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PROJECT INFORMATION SHEET

Construction of a photovoltaic farm with a capacity of up to 5 MW together with the accompanying infrastructure on plots No. 11 and 9/30 in Strzałkowo, Stupsk municipality, Mława district, Mazowieckie voivodeship

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Table of contents

1. Type, scale and location of the project

The planned project will consist in the construction of a photovoltaic farm with a capacity of up to 5 MW together with the accompanying infrastructure on plots No. 11 and 9/30 in Strzałkowo, Stupsk municipality, Mława district, Mazowieckie voivodeship.

The project information sheet was prepared in order to obtain the decision on environmental conditions for the planned project under the Act of April 27, 2001 – Environmental Protection Law (consolidated text, Journal of Laws of 2020, item 1219, 1378) and Act of October 3, 2008 on providing access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments (consolidated text, Journal of Laws of 2020, item 283, 284, 322, 471, 1378).

In accordance with § 3 section 1 point 54 letter b of the Ordinance of the Council of Ministers of September 10, 2019 on projects that may have a significant impact on the environment (Journal of Laws of 2019, item 1839), the project in question constituting: "*industrial facilities, including photovoltaic systems or storage facilities with accompanying infrastructure, with development area not smaller than 1 ha in areas other than those mentioned in letter a*" is classified as a project likely to have a significant impact on the environment, for which the preparation of the environmental impact report may be required.

The project information sheet is an attachment to the application for issuing the decision on environmental conditions, pursuant to Article 74 section 1 point 2 of the Act of October 3, 2008 on providing access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments.

The area of the project in question is not covered by the local development plan. Pursuant to § 60 sections 1 and 2 of the Resolution No. XXXVIII/238/2018 of the Stupsk Municipal Council of April 10, 2018 on the adoption of an amendment to the local development plan for the Stupsk municipality, the study area is intended for a photovoltaic power plant area, where it is permissible to locate underground and overhead networks, equipment, technical infrastructure facilities and access roads and squares, related to the operation of the power plant.

1.1 Project location

The entire area of the described project is located on land belonging administratively to the Stupsk municipality. Fig. 1 shows the location of the Stupsk municipality on the map of the Mława district.

Fig. 1. Location of the Stupsk municipality in the Mława district

The project in question will be located in the Mazowieckie voivodeship, Mława district, Stupsk municipality, in the Strzałkowo cadastral district, on a part of plots with cadastral No. 11 and 9/30. The location of the planned project is shown in Fig. 2.

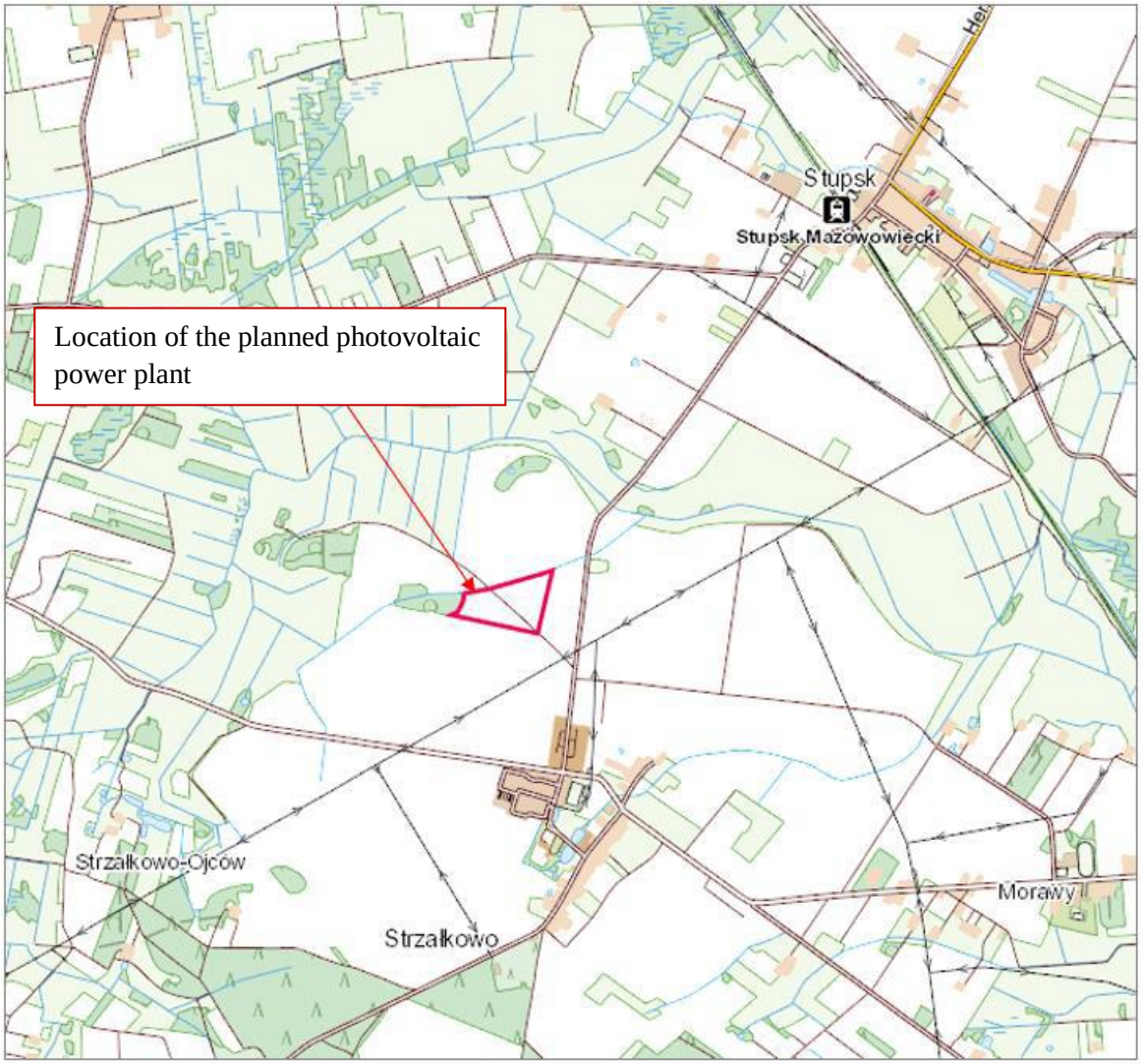

Fig. 2. Location of the planned photovoltaic power plant in Strzałkowo

At a distance of 100 m from the boundary of the planned project, there is deciduous forest plot No. 3078/4 and road lane plot of the local road marked with cadastral No. 10, Strzałkowo cadastral district.

1.2 Description of the planned project

The project in question consists in construction of a photovoltaic farm with a capacity of up to 5 MW. The capacity of a photovoltaic farm shall be interpreted as the maximum power generated by the electricity generating source to the distribution network or to the internal network. The project will be located on plots No. 11 and 9/30 in Strzałkowo, Stupsk municipality. The photovoltaic power plant will produce electricity and feed it into the power network. The project is currently at the planning stage, so the Investor has not yet chosen the

final technology to be used. For the purpose of the analysis, the optimum assumptions were adopted for this type of project, however, the final technology will be selected at the design stage. Currently, the Investor has not yet been issued the conditions for connection to the power operator network, so the connection point of the farm has not yet been determined. The project area will be fenced with an openwork fence up to 2.20 m high. The photovoltaic system will use up to 15,000 photovoltaic panels of up to 700 Wp each, installed on steel installation structures inclined at an angle of up to 30 degrees, driven into the ground. The individual panels will be connected to each other by solar cables forming sections. Each section will be connected to inverters using solar cables running in the installation structure. The height of the structure will not exceed 5.00 m. Within the project area, it is planned to build up to 5 transformer stations with the following max. dimensions: 7.00 m long, 5.00 m wide and 3.00 m high. The area of one transformer station will not exceed 35.00 m^2. The transformer stations will be equipped with transformers and power equipment. The surface around the transformer station (the so-called band) will be paved.

Access to the planned project will be provided along existing public roads. An internal road and a maneuvering area will be built in the farm area. The location of the planned photovoltaic power plant will not cause any change in the use of adjacent land, nor will it adversely affect the water circulation system.

2. Area of the property occupied

The photovoltaic power plant will be built on a part of plots No. 11 and 9/30. The area intended for the power plants covers the southern part of plot No. 11 and eastern part of plot No. 9/30, and occupies an area of approx. 5.58 ha, as specified in the local development plan for the Stupsk municipality adopted by Resolution No. XXXVIII/238/2018 of the Stupsk Municipal Council of April 10, 2018. According to this document, the area where the solar power plant is planned is intended for construction of a photovoltaic power plant together with underground and overhead networks, equipment, technical infrastructure facilities and access roads and squares, related to the operation of the power plant (area marked with 3EF symbol). The exact boundaries of the project area are shown in Figure 3.

Fig. 3. Planned area for the photovoltaic power plant

The planned project is located:

- in an area where environmental standards are not exceeded,
- outside the mining damage zone,
- outside the conservation protection zone and areas of historical or archaeological significance,
- outside the area of location of buildings listed in the register of historic monuments to be preserved,
- outside health resort and health resort protection areas.

3. Current use of the property occupied

Plots No. 11 and 9/30 are currently used primarily for agricultural purposes, which

illustrates the main business activities in the area. These areas are dominated mainly by class IIIa, IIIb, IVa, IVb, V and VI arable land. A smaller part of the area is occupied by class IV and V meadows and pastures as well as forest and water wastelands and land designated for roads.

Within plot No. 11, there are 4 drainage ditches with a width of 1 m each and with a total length of approx. 1,648 m, which are supplied by the Dunajczyk watercourse, located north of the plot. There are no buildings on the plot; it is entirely used for agricultural purposes, except for an area of approx. 1.2 ha, occupied by a forest wasteland, overgrown mainly by silver birch.

A medium voltage power line with a length of approx. 722 m runs through the south-eastern part of the plot.

Access to the plot is provided from a local road that crosses the project site. The road begins at the connection with sub-regional road No. 2349W, marked with cadastral No. 75. The route of the road begins in the south-east and runs north-westwards.

The area for the photovoltaic power plant includes the southern part of plot No. 11 and the eastern part of plot No. 9/30. The project will be built on class RIVb and RV agricultural land. As the planned project area is used for agricultural purposes, the main species are current annual grain crops. The planned project in no way contributes to the destruction or devastation of natural habitats or threat to protected species. The project does not require conversion of natural habitats, removal of trees and shrubs, or occupation of sensitive habitats that are potential habitats for protected species.

4. Condition of the natural environment

4.1 Topography

According to the Study of Conditions and Directions of Spatial Development of Stupsk Municipality of August 31, 2015, Strzałkowo is located in the North Mazovian Lowland, which is characterized by flat and undulating plains cut by river valleys, including the Wkra and the Narew river valleys. The land relief was shaped under the influence of the activity of the Central Poland ice sheet mainly in the Warta, Wkra and Mława stadials. In the area of the Stupsk municipality there are two geomorphological units: a moraine upland elevated up to 174 m a.s.l. and an outwash plain elevated 125–143 m a.s.l. The vast majority of the municipality's area, including Strzałkowo, lies on an outwash plain with a slope of less than 2% towards the river valleys. The topography is varied with river valleys, depressions, and closed depressions.

The southern part of the project site is slightly elevated to the north. After crossing the road

plot, the elevation decreases from 133.2 m a.s.l. to 130.2 m a.s.l. to the north. The elevation difference for this area is approx. 3 m. The land profile is shown in Figure No. 4.

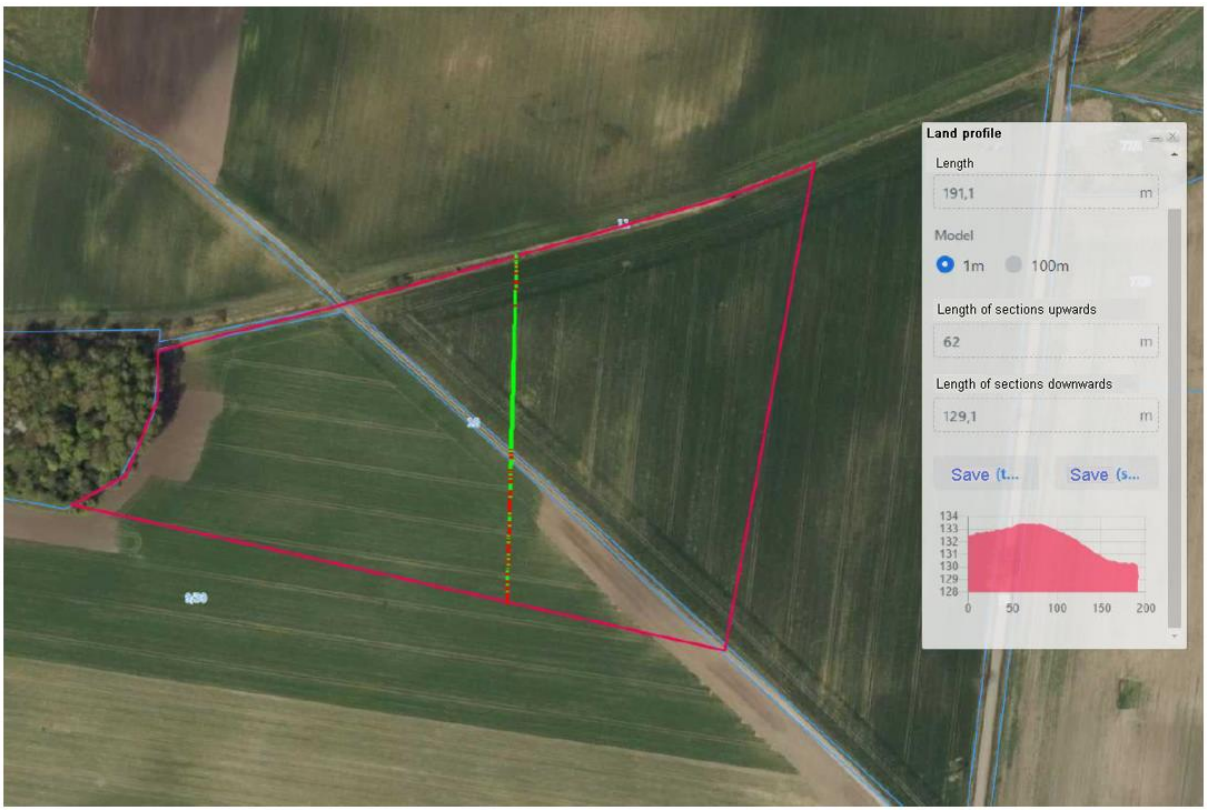

Fig. 4. Land profile of the project area for the photovoltaic farm

4.2 Geological conditions

The area of Strzałkowo is covered by various quaternary formations forming alternate layers of varying thickness and spatial distribution. Almost the entire surface of the project area is formed from glacial till (moraine and glacial deposits). The northwestern part of the area consists of sands and silts, locally gravels and kettle clays, formed from lacustrine and kettle deposits.

4.3 Soils

In the area of the planned project, the arable land is dominated by 6-weak-rye complex, where haplic and folic cambisoils formed on a substrate of slightly loamy and loose sands occur (Fig. 5). A small area is occupied by 5-good-rye complex, within which there are degraded black earths and gray soils on a substrate of slightly loamy and loose sands. The western part of the analyzed area is composed of weak and very weak grassland, where muck and mineral and mucky soils have developed on slightly loamy and loose sands.

Fig. 5. Soil and agriculture map

4.4 Water circulation system

Strzałkowo is located in the catchment basin of the Łydynia river, which is a left-bank tributary of the Wkra river. The total length of the catchment basin is approx. 72 km, and its area is nearly 698 km^2. Plot No. 11 is located in the vicinity of the Dunajczyk watercourse with a width of approx. 4 m, located to the north of the analyzed area. On the north, the project site borders on a drainage ditch with a width of approx. 1 m, which begins at the connection with the Dunajczyk watercourse.

As far as groundwater is concerned, Strzałkowo is characterized by a low usable value of this level's waters due to a considerable share of areas with poor aquifer insulation.

Major Groundwater Basins (MGBs)

The analyzed project is located outside the range of occurrence of the Major Groundwater Basin (Fig. 6). In the nearest area, there are two Major Groundwater Basins:
Upper Łydynia Basin – approx. 3.97 km away
Działdowo Basin – approx. 7.29 km away

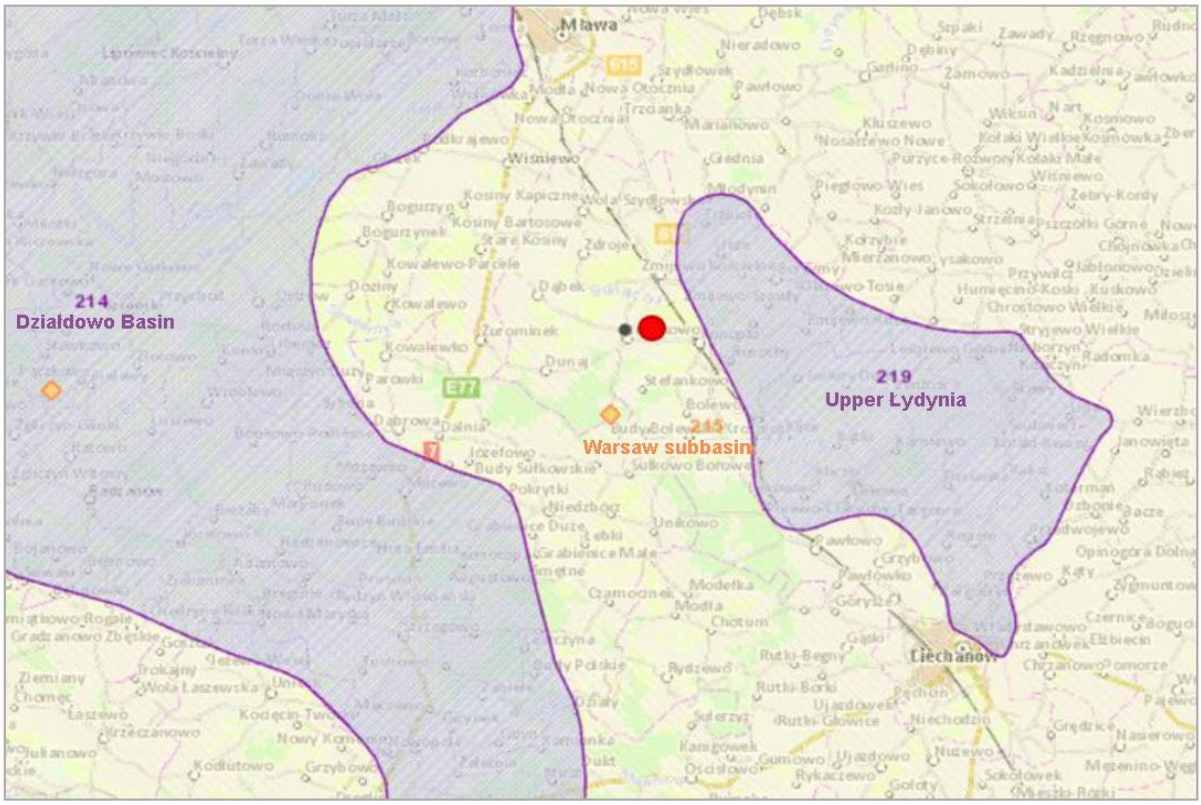

Fig. 6. Location of Strzałkowo in terms of the MGBs

Homogeneous Groundwater Bodies (HGBs)

The area in question is located within the range of the Homogeneous Groundwater Body PLGW200049 in the Vistula river basin, Middle Vistula water region. The HGB is characterized by good quantitative and qualitative status and good chemical status. Achievement of environmental objectives is not threatened. Figure 7 shows the location of Strzałkowo in terms of the HGBs.

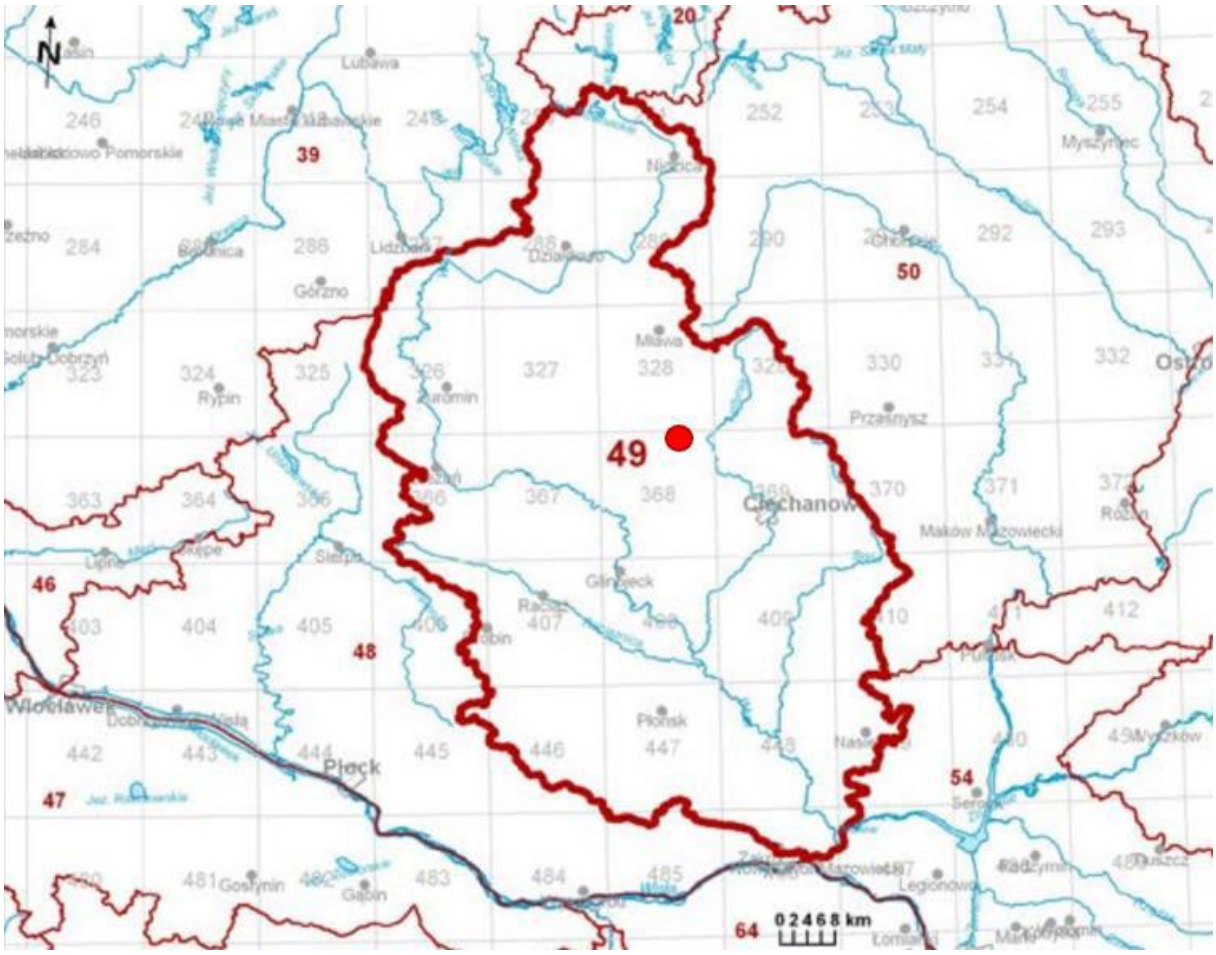

Fig. 7. Location of Strzałkowo in terms of the HGBs

Homogeneous Surface Water Bodies (HSWBs)

There are no Homogeneous Surface Water Bodies in close proximity to the planned project area. The closest, at a distance of approx. 320 m, is the Homogeneous Surface Water Body RW20001726866 Łydynia from the springs to Pławnica, which is characterized by good chemical and ecological status, but the achievement of environmental objectives in the case of this water body is threatened due to agricultural pressure (Fig. 8).

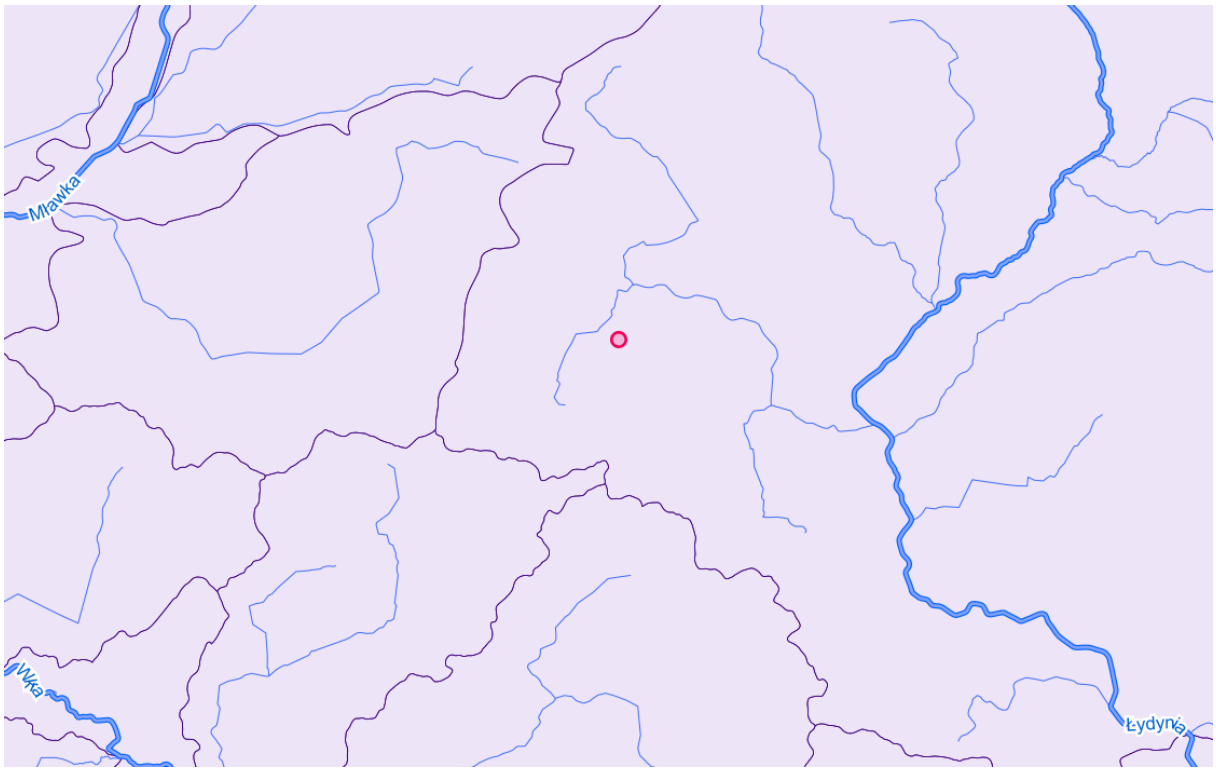

Fig. 8. Location of the project in terms of the HSWBs

Impact of the implementation of the project on the achievement of environmental objectives for the HGBs and HSWBs

As part of the execution of the photovoltaic farm, solutions will be taken to protect the condition of surface and groundwater against the negative impact of project implementation, among others:

- it is not expected to store any fuels or other substances on the project area that could adversely affect surface and groundwater,
- panels and inverters will be free of liquids that may adversely affect the aquatic environment,
- transformers will be placed in a prefabricated transformer station equipped with sealed oil bunds capable of holding 100% of the transformer oil,
- rainwater will naturally sink into the soil,
- the machinery, equipment and means of transport used during the construction and decommissioning phases of the installation shall be in good working order,
- no work will be conducted that could disturb the existing water circulation system.

According to Articles 56–60 of the Act of July 20, 2017 – Water Law (Journal of Laws of 2018, item 2268), the environmental objective for homogeneous surface water bodies not designated as artificial or heavily modified is to protect or improve their ecological status and

chemical status so as to achieve at least good ecological status and good chemical status of the surface water, and to prevent deterioration of their ecological status and chemical status. The environmental objectives for artificial and heavily modified homogeneous surface water bodies are to protect those water bodies and to improve their ecological potential and chemical status so as to achieve at least good ecological potential and good chemical status of surface water, and to prevent deterioration of their ecological potential and chemical status.

Achieving these objectives is accomplished through:

- gradual reduction of pollution caused by priority substances and substances particularly harmful to the aquatic environment,
- abandonment or gradual elimination of emissions of priority substances and substances particularly harmful to the aquatic environment to surface water.

The environmental objectives for homogeneous groundwater bodies are primarily to prevent or limit the introduction of pollutants into them, to prevent deterioration or improve their status, to protect these water bodies and take corrective actions, and to ensure a balance between intake and supply of those waters. The above objectives are realized by taking actions included in the water management plan for the specific river basin.

The implementation of the planned project will not pose a threat to the environmental objectives defined in the *Water Management Plan for the Vistula River Basin* and the environmental objectives defined in the Act of July 20, 2017 – *Water Law*. The construction of the photovoltaic power plant will contribute to the improvement of the groundwater condition by discontinuing the use of pesticides and fertilizers in the area.

Flood hazard

According to the information available in the IT System of the Country Protection of the National Water Management Authority, Polish Waters ("Wody Polskie"), the project area is located outside the areas of flood hazard and risk (Fig. 9). The nearest flood hazard area is approximately 5.02 km away. This is a particular flood hazard area of the Łydynia river.

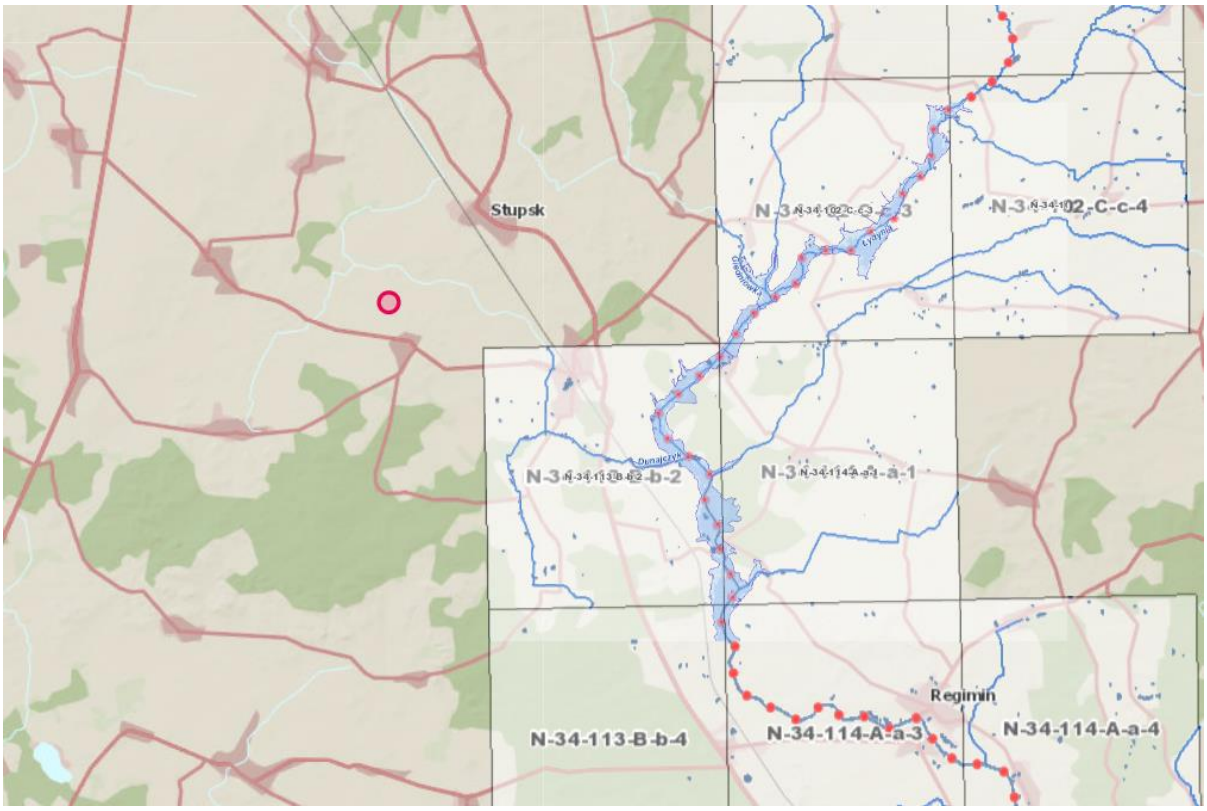

Fig. 9. Flood hazard map

4.5 Climatic conditions

The area of the Stupsk municipality belongs to the Mazowiecko-Podlaskie climatic region, characterized by a large variety of weather conditions, which is associated with the movement of atmospheric fronts and frequent variability of air masses. In the area of Stupsk municipality, areas covered by sandy formations located mainly in its northern part are characterized by good thermal conditions. These areas are sufficiently ventilated and feature groundwater occurrence below 2 m a.s.l. Strzałkowo is characterized by the best climatic conditions in the Stupsk municipality, as this area is covered by more compact formations, which are less exposed to air temperature fluctuations in the ground layer.

4.6 Vegetation

The vegetation of Strzałkowo municipality consists mainly of agrocenoses of arable lands and pastures, wastelands, uncontrolled greenery and greenery accompanying developed areas. Semi-natural meadow and swamp communities found along watercourses and in closed depressions, as well as mid-field clumps of shrubs and trees and avenues of roadside trees are an important variety for the natural environment. A small area of Strzałkowo, approx. 1.6%, is

covered by forests and wooded areas. The project area is devoid of any areas overgrown with trees and shrubs. To the east, the area where the photovoltaic farm is planned is directly adjacent to a moist mixed forest. The tree stand consists mainly of the silver birch, aspen, pedunculate oak and white willow, while the undergrowth layer includes the pedunculate oak, glossy buckthorn and white willow. A moist mixed forest of 0.98 ha is located approx. 460 m from the planned project. The tree layer is dominated by the Scots pine, pedunculate oak, trembling poplar, silver birch, northern red oak, and single sycamore maples and Norway maples. The undergrowth layer is overgrown with the trembling poplar and silver birch.

5. Technology type

Limited natural resources of fossil fuels and the continuing rise in their prices, as well as greater awareness of environmental issues, are driving growing interest in renewable energy sources. One of them is, in fact, the energy generated from the Sun. Interest in producing electricity from the Sun dates back to the 1950s. Since then, there has been a gradual development of works related to the application of this energy source. Over the past 10 years, solar power industry has become one of the fastest growing industries in the world. Converting solar energy into electricity is now being done with state-of-the-art technologies around the world. Reliability of photovoltaic cells and their long service life (even 30 years), as well as ease of use, low operating costs and environmental values make the use of this type of installation has become popular both among individual users and large companies.

The Sun provides more energy to the Earth in an hour than we consume in a year, so using the sunlight to generate electricity is considered the technology of the future. Sunlight reaching the Earth carries with it energy in the form of radiation quanta, i.e. photons. When a photon reaches an atom, it knocks an electron out of the valence shell, which creates an excess of electric current carriers inside the semiconductor. The conversion of solar energy in photovoltaic modules into electricity takes place without additional mechanical equipment. The operation of photovoltaic power plants requires the operation of cell control devices and voltage-to-current converters for synchronization with the power network. The operation of photovoltaic cells requires the use of inverters to convert the direct current to alternating current at the appropriate frequency. The electricity produced by the photovoltaic farm is supplied to the power network through a transformer station and a power connection. A photovoltaic farm operation diagram is shown in Figure 10.

Fig. 10. Photovoltaic farm operation diagram

The main material used for photovoltaic cells is silicon, as it is the most popular semiconductor material and has a high durability of crystal structures. The structure of a typical photovoltaic cell resembles that of a diode. Cells whose layers are made of the same material (a single crystal of silicon) are called monocrystalline cells. Cells built from multiple crystals of the same material are called polycrystalline cells with homojunction, whereas cells made from multiple crystals of different materials are called polycrystalline cells with heterojunction.

Due to the limited availability of silicon in the world and the increasing demand for it, thin-film module production technologies are also used, where the modules are constructed from amorphous silicon, indium-copper diselenide, and cadmium telluride. This technology is characterized by the construction of the entire module from a single cell and a strong reduction of the materials used in it. An example of a photovoltaic installation is shown in Figure 11.

Fig. 11. Example of a photovoltaic installation

Photovoltaic modules are mounted on free-standing structures (so-called tables) consisting of edge legs and a middle leg, driven into the ground to a depth of at least 1.5 m (the exact depth of leg-driving is determined after field pulling tests). The structure also consists of rafters, purlins and other elements not in contact with the soil, made of steel covered with a corrosion and weather resistant coating. The entire structure is bolted together using stainless steel components, and the modules are attached using mounting clamps. Figure 12 shows an example table structure for photovoltaic modules.

Fig. 12. Table structure for photovoltaic modules

The inverter is one of the most important components of a photovoltaic installation. The inverter works by converting the electricity generated by the photovoltaic panels (DC voltage) into electricity (AC frequency and amplitude). Photovoltaic panels are connected to each inverter in so-called strings. Each inverter operates independently of the others, which ensures high system efficiency in case of failure or ongoing maintenance repairs during power plant operation. Apart from the major function, which is the conversion of energy, the inverter has additional roles such as monitoring the operation of the photovoltaic installation, as well as synchronization with the network. An example inverter is shown in Figure 13.

Fig. 13. Inverter by Huawei

A transformer station is built of prefabricated elements. It is a small, one-story facility covered with a flat roof, permanently connected to the ground.

It consists of:

- MV switchgear,
- transformer in a transformer chamber suitable for operation with a photovoltaic installation,
- LV switchgear,
- cable basement, i.e. foundation of the station,
- equipment necessary for farm operation.

The station is equipped with a sealed bund capable of holding 100% of the transformer oil. In addition, the station is equipped with OH&S equipment and a hand-held fire extinguisher for extinguishing electrical and electronic devices. Figure 14 shows an example of a container transformer station.

Fig. 14. Example of a container transformer station by ZPUE S.A.

Supporting structures and other metal parts that do not conduct electricity, but which may present a shock hazard if voltage is applied to these parts, are subject to protective grounding. A flat bar will be laid along the load-bearing structures to which the mounting structures and all conductive components will be connected. The designed station has common grounding that fulfills the functions of working, protective and lightning protection grounding, which are connected to common grounding outside the station.

The designed cables will be laid in a cable trench at a depth of 70 cm for LV cables, on a sand layer at least 10 cm thick. The laid cables will be backfilled with a layer of sand at least 10 cm thick, followed by a layer of native soil at least 15 cm thick. The cable will be covered with blue plastic foil. The width of the foil will be chosen so that it covers the laid cable, but not less than 20 cm. The cables will be provided with permanent markings along their entire length at intervals of no more than 10 m and additionally at characteristic points.

The generated energy will be discharged into the distribution system operator network, and thanks to high quality materials used, the planned project will be characterized by high durability and safe operation of the system.

6. Possible Project Variants

According to *Energy Policy for Poland until 2030*, one of Poland's goals in the field of energy is to increase the share of renewable energy sources in final electricity consumption. This is to be achieved by actions such as supporting the development of technologies and the construction of new RES units and power grids to connect to. Therefore, it should be concluded that the planned project will contribute to the implementation of the plans set out by the Ministry of Economy concerning the Polish energy industry. The project will result in the sustainable development of RES, without negative impacts on agriculture, forestry or biodiversity. The implementation of this photovoltaic power plant will also have another positive effect, namely, the reduction of carbon dioxide emissions into the environment. However, given current environmental and legal conditions and constraints, it was necessary to develop possible project variants.

Variant 0 – variant in which the project is abandoned and the current use of the area intended for the project is continued by the cultivation of RIVb and RV agricultural land. Given the environmental (location on the soils of lower classes, outside the nature conservation sites) and administrative-formal (designation of the area for a photovoltaic farm in the local spatial development plan) conditions, it is assumed that this variant may be undertaken only if it problematic to connect to the power grid. Failure to implement the project may adversely affect Poland's commitments to achieve a share of RES in final electricity consumption of at least 21% in 2030. The development of solar energy as one of the renewable energy sources is necessary because:

- the location of our country creates favorable conditions for the production of clean solar energy and allows us to forgo conventional energy sources that emit huge amounts of pollution to the environment,
- the increasing demand for energy requires increased production and supply of electricity, primarily renewable energy,
- As a member of the European Union, Poland accepts and enforces the requirements and standards of the EU.

Variant I – alternative technical variant. This variant assumes rearranging the photovoltaic panels if more panels with less power are used. In that case, a more distributed infrastructure would take up more land for the installation and reduce the space to freely operate the PV farm. Given the environmental benefits of renewable energy sources, this variant is clearly less

favorable than the variant proposed for implementation both for the Investor and in terms of environmental benefits.

Variant II – variant proposed for implementation. This variant assumes the most rational development of a given space by installing the smallest possible number of panels of the highest possible power, but not exceeding 5 MW in total. With the optimal distribution of infrastructure, it will be possible to occupy and transform a slightly smaller area of land, which will benefit the environment.

Photovoltaic power plant is a kind of pro-environmental project contributing to the reduction of pollutants, emitted into the atmosphere during the operation of conventional power plants, mainly sulfur oxides, nitrogen oxides, carbon oxides, and particulate fractions. The construction of power plants generating energy from renewable sources is in accordance with the Polish Constitution's principle of sustainable development and the obligations required under membership in the European Union.

The proposed variant is the optimal solution from environmental, economic, and social perspectives. This option meets the conditions concerning the environmental conditions, and the range of impact of the project will be within the boundaries of the plot in question and will be limited to the area occupied by photovoltaic panels and accompanying infrastructure. During operation, the photovoltaic installation will not be a source of fumes, noise, radiation or other harmful emissions. At the end of the plant's operation, the materials from which the photovoltaic panels are constructed will be fully recycled. Trenches following the removal of cabling and concrete foundations will be immediately filled with natural soil. The area subject to the project will be restored to its original condition.

7. Expected amounts of water, raw materials, materials, fuels and energy to be consumed

7.1 Construction stage

The project will involve construction work consisting of:

- driving structural profiles,
- opening the cable trenches,
- the foundation of the transformer station,
- construction of internal road and maneuvering area,
- installation of the fencing,
- assembly of the skeleton of the photovoltaic panel supporting structure,

- laying of cables in trenches,
- backfilling the trenches.

The photovoltaic power plant project will use ready-made prefabricated elements, aggregate and installation elements – cables, connectors, panel mounting elements. During the works, it will be necessary to use specialized construction equipment for transportation of earth masses, ready-made prefabricated elements, carrying the waste off the site (by trucks), earthworks and works involving the transportation of construction materials on the construction site (excavator, bulldozer, mobile crane).

During the completion of the project, it is not planned to use more fuel volume than 500 dm^3. The fuel will be used by machines and equipment operating at the construction stage.

During the completion stage, the estimated electricity demand will amount to at most 100 kWh. It shall be intended for the power supply of power tools to be used during the installation of photovoltaic cells. The power generator set shall be used as a source of electricity. At the construction stage, the demand for gas and thermal energy is not expected.

7.2 Operation stage

During the operation of the photovoltaic farm, the amounts of raw materials used will be as follows:

- water – at the stage of power plant operation, no demand for water for process or staff purposes is expected; during periodic maintenance of photovoltaic panels the estimated use of water for cleaning the surface of panels will be about 500 m^3 per year and water for this purpose will be supplied from outside, e.g. by means of water trucks,
- thermal energy – not applicable,
- sanitary sewage disposal or treatment – not applicable,
- fuel for agricultural machines performing maintenance activities (grass mowing) – about 5 Mg,
- electricity for the operation of the photovoltaic power plant (for the so called auxiliaries: lighting, monitoring system) will be supplied from internally generated power. The auxiliary consumption is estimated at no more than 50 kW for the power plant, and during nighttime or winter the power will be supplied from the grid via a connection.

8. Environmental protection solutions

A photovoltaic power plant is an environmentally friendly project that produces electricity from a renewable energy source. It does not introduce any pollutants into the air or produce any waste, which makes it different from power plants that incinerate fossil fuels for energy. However, according to the Ordinance of the Council of Ministers of September 10, 2019 on projects that may have a significant impact on the environment (Journal of Laws 2019, item 1839), a photovoltaic farm with an area of more than 1 ha is classified as a project that may significantly affect the environment. Therefore, a number of actions have been taken to minimize the impacts that may be associated with the implementation of this project:

1) the trenches will be dug and routed in a manner that is safe for animals,
2) at the stage of earthworks, the excavations shall be inspected daily prior to the commencement of works, and the animals trapped in them shall be moved to a safe place.
3) all waste and contaminations will be removed from the trenches prior to backfilling them,
4) a fence will be installed in such a way as to allow free roaming of animals living in nearby areas,
5) grass will be mowed on dry and sunny days, from the center of the farm toward the edges to allow animals to escape,
6) no farm protection chemicals or artificial fertilizers will be used to cultivate the farm site,
7) all materials will be transported during daylight hours,
8) air pollutant emissions will be minimized through the cost-reasonable use of machinery and vehicles whose engines will be turned off during loading and unloading,
9) no waste is expected during the operation of the facility, however during the construction phase, gray and black water from the area of construction personnel amenities will be collected by a company that removes liquid wastewater,
10) waste generated during operation will be removed from the power plant site by maintenance service providers immediately after generation,
11) no waste or pollutants will be collected at the farm site,
12) the station will be equipped with an emergency sealed sump capable of holding 100% transformer oil.

9. Types and estimated amount of substances or energy released into the environment by using the solutions aimed to protect the environment

9.1 Construction stage

1) Grey and black water

Grey and black water generated during the construction phase will be collected by a liquid waste disposal company holding appropriate permits.

2) Process wastewater

Not applicable – no process wastewater will be generated during the construction of the power plant.

3) Emission of pollution into the air

Pollutants will be released into the air only as a result of fuel combustion by vehicles and machinery carrying out earthworks and transporting materials at the project site. However, this impact would be periodic and limited to the duration of the power plant construction. As a result of machine operation, the following substances will be released into the air: nitrogen oxides, carbon monoxide, sulfur dioxide, aliphatic hydrocarbons, aromatic hydrocarbons and suspended particulate matter. The quantities of these substances will not significantly impact the air quality, most of the assembly work will be done manually, construction machinery and vehicles will not be heavily loaded, and will be used mainly for loading, unloading and transporting materials. Upon completion of construction works, the sanitary condition of the air will become the same as before the construction.

4) Rain water

Rain water will be drained through the surface to green areas and its existing condition will not change.

5) Noise intensity

The intensity of noise associated with the construction works will be periodic and will not pose a nuisance for the residents of the vicinity as the nearest buildings are located at a distance of about 345 m from the project boundary. All materials will be transported to the construction

site (including but not limited to prefabricated components, photovoltaic panels) and will be installed at daytime.

9.2 Operation stage

1) Grey and black water

Not applicable – the power plant does not generate gray and black water.

2) Process wastewater

Not applicable – the power plant does not generate process wastewater.

3) Rain water

Rain water will be drained through the surface to green areas and its existing condition will not change.

4) Emission of pollution into the air

Not applicable – the power plant does not produce pollution.

5) Noise intensity

Not applicable – the power plant does not generate noise, so it does not exceed the allowable environmental noise level, which for these areas is 55 LaeqD during the day and 45 LaeqD during the night.

10. Possible cross-border environmental impact

There is no cross-border environmental impact of the project due to the installation of a photovoltaic power plant. The planned project will be carried out in its entirety on the territory of the Republic of Poland, in Mazowieckie Voivodeship, in Mławski Poviat, Stupsk Commune.

11. Areas protected under the Act on Nature Conservation of 16 April 2004 (Journal of Laws 2004 No. 92 item 880, as amended), located within the range of the project's significant impact

The planned project consisting in the construction of a photovoltaic farm on a part of plots No. 11 and 9/30 in Strzałkowo is located in an area that does not include any forms of nature protection. The closest protected area is the Nadwkrzański Obszar Chronionego Krajobrazu (the Wkra Riverside Landscape Protected Area), which is located 0.8 km from the area where the project is planned. A dozen or so kilometers from the area, there are numerous monuments of nature, reserves, protected landscape areas, as well as ecological areas and documentation sites. Figure 15 shows the location of the planned photovoltaic power plant in relation to nature protection forms.

Fig. 15. Location of the photovoltaic power plant in relation to protected areas

Table 1 shows the distances of the planned photovoltaic farm from the different forms of nature protection.

Table 1. Distances of the planned photovoltaic farm from particular forms of nature protection

NATURE RESERVES	
Lekowo	8.8 km
Modła	10.4 km
Olszyny [alder forests] Rumockie – buffer zone	13.0 km
Olszyny [alder forests] Rumockie	13.1 km
Dolina Mławki	15.7 km

PROTECTED LANDSCAPE AREAS	
Nadwkrzański	0.8 km
Krośnicko-Kosmowski	3.3 km
Zieluńsko-Rzęgnowski	8.8 km
NATURA 2000 SPECIAL PROTECTION AREA	
The Wkra and Mławka Valleys	10.2 km
NATURA 2000 SPECIAL AREAS OF CONSERVATION	
Olszyny Rumockie	13.1 km
Góra Dębowa near Mława	17.8 km
Baranie Góry	20.6 km
DOCUMENTATION SITES	
Morena Rzęgowska	18.4 km
ECOLOGICAL AREAS	
Seracz River Refuge	10.2 km
Ecological area 475	17.0 km
MONUMENTS OF NATURE	
Common ash – Fraxinus excelsior	0.9 km
Pedunculate oak – Quercus robur	0.8 km
Silver poplar – Populus alba	2.7 km
Group of trees – Pedunculate oak – Quercus robur	2.8 km
Group of trees – European larch – Larix decidua	2.8 km
Northern red oak – Quercus rubra	2.8 km
Group of trees – Small-leaved lime – Tilia cordata	4.1 km
Glacial erratic	4.9 km
Glacial erratic	6.3 km
Group of trees – Small-leaved lime – Tilia cordata	6.5 km
Pedunculate oak – Quercus robur	7.1 km

The Nadwkrzański Protected Landscape Area is located on the Ciechanów Upland, the Wkra River Valley and the Mazowiecka Lowland. The area covers 97,910.40 ha and includes part of the communes of Żuromin, Mława, Ciechanów, Płońsk and Nowodworski poviats. The Nadwkrzański Protected Landscape Area (the Riverside Landscape Protected Area) includes areas protected due to their distinctive landscape with varied ecosystems, which meet the needs of tourism and recreation and function as ecological corridors. The area is mainly agricultural land and few trees and shrubs outside the forest. Valuable parts of forests are protected in reserves, such as: Dziektarzewo and Gołuska Kępa – where sections of mixed forest growing on the scarp of the Wkra River are protected.

Another valuable asset of the Ciechanów land is the Krośnicko-Kosmowski Protected Landscape Area covering 19 547.70 ha. It is located approximately 3.3 km from the planned

project site. The landscape of the area is characterized by the distinctive kame and moraine forms (hills), whose height reaches 200 m above sea level.

At a distance of about 8.8 km from the planned photovoltaic farm, there is the Lekowo Nature Reserve with an area of 5.31 ha. It is a forest reserve, the protection of which was established in order to preserve a fragment of an oak old-growth forest of natural origin with a rich ground flora. In addition to the sessile oak, species of pine, hornbeam, small-leaved lime, and Norway maple occur in the forest. Among the plants under total protection, we can find martagon lilies and fungi: common stinkhorn and cauliflower fungus (*Sparassis crispa*) and those under partial protection – glossy buckthorn, cowslip primrose, and lily of the valley. Its area being small, the reserve is mainly a refuge for small animals, while for larger mammals, it is rather as a resting and feeding ground in their migration throughout the forest complex.

Modła Nature Reserve occupies 10.58 hectares, almost twice the area of the previous reserve. The reserve was created to preserve and protect a fragment of pine-oak old-growth forest and the breeding site of black stork. Sessile oak (*Quercus petraea*) occupies almost the entire reserve; pine is only an admixture, just like the other tree species occurring here: hornbeam, small-leaved linden, Norway maple and sycamore. Shrubs include hornbeam, sycamore, hazel, spindle tree, alder buckthorn, hawthorn, and juniper. The ground flora is dominated by: wood anemone, finger sedge, early dog-violet, male fern, lily of the valley, false lily of the valley, lingonberry, sheep fescue, and rough small-reed. This reserve accommodates a black stork nest, which was inhabited for many years, but is currently unoccupied. The reserve is a refuge for birds and mammals, which willingly use the natural water reservoir located within the reserve.

Olszyny Rumockie (Rumockie alder forests) is a special habitat protection area of 149.50 ha, located in the floodplain and alluvial land in the middle course of the Mławka River, which splits the area into two parts. The Olszyna Rumocka nature reserve consists of ash and alder riparian forests. Over 90% of the area is covered by forest. The upper tree layer is dominated by black alder, and the share of admixture species (birch and ash) is small. The lower tree layer is sporadic and consists of ash and alder. The undergrowth in the discussed riparian forests is poor and characterized by a small number of shrub species; the dominant species are: European spindle, red currant, bird cherry, elder and alder buckthorn. The herbaceous layer is formed by nitrophilous species (common nettle, red dead-nettle, stickywilly, and wood stitchwort). Beavers have been found to inhabit the refuge. It is a breeding ground for numerous bird species, including the black stork. Next to the reserve are the fish ponds in Rumoka (Figure 16). They form a complex of 13 artificial water reservoirs (Staw przy Drodze, Olszynowy,

Moczydło, Żuławy, Karczurek, Połomia, Zimowy, Rudka and 5 smaller ponds). The total area is about 100 ha (about 80 ha flooded). The ponds are used to raise king carp and wild carp. Tench, pike perch and pike are found in small numbers.

Fig. 16. Olszyny Rumockie Nature Reserve

Approx. 10.2 km to the east of the planned project, there is a Natura 2000 Site of the Wkra and Mławka Valleys with an area of 28,751.54 ha. The area includes the upper section of the Wkra River valley from Działdowo to Radzanów and the lower section of the Mławka River valley (a tributary of the Wkra River) from Mława to the river mouth near Ratów. There are fragments of 65-85 years old alder-ash tree stands with admixtures of European white elm and spruce. In oak-hornbeam forests, the tree stands are dominated by artificial renewals of pine with admixture of oak. On the steep inclines there is a slope broadleaved forest. The islets and beaches are covered with willow bog bushes. The refuge is inhabited by two animal species valuable for entire Europe: the beaver and the European otter. The area was established primarily to protect birds associated with aquatic habitats. A total of 22 breeding species and 15 migrating and occasionally visiting species were found in the Wkra and Mławka Rivers Valley Special Protection Area, including: ruff, white-tailed eagle, Montagu's harrier, western marsh harrier, white stork, black stork, corn crake, spotted crake, woodlark, tundra swan, whooper swan, lesser spotted eagle, greater spotted eagle, whiskered tern, Caspian tern, common tern, European golden plover, short-eared owl, buff-bellied pipit, kingfisher, common

crane.

Within a radius of 30 km, there are 27 ecological areas and as many as 1475 monuments of nature. Figures 17-22 show the monuments of nature closest to the project site.

Fig. 17. Common ash – Fraxinus excelsior

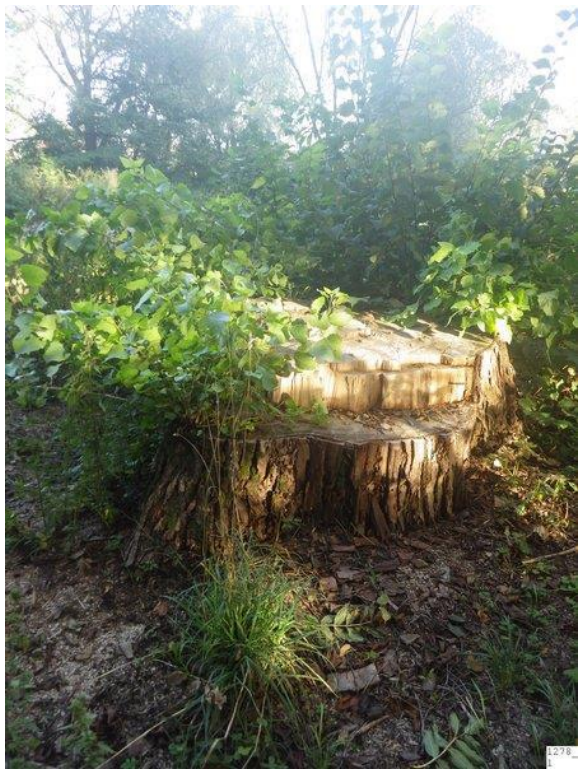

Fig. 18. Pedunculate oak – Quercus robur

Fig. 19. Silver poplar – Populus alba

Fig. 20. Northern red oak – Quercus rubra

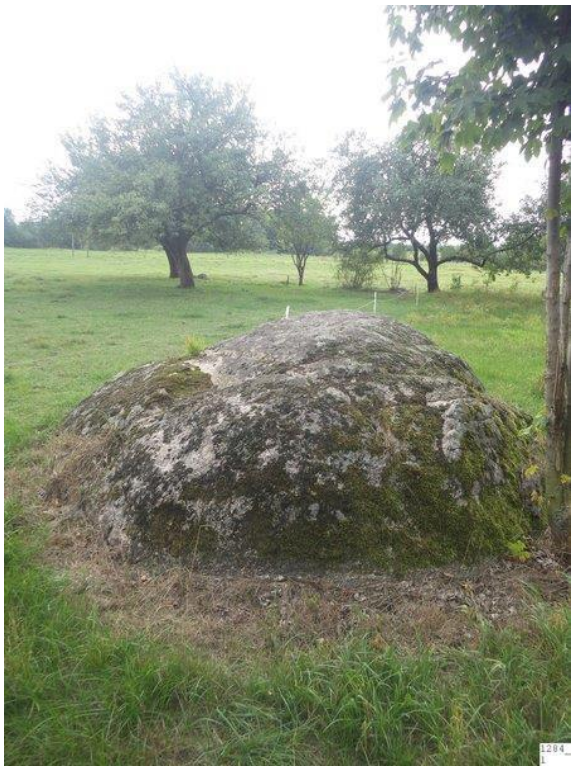

Fig. 21. Glacial erratic in the commune of Strzegowo

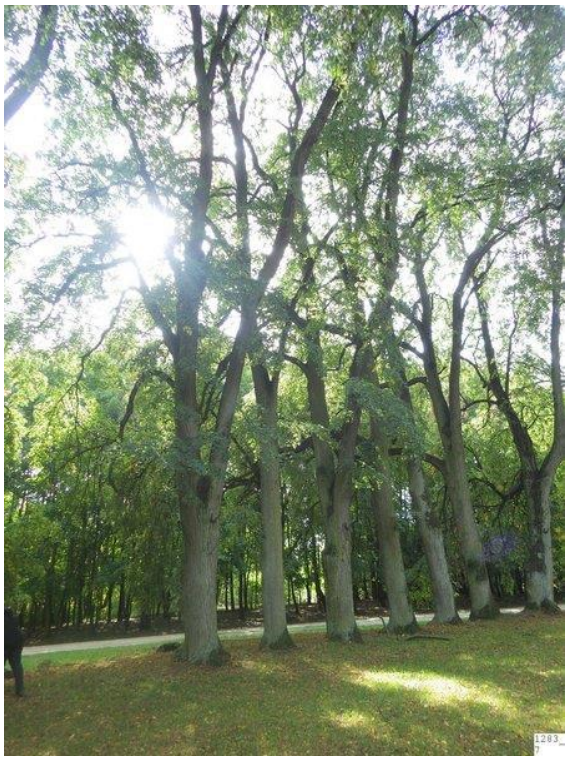

Fig. 22. Group of trees – small-leaved lime – Tilia cordata

The planned project is located beyond the range of nature protection forms and does not directly border on them, so it will not cause any threat to the valuable natural species of plants and animals under protection.

12. Impact of the planned road on traffic safety for a road in the trans-European road network

The construction of the photovoltaic farm includes the construction of an exit from a public road and the construction of an internal road to access the transformer station. The completion of these facilities will not cause a traffic safety hazard on the trans-European road network.

13. Projects being completed and completed, located in the area of the project planned to be completed or projects whose impacts fall within the area of the planned project's impact

No other projects are underway in the area where the photovoltaic power plant is to be

developed. Also in the area of the project impact, i.e. within the radius of 100 m, no other projects have been located or are being completed, whose impacts could cumulate with those of the planned project. In the vicinity of the project site, there is only land used for agriculture and forest land.

14. Risk of a major accident or natural and construction disaster

The photovoltaic power plant is not a project whose implementation may involve the risk of a major accident or natural disaster. The project will not be located in a flood hazard zone, in a zone threatened by the possibility of landslides, movements of the Earth's crust, occurrence of gusty winds, etc. The only component of a solar power plant for which one can assume the possibility of an accident and being burned is the transformer, where oil is used. However, the possibility of this unit's failure has been provided for and it has been decided to take protective measures, namely, the bottom of the transformer chamber will be made tight to contain all the oil in the transformer. The transformer will be located in a concrete building of the transformer station, which ensures that fire can spread no further. In addition, other components of the photovoltaic farm will be made of completely non-flammable materials.

The construction and operation of the photovoltaic power plant will not pose the risk of a structural collapse. The photovoltaic farm will be mostly made of prefabricated components and assembled with simple hand tools. When simple occupational health and safety rules are followed, the work will not be risky even for those performing the work. Once built, the solar power plant facility will offer a simple operation and design.

Any failure can only be a technical fault, and damaged farm components will be replaced on an ongoing basis.

15. Expected amounts and types of waste generated and their impact on the environment

Any waste or pollution will only be generated during the construction phase of the photovoltaic power plant. Construction waste such as concrete, crushed concrete, waste paper, pallets, scrap metal, soil and earth will be generated during the construction of the facility. These wastes can be recycled in order to minimize the environmental burden from the residues from the construction of this energy facility. Pursuant to the Ordinance of the Council of Ministers of November 20, 2015 *on the list of waste types which natural persons or organizational units not being entrepreneurs may recycle for their own purposes, and on*

admissible methods of such recycling (Journal of Laws of 2016, item 93), concrete waste can be recycled, crushed and used for, among other things, surface hardening, foundation construction, bedding for floors on the ground. Waste metal parts can be used for minor repairs and maintenance, while wood can be turned into fuel as long as it is not contaminated with impregnations and protective coatings or used as building material. Table 2 presents the waste that may be generated during construction (based on Journal of Laws of 2016 item 93).

Table 2. Summary of waste likely to be generated during construction

Item	Waste code	Waste type
1.	15 01 01	Paper and cardboard packaging
2.	02 01 10	Waste metal
3.	17 01 01	Concrete waste and crushed concrete from demolitions and overhauls
4.	17 01 07	Mixed waste containing concrete, bricks, tiles and ceramics as well as pieces of fit-out other than those mentioned in 17 01 06
5.	17 04 05	Iron and steel
6.	20 02 02	Soil and earth including stones, other than those referred to in 17 05 03
7.	17 04 02	Aluminum
8.	20 01 38	Wood other than mentioned under 20 01 37

Waste from the operating photovoltaic power plant will be generated during the servicing of the power plant. Their small quantity will not be stored, thus it is planned to immediately transport used equipment and materials to landfills, or for reprocessing by specialized companies, in accordance with regulations.

16. Demolition work for projects likely to have a significant impact on the environment

Implementation of the planned project will not involve demolition of existing buildings. The expected operation life of the subject photovoltaic power plant will be 25-30 years. After this period, photovoltaic modules planned for use that are built of fully recyclable materials will be collected by PV equipment manufacturers who will recycle the panels. After the operational period, physical decommissioning of the project facilities will occur and will be conducted in a manner that restores the site to its pre-construction condition. Impacts during the decommissioning phase are estimated to be similar to those during the construction. Operation of the equipment will generate noise, but these impacts will be temporary, short-term, and dependent on how construction activities are conducted.

The investor has not yet selected the final model of photovoltaic panels and inverters,

but for the analysis of the expected amount and types of waste generated at the project decommissioning stage, the optimal assumptions for this type of installation have been estimated. Due to dynamic technological advances related to renewable energy sources, individual quantities and waste types are subject to change. A summary of the waste that may be generated during the operation is shown in Table 3.

Table 3. Summary of waste that may be generated during decommissioning

Item	**Waste code**	**Waste type**
1.	02 01 10	Waste metal
2.	17 01 01	Concrete waste and crushed concrete from demolitions and overhauls
3.	17 01 07	Mixed waste containing concrete, bricks, tiles and ceramics as well as pieces of fit-out other than those mentioned in 17 01 06
4.	17 04 02	Aluminum
5.	17 04 05	Iron and steel
6.	17 04 07	Mixed metals
7.	17 05 04	Soil and earth including stones, other than those referred to in 17 05 03
8.	20 01 40	Metals
9.	20 02 02	Soil and stones

During the decommissioning phase, all waste will be placed in the demolition service facilities and the demolition site. Both the installation and the demolition work will be done by a specialized company holding the required permits. The entire panels will be taken outside the plant's site and disposed of. Decommissioning will take place in line with provisions for land reclamation, waste management, water protection and other environmental regulations in force during the decommissioning work.

References

1. The Act of April 27, 2001. Environmental Protection Law (Journal of Laws of 2020, item 1219, 1378, as consolidated).
2. The Act of 3 October, 2008 on providing access to information about the environment and its protection, participation of the public in the environment protection and assessment of the environmental impact (Journal of Laws of 2020, No. 283, 284, 322, 471, 1378, consolidated text).
3. Act of April 16, 2004 on nature conservation (Journal of Laws 2004 No. 92, item 880, as amended)
4. Act of July 20, 2017 – Water Law (Journal of Laws 2018, item 2268).
5. Ordinance of the Council of Ministers of September 10, 2019 on the types of projects that may significantly impact the environment (Journal of Laws of 2019, No. 1839).
6. Ordinance of the Minister of the Environment of November 20, 2015 on the list of types of waste that natural persons or organizational units which are not entrepreneurs may recycle for their own purposes, and on the list of permitted recycling methods (Journal of Laws of 2016, item 93).
7. Resolution No. XXXVIII/238/2018 of the Commune Council of Stupsk dated 10 April 2018. on adopting amendments to the local spatial development plan of the Stupsk Commune.
8. Resolution No. X/49/2015 of the Stupsk Municipality Council of 31 August 2015 on the Study of conditions and directions for spatial development of the Stupsk Municipality.
9. Environmental protection program for Stupsk commune for 2016–2019 with the perspective until 2023.
10. The Vistula river basin management plan (Monitor Polski No. 49, item 549).

List of figures

List of tables

Appendices

Appendix No. 1 – Nature-oriented opinion
Appendix No. 2 – Land development concept

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