planned 110 kV cable line.
- **ecological sites** – the closest of which are located approximately 77 km from the planned 110 kV cable line and at least approximately 3.1 km from the nearest planned location of wind turbines.

5. DESCRIPTION OF MONUMENTS PROTECTED UNDER THE REGULATIONS ON MONUMENT PROTECTION AND CARE AND ON THE PROTECTION OF

[11] Shadow List – a list of Natura 2000 sites submitted by NGOs.

THE OTHER CULTURAL HERITAGE IN THE LOCATION OF THE INVESTMENT

Within the location of the Wieliszewo wind farm there area no facilities listed to the register of monuments on the basis of the provisions on the protection and care of historic monuments as well as no objects of significant cultural values.

The closest object entered in the register of historic monuments of Pomorskie Province is a park in the Malczkowo village (Pomorskie Province reg. No. 1612 of 11 December 1996), located approximately 2 km to the east of the nearest planned wind turbine.

With respect to the planned 110 kV cable line, the nearest monument entered in the register of the Pomorskie Province (No. 341 of 28 April 1964) is the palace and park complex in the village of Karżniczka, located approximately 550 m away from the planned 110 kV cable line.

None of the planned locations of the wind turbines and their access roads poses a threat to this object.

Moreover, in the vicinity of the wind farm site there are zones of limited and partial conservation and archaeological protection. The closest one (limited conservation and archaeological protection) is approximately 19 m from the closest planned wind turbine.

In its area, development projects are permitted provided that the conditions specified in the “Local zoning plan for the Wieliszewo geodetic precinct” are met.

6. ENVIRONMENTAL IMPACT ASSESSMENT OF THE INVESTMENT SCENARIO SELECTED FOR IMPLEMENTATION

Construction stage

Impact of the planned turbines and associated infrastructure on abiotic environment will take place primarily at the investment stage lasting usually several months. This will result in significant surface transformations (land levelling for the new roads and locations of the turbines), vegetation will be liquidated (primarily agrocenoses and wasteland vegetation) and large volumes of waste will be produced (excavation debris) in the case of excavation to lay cable lines, all soil will be used to fill the excavations. Environmental nuisance will be related to vehicle traffic in terms of earthworks, transport of output and construction elements of the turbines.

Investment exploitation stage

Operation of the Wieliszewo wind farm will have negligible impact on water conditions and local climate conditions.

In accordance with the ornithological survey (Antczak 2010 – **Appendix 4**) *Taking into account all the recommendations, it was concluded that the planned wind farm will not have a significant adverse impact on avifauna.*

In view of the above, the site of the Wieliszewo wind farm in the Potęgowo commune may be considered potentially safe for birds.

According to the results of the chiropterological survey (Kościów 2010 – **Appendix 4**):

(...) it is estimated that the project consisting in the construction and operation of the Wieliszewo wind farm will not have a significant adverse impact on the populations

of bats identified in the area of Nowa Dąbrowa, Wieliszewo and the forest near Domaradz.

For the planned Wieliszewo wind farm in the Potęgowo commune, the acoustic analysis of the turbines operation was performed. According to the computations made, implementation of the analysed investment in its planned form is possible. The designed wind farm can operate without any restrictions during the day and at night.

The planned investment, including operation of the wind turbines will pose no risk to humans in terms of infrasound emission.

The planned investment will not act as a source of excessive emission of electromagnetic radiation.

According to landscape analysis, the planned array of 17 wind turbines (Wieliszewo wind farm) will be a new specific element of landscape anthropization in the Potęgowo commune: Its landscape exposure will take place from villages located in the vicinity of the project site, i.e.: Nowa Dąbrowa, Wieliszewo, Owczarnia, Stara Dąbrowa, and Malczkowo (from a distance of several hundred meters to over 1.5 km). From the transport routes in the area of the location of the investment, wind turbines will be visible mainly from state road No. 6 (from a distance of approximately 1 km) and from provincial road No. 211, which is a hardened road, and dirt roads crossing the area of the location and its surroundings.

The planned wind turbines will be visible from forms of nature protection, i.e. the Natura 2000 site of Community importance – Dolina Łupawy to the north-east, from a distance of approximately 2.2 km. Due to the distance, the turbines will be hardly or not at all visible from other forms of nature protection (including the Dolina Słupi Landscape Park) located in further surroundings;

In many of the above cases, visibility of the planned wind turbines will be limit or even eliminate road tree lanes, forest complexes and patches, tree stands, bushes and construction facilities.

Location of the wind farm planned for exploitation for 25-30 years (periodic landscape impact within the agricultural areas, will contribute to protection of landscape against introduction of permanent settlement type devaluating the investments);

Decommissioning of wind farm will cause restoration of landscape to the initial state (provided that the agricultural use will be continued).

Tangible assets in the area of the location of the planned investment are represented by the network of county and commune roads, private roads (mostly dirt roads), elements of technical infrastructure, and in the surroundings by rural development of diversified architectural nature and technical condition. When constructing the Wieliszewo wind farm, it will be necessary to reconstruct and modernise part of the commune roads and other local dirt roads and to construct the new assembly roads. This will improve the condition of road network within the location of the wind farm and its surroundings and contribute to the improved living conditions of the local community.

Apart from road infrastructure, the power plant construction will have no impact on any other tangible assets. In particular, the construction of the Wieliszewo wind farm will result in no adverse impact on investment of the village in the surrounding areas.

Trenches for the 110 kV cable line will be made along roads, in places where the line will be installed under hardened roads, a trenchless method will be used, which will not have an adverse impact on the condition of hardened roads.

Impact on tangible assets at the exploitation stage will refer to the scope of land use in the scope of excessive impact of wind farm on acoustic environment. The area of the turbines and their excessive noise impact is and will remain in agricultural use. The owners of these area will be unable to change the land use from agricultural to development lands associated with permanent stay of people (settlements, single family houses, etc.). Operation of the turbines will not affect agricultural activity, with regard to which the lands as arable lands will not lose its value. Value of plots of the power plant location will increase due to incomes from area lease (direct economic benefits). The local self-government of the Potęgowo commune will obtain indirect economic benefits due to an increase in property tax.

Investment decommissioning stage

At the decommissioning stage of the planned investment, the following environmental impact is expected:

- temporary emission of pollution to atmosphere and noise emission (vehicles and demolition machinery),
- construction material waste production (debris, scrap, etc.);
- production of other waste, including hazardous waste (e.g. consumed oils and greases);
- restoration of landscape to the pre-investment stage.

7. INVESTMENT IMPACT ASSESSMENT ON LEGAL FORMS OF NATURE CONSERVATION AND LANDSCAPE PROTECTION

Construction and operation of the Wieliszewo wind farm will cause no risk to the protected flora species (location in agricultural areas, where no vascular species covered with species protection were found) and fauna species, excluding potential risk to flying animals. According to the environmental monitoring, risk both for bats and birds is low. Impact on the protected species cannot be excluded, although of individual nature and posing no risk to the population.

Implementation of the project does not pose a threat to the protected values of nature reserves (including the closest nature reserve Źródliskowe Torfowisko located approximately 12 km to the south-west from the nearest planned wind turbine) and will not breach the provisions of the Nature Conservation Act (Journal of Laws of 2004, No. 92, item 880, as amended) applicable to nature reserves.

The passage of the cable line under the bed of the Charstnica watercourse will be carried out using the directional drilling method. This method is trenchless and minimises the impact on the structure of the river's bed and its hydrological regime.

Near the six ecological sites, the power line will be installed along the existing roads. Excavations made in the vicinity of ecological sites (bogs) will not disturb the ecological values of these areas. In conclusion, the impact of the planned 110 kV cable line on the forms of nature conservation will occur only at the stage of its construction and will not adversely affect the protected plant species and their habitats within such forms of nature conservation.

Implementation of the project will pose no risk of devaluation of the protected values of the Dolina Słupi Landscape Park (at a minimum distance from the closest project location area of approximately 7.5 km to the south-west). Due to the distance and presence of natural obstacles (tree stands, forest complexes, rural settlement and inclines), wind turbines will be hardly or will not be visible from the park area. The wind

farm will be also located outside the Park buffer zone (in a distance of more than 80 m from its border).

Implementation of the planned project will cause no deterioration of natural habitat status and flora and fauna status and have no adverse impact on the species, for the protection of which the Natura 2000 and Shadow List 2010 sites were established. In accordance with the ornithological survey (Antczak 2010), *Taking into account all the recommendations* (made in the ornithological survey)*, it was concluded that the planned wind farm will not have a significant adverse impact on avifauna.*

Construction and operation of the Wieliszewo wind farm will cause no disintegration of any of the Natura 2000 sites or impact on the integrity of the Natura 2000 sites (the turbines will be located outside the Natura 2000 and Shadow List 2010 sites).

To summarise, after taking into account the recommendations of the authors of the ornithological and chiropterological survey, the planned Wieliszewo wind farm will cause no significant impact on the Natura 2000 sites.

8. DIAGNOSIS OF POTENTIALLY SIGNIFICANT IMPACTS OF THE PLANNED INVESTMENT ON THE ENVIRONMENT, INCLUDING CROSS-BORDER IMPACTS AND DESCRIPTION OF THE APPLIED PROJECTION METHODS

At the construction stage of the planned investment, the following environmental impacts will occur: lithospheric surface layer transformation (excavations), liquidation of soil cover and of vegetation (applies to arable land, idle land and ruderal roadside vegetation), impact on fauna (frightening), emission of pollution to the atmosphere (vehicles and construction machinery), noise emission (vehicles and construction machinery) and waste production (primarily soil from excavation for wind turbine foundations). These will be insignificant and short-term impacts.

At the exploitation stage of the planned investment, the significant environmental impacts will include: reduction of pollution emission to atmosphere from the conventional energy sources, noise emission by the turbines and landscape anthropization (primarily direct and long-term impact). The remaining impacts include: potential impact on birds and bats, very low emission of ultrasounds by the turbines, negligible emission of electromagnetic radiation at the level not exceeding the permissible standards in publicly available sites, low optical effects (negligible stroboscopic and low shadow effect) and the potential individual impact on subjectively assessed environmental conditions of qualify of life of humans (cumulative impact effect). No negative impact on human health will take place.

At the decommissioning stage of the planned investment, the potentially significant environmental impacts will cover production of construction material waste (direct, short-term and periodic). The remaining environmental effect include emission of pollution to atmosphere and noise emission (vehicles and demolition machinery). The landscape will be restored to the pre-investment stage.

The Wieliszewo wind farm, due to the scale of investment and location in a distance of 30 km + 12 sea miles from the border of Poland (Polish territorial waters border on the Baltic Sea) will cause no cross-border environmental impact.

Investment work and planning procedures are carried out in the vicinity of the Wieliszewo wind farm aimed at locating of the other wind farms in this location. The most important cumulative effect of environmental impact of wind farms will be their impact on landscape, that will result in change of the landscape features of the region.

Dominating cultural agricultural landscape (arable and settlement) will be replaced with cultural agricultural and infrastructural (industrial landscape) with specific physiognomic dominant in a the form of wind power plant structures, perceived in large complexes, individually from various distances, in favourable weather conditions even up to approximately 20 km.

Landscape impact will be of periodic nature (approximately 25-30 years) and will secure this area against excessive settlement investment pressure permanently devaluating the landscape.

Impact on fauna, in particular avifauna, can cover reduced attractiveness of the location of wind farm as feeding sites and obstacles in bird migration in local scale.

Also, the designed wind farm and the existing and designed high voltage power lines located near the wind farm site will have no cumulative impact on avifauna.

At present, it is not possible to predict the cumulative effect of the planned Wieliszewo wind farm with the planned wind farm in the geodetic precinct of Łabiszewo because the final locations and parameters of the wind farms in this area are not known (no local zoning plan has been adopted and no environmental permit has been issued).

9. PROPOSED ACTIONS AIMED AT PREVENTING OR MITIGATING ADVERSE ENVIRONMENTAL IMPACT AND ENVIRONMENTAL COMPENSATION

Mitigating of the environmental impact of the planned Wieliszewo wind farm can be obtained by applying environmental-friendly technology of construction works, selection of technical parameters of the planned wind farms limiting their environmental impact and forming of natural environment of the location and its surroundings. Detailed solutions are presented in Section 10.

10. ANALYSIS OF POSSIBLE SOCIAL CONFLICTS ASSOCIATED WITH THE PLANNED INVESTMENT AND CURRENT PUBLIC CONSULTATIONS RELATED TO THE PROJECT

With regard to the planned construction of the Wieliszewo wind farm, the following social conflicts may arise:

- protest of ecologists and environmentalists against the location of the wind far at the distance of 2.2 km and more from territorial forms of nature protection, including landscape parks, protected landscape areas, Natura 2000 sites and Shadow List 2010 sites (special birds protection area and sites of Community importance);
- protest of inhabitants from the nearest localities may arise, from whose some may protest fearing noise, deterioration of landscape values of the surroundings and limiting the right to dispose their land properties.

These social conflicts could be of discussion or subjective nature (landscape impact) or would be deprived of content-related, legal and formal bases (impact on noise, nature conservation forms and land real-properties). Any potential protests will be strongly emotional with economic prerequisites.

Within the proceeding on environmental impact assessment on the planned investment related to issuing of the environmental permit and consent for implementation of the investment, ensuring social participation is required under the law.

12. PROPOSED MONITORING OF ENVIRONMENTAL IMPACT OF THE PLANNED INVESTMENT

The designed Wieliszewo wind farm, upon its putting into exploitation, will require monitoring in the scope of noise level measurement in the environment and control of the potential impact on behaviours and mortality of bats and birds.

List of figures

Fig. 1 Location of the planned Wieliszewo wind farm against administrative division (1:150,000)

Fig. 2a Location of the planned wind turbines in an alternative scenario

Fig. 2b Location of the planned wind turbines in the baseline scenario

Fig. 3 Location of the ornithological monitoring area against the background of the Wieliszewo wind farm

Fig. 4 Location of the chiropterological monitoring area against the background of the Wieliszewo wind farm

Fig. 5 Location of the area of the Wieliszewo wind farm against the nature protection forms (1:120,000)

Fig. 6 The Wieliszewo wind farm – view of the sound field, during the day and at night

Fig. 7 Planned wind farms near the designed Wieliszewo wind farm (1:100,000)

List of photos

Photo 1 Visualisation of the planned turbines, view from the area of Domaradz village to the south-east

Photo 2 Visualisation of the planned turbines, view from national road No. 6 in the area of Nowa Dąbrowa village to the south-east

Photo 3 Visualisation of the planned turbines, view from provincial road No. 211 in the area of Nowa Dąbrowa village to the west

Photo 4 Visualisation of the planned turbines, view from Wieliszewo village to the north

Photo 5 Visualisation of the planned turbines, view from the eastern part of Wieliszewo village to the north

Photo 6 Visualisation of the planned turbines, view from the local road Boguszce-Domaradz to the west

Photo 7 Visualisation of the planned turbines, view from provincial road No. 211 to the west

Photo 8 Visualisation of the planned turbines, view from the area of Karżnica village to the south-west