

***Report on the environmental impact of the project “Building motorway A1 in section Stryków I km 295+850 (without interchange) – border of the łódzkie/śląskie provinces km 399+742.51”***

***Summary in a non-specialist language***

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## 1. GENERAL DESCRIPTION OF THE ANALYZED PROJECT

The project is to build a 103.9 km section of toll motorway A1 from interchange “Stryków I” (without interchange) to the border of the łódzkie/śląskie provinces (*województwa*).

Between interchange “Stryków I” and interchange “Tuszyn” the motorway will be built on a new route while from interchange “Tuszyn” to the border of łódzkie/śląskie provinces, the already existing national road No 1 (and partly existing motorway) will be adjusted to the parameters of a class A road (motorway).

The section in question constitutes a part of Trans-European Motorway (TEM). On the territory of Poland toll motorway A1 goes through Gdańsk–Toruń–Łódź– Częstochowa– Katowice to the south border with the Czech Republic in Gorzyczki.

The planned section is entirely located on the territory of łódzkie province (*województwo*) in the following districts: zgierski, łódzki wschodni, piotrkowski, radomszczański. It goes through cities of Łódź and Piotrków Trybunalski and communes: Stryków, Nowosolna, Łódź, Andrespol, Brójce Rzgów, Tuszyn, Czarnocin, Moszczenica, Grabica, Piotrków Trybunalski, Wola Krzysztoporksa, Rozprza, Kamieńsk, Gomunice, Ładzice, Radomsko.

There are 9 interchanges planned along the analyzed route, 11 Motorway Service Areas (with 3 existing areas scheduled to be removed) and 2 Motorway Maintenance Depots (MMD). The detailed information is listed below:

The planned interchanges:

- “Stryków” – with motorway A2 (is not included in the analysis),
- “Brzeziny” – with national road No 72,
- “Andrespol” – with provincial (*wojewódzka*) road No 713,
- “Romanów” – with provincial road No 714,
- “Tuszyn” – with national road No 1,
- “Piotrków Trybunalski” – with national road No 8 (direction Warsaw – road branching),
- “Bełchatów” – with national road No 8 (direction Wrocław),
- “Kamieńsk” – with provincial road N0 484,
- “Radomsko” – with national road No 42.

The planned Motorway Service Areas (MSA):

- MSA of category I: “Skoszewy Zach.” – km 299+800 (the western side),
- MSA of category I: “Skoszewy Wsch.” – km 299+800 (the eastern side),
- MSA of category III: “Wiśniowa Góra Zach.” – km 316+500 (the western side),
- MSA of category II: “Wiśniowa Góra Wsch.” – km 316+500 (the eastern side),
- MSA of category II: “Kargał Las” – km 353+100 (the western side),
- MSA of category II: “Siomki” – km 358+200 (the eastern side),
- MSA of category II: “Wola Krzysztoporska” – km 358+400 (the western side),
- MSA of category II: “Danielów” – km 372+000 (the western side),
- MSA of category III – km 379+200 (the eastern side),
- MSA of category II – km 388+800 (the western side),
- MSA of category III – km 388+800 (the eastern side).

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Fig. 1.1. The route of the project in the background of the administrative division of the łódzkie province.

Legenda – Legend

przebieg autostrady – the route of the motorway

nazwa województwa – the name of the province

nazwa powiatu – the name of the district

nazwa gminy – the name of the commune

Fig. 1.2. The route of the analyzed section of motorway A1 (part 1)

MOP I Skoszewy Zach - MSA I Skoszewy Zach.

MOP I Skoszewy Wsch. - MSA I Skoszewy Wsch.

Węzeł Brzeziny – Interchange Brzeziny

Węzeł Andrespol – Interchange Andrespol

MOP III Wiśniowa Góra Zach. – MSA III Wiśniowa Góra Zach.

MOP III Wiśniowa Góra Wsch. – MSA III Wiśniowa Góra Wsch.

OUA Romanów – MMD Romanów

Węzeł Romanów – Interchange Romanów

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Fig. 1.3 The route of the analyzed section of motorway A1 (part 2)

Węzeł Tuszyn – Interchange Tuszyn

PPO Papieże – TS Papieże

Węzeł Piotrków – Interchange Piotrków

Węzeł Bełchatów – Interchange Bełchatów

MOP II Kargał Las – MSA II Kargał Las

MOP II Wola Krzysztoporska – MSA II Wola Krzysztoporska

MOP II Siomki – MSA II Siomki

PPO Jeżów – TS Jeżów

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Fig. 1.4. The route of the analyzed section of motorway A1 (part 3)

MOP II Danielów – MSA II Danielów

OUA Kamieńsk – MMD Kamieńsk

SPO Kamieńsk – RTP Kamieńsk

Węzeł Kamieńsk – Interchange Kamieński

MOP III – MSA III

Węzeł Radomsko – Interchange Radomsko

Motorway Service Areas to be removed (currently located by national road No1 ):

- MSA of category I in km 380+550 (the western side),
- MSA of category I in km 396+550 (the eastern side),
- MSA of category II “Wroników” – km 364+600 (the eastern side).

There are 2 Motorway Maintenance Depots (MMD) planned in the analyzed section:

- “Romanów” – km 319+600
- “Kamieńsk” – km 375+300.

The following technical parameters were approved for the individual sections of the motorway (by separate location decisions):

	Section interchange “Stryków I” (km 285+850) – interchange “Tuszyn” (km 336+000)	Section interchange “Tuszyn” (km 336+000) – interchange “Kamieńsk” (km 375+800)	Section interchange “Kamieńsk” (km 375+800) – the end of the motorway (km 399+742.51)
Technical class	A-motorway	A-motorway	A-motorway
Planned speed	120km/h	120km/h	120km/h
Width of a lane	3.75 m	3.75 m	3.75 m
Number of lanes	2x3	2x2 (2x3 lanes in section interchange “Piotrków Trybunalski” – interchange “Bełchatów” – section length – about 3	2x2
Target number of lanes		2x3 lanes (2x4 lanes in section interchange “Piotrków Trybunalski” – interchange	2x3
Width of median strip	5.0 m	3.50 m (without sides	4.5m
Width of emergency lane	3.0 m	3.0 m	3.0 m
Width of dirt shoulder	1.25 m	1.25 m	1.25 m

The construction of the motorway route is of critical importance to łódzkie province. The planned road with motorway A2 will take most of the transit traffic from national roads in the Łódź region and will facilitate their traffic capacity, which is especially important in the case of residential areas through which this road runs. Less traffic in these areas will improve road safety for the pedestrians, bikers and car drivers and will enormously influence the condition of the environment.

## 2. DESCRIPTION OF THE ENVIRONMENT IN THE VICINITY OF THE PLANNED A1 MOTORWAY

### 2.1. Geological structure and hydrogeological conditions

The motorway section in question runs within the borders of two geological units: the Kujawy swell – made of Jurassic sediment (sandstones, mudstones, clay-stones, marlstones and limestones) and the Łódź basin, located south of the swell, filled with Cretaceous sediment (sands, clays, marls and limestones) with the border between the two near the village of Nowosolna.

In both cases on the older deposits there occurs discontinuous cover of Tertiary deposits (in the form of sands, loams and clays and in the Łódź basin in the form of brown coals) and compact, but diversified in terms of thickness (sometimes reaching over 100m), series of Quaternary deposits (from clays to sands, slits and peats).

The land surface is slightly hilly, generally rising in the southern direction. The differences in height are not big and do not exceed 90 meters in the closest vicinity of the planned route. The highest point of the land is located near Pilchtów ( 260 m above sea level) and the lowest point is near Stryków (172 m above sea level).

The planned section of the motorway is located within three hydrogeological regions: the Kujawsko-Mazowiecki region, Łódź Basin and Miechowska Basin.

#### The Kujawsko-Mazowiecki Region (km 295+000 – 316+000)

Within this region the aquifers are connected with Upper Jurassic and Quaternary deposits.

The aquifer of Upper Jurassic occurs at 40-120 m deep in cracked carbonate sediment. It is a quite abundant layer (yield of 200 m<sup>3</sup>/h) and its waters are of good and satisfactory quality.

The second aquifer is the Quaternary level connected with sand and gravel sediment starting at 40 meters deep. The potential yield levels of the individual wells are between 30 and 70 m<sup>3</sup>/ h. The quality of water in this aquifer is changeable.

#### The Łódź Basin Region (km 316+000 – 379+000)

In this region the most important aquifers are those occurring in Cretaceous and Quaternary formations, while the Tertiary deposits are of less importance.

The potential yield levels of the individual wells are between 30 and 120 m<sup>3</sup>/ h. The quality of water in the Cretaceous deposits is generally good.

There are also Quaternary aquifers on several levels connected with the sand-gravel interbedding within clays:

- shallow near-surface level – most of the dug wells are connected with it,
- supramorainic level – alluvial; it spreads on larger areas in the river valleys and there it constitutes a usable level,
- intermorainic level – the main usable layer of Quaternary waters
- submorainic level – occurs in the deeper sand-gravel layers. The yield levels of the individual wells are between 30 and 80 m<sup>3</sup>/ h.

#### The Miechowska Basin Region ( km 379+000 – 400+000)

The main aquifer is connected with Upper Cretaceous deposits formed as marlstones, limestones and lime silicate rocks (opoka). This is fissure water occurring up to 25 m deep (except for the motorway section 379+800+384+600, where the Cretaceous sediments do not occur). The yield of a single hole ranges from several to 70m<sup>3</sup>/h, sometimes reaching 170m<sup>3</sup>/h. The quality of the water is generally good.

In this section, carbonate Upper Jurassic formations are also water-bearing and occur at 25-60 m deep. The water-table of these waters is perched and the yield levels ranges from several to 70 m<sup>3</sup>/h.

The Quaternary water-bearing level is connected with sand and sand-gravel deposits whose thickness is rarely above 15m. These aquifers are unconfined or under small pressure. The yield is within several to 30 m<sup>3</sup>/h.

The analyzed route of the motorway runs within the limits of 4 High Yield Aquifers.

Table. 2.1 The list of High Yield Aquifers interrupted by the planned motorway A1

Km	Motorway section	HYA number	Aquifer	Name of HYA
From the beginning of the motorway to 315+000	Stryków-Andrespol	403	Q	Brzeziny-Lipce Reymontowskie
299+000 – 307+800	Andrespol	404	J3	Koluszki-Tomaszów
317+000 – 347+400	Brójce-Srock	401	K1	Niecka Łódzka
373+300 to the end of the motorway	Rozprza – the province border	408	K2	Niecka Miechowska

## 2.2. Soils

The analyzed area is diversified in terms of soil cover.

From km 295+300 to 321+950 there are more brown soils – leached or acid – of diversified fertility – ranging from good rye complex through weak rye complex to very weak rye complex. Occasionally pseudopodsolic soils included in the very good rye complex as well black earths (near watercourses) included in the medium grasslands complex.

From km 321+950 to 329+500 soil fertility deteriorates due to domination of sands in the ground or low-loamy sands underlain with sands – they are sand soils of various types, included in weak rye complex, and in marshy areas – black earths included in the cereal-fodder complex or to medium grassland complex.

Better pseudopodsolic soils are from km 329+500 to km 331+700. They are included in the good wheat complex or very good rye complex.

Brown leached or acid soils occur again from km 331+700 to km 341+700 where, similarly to the initial section of the motorway are very diversified in terms of fertility – from good rye complex to very weak. Near km 336+400 – 337+700 there are small patches of brown soils proper belonging to good wheat complex.

Brown soils belonging to good wheat complex are also found in the further sections of the motorway – from km 341+700 to 348+000. Apart from them there are also pseudopodsolic soils belonging to very good rye complex or cereal-fodder strong complex.

Of poorer qualities are the soils from 348+000 to 351+100 where rust-colored soils, podsolic or pseudopodsolic soils dominate that belong to rye complexes: very good, good and weak

A large diversification of the soil agricultural usefulness was found from km 351+100 to km 356+750. Depending on the land and water conditions the pseudopodsolic soils found

there were included in: good wheat complex, good and very good rye complex , strong cereal-fodder complex.

From km 356+750 till the end of the analyzed section sand soils dominate, mainly those belonging to weak rye complex. There are patches of pseudopodsolic soils from good wheat complex and sand soils from very weak rye complex.

As part of “Analysis of environment monitoring in the vicinity of the planned motorways and expressways in the łódzkie province in 2005” Provincial Environment Inspectorate (PEI) in Łódź conducted a study of soil contamination levels in the vicinity of the planned section of the motorway, in 5 measure points. The obtained data were compared to the standards for group B soils (arable lands except for soils under ponds and ditches, forests, tree-covered, bush-covered lands, developed and urbanized lands except for industrial and traffic lands and minerals) and for C group soils (industrial lands, minerals, traffic lands). The conducted analyses revealed that:

- the concentration levels of the assayed metals in the control-measurement points did not exceed limit values for soils of group B except for the control-measurement point in Wardzyń, where the concentration of cadmium in the examined sample exceeded limit values for both B and C groups.
- in all the analyzed control-measurement points the limit concentration values for polycyclic aromatic hydrocarbons for soils of group B.

### **2.3. Surface waters**

The planned route is located in the basin of the middle section of the Vistula River, and within river catchment area of two big rivers” the Bzura River (in the north), the Pilica River (in the east) and the Warta River (in the south).

The large watercourses in the region include the following rivers: Moszczenica, Miazga, Wolbórka, Strawa, Dąbrowka (Bogdanówka), Kamionka, Widawka and Warta.

The quality of the surface water ranges between III and V purity class (the classification in accordance with the non-effective Regulation of the Minister of Environment of 11 February 2004 on the classification for presentation of the condition of surface and deep groundwater, the monitoring method and result interpretation method as well as presentation of the condition of these waters). Detailed data with control-measurement points indicated are given in the table below.

Table 2.2. Classification of surface waters – rivers in the vicinity of the planned motorway ( source: PEI in Łódź)

River	Name of measuring-control point	Class
Moszczenica	to the north of Stryków	IV
Strawa	Piotrków ul. Włóknicza (Street)	IV
Strawa	Intake Przyglów	V
Wierzejka	Meszcze	IV
Wolbórka	Wolbórz	IV
Mizaga	Bedoń	III
Mizaga	Karpin	V
Mizaga	Prażki	IV
Radomka	Dąbrówka	V
Widawka	Rogoźno	III
Widawka	Podgórze	III
Ner	Łódź, Łaskowice, Smulsko, Józefów, Lutomiersk, Puczniew	V
Warta	Bobry	III
Warta	Szczepocice	IV
Warta	Ważne młyny	III

At km 315+000 about 1200 meters west of the planned motorway there are sources of the River Ner.

#### 2.4. Air and climate

The planned section of the motorway is located within transitional mesothermal climate which has the following parameters in the łódzkie province:

- annual average precipitation total from 500 to 600 mm
- annual average air temperatures 7.5-7.8
- duration of the vegetation season on average lasts 210-220 days
- west winds dominate (20%), south-east (10-12%), distinctly marked directions: west and north-west, least frequent – north

The air pollution level in the vicinity of the planned project can be regarded as good. As the study conducted by the Provincial Environment Inspectorate in Łódź shows (the results are published in “Analysis of environment monitoring in the vicinity of the planned motorways and expressways in the łódzkie province in 2005”) along the motorway A1 no exceedance of limit values was reported for sulphur dioxide, nitrogen dioxide and benzene.

Annual average SO<sub>2</sub> concentration outside of the developed areas was from 6 µg/m<sup>3</sup> near Stryków up to 13 µg/m<sup>3</sup> in Jordanów near Łódź, which constitutes 30%-65% respectively of the annual average limit value for plant protection Da = 20 µg/m<sup>3</sup>. In the developed areas annual average concentrations were within 7-12 µg/m<sup>3</sup> with the rural areas showing lower values.

NO<sub>2</sub> concentrations outside of the developed areas ranged from 9 µg/m<sup>3</sup> near Stryków to 13 µg/m<sup>3</sup> near Głowno. In the developed areas NO<sub>2</sub> concentrations was from 14 µg/m<sup>3</sup> to 20 µg/m<sup>3</sup>. Near the main roads annual average concentration values were within 20 – 26 µg/m<sup>3</sup>, which constitutes 50-6-% of the limit value for human health protection set at 40 µg/m<sup>3</sup>.

Measurement of benzene concentration which was conducted at measuring point located in Kamięnsk by the route Piotrków Trybunalski – Radomsko did not show exceedances of the annual average limit concentration of 5 µg/m<sup>3</sup>. The highest measured annual average concentration was 2.96 µg/m<sup>3</sup>, which translates into 60% of limit value.

Lack of exceedances of limit values of substances in the air for human health protection for SO<sub>2</sub>, NO<sub>2</sub>, CO, suspended particulate matter, Pb and benzene in the vicinity of the planned motorway was recorded also in 2006.

The level of pollution presents somewhat differently for individual districts through which the motorway will run. In each of them exceedances of limit values for human health protection and plant protection were recorded.

- the zgięski district for nitrogen dioxide, suspended particulate matter and ozone,
- Łódź metropolitan area for suspended particulate matter, ozone,
- the east łódzki district for ozone,
- the piotrkowski district for ozone,
- the city of Piotrków Trybunalski for suspended particulate matter,
- the radomszczański district for suspended particulate matter, ozone.

## 2.5. Noise climate

The creation of noise climate in the environment is influenced by such noise sources as: road, rail and air transport, industrial plants, service points, high-voltage lines and others. The most important one affecting noise climate in the environment is traffic noise. Outside of urban areas the noise mainly comes from vehicle road traffic. Other sources of rail and traffic noise are of a local character.

The planned motorway A1, from interchange Stryków I to the border of łódzkie/śląskie provinces will run between the already existing national roads No 8, No 14, No 91 and No 1, the last of which it will partially substitute. At the moment the traffic on those roads is heavy and the planned motorway will aim at reducing the traffic on the above-mentioned roads by taking over a large part of the traffic, mainly in the section Łódź (Warsaw) – Częstochowa.

Noise climate around other existing national roads is created mainly by the roads themselves which is a result of heavy traffic on them. In the following years this traffic will increase thus leading to larger noise range and deterioration of noise climate. To protect the residential areas located in the close vicinity of the roads in question adequate acoustic protective measures should be taken, however, a more beneficial solution will be building a road that will take over some of the traffic and will run through these areas where there are less residential housing. A confirmation of these conclusions was provided by long-term measurement made in 2007 as well as acoustic maps of national roads No 1 (from Łódź to interchange with the existing motorway A1), No 8 ( from interchange with the existing motorway A1

to Wolborz) and No 14 (from Pabanice to Łódź). Fragments of acoustic maps for the analyzed sections of the existing roads are presented in Fig. 2.1 – 2.4.

Based on the analysis of the maps in question it can be said that the existing national roads No 1, No 8 and No 14 are the source of inconvenience to all the areas located in their vicinity for which noise limit levels were determined ( areas marked in yellow on the map on the left or the upper map).

Fig.2.1 Map of exceedances of noise limit levels at night [ $L_N$ ] in Rzygów by national road No 1.

brak przekroczeń wartości dopuszczalnych – no exceedance of limit values

tereny o nieokreślonych wartościach dopuszczalnych – areas with undetermined limit values

Fig. 2.2. Map of exceedances of noise limit levels at night [ $L_N$ ] in Tuszyn by national road No 1 .

brak przekroczeń wartości dopuszczalnych – no exceedance of limit values

tereny o nieokreślonych wartościach dopuszczalnych – areas with undetermined limit values

Fig. 2.3. Map of exceedances of noise limit levels at night [ $L_N$ ] in Kruszyn, Głuchów and Gołygów by national road No 1 .

brak przekroczeń wartości dopuszczalnych – no exceedance of limit values

tereny o nieokreślonych wartościach dopuszczalnych – areas with undetermined limit values

Fig. 2.4. Map of exceedances of noise limit levels at night [ $L_N$ ] in Rakowiec by the national road No 1 .

brak przekroczeń wartości dopuszczalnych – no exceedance of limit values

tereny o nieokreślonych wartościach dopuszczalnych – areas with undetermined limit values

## **2.6. Natural environment, protected areas**

The location of the motorway (except for the section crossing Wzniesienia Łódzkie National Scenic Park) is of little landscape diversification. Flat landscape with little diversity dominate (river valleys, forests). Four basic types of landscape were distinguished in the area of the project. The division criterion was the degree or quality of changes that had taken place depending on the distortion of the natural relations in the environment and changes brought about by human activity. The types are:

- landscape similar to natural – forests and midforest meadows and clearings, river valleys,
- natural-cultural landscape – overgrowing meadows landscape, agro-sylvan landscape – small forest areas among meadows and fields and agricultural landscape – meadows, farm fields, agricultural drainage ditches, woodlots, single farmsteads, gardens adjoining to the house, orchards,
- cultural landscape – connected with settlement,
- degraded cultural landscape – traffic route landscape, landscape of the vicinity of high-voltage transmission lines

The planned motorway runs, in larger part, through the areas belonging to landscape similar to natural and natural-cultural landscape. In terms of the area cover, cultural harmonious landscape takes up the most space and includes: arable lands, meadows and to a lesser extent, forests, copses, orchards.

The information below concerns valuable natural objects and areas found on the route of the planned motorway:

#### Nature monuments

1. km 361+000 about 180 km east of the motorway axis – in Parcela Jeżow – European white elm with a circumference of 742 cm; one of the largest and oldest white elms in Poland, estimated age about 350-380 years.
2. km 369+450 about 400 east of the motorway boundary – in Budy Porajskie – small-leaved lime with a circumference of 590 cm. Small wooden shrine hung from the east side. No information plate – probably it was stolen. There are traces of conservation and sanitation cuttings.

#### Trees qualified to be recognized as nature monuments:

1. km 297+900 – 298+200, from 400 to 550 m east of the motorway boundary – a group of grand beech trees on the north-west edge of Janinów nature reserve, circumference ranges 270-300 cm.
2. 298+300, about 250 m west of the motorway boundary – common maple in front of an estate in Rosyjka (eastern side of Skoszewy Stare),
3. km 299+200, about 600 m west of the motorway boundary – small-leaved lime in the line of a commune road leading through Skoszewy Nowe (in the western part of the village), with a circumference of about 290 cm branching from 1 m up,
4. km 301+400, about 50 m west of the motorway boundary and directly at the planned entrance of the commune road onto the viaduct – small-leaved lime on a farm in Laski with a circumference of about 463 cm,
5. km 306+400 – 306+550, about 100-150 m east of the boundary line – a group of grand trees: limes and horse chestnuts with circumference over 250 cm by the north-west edge of the Wiączyń nature reserve, close to an old forest guard's lodge
6. km 313+300 – 350+400 m west of the motorway boundary – a group of grand trees, mainly small-leaved limes in an old park by a manufacturer's residence,
7. km 314+950, about 450 m west of the motorway boundary – grand English oak with a circumference of 250 cm, growing on a woodlot strip

8. km 337+450, 300 m west of the motorway boundary – in Mąkoszyn – common pear growing on a border strip, with a circumference 196+192 cm, branching up to 1 m,
9. KM 345+700, 0-70 west of the motorway boundary – in Władysławów – a group of trees growing in the abovementioned tree-covered woodlot: 5 English oaks with circumferences: 467 cm, 329 cm, 360 cm, 400 cm, 385 cm; common maple with a circumference of 295 cm. Visible signs of sanitation-maintenance activities; no information plates. Four out of the mentioned oaks are in the close vicinity of the western the motorway boundary,
10. km 361+600, 150-400 east of the motorway boundary – in Parcela Jeżów – trees belonging to the park landscape from the end of the 19<sup>th</sup> century. Historic sylva consisting of: several old common beech trees, a line of small-leaved limes and an oak. At the moment the park is the registry of monuments of the łódzkie province (Environment Protection Program, commune of Wola Krzysztoporska).
11. km363+800, 120-180 m west of the motorway boundary – in Adolfinów. A roadside 300-meter line of several dozens of English oaks along the western edge of the forest. The circumference of the largest trees are over 300 cm.
12. km 389+200, direct vicinity of the existing national road, on its western and eastern side (larger part of the park, especially its eastern part will be inside the land strip limited by the motorway boundaries) – in Stobiecko Szlacheckie – a group of old, grand trees in a post-manor park.
13. km 389+300 – 389+470, about 100 m east of the motorway boundary - in Stobiecko Szlacheckie – a line of crack willows with large circumferences.
14. km 396+200, about 30 m west of the motorway edge, inside the strip limited by motorway boundaries – in Brodowe – small-leaved lime growing by a deserted farm.

### National Scenic Parks

At 296+800 the planned motorway enters the protection zone of Wzniesienia Łódzkie National Scenic Park, then at 298+300 it enters the Park, and then “leaves” it at 303+600 (there is no protection zone there). It runs for 5.3 km through he Park.

Wzniesienia Łódzkie National Scenic Park was established in 1996 by the regulation of Governor of Łódź and Governor of Skeirniewice. It is located north-east of the Łódź metropolitan areas, between Łódź, Brzeziny and Stryków, on the territory of communes of Brzeziny, Stryków, Nowosolna, Łódź, Dmosin and Zgierz. The Park covers the area of 10 748 ha while the protection zone spreads on 2 996 ha. The dominating landscape in the Park is arable lands with woods constituting 28% of the area (thus within the analyzed impact motorway section there are mainly arable lands, to a lesser extent orchards, rural housing, grasslands and forests).

The flora of the Park is diversified. So far the occurrence of 730 species of vascular plants was recorded, including 60 protected trees and bushes and several dozens of rare and protected species of herbaceous plants. Altogether there are 24 species of spermatophytes and pteridophytes in the park under strict species protection and 15 species of vascular plant under partial protection.

The fauna of the Park is very diversified as well. There are 34 species of mammals with 22 under strict protection.

The species protected in Poland include: Eastern European hedgehog, common shrew, least weasel, ermine.

There are 112 bird species under strict species protection, including: honey buzzard, sparrow hawk, kestrel, hoopoe.

There are also 3 species of reptiles and 12 species of amphibians under strict protection.

There are three forest nature reserves in the park:

- Struga Dobieszkowska
- Łagiewnicki Forest
- Janinowskie Ravine

It is planned to establish a nature reserve in the western part of the park – Żabieniec Peatbog (about 4 ha).

### Nature Reserves

The analyzed section of the motorway does not cross any nature reserve and does not run in the direct vicinity of the borders of a nature reserve. The closest nature reserve in relation to the planned motorway is the already mentioned Janinowskie Ravine.

It is a forest reserve spreading on 41.66 ha, established in 2000. The land is located in the commune of Brzeziny, within the limits of Wzniesienia Łódzkie National Scenic Park, 0.8-1.5 km east of the planned motorway. The forest under protection include deciduous and mixed woods within the boundaries of the largest, in the central Poland, sylvan complex of beech trees.

### Protected Landscape Areas

Protected Landscape Area of the Mrogi and Mrożycy Valleys – the motorway runs along the border of PLA of the Mrogi and Mrożycy Valleys, 100-300 m west at km 306+400 – 307+600.

The Tuszyńsko-Dłutowsko-Grabiański Protected Landscape Area – the protected landscape area including the valley of the Wolbórki river. The motorway crosses the land at 323+820 – 325+530 and then at 325+530 – 328+160 it runs along the western border of the area.

The Pajęczańsko-Gidelski Protected Landscape Area – the planned protected landscape area includes the valley of the Warta River and crosses the area at km 394+530 till the end of the analyzed section, and at km 393+050 – 394+530 the motorway will run along the western border of the area.

### Nature-Landscape Complexes

Nature-Landscape Complex of Miazga Valley – the motorway will cross the area at 308+030 – 308+830.

Nature-Landscape Complex of Ner and Sokołówka - the motorway will cross the area at 314+390- 315+420

At 370+200, 180 m east of the motorway boundary – in Norbertów there is a glacier pond covering 0.16 ha recognized as an ecological site.

#### Postulated ecological sites

- Popielarnia (Łódź) km 309+300, 0-100 west of the motorway boundary – damp meadows and small overgrown reservoirs with rushes in the vicinity of the planned motorway (about 100 m to the west). In places located higher there are various type of meadow vegetation growing. The reservoirs are part of an old hydrological system of the sources of the Ner River.
- In the impact land strip (km 320+850, about 250 m west of the motorway boundary), on the forest border there is a morass with numerous marsh and rushes species e.g. dropwort.
- (km 345+950 – 346+350), 100-400 west of the motorway boundary – in Władysławów – complex of meadows, rushes and trees growing in the local land depression. The natural value of landscape is determined by the centenarian oak-hornbeam sylvia. There are English oaks with circumference of 314 cm, 349 cm, 410 cm and couple of oaks with a circumference of breast height > 250 cm. There are also hornbeams with circumference > 150 cm. The most magnificent hornbeam measured 236 in breast height. There are two species under legal protection in the area: sweet woodruff and common ivy (km 346+080, about 270 and 200 west of the motorway boundary). From the west and south the sylvia borders with colorful, multispecies fresh and damp meadows. On these meadows monumental English oaks grow individually or in lines.
- Km 396+150, about 250 m west of the motorway boundary – in Brodowe – transitional overgrowing moor.

#### Areas recognized as environmentally valuable

- km 296+100 – 296+800, complex of meadows and riparian forest in the valley of Moszczenica near Kazmierzów-Sierznia. There are patches of damp meadows here with frequent occurrence of snake weed in the ground cover. The meadows, forest and rushes is the feeding ground for buzzard and nesting site for lapwing.
- km 297+700- 298+700, 500-1000 m of the motorway – fragment of Janinów nature reserve, a valuable oak complex, with 200-year old trees
- km 301+200 – 302+000) – valley lowering near Laski of spectacular scenic value (very diversified surface features) and significant environmental values (patches of valuable meadows).
- km 302+700 – 303+600 – near Plichtów Mały – deep water-head valley of Moszczenica and highest point of Wzniesienia Łódzkie of great scenic and environmental value. On a damp meadow, near Plichtów-Moskwa, where at the end of the previous century the occurrence of individual species of the protected western marsh orchid was recorded (however, in the recent years the presence of this species was not verified). In a natural sward at the hill slope there is club-mosse site (km 303+300, about 300 m east of the motorway boundary). Recently, along the planned motorway and in its closest vicinity in the region of the high points near Plichtów the occurrence of rare and protected invertebrate was confirmed: long-winged bush cricket – rarely occurring

in Poland or calasoma of the *Carabidae* family, rare in this region and under strict protection.

- Natural sward created in place of unused arable lands (km 303+200 – 303+600) are an important breeding site for the lark (at least several couples) and a regular feeding ground for buzzard and kestrel.
- At km 306+400 – 306+900 the planned motorway runs about 50-150 m west of the border of a large forest complex – Wiączyń forest reserve. It is one of the most valuable forest complexes near Łódź with wet-ground forest and oak-fir forest (communities protected under Natura 2000). In the north-east part of the complex (about 3.5 km of the planned motorway) there is Wiączyń nature reserve including a protected fragment of fir-oak forest with oaks aged 200-300 years.
- km 307+100 – the motorway crosses the valley of the upper part of a small watercourse Miazga (left tributary of Wolórka River, Pilica catchment area). The planned motorway crosses, in this section, the area of the planned nature-landscape complex “Valley of Miazga”.

### Ecological corridors

River valleys and depression belts are the natural ecological corridors which are used both by small and big mammals (wild boars, roe, rabbits). Watercourse valleys are also the migration pathways of reptiles and amphibians.

The valleys of the following rivers function as local ecological corridors: Dąbrówka, Kamionka, Rów E and other smaller streams. The abovementioned valleys are the migration pathways of deer and wild boars.

Apart from the river valleys, also valley-forest belts act as ecological corridors. This is the case for the corridor stretching from the peatbog valley near Budy Porajskie that runs through forest complexes near Michałów to the Jeziorka River valley and the valley drained by Rów E.

Forest complexes have an important function in the migration of animals. The motorway crosses small forest complexes near Dąbrowa, Norbertów and Siomki.

In the analyzes area of the planned motorway A1 the ecological corridors and migration fauna are manly connected with the hydrological network and the mosaic of forest, meadow and bush communities constituting complexes of high biodiversity which favors the existence and migration of most of the fauna species found there. The valleys and forest complexes nearby crossed by the motorway are the main fauna migration axes on a supraregional level.

### **2.7. The Natura 2000 areas**

The motorway does not cross any areas belonging to the European Environmental Network Natura 2000, the existing one or planned (entered on the Shadow List). The motorway does not run in the direct vicinity of the Natura 2000 areas.

The closest, officially demarcated area of Natura 2000 – “Meadow in Bęczkowice” (PLH 100004) is 16 km away from the planned motorway in the eastern direction.

Somewhat closer (6km), however, there is a potential Natura 2000 area, reported for protection by environmental organization – “Cyrusowa Wola” PLH 100012.

## **2.8. Description of historical places and buildings, protected under laws on the protection and maintenance of places of national heritage, located in the vicinity or within the direct impact range of the planned project**

In the vicinity of the motorway A1 the following architectural monuments were found:

- commune of Tuszyn
  - house no 188, made of brick, dated c. 1925 in Modlica (included in the provincial register of immovable monuments)
- commune of Wola Krzysztoporska
  - An inn dated 18/19<sup>th</sup> centuries in Wygoda
  - Water mill from the end of the 19 c. in Laski
  - Court park from the end of the 19<sup>th</sup> c. in Jezów
- commune of Kamieńsk
  - Roman Catholic chapel from the beginning of the 18<sup>th</sup> c. in Ochocice
- commune of Ładzice
  - Court complex in Stobieck Szlachecki (park dated to 19<sup>th</sup> c, and the court the beginning of the 19<sup>th</sup> c.)

The route of motorway A1 interferes with the court complex in Stobieck Szlachecki in the place where national road No 1 is now running.

There are additional two architectural monuments located near the planned motorway:

- commune of Grabica
  - Post-manor park from 1905-1915 in Brzoza
- commune of Rozprza
  - Post-manor park from the turn of the 19c. century

The ground testing of the route of the planned motorway A1 verified and revealed a total of 132 archeological sites located in the vicinity or interfering with the planned route. The described sites are not evenly distributed. Most of the sites were found in the ice-marginal valley Pradolina Warszawsko\_Berlińska. There are cultural sites, mainly from the period of Lusatian Culture and some from the Middle Ages – the Przeworsk culture period.

## **3. DESCRIPTION OF THE ANALYZED VERSIONS OF THE PROJECT**

### **3.1. The version not to build the motorway**

The analysis of the version not to carry out the project means that the building of the motorway does not take place.

The area between Stryków and the border of łódzkie and śląskie provinces is currently connected through a network of roads, out of which the most significant ones, for the planned motorway, are national roads No 1, No 2, No 14, No 91, No 8 and the existing section of motorway A1 near Piotrków Trybunalski.

Building of the motorway A1 will contribute to relieving the traffic on national roads No 8, No 1 and No 14.

Abandoning the idea of building this section might mean:

- increased traffic on the existing national road network. The results of measuring traffic levels on national roads indicating an increase in traffic within 5-year period (2000-2005) on national roads in Poland reached 18% and in łódzkie province – 13%,
- increased number of accidents and collision,
- rapid deterioration of the technical conditions of the existing roads,
- increased inconvenience of roads for the inhabitants of towns and villages located in their direct vicinity. The existing roads do not have the necessary environmental protections – this is especially important for the Łódź metropolitan area which is crossed by national roads No 14 and No 1,
- deepened interference with the animal world – increased traffic on the existing roads without the structures maintaining passage continuation – will influence population of some species (wild boars, roes, deer, elks)

### **Noise**

Forecast analysis done as part of the report on environmental impact for the existing sections of national roads No 14, No 1 and Nr 8, shows that building motorway A1 will improve noise climate in the vicinity of these roads, in sections located in łódzkie province. The motorway will take over most of the traffic congestion which will translate directly into lowering the noise level in the neighborhood. The analysis of the distances of equal loudness contours of noise level at limit values indicates that decrease in traffic congestion, after putting the planned motorway in operation, will result in reducing their range. In 2025 the difference might reach 40-51 %(NR No 14) and about 20-24% (NR No 8).

It must be stated, however, that the motorway will worsen noise climate in the housing areas located in its vicinity. Residential housing might be in the zone of noise impact with levels exceeding limit values which will necessitate using soundproof protection in a form of sound barriers.

### **Air**

Motorway A1 in the analyzed section will relieve traffic and ensure smooth traffic flow on the existing national roads. The concentration of harmful substances on national roads will significantly decrease. If, however, the project is not put through, the increase in traffic will result in increase in exhaust emission which will adversely affect the densely populated areas along the existing roads. These changes are visible especially by national road No 8 and No1.

### **Natural environment**

In terms of how the abandoning of the idea of building the motorway will influence the natural environment, one can take a local (location of the motorway) and wider point of view.

From the local point of view, building the motorway will result in taking up about 1300 ha of land, mostly arable. In the version not to build the motorway, according to the current knowledge, these areas will remain arable. From this point of view it can be stated that building the motorway will result in reduction of biologically active areas, cutting down several trees of great sizes which have important local landscape functions and small patches of

protected habitats, which will not significantly have a negative effect considering their common occurrence in nature.

In short sections the motorway will cross forest complexes leading to their severance which will result in the so-called edge effect. It can contribute to weaker condition of the sylvae as well as occurrence of unwanted phenomena (windfalls, spreading of invasive plant species). When a road crosses a forest complex the thing to bear in mind is also the changes in microclimate manifesting as increasing aeration of the forest interior and its lighting which results in decrease in humidity and raise of temperature. The species that will react to these changes in the first place are moss and lichen.

On the other hand, if the motorway is not built, the barrier effect will continue to exist in the network of the existing roads (especially NR No 1) and it will deepen along with the predicted increase in traffic. Building the motorway is connected with constructing crossing structures for animals which will facilitate contact between populations separated by the road.

### **The environment as a whole**

From the local and environmental point of view the version not to build the motorway would be the best solution: it would save 1300 ha of land, maintain the existing noise comfort for the inhabitants of areas adjoining to the motorway, allow the fauna to exist in peace.

However, a more wider picture of the impact the existing and planned roads have on the human and natural environment helps to see the benefits that comes from building the motorway. This includes: minimizing traffic inconvenience of the most loaded roads, improvement of noise climate in Łódź and reducing the number of accidents on the existing roads.

## **3.2. Versions considered in the early stages of project preparation**

### **The section from interchange “Stryków I” to interchange “Tuszyn”**

Because the route of the motorway in this section was included in the spatial planning of the communes already in the 1980s and 1990s, even before issuing location proposal, no option analyses were conducted here.

### **The section from interchange “Brzeziny” to interchange “Romanów”**

As part of feasibility and project studies three versions were analyzed of how the motorway would run from interchange “Brzeziny” to interchange “Romanów”: eastern version, western version and modified western version. At the time of obtaining location proposal for the motorway in 1994 the eastern and western versions were analyzed. However, due to critical clashes of the two variants with the motorway areas, a new versions was sought after to omit those clashes – this is how modified western version was created.

From interchange “Brzeziny” to the crossing of national road No 72 the planned route is identical in all versions.

Eastern version after crossing national road No 72 was directed to south-east and ran on the most westbound fragment of the complex “Wiączyński Forest”.

Then it advanced through arable lands and then crossed the housing area of Wiączyń and the village of Bedoń Przykościelny. In this version the motorway was to cross the Miazga River.

Then the route led through compact settlement of Andrespol and Andrzejów residential development. Further on, the motorway ran in the south-west direction through agricultural

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lands and crossed the development areas of the former village of Feliksie – now ul. Feliksińska street in Łódź.

Then, up to interchange “Romanów”, the route ran through agricultural lands in a joint passage with the western version.

Western version from the crossing with national road Nr 72 ran in the south-west direction, passed the housing areas of Nowosolana and Wiączyń Dolny. Then the motorway ran through agricultural lands with several crossings of tree-covered plots.

After interchange “Andrespol” the version was led through numerous tree-covered plots, and then it approached the housing area of Łódź-Olechowa (it crossed compact settlement at ul. Zakładowa street and crossed the railways station Łódź-Olechów.

Further on, the version ran through agricultural lands in the vicinity of the Ner River valley and passed the housing area of Giezmow.

Then, up to interchange “Romanów” the route ran through agricultural lands in a joint passage with the eastern version.

Western version ran in a direct vicinity of the city of Łódź and caused separation of buildable developed lands from the city.

At the moment, due to the issue of the final (but still ineffective) decision on location of the motorway according to version other than the western one, these areas, including the western version route are covered by mutli-family housing.

Because of the conflicts described above, a version minimizing those conflicts was drafted – modified western version (however, even in this version, it was impossible to avoid all conflicts).

Modified western version from crossing with national road No 72 runs in the south-west direction, in a passage adjoining to the western version. At km 307+500 the rout was led in the vicinity of the housing areas of Nowosolna and Wiączyń Dolny.

Modified western version was selected for implementation and obtained location decision which is still ineffective. 14 motions to reopen proceedings and 4 appeals were filed with the Ministry of Infrastructure.

### **The section from interchange “Romanów” to interchange “Tuszyn”**

Due to the fact that the motorway I this section was included in the spatial planning of the communes already in the 1980s and 1990s, long before issuing location proposal, option analysis was not conducted. Location proposal and then location decision were issued for this version.

### **The section from interchange “Tuszyn” to the border of the łódzkie/ śląskie provinces**

Due to the fact that the route of the motorway in this section was proposed as the extension of the existing national road No 1 ( adjusted to the parameters of class A road), no other location solutions were tested.

### **Implementation versions**

Because the final decision on the motorway location for the analyzed section A1 were issued, location, location option analysis was not discussed in this report.

## **4. ASSESMENT OF THE ANTICIPATED ENVIRONMENTAL IMPACT**

### **4.1. Impact on the land surface and soils**

At the time of building the motorway A1 the biggest influence on the environment is connected with the mechanical disturbance of soil profiles and with permanent occupation of the land in the route of the planned motorway. About 1311 ha will be permanently and irreversibly changed and occupied.

Additionally, some part of the area will be taken on a temporary basis in order to build access road to the construction site and arrange proper site facilities. Damage caused because of this will be temporary – after some time, natural reconstruction will be possible.

Implementation of the project will also involve moving huge quantities of earth. It will be necessary to build embankments in a few places where the road could run.

Due to construction works, mainly excavations, there is also the risk of changing water circulation system.

During construction works there may occur a temporary secondary soil particle dusting due to mechanical works and earth contamination by fuel leaks from construction equipment. However, if the site properly secured and organized the possibility of this happening is considered very small.

Construction works will generate waste and small quantities of waste water.

The potential hazard once the motorway is used is soil contamination by the airborne substances and those carried by the waters flowing from surfaces. The soils are contaminated by elements of exhaust emission and dust generated by the traffic, road surface wear, tire wear and wearing of other car parts. Chemicals used for winter road maintenance constitute considerable source of contamination. Inadequate use of salt (in large quantities) might cause the release of chloride ions to the melt waters and soil salinity.

Soil contamination is not determined only by the level of emission or the impact of degrading elements but to a large extent by the resistance of the soils. This resistance varies and depending on the soil type it is determined mainly by soil reaction and soil sorption complex capacity.

It can be predicted that the planned motorway will not significantly influence the concentration of pollutants in soils. Most soils in the analyzed section is of medium or low sensitivity to traffic pollution.

Due to the fact that the vehicles are more and more technologically advanced and use unleaded petrol, the amount of pollutants released into the surface layer of the soils tends to decrease. The proposed road surface water drainage and purification will result in reducing of the negative impact of the road on the ground surface and soils.

### **4.2. Impact on the surface and underground waters**

The works connected with the planned project can negatively influence both surface water and groundwater.

During construction the contamination might come from:

- rain and meltwater run-offs from the construction site and washing out of the pollutants from the materials used for construction

- inadequate storage of construction materials and materials used in road surface works, finishing works and in anticorrosive protection,
- wrong location of the site facilities and inadequate organization of the hygiene facilities,
- contamination of water with chemicals (especially petroleum derivatives) leaking from machines due to their failure,
- direct release of hazardous substances into natural watercourses during construction works on bridges.

A very dangerous situation might take place when there is a leakage of petroleum derivatives or other chemicals dangerous for human health and the environment in land depressions (especially those with water stagnation) and directly adjoining to watercourses. In this case the range of negative impact is expected to be large, as is the possibility of rapid release of pollutants directly to natural watercourses and groundwater which results in the contamination of a large area.

The biggest negative impact will come from works in the watercourse troughs. Suspended matter generated as a result of construction works increasing water turbidity impede sunlight penetration, which blocks photosynthesis.

The source of direct negative impact on surface water, and indirectly on groundwater at the use stage comes from pollutants from spills, road surface rain and melt water run-offs and hazardous discharges in the case of critical failure.

Pollutant concentration in rainwater run-offs depends on many factors including: traffic congestion, vehicle technical condition, land development, climate conditions or the width of the drained road prism.

The predicted pollutant concentrations in sewage indicated that exceedances of limit concentration values for total suspended solids will occur. For concentration of petroleum derivative hydrocarbons it was indicated that contamination of rain water flowing from road surface will be slight.

Another negative influence is connected with winter road maintenance by using salt to fight slipperiness. Increase in salt concentration in water might cause a lot of disturbances in fish and other species. The road drainage system does not allow to eliminate chlorides because they are compounds that do not undergo sorption, biodegradation or decomposition and reach the recipient in an unchanged form.

Because there is a huge possibility of critical failures, it is necessary to secure ground and water environment in areas where the motorway will run by means of vulnerable aquifers and in points of interference.

#### **4.3. Impact on the noise climate**

During construction negative acoustic phenomena will occur in the construction site and its vicinity. This can cause noise climate deterioration because heavy equipment is the source of high-level sound emissions. Carrying out the works means that

many noise sources are concentrated on a relatively small area. Traffic of lorries with loads and materials will adversely affect noise climate around the construction site. Heavy construction equipment can be the source of sound at 90dB. Vehicles carrying machines and equipment as well as building materials emit noise at levels higher than 80dB. Noise generated during construction will be a reversible and transitional phenomenon. It will undergo dynamic changes. The zone of sound level actual values impact includes all buildings located along the planned motorway at small distances from the edge of the constructed road.

It is predicted that the biggest negative impact on people in terms of noise at the implementation stage will be connected with building the motorway and the necessary infrastructure (viaducts, traffic diversions, interchanges, ramp lanes). Motorway sections between interchanges “Brzeziny” – “Romanów” and “Bełchatów”- “Radomsko” will be located in the vicinity of densely developed areas where the noise will affect a large number of people.

The implementation of the project will involve ensuring communication between the housing areas and agricultural lands located on both sides of the motorway and modified national road No 1. It is planned to build several viaducts, build or modify eight interchanges and modernization of provincial, district and commune roads. Building viaducts and interchanges, in some cases, will take place close to the residential housing. Noise impact will be felt by the inhabitants of areas close to construction sites. It is important that the construction works be done only during the day and as short as possible.

The planned motorway runs mainly through areas with dispersed distribution of homestead, housing-service, single and multi-family housing. Once the motorway is completed noise climate is expected to deteriorate in this area. The section of the motorway from interchange “Brzeziny” to interchange “Romanów” will be located close to densely populated areas where a lot of people will be exposed to the negative noise effects. It is worth mentioning, however, that since the motorway will take over some of the traffic, the noise climate around national roads No 1, No 8 , No 14 will significantly improve. At the moment the noise levels are very high in those areas. To determine the condition of noise climate after implementation and completion of the planned project of motorway A1(section from interchange “Stryków” to the border of łódzkie/śląskie provinces), the report on environmental impact included forecast on equal sound level considering its location, landscape formations and housing, The forecast was made for the following time spans:

- 2010 – version upon putting motorway A1 in operation ,
- 2025 – version after 15 years following the start of using motorway A1.

In the conducted analyses the following limit values of equal sound level were accepted for areas located in the vicinity of the planned motorway A1 (in accordance with the effective regulation on sound limit values in the environment):

- for the time of day between 6 a.m. and 10 p.m.: **60 dB** for the allotment gardens, homesteads, residential-service housing and multi-family housing ,
- for the time of day between 6 a.m. and 10 p.m.: **55 dB** for the single-family residential housing

- for the time at night between 10 p.m. and 6 a.m.: **50 dB** for homesteads, residential-service housing and multi-family housing

For school and kindergarten buildings the limit value is **55 dB** during the day while for cemeteries **60dB** during the day.

Based on the forecasts and analyses of noise climate for the areas located along the planned motorway A1, it can be stated that building the route will contribute to decreasing traffic congestion on the neighbouring national roads (except for NR No 91) and thus will positively influence noise climate compared to the present state. However noise climate in the areas adjoining to the planned motorway will deteriorate.

The forecast results showing graphic noise distribution of the planned motorway A1 area presented in Appendix 5 to the report on environmental impact.

#### **4.4. Impact on the air**

During the implementation stage the pollutant emission to the air will occur due to the traffic and the work of heavy equipment. The amount of pollutant emission will depend on the technologies used during construction works. Building of the motorway will involve using milling machines, ripper, loaders, trucks for transporting building materials, static and dynamic rollers and many other. Depending on the advancement of the works, the time and number of machines and equipment will change thus the impact on the air quality – gaseous effluents (mainly  $\text{NO}_x, \text{SO}_2$ ), dust and heavy metals in dust – will change over time. The effects will be reversible and short- or medium-term duration (depending on the time of the works). Direct impact, especially of dust pollutants, will be connected with buildings located by the road and with vegetation – both natural and agricultural.

Air pollution can be divided into primary pollutants occurring in the air in the same form they are released into the atmosphere, and secondary pollutants which are products of physical changes and chemical reactions occurring between the atmosphere components and substances entering it. Products of these reactions are sometimes even more harmful from primary pollutants.

Air pollutants are very mobile and can spread on large distances and get into other elements of natural environment. The intensity of their spreading depends on meteorological and ground conditions. The analyzed road runs primarily through flat areas, agricultural lands which favors good aeration of the land.

Based on the analyses conducted as part of the report on environmental impact, it was stated that when the motorway A1 is used the main problem will be the possible exceedance of reference level for nitrogen oxides  $\text{NO}_x$ , per nitrogen dioxide ( $\text{NO}_2$ ).

The conducted forecast indicated that exceedances of limit values for  $\text{NO}_2$  will occur along the whole planned section of motorway A1 (from interchange “Stryków I” to the border of łódzkie/śląskie provinces) both in 2010 and in 2025.

The biggest exceedance of limit value for nitrogen dioxide (average annual concentration  $228.559 \mu\text{g}/\text{m}^3$ ) will occur in the section “Stryków I” – “Brzeziny” in 2010.

Maximum exceedance range of limit value for this substance in this section will be about 75 m from the road axis.

Additionally, there is a possibility of exceedances of limit value for sulphur dioxide for human health protection ( $30 \mu\text{g}/\text{m}^3$ ). The exceedances occur in the section "Stryków I" – "Brzeziny" in 2025 ( $37.507 \mu\text{g}/\text{m}^3$ ) while in the same section but in 210 values of sulphur dioxide is closer to limit value ( $28.594 \mu\text{g}/\text{m}^3$ ). For plant protection ( $20 \mu\text{g}/\text{m}^3$ ) the exceedances of the limit value occur in 2010 in sections "Stryków I" – "Brzeziny" and "Andrespol" – "Tuszyn", and in 2025 in sections "Stryków I" – "Tuszyn", "Piotrków Trybunalski" – "Bełchatów" and "Radmosko" – border of łódzkie/ śląskie provinces.

Exceedances of limit value for sulphur dioxide are not that significant and their impact range falls within 12 m of the road axis which means that they will not go beyond the lane.

#### **4.5. Impact on the animated nature**

The environmental impact of the project on the flora will mean destruction of common plant communities in the land used for the motorway including the construction site. In this way part of biologically active zone will be lost. It will be necessary to cut out the existing woodlots. This is the case especially in places where the motorway crosses the forest. Additional danger lies in exposing sylvia without protective wall in a for of transitional zone as well as entrance of air pollutants directly into the sylvia.

During the construction stage drainage or irrigated, which due to changes in habitat conditions will cause withering of certain plant species which will be replaced by species better adjusted to the altered environment conditions. As a result this process can cause change of all plant communities. Works conducted in peat bogs and marshy lands as well as unimproved meadows will destroy the community structures and reduce animals' life activity. Long-term drainage can cause total destruction of plant communities and animal species dependent on them.

In places where the motorway will cross river valleys the riparian flora will be destroyed by cutting down trees, bushes and other plants growing on river banks. Destruction of this flora can have an indirect influence on the increase of pollutants in the crossed watercourses because those species not only keep the balance of the river bank habitat but also act as biological filters.

On the route of the motorway there were many valuable natural objects found that could be affected by the motorway.

At 296+650 there is grassland connected to the valley of a nameless watercourse. Some meadow fragments are of great natural values, especially in places where snake weed occurs or habitats protected under Natura 2000.

On the route of the motorway there are common occurrences of seminatural communities of damp and fresh meadows. Natural meadows spread on at least several thousand of hectares, mainly in the valleys of Ner, Warta and Pilica rivers. Near Łódź, including Wzniesienia Łódzkie National Scenic Park, mainly due to watershed location, meadow communities are considerably rare. Near Łódź, the share of natural and seminatural communities is

considerably lower than in other areas. Patches of well formed meadows, with rich flora are of great scientific, educational and environmental value. They are the source of many species which were common in the past and currently are becoming rarer. Destruction of local population causes long-term and irreversible elimination of a given plant species in the region. Since many meadow plants are the food for animals –mainly insects – their disappearance entails impoverishment of the fauna.

At 296+600 there are natural riparian tree stand in the watercourse valley with alder being the dominant tree and individual poplar tree planted later. Riparian tree stand represent the Natura 2000 habitat. Small fragment of the tree stand is within the limits of the motorway boundaries.

Natural riparian tree stand are found in the valleys of almost all watercourses in the region. Larger riparian complexes occur in the valleys of larger rivers and in the sections of streams flowing through forests (in Wzniesienia Łódzkie National Scenic Park).

Near Laski (km 301+300 – 301+600) and Plichtów (km 303+000- 303+100) there are grasslands in the valleys of local watercourses and depressions. These are mainly transitional meadows – between damp and fresh. Part of the meadows represent the Natura 2000 community. Within the boundaries of the motorway there are relatively small areas of meadows near Laski and the valley of Moszczenica near Plichtów.

At km 297+700 – 298+700 on the east side of the motorway, about 500 m of the motorway axis there is a small fragment of Janinów complex - a valuable oak forest – with *Luzulo pilosae-Fagetum* beech communities (protected under Natura 2000). In the forest there is a separately marked oak seed stand which provides the forest nurseries in the region with a valuable sowable material. In the north part of the forest there is also a nature reserve – ravine “Parowy Janinowskie”. The construction of the motorway will not directly affect the preservation of the protected habitat of beech forest because of the relatively big distance.

In Laski at km 301+400, about 50 m west from the motorway boundary and directly at the planned entrance ramp to the viaduct there is a small-leaved lime of monumental size. The danger during the construction of the motorway may be that the root ball is disturbed which is why the works near the tree must be done very carefully.

At km 302+700 – 303+ 600 – near Plichtów Mały there is a water-head valley of Moszczenica and highest point of Wzniesienia Łódzkie hills of great landscape and natural value with clubmass growing nearby. This site is not gong to be affected by the motorway because it is relatively far away from it.

Between km 308+100 and km 308+400 there is a small depression, partly with an open water-table and rushes growing on the fringes. This site is seriously endangered by the motorway construction. However, maintaining hydrological regimes and proper security during earthworks (e.g. before temporary storage of earth mass) will ensure preservation of this locally valuable marsh.

At km 306+400 – km 306+900 the planned motorway runs about 60-150 m west of the border of a large Wiączyń forest reserve. It is one the most valuable forest complexes near Łódź. In the north-east part of the complex (about 3.5 km of the planned road) there is a nature reserve “Wiączyń” with a protected fragment of fir-oak forest. The motorway will affect the complex by increasing the sound level in it and by limiting

migration options for the animals to agricultural lands located west of the complex. Impact on the water circulation systems and potential changes in the communities will probably be small.

At km 320+850 about 50 m of the motorway, at the edge of the forest there is a valuable marsh with numerous marsh and rushes species like *Oenanthe aquatica*. If the water circulation system is not significantly changed in this region then the motorway will not affect it.

Another place worth mentioning is a fully naturalized old park tree stand by a manufacturer's summer villa, in Łódź, between rails and ul. Przylęcie street (km 313+250 – 3313+550). It is a wet-ground forest, protected under Natura 2000. Grand small-leaved limes and horse chestnuts grow here, as well as hornbeams and European ashes. Because of the distance between the planned road the site, the motorway should not affect this valuable habitat.

There are valuable patches of well maintained damp meadows found in a direct vicinity of the river Wolbórka (km 325+000) and west of Wielkopole (km 326+350). The rich flora includes: Yorkshire frog, fescue, meadow buttercup, ragged robin, water avens and European swamp thistle. It is also a place where western marsh orchid is widely found. Its occurrence was verified at km 324+900, about 300 m west of the motorway boundary and at km 326+40, 0-350 m west of the motorway boundary. The sites are in the direct vicinity of the motorway and are at risk of being destroyed by the motorway.

In the dry meadows the ground cover includes oat-grass and small plantain, autumn velvet asity and dove clover. Most parts of the meadows meet the criteria for the Natura 200 system. The motorway crosses the areas of valuable meadows in several sections: km 324+560 – 325+000, km 325+625 – 327+750, km 328+240 – 328+480. The impact will be direct – taking part of the habitat, and indirect – potential changes in conditions in the habitat.

At km 325+630 – 326+900 there are large meadows with protected species of orchid – western marsh orchid. The plant is dispersed in many places. Preservation of the population requires maintaining characteristic habitat in the place where they grow and (or) in the closest vicinity.

The impact of the motorway of the site in question will be twofold: direct destruction of the habitat taken by the species and potential indirect influence by changing the water circulation systems and methods of land management in the vicinity of the motorway. Only extensively used meadow patches provide the habitat for western marsh orchid. Maintaining the meadow habitats near the planned motorway in their natural state might contribute to the preservation of the local population of this protected species.

Between km 330+200 and 331+100, west of Głuchowo there is a small valley with a small forest complex with wet-ground forest habitat (protected under Natura 2000). North and east of the forest there are valuable damp meadows abounding in snake weed and ragged robin. Part of the meadows will be on the way of the planned motorway (km 330+200) which entails total occupation of the habitat for the purpose of building the road and possibility to change water circulation systems.

Another place worth mentioning, for biocenotic and landscape reasons, is reservoir located between Władysławów and Polecie (km 346+000) – 150 m west of the motorway. On the sides of the reservoir there are rushes and common reed growing, *Scirpetum lacustris* and riparian carex. The reservoir is surrounded from the east,

north and south with wet-ground tree stands, and from the west it borders with the meadows. Because the complex is quite far away from the planned motorway (100-400m) only potential, drastic drainage of the land in the vicinity of the road could adversely affect the site.

At km 345+700, in Władysławów, there is a group of trees in a woodlot: 5 English oaks and common maple. Four of the oaks in question are within the motorway route. Only adequately led service road and carefully conducted construction works will not lead to the destruction of the trees and damage of their huge root calls. Apart from that, potential drainage of the land and increased air pollution brought about by the construction can pose threat to the existence of the trees.

At km 345+950 – 346+ 350, 100-400 m west of the planned motorway (in Władysławów) there is a complex of meadows, rushes and tree stands of great landscape and natural value. A oak-hornbeam sylvia of more than 100 years grows here. In the site there are two protected species found: sweet woodruff and common ivy. From the west and south the tree stand borders with colorful, multispecies fresh and damp meadows where, single as well as lined oaks of monumental sizes grow. These trees and protected plants are not exposed to mechanical damage during the construction of the motorway. Their existence might be endangered only by a dramatic fall in deep groundwater levels.

Of natural value are also meadows in the valley of Kamionki and near the village of Huta Porajska. The alders in the latter complex are well preserved, as are the meadows near the villages of Danielów, Aleksandrów and Politki. In more damp places there are small fragments of species-poor meadows with dispersed sieve plate and compact sieve plate (the Natura 2000 habitat). The meadows are not located in the areas designated for building the motorway so they are not endangered by the project. Only dramatic disturbance of the existing water circulation system can cause the destruction of the molinion meadows.

Additionally, in the forest division no 379 of the Piotrków Forest Inspectorate (km 363+400 – 364+150) there are fragments of wet-ground forest (the Natura 2000 habitat) with many English oaks present in the sylvia. This forest is not natural. In the north-east side black locust, black cherry and blackberries were planted. Swallow-herb and red robin grown in the ground cover. The central part of the park is covered with pine trees. In the south-western part centenarian English oak dominates. The fragments exposed to sun, in the south-west, abounds in lily of the valley (protected species); and in some places cypress spurge can be found as well. The sites of these species are not endangered by the construction of the motorway. The complex described above is crossed by the existing national road No 1. The motorway will sever this forest complex even more and will lead to cutting down of trees inside the motorway route so only small fragments of the wet-ground forest will be destroyed. These areas will be partially destroyed during construction so the works should be reduced to a minimum and do not go beyond the area designated for building. Destruction of these small fragments will not be significant for the protection of this type of habitat in the vicinity and in the region.

The most valuable forest, in the described section, is the one located in Parzniewice Forest Reserve (km 364+650 – 364+900) over 200 m west of the planned motorway. Typical wet-ground forest is preserved here (the Natura 2000 habitat), with hornbeam-lime-oak sylvia. In some places there is also common beech tree and silver fir and single pine trees. The undergrowth includes hornbeam. The existence of this forest is not directly endangered by the project.

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At km 361+000 about 180 km east of the motorway axis, partly on the route of the motorway European white elm grows – it is a nature monument. The tree is in the direct vicinity of the existing local road. According to the project a local road is planned in the direct vicinity of the nature monument which can result in damaging large root system of the tree and even its trunk.

In the watercourse valleys, in narrow strips alder-ash riparian forest grow (priority Nature 2000 habitat) with some undergrowth of European ash and very rich riparian cover ground. Fragments of the forest located within the boundaries of the planned motorway will be destroyed which will not affect the protection of the habitat in this region. The existence of the remaining, definitely larger part will depend on the maintenance of the existing water circulation system. For protection of such habitat in the described section the building in the Widawka valley will be most important. The motorway should cross this valley by with an adequately wide trestle. This would ensure maintenance and even improvement of the existing water circulation systems of the valley – keeping its function of ecological corridor and protection of the valuable habitats, including wet-ground forests.

The largest areas of meadow-rushes complexes are found in the western part of the section (km 395+700 – 397+250), in the valley of nameless watercourse (the so-called “Pazne Meadows”). They are the most valuable non-forest areas in terms of flora and landscape. In places not affected by strong flooding colorful fresh meadows had grown harboring many species (fescue, smooth meadow-grass, cocksfoot, meadow foxtail and others). More damp places are covered with seminatural communities of improved and well-fertilized meadows with lots of marsh marigold, *Scirpus sylvaticus*, and meadowsweet etc. There are also fragments of lowland peat bogs with *Carex fuscae*, marsh cinquefoil and *Ranunculus flammula*. The floristic and habitat values of the “Pazne Meadows” can only be endangered by dramatic land movements near the motorway (due to construction works – deep excavations, drainage ditches etc). That is why it is advisable to spare use of the land during construction works.

Two small mid-forest peat bogs (the Natura 2000 habitat) are located at km 396+150, 250 m west of the motorway boundary and km 396+230, 30 m west of the motorway boundary in Brodowe. These sites are slightly dry but retained their natural values. They are the sanctuary of rare and endangered plant species like peatmoss, marsh Labrador, *Menyanthes trifoliata* (protected species), *Vaccinium oxycoccos*, andromeda, tormentil. Due to drainage of the land the pine tree enters the bog. The construction of the motorway with the existing water circulation retained in the bog will not cause destruction of the abovementioned species.

At km 396+200, 30 m west of the motorway edge, inside the strip demarcated by the motorway boundaries (in Brodowe) there is a small-leaved lime qualifying as a nature monument and growing next to a deserted farm. The construction of the motorway (building service road) can damage or destroy the tree.

At 396+150 and km 396+230, 250-300 m west of the planned motorway (in Brodowe) there is an overgrowing transitional peat bog. Only drastic drainage of the lands may cause damaging changes to the bog and initiate rapid succession to coniferous forest.

At the south-eastern end of the analyzed motorway section (edge zone of the Warta River) there are natural, relatively big patches of alder tree stands.

But the most interesting tree stands are connected with the Warta flood terrace. Between the riverbed, oxbow lake (western part of the section) fragmentary willow riparian forest formed (priority Natura 2000 habitat) – characteristic element of valleys of big rivers, with white poplar, white willow and crack willow. It must be stressed that on a regional scale this type of habitat is very rare and even small patches require protection considering their natural and landscape values. Spare use of the areas during construction works and retianing the existing water circulation systems in the Warta valley will ensure survival of the Natura 2000 habitats mentioned above.

There are also valuable oxbow lakes preserved in the Warta valley, in different succession stages (the Natura 2000 habitat). Several interesting plant communities occur there: single-layered duckweed communities, protected species like yellow water-lily, white lotus. In couple of oxbow lakes some interesting species were found, including fetaher foil and *Menyanthes trifoliata* (protected species). With a carefully planned construction works, not interfering with the hydrological systems in the Warta valley there should be no destruction of the mentioned habitats or the species living in them.

This does not hold true, however, for the oxbow lakes located in the direct vicinity of the motorway boundaries. The site at 399+070 situated in the area designated for the project will be completely destroyed together with protected species living there. A large oxbow lake at 399+000, 0-200 m west of the motorway boundary will be partially modified (0.14 ha of the oxbow lake will be covered with sand) which does not have to entail extinction of the protected plant species. If it is necessary to destroy sites of protected species, like yellow water-lily or white lotus, it is possible to move these plants (with rootstalks) to water reservoirs located out of the motorway reach.

It must be stressed that if the trestle is built and the existing embankments are dug up, the valley will be unblocked to a large extent and its function as an ecological corridor will be considerably strengthened.

Permanent occupation of land for the purpose of building the motorway and temporary occupation of the adjoining areas for stacking yard and access roads are connected with the destruction of the floral and faunal habitats. Vegetation growing in this area will be cut out and the surface layer of the soil will be removed. Degradation of the flora in this area means it will no longer function as the habitat for animals. Especially small animals which cannot leave the area taken by the motorway quickly will be seriously affected by the project.

Construction stage will sever ecological corridors used by the animals which will result in isolation of individual populations.

The presence of many machines and activities connected with constructing the motorway will have an especially adverse effect on the Wzniesienia Łódzkie National Scenic Park which is crossed by the planned motorway for about 5.3 km. It will disturb natural conditions in the park.

Along the route of the motorway many sites of protected animal species were found. Waterlogged areas around big and small glacier ponds inhabited by amphibians – smooth newt, European fire-bellied toad, European tree frog and other.

Field work also showed that there are many species of protected birds along the route of the planned motorway. Based on the nature of the project the impact on the avian fauna can be divided into two types:

- The impact of the modification of the existing NR No 1 and A1 on the birds and their habitats. The range of the project in this section means widening the already existing road and building or modernization of the engineering structures and building service roads which are often led on the existing local roads. In this case no significant impact on the found bird species is expected.
- The impact of the new route of A1 from interchange “Stryków I” to interchange “Tuszyn” – in this section bird habitats will be occupied and they will be exposed to negative effects of the project. The following bird species were found in the analyzed section.

Table 4.1 Valuable bird species found near the planned route of motorway A1 from interchange “Stryków I” to interchange “Tuszyn”

Species	Motorway km	Approximate distance from the road edge
Buzzard	296+600	500
Lapwing	296+600	570
Lark	303+400	210
Kestrel	303+400	120
Buzzard	303+500	160
Woodpecker	320+700	110
Crow	331+200	390
Buzzard	333+400	410
Lapwing	335+600	410
Lapwing	339+200	310
Lapwing	340+400	300
Lapwing	342+100	100

The species above except for kestrel are common and live everywhere in Wzniesienia Łódzkie National Scenic Park and adjoining areas. Partial occupation of the habitats of these birds will not cause significant changes in their populations.

Negative impact of the motorway construction stage on the animals is not only connected with the severance of the continuation of ecological corridors used by animals but with increased noise emission. Road traffic within the motorway and the construction sites and human presence will scare the animals away.

In the analyzed area of the motorway A1 route ecological and migration corridors of the fauna are connected mainly with the hydrological network and the mosaic of forest, meadow and bush habitats constituting complexes of high biodiversity and conducive to existence and migration of the most of the faunal species found there. River valleys crossed by the motorway and the adjoining forest complexes constitute the main migration axes on a supraregional level. The motorways interfere with faunal migration corridors of national levels in two sections. These corridors are of crucial importance for seasonal migration and elk and wolf migration and are important for migration and dispersion of other large ungulates on a national level. Additionally they are crucial for maintaining spatial coherence of the Natura 2000 network on a national scale.

Table 4.2. Interferences of motorway A1, section “Stryków I” – the border of the province including ecological corridors

No	Section	Corridor status
1	300+100 – 300+500	Local
2	306+800 – 307+200	Local
3	324+890 – 327+420	Regional (Wolbórka River valley)
4	327+510 – 328+060	Local
5	332+430 – 333+410	Local
6	334+200 – 335+510	Local
7	352+000 – 352+400	Local
8	357+700 – 358+100	Local
9	361+750 – 362+900	Local (Dąbrówka river)
10	369+350 – 371+310	Local
11	374+630 – 374+950	Local (Kamionka river)
12	379+850 – 382+700	Local complementary South-Central corridor section: Widwka Valley
13	387+760 – 388+450	Local
14	393+050 – 399+742 (within the motorway boundaries)	South-Central Corridor of international significance section: Warta Valley

#### 4.6. Impact on the landscape

The location of the motorway (except for the section crossing Wzniesienia Łódzkie National Scenic Park) is of little landscape diversification. Flat landscape with little diversity dominate (river valleys, forests). Four basic types of landscape were distinguished in the area of the project. The division criterion was the degree or quality of changes that had taken place depending on the distortion of the natural relations in the environment and changes brought about by human activity. The types are:

- landscape similar to natural – forests and midforest meadows and clearings, river valleys,
- natural-cultural landscape – overgrowing meadows landscape, agro-sylvan landscape – small forest areas among meadows and fields and agricultural landscape – meadows, farm fields, agricultural drainage ditches, woodlots, single farmsteads, gardens adjoining to the house, orchards,
- cultural landscape – connected with settlement,
- degraded cultural landscape – traffic route landscape, landscape of the vicinity of high-voltage transmission lines

The planned motorway runs, in larger part, through the areas belonging to landscape similar to natural and natural-cultural landscape. In terms of the area cover, cultural harmonious landscape takes up the most space and includes: arable lands, meadows and to a lesser extent, forests, copses, orchards.

The landscape of the areas designated for the planned motorway belong mainly cultural landscape. Only in the first section (from interchange “Stryków I” to interchange “Brzeziny”) the landscape is similar to natural because the motorway runs through Wzniesienia Łódzkie National Scenic Park.

Photo 4.1 The landscape of Wzniesienia Łódzkie National Scenic Park

Between interchange “Brzeziny” and interchange “Romanów” the planned motorway constitute a ring road of the city of Łódź and goes through urban areas, while in the further section from interchange “Romanów” to the border of łódzkie/śląskie provinces agricultural landscape dominates – open areas of fields and wastelands, covered with clusters of trees and bushes. Only in short sections the motorway crosses small forest complexes.

The planned motorway will run along the new route from interchange “Stryków I” to interchange “Tuszyn” – and thus it will constitute a new, distinctive feature of the landscape in this region. It will be especially visible in the section when it crosses Wzniesienia Łódzkie National Scenic Park with many height differences of the land. To overcome those height differences it will be necessary to build embankments and pits in some sections.

In the section from interchange “Tuszyn” to the border of łódzkie/śląskie provinces the motorway will run on the route of the existing national road No 1 and thus it will not cause major changes in the landscape.

Photo 4.2. The route of the existing A1 section near Piotrków Trybunalski (agricultural landscape)

The impact of the planned motorway on the landscape was analyzed from a spatial perspective, that is how it will be perceived from a greater distance (within a given landscape) and from a local point of view, that is the perception of the road from the direct vicinity (in the context of local landscape interiors)

The evaluation of the impact of the planned motorway (including the planned sound barriers) on the landscape was based on the analysis of the completed built features with similar land development.

It was found that the spatial elements which are blended with the surroundings have little impact on the landscape.

The impact of the road on the landscape is presented below.

**Landscape similar to natural like forest landscape** with the bushes and tree undergrowths has limited visual range. Midforest meadows and clearing and forest roads constitute landscape interiors.

Photo 4.3. The visibility in the forest is reduced to narrow and short access points.

Due to limited observation range in the forest areas, the planned motorway will be not be that visible from the forest interior and from areas outside of the forest complexes. From this perspective the motorway will have a small impact on the landscape.

Forest clearance for the purpose of building the motorway will cause local but permanent change in landscape similar to natural. Building the road through the forest will result in opening of the forest interior. This can lead to cutting down of the trees, especially tall pine trees not adjusted to the wind activity. The landscape along the planned road will change into an anthropological landscape.

**Agricultural-sylvan landscape** features many landscape interiors bordered with forest fragments and woodlot tree stands. Natural succession in these areas takes place very rapidly.

Photo 4.4. Visibility in agricultural-sylvan landscape – borders with the walls of the landscape interiors.

Because there are many visual closures, the planned motorway will not be very visible in such landscape.

If the motorway crosses landscape interior, two smaller interiors will be created. It will not influence the landscape.

**The landscape of overgrowing meadows** features narrow and remote openings bordering with the tree stand line on the horizon.

Photo 4.5. The landscape of overgrowing meadows

The motorway built in this landscape is visible through the screen of young trees and after some time will blend with the landscape.

Agricultural landscape is open, landscape openings border with woodlot tree stands and the greenery adjoining the housing.

Photo 4.6. Wide landscape opening in the agricultural landscape

The motorway on the level of the ground is usually well blended with the agricultural landscape. The most visible feature of the motorway in this case will be the bridges with the access roads. Blending the bridge structures with the landscape depends, to a large extent, on their coloring similarly to those sections of the road that run on the embankments. In such places the motorway will cross landscape axes.

Photo 4.7. Overpasses will give a new perspective to the landscape observation.

Photo 4.8. The road led in a pit is not visible from the adjoining areas. Such a solution makes it possible to lower access embankments to the overpass.

Since the agricultural landscape is open the motorway will be visible in sections led on the embankments.

Photo 4.9. A road on an six-meter embankment. At the bottom there are trees and bushes.

**The landscape of suburban and rural settlement** consists of one- or two level housing.

Thanks to the adjoining greenery the housing blends to a large extent with the surroundings and at the same time is separated from the adjacent lands. Landscape openings occur mainly along the axes of the existing roads and in the undeveloped lands between the housing areas.

In the developed areas it is important to protect people from the negative effects of the motorway on human health and life. Thanks to the application of protection solutions the planned motorway will be separated from the developed areas by means of sound barriers or it will be completely hidden in the pits.

Due to a limited access of the motorway, its fencing and heavy traffic will cause separation of the settlement areas. The connection between the separated areas will be maintained by means of overpasses or underpasses along the planned motorway. Most of the local roads perpendicular to the planned motorway will have no access to the landscape.

Landscape damage compensation in the cultural landscape is possible if cultivated green areas are created along the planned motorway., like for example greenery strips.

Photo 4.10. An example of a road blended in the cultural landscape (single-family housing on the right side, the road is behind the sound barriers hidden in the greenery).

Degraded cultural landscape is found in the heavily developed urban areas. Land conditions in such landscape are completely modified by human activities.

In the vicinity of the planned motorway the existing routes with service-commercial housing and production-storage housing, multifamily housing and high-voltage transmission lines constitute this type of landscape.

Building the motorway in such landscape will fasten urban modifications.

#### **4.7. Planned demolitions and waste management**

In order to build the motorway it will be necessary to remove the existing housing which is located on the way of the route established by location decisions.

Part of the waste will come from the demolition of the housing, in places where it interferes with the route. The project will require demolishing 361 buildings. Lack of quantitative evaluation makes it impossible at this stage to estimate exactly how much waste will be involved in the housing demolition.

The waste environmental impact will be small. The waste is generated along the route (mainly on the impervious surface area) and is easy to remove and then to utilize or reuse.

#### **4.8. Impact on the protected areas, established under separate regulations**

Constructing the motorway on the territory of Wzniesienia Łódzkie National Scenic Park will have the following negative effects:

- Part of a biologically active area will be occupied
- Small fragments of habitats protected under a directive on habitat will be destroyed
- The motorway with its heavy traffic and total hoarding off will cause the barrier effect which will impede contact between the habitats on the opposite sides of the motorway
- The motorway will have a significant impact on the landscape. Due to height differences it will be necessary to lead the motorway on embankments, trestles and partly in a pit. Additionally, the route of the motorway near the housing areas requires building sound barriers.
- In the Park, in place with open space, 2 Motorway Service Areas were created. They will be visible from a distance.
- Alien species not occurring naturally in the Park will migrate along the motorway into the Park.

Positive effects of the project:

- The Park will become a more popular tourist spot thanks to better connections with big metropolitan areas (Warsaw, Łódź). More tourists will visit the place which is beneficial because it will be a chance to present the values of the Park and provide environmental education. At the same time it will bring negative effects – increased waste generation, which is why this point is include in the positive and negative list of effects.

#### **4.8.2. The planned Protected Landscape Area of the Mrogi and Mroźcy River Valleys**

The motorway will go along the border of PLA the Mrogi and Mroźcy River Valleys about 100-300 m west of it in section 306+400 – 307+600. Therefore it will not influence the landscape and nature of the valleys.

#### **4.8.3. The planned Tuszyńsko-Dłutowsko-Grabiański Protected Landscape Area**

The motorway crosses the Tuszyńsko-Dłutowsko-Grabiański Protected Landscape Area at km 323+820 – 325+530 and then at km 325+530 – 328+160 it goes along the western border of the area.

Due to the fact that the objects of protection of Tuszyńsko-Dłutowsko-Grabiański Protected Landscape Area are not known at this time (the area is being planned), it is impossible to evaluate the impact of the motorway of the environment.

#### **4.8.4. The planned Pajęczańsko-Gidelski Protected Landscape Area**

The motorway crosses the protected landscape area at km 394+530 till the end of the analyzed section while in section 393+050 – 394+530 the planned route will go along the western border of the area.

Due to the fact that the construction of the motorway in this section will mean enlarging the existing national road No 1, no negative effects on Pajęczańsko-Gidelski Protected Landscape Area are predicted provided that the works will be done only within the motorway lane.

The new element to appear in the landscape will be the sound barriers.

#### **4.8.5. The Widawka River Valley Protected Landscape Area**

The Widawka River Valley Protected Landscape Area is crossed by the planned motorway at 380+420 – 382+380 while at km 379+690 – 380+420 it goes along the border of the area.

Due to the fact that in the interference section the construction of the motorway will mean enlarging national road Nr 1, no negative effects on The Widawka River Valley Protected Landscape Area are expected.

The proposed crossings for animals, both in forest corridors, as well as along the watercourses ensure that the provisions stipulated in the regulation establishing PLA are fulfilled in terms of maintaining and recreating ecological corridors while the planned drainage system will contribute to the increased water retention.

#### **4.9. Impact on the Natura 2000 areas**

The motorway does not cross any areas belonging to the European Environmental Network Natura 2000, the existing one or planned (entered on the Shadow List). The motorway does not run in the direct vicinity of the Natura 2000 areas.

The closest Natura 2000 area (6km) is “Cyrusowa Wola” PLH 100012. animal species living in this area do not migrate far. Therefore negative impact of motorway A1 on “Cyrusowa Wola” area is not expected.

The closest, officially demarcated area of Natura 2000 – “Meadow in Bęczkowice” (PLH 100004) is 16 km away from the planned motorway in the eastern direction.

This area include a peat bog in the Luciąża valley. The Luciąż River does not interfere with the planned section of motorway A1 so there is no possibility of negative impact on the optional migration corridor for protected animal species.

Based on the conditioned described above there is no possibility of negative impact of the planned motorway on the Natura 2000 areas.

#### **4.10. Impact on the protected national cultural heritage**

##### **4.10.1. Places of architectural heritage**

The construction of the planned motorway will affect the places of national heritage in its vicinity – this particularly concerns court complex in Stobiecko Szlacheckie (park from 19<sup>th</sup> c. and court from the beginning of the 19<sup>th</sup> c.) which is crossed by the existing national road No 1.

Fig. 4.1. The current distribution of buildings in the park entered in the register of monuments in Stobiecko Szlacheckie.

Sala gimnastyczna i przedszkole – the gym and kindergarten

Boiska szkolne – school playing fields

Szkołą podstawowa – primary school

Boisko szkolne – school playing field

Legenda – Legend

Obszar parku wpisanego do rejestru zabytków – part of the park entered in the register of monuments

Linie rozgraniczająca autostrady A1 – motorway boundaries

Drogi serwisowe – service roads

In 1957-1960 the court with the park became the property of the Education Department in Radomsko which adapted it for the purposes of the school that uses it to this date.

In 1970-1973 because of the construction of the road Warsaw- Katowice (national road No1), the park was divided into 2 parts by cutting down the trees. The road occupied an about 80-meter wide strip of land.

The construction of A1 in the analyzed section is connected with adjusting the existing national road to the parameters of a motorway. The road will be widened by about 7-9 meters. Near the park the road edge will be in the vicinity of the walls of the school property which is the border of the area under protection (entered in the register). During construction it might be necessary to cut down couple of the closest lying trees. Additionally, to protect the school area and the kindergarten from the above-the-limit sound levels it will be necessary to build sound barrier on the road edge.

Based on the analysis of the distribution of buildings in the park, the motorway boundaries will not interfere with the buildings but they will encompass the cinder volleyball field and fragment of clay soccer field. The area of the motorway will be fenced thus preventing the children from using the tree-covered part of the park.

The construction of the motorway will not significantly affect the park located on both its sides. The most negative effects will be the sound barriers and service road running through the park. They will cause visual separation between the two parts of the park. They will also limit park visibility.

The positive aspect of the motorway is improvement of the security around the school and kindergarten. At the moment the existing national road No 1 is not fences but the school area has low fence structures. The big playing field is on the other side of the existing national road No 1 in the remaining part of the park, To get to the playing field it is necessary to leave school premises and taking a underpass. The underpass is dangerous to move on because it is very narrow and vehicles can only go one by one. There is a sidewalk along the road but it ends before the underpass due to limited lighting which forces the pedestrians to walk on the road. Vehicles move 1 m away from the pedestrians which creates dangerous situations (photo 4.11).

Photo 4.11. The narrow passage which also function as crossing for pedestrians near the school and kindergarten

The construction stage might also endanger three historical places located near the existing roads which can serve as access roads to the construction site (transport of materials).

- An inn dated 18/19<sup>th</sup> centuries in Wygoda
- Water mill from the end of the 19 c. in Laski
- Roman Catholic chapel from the beginning of the 18<sup>th</sup> c. in Ochocice

#### **4.10.2. Archeological sites**

On the route of motorway A1 archeological surface verification analysis was carried out which based on the report by Prof. Konrad Jażdżewski Foundation for Archeological Research, revealed that there were no valuable archeological sites on the route of the motorway that would require rescue excavations.

#### **4.10.3. Łódź-Olechów forced labor camp**

The question of a possible finding of remains of the forced labor camp Łódź-Olechów is to be unresolved until the start of earthworks. At the moment the documents confirming grave locations do not exist or are not available.

At the early stage of the preparation of the analyzed motorway section (the fragment constituting the ring road for the city of Łódź) a detailed analysis of the problem was conducted.

Based on the collected documents on the explanation of the grave locations of the forced labor camp it was also impossible to determine specific places, the number of people killed or the burial areas of the victims.

Summing up, there are no documents that would enable confirmation of the grave locations. It must be taken into account, then, that the location of the graves might be revealed during the construction of motorway A1.

## **5. DESCRIPTION OF THE PLANNED ACTIONS AIMING AT PREVENTION, LIMITATION OR ENVIRONMENTAL COMPENSATION OF THE NEGATIVE ENVIRONMENTAL IMPACTS AND ASSESSMENT OF THE EFFECTIVENESS OF THE PROPOSED METHODS AND MEASURES**

### **5.1. Impacts at the implementation stage**

- The construction of the motorway will entail irreversible occupation of biologically active areas spreading on 1311 ha
- The construction of the motorway can affect surface and deep groundwaters both quantitatively and qualitatively.
- The necessity to perform deep excavation works there exists a risk of altering water circulation systems
- The main causes of impairing the quality of waters might be:
  - rain and meltwater run-offs from the construction site and washing out of the pollutants from the materials used for construction
  - inadequate storage of construction materials and materials used in road surface works, finishing works and in anticorrosive protection,
  - wrong location of the site facilities and inadequate organization of the hygiene facilities,
  - contamination of water with chemicals (especially petroleum derivatives) leaking from machines due to their failure,
  - direct release of hazardous substances into natural watercourses during construction works on bridges.
- A proper organization of the construction site – in accordance with the guidelines in the report on environmental impact will help avoid such effects. That is why application of additional protective measures is not necessary.
- Failure to maintain an adequate technological regime may lead to soil contamination (and indirectly or directly to water contamination) by fuel leaks from construction machines. The possibility of that taking place can be considered small with proper protection of the site and work organization. Application of additional protective measures is not necessary. It is of crucial importance to have sorbents for toxic substances.
- During the construction works unfavorable sound phenomena will occur in the construction zone and its vicinity. These effects might cause deterioration of sound climate because heavy machines used for building a ring road are the sources of high-volume sound emission.
- Work time should be optimized to limit the number of rides of heavy machines and vehicles. Construction works close to residential housing must be conducted only during the day (from 6 a.m. to 10 p.m.)
- No parking areas for machines and vehicles or stacking yards should be created in the vicinity of aquifers vulnerable to contamination:
  - from km 295+850 to km 299+750
  - from km 301+350 to km 302+450
  - from km 303+150 to km 306+200
  - from km 314+900 to km 321+350
  - from km 347+500 to km 348+800

- from km 361+300 to km 362+000
  - from km 382+000 to km 382+500
  - from km 383+600 to km 399+742.51
- Following the guideline of the Management of Wzniesienia Łódzkie National Scenic Park from km 295+850 to km 304+000 no parking areas for machines, vehicle or stacking yards can be created in the Park, its protection zone and adjacent lands. It is allowed to create parking areas and stacking yards on the sites designated as Motorway Service Areas Skoszewy Wschodnie and Skoszewy Zachownie (km 299+600 – 299+900).
  - In cases where the construction works would significantly affect the protected buildings or people's safety it is suggested to build temporary sound barriers.
  - Special attention must be paid to the school in Stobiecko Szlacheckie which will be about 80 m from the motorway. Construction works carried out during the day will disturb children while they are studying which is why the area should be protected with temporary sound barriers or, if possible the works should be planned to be executed during summer vacations.
  - In section from interchange "Brzeziny" to interchange "Romanów" the construction works will be carried out very close to single and multi-family housing areas for which the sound limit value is 55 dB during the day. If the works around these areas are to last long then the houses should be protected from the sound effects until the proper sound barriers are built.
  - The construction of the motorway will entail increased movement of heavy equipment and thus increased sound volume in the area. This will scare away animals which will probably relocate for the period when the works are done.
  - The construction of the motorway will cause destruction of animal habitats (especially of small animals and invertebrates) located on the route of the planned road
  - Soil from areas taken by the road and shoulders should be stored and used once the construction is finished to strengthen slopes and manage roadside greenery. It can also be used for recultivation of the lands for construction facilities and access roads.
  - Works near trees not designated for cutting down should be carried out in such a manner so as not to cause damage, especially to the root system and bark. In such cases it is suggested to use special screens to protect individual trees.
  - It is advised to shorten the time of excavations in the direct vicinity of the trees and bushes growing near the road and not designated for cutting down.
  - Avoid bringing heavy equipment to the area not designated for the motorway.
  - The motorway construction at km 325+650 – 326+900 will cause partial destruction of the protected plant site – western marsh orchid. The motorway construction will not affect the representativeness of this species in the region. It is one of the most commonly occurring orchids in Poland.

- To minimize the possible effect on the valuable natural sites it is suggested not to cross the designated construction area and limit changes to the water circulation systems.
- Works near Widawka River and nameless watercourse at km 379+800 (where brook lamprey lives) connected with disturbances of the riverbed or banks should be carried out as quickly as possible from mid-June to the end of March (that is not in the reproductive period for brook lampreys).
- To avoid negative impact on the oxbow lakes of Warta River and to clear the migration corridor of national importance it is advised to lengthen the bridge on Warta River at least to km 399+100.
- Near the motorway the following trees of monumental measurements grow:
  - km 301+400, about 50 m west of the motorway boundary at the planned entrance of the commune road onto the viaduct – small-leaved lime on a farm in Laski. The tree location does not interfere with the motorway but is directly in the vicinity of the local road, In order to leave it intact the construction works must be carried out within the designated motorway boundaries. No works should be conducted in the vicinity of the tree because of its large root system.
  - km 345+700 – in Władysławów – a group of trees growing in the abovementioned tree-covered woodlot. Four out of the mentioned oaks are in the close vicinity of the western the motorway boundary. Based on the oak location it is possible to lead the service road in such a way so as not to damage the oaks – this issue must be analyzed thoroughly at the project preparation stage.
  - km 361+000 about 180 m east of the motorway axis partly within the motorway boundaries there is European white elm – nature monument. It is located directly by the existing road. The root system is under the road so any modification requiring earthworks will endanger the elm. That is why it is necessary to reduce and move the works away from the elm.
  - km 396+200, about 30 m west of the motorway edge, inside the strip limited by motorway boundaries there is small-leaved lime growing by a deserted farm and it qualifies to be protected as a nature monument. The construction of the road running near the tree might cause damage to the trunk, branches or roots. If it is possible the service road should be moved away from the monumental tree.
- The planned motorway will occupy the feeding ground of lapwing and other commonly found birds in the analyzed area. This, however, will not cause significant changes in their population in the area.
- The motorway will also occupy some of the kestrel habitat. It will not affect the abundance of the species in the area.

## **5.2. Impacts at the use stage**

### **5.2.1. Impact on the land surface and soils**

- The potential hazard once the motorway is used is soil contamination by the airborne substances and those carried by the waters flowing from surfaces

- It can be predicted that the planned motorway will not significantly influence the concentration of pollutants in soils based on analysis conducted in other existing roads with similar traffic congestion.
- Minimization of the negative effects of the motorway on the ground surface and soils means limiting spreading of the pollutants, mainly heavy metals and petroleum derivative hydrocarbons. Reducing the danger of contamination from pollutant run-offs will be ensured by drainage and purification system from the road surface consisting of sediment/sand traps and retention-infiltration reservoirs.
- To reduce the chloride concentration in the road waste sewage it is advised to limit the use of deicing agents containing chlorides and comply with the regulations on winter road maintenance.
- Plantings of roadside greenery, proposed in this analysis will have a positive effect on the soil protection. The greenery will limit the road impact on the soils by reducing secondary dusting from the ground. It also stops the spread of pollutants and prevent erosion.

### **5.2.2. Impact on the surface and underground waters**

- The source of direct negative impact on surface water, and indirectly on groundwater at the use stage comes from pollutants from spills, road surface rain and melt water run-offs and hazardous discharges in the case of critical failure.
- Based on the conducted analysis it seems that the limit level for total suspended solids might be exceeded
- The predicted concentration of petroleum derivative hydrocarbons in rain run-offs from the surface of motorway A1 will not exceed limit values.
- Virtually along the whole route the motorway will cross various watercourses and melioration ditches. The watercourses will receive rain and melt water run-offs from the motorway.
- In the analyzed section of motorway A1 couple of fragments were identified that run through areas of high or raised susceptibility to groundwater contamination usually caused by the presence of poorly isolated main aquifer”
  - from km 295+850 to km 299+750, Area of High Protection HYA 403
  - from km 301+350 to km302+450, water-head areas and protected catchments of Moszczenica and Miazga Rivers, Area of the Highest Protection HYA 403
  - from km 303+150 to km 306+200, water-head area of Miazga River, Area of the Highest Protection HYA 403, indirect protection zone of water intakes in Nowosolna
  - from km 307+300 to km 314+900, water intakes for Andrzejów, Area of the Highest Protection HYA 403

- from km 314+900 to km 321+350, Area of the Highest Protection HYA 401,
  - from km 321+350 to km 329+700, waterlogged areas in the Wolbórka river valley, HYA 401 without isolation,
  - from km 330+300 to km 332+750, HYA 401 without isolation,
  - from km 333+400 to km 337+850, HYA 401 without isolation,
  - from km 347+500 to km 348+800, groundwater intake in Szkekaniny,
  - from km 349+550 to km 349+750, no isolation of aquifers,
  - from km 352+100 to km 352+250, no isolation of aquifers,
  - from km 357+200 to km 358+800, no isolation of aquifers,
  - from km 361+300 to km 362+000, groundwater intake in Jeżow, waterlogged areas in the Dąbrówka valley
  - from km 366+800 to km 369+000, no isolation of aquifers,
  - from km 371+650 to km 372+100, no isolation of aquifers,
  - from km 374+200 to km 375+800, HYA 408 without isolation, waterlogged areas in the Kamionka River,
  - from km 379+550 to km 382+000, partial isolation of HYA 408,
  - from km 382+000 to km 383+600, waterlogged areas in the Widawka river valley, HYA 408 without isolation
  - from km 383+000 to km 399+742.51, Area of High Protection HYA 408, indirect protection zone of water intake in Dobroszyce, waterlogged areas in the Warta river valley
- To minimize the negative effects on the waters in the analyzed section it is advised to build leak-proof drainage system for rain offs and melt waters
  - Leak-proof system for rain run-offs can be done by means of: leak-proof road ditches sealed (sloped and bottom), grass covered ditch (tighten with geomembrane or benthonic mat or through leak-proof storm drainage system);
  - In other motorway sections there is no need to introduce additional protection of rain water drainage. It is advised, however, to drain rain water by using grass-covered ditches. In this way the drain capacity of the ditch will be used.
  - Because of the possibility of exceedance of total suspended solids level, waste water pretreatment will be necessary before entering sediment/sand traps. At the outlet of each sediment/sand trap it is advised to use a valve that would facilitate cutting off the run-off if hazardous substances spill.
  - Slope run-offs will go to open grass covered ditches and as the so-called pure water will not require purification
  - Building of several retention-infiltration reservoir in the analyzed motorway section was proposed. Their purpose is partial drainage of rain and melt water run-offs pretreated in sediment/sand traps to the ground and mitigate run-off wave before directing it to recipient.
  - Approximate location of the planned retention-infiltration reservoirs is shown in the table below:

The right side		The left side	
296+700	376+880	296+670	376+850
299+020	378+040	299+020	376+880
300+000	378+020	300+000	378+040
300+060	378+510	300+060	378+010
301+670	378+490	301+670	378+510
305+320	379+620	305+080	378+490
305+800	379+600	305+800	379+620
307+030	379+820	307+030	379+600
307+090	379+860	307+090	379+840
310+070	380+130	308+520	379+870
312+640	380+180	310+060	380+130
313+710	381+420	310+870	380+170
315+830	381+460	311+440	381+430
315+760	382+030	313+710	381+460
317+400	382+230	315+830	382+000
317+950	382+300	315+760	382+240
318+610	383+920	317+400	382+300
319+100	383+950	317+950	383+920
320+110	385+010	318+610	383+950
323+590	384+980	320+130	385+010
325+770	385+320	323+570	384+980
326+400	385+360	324+880	385+320
328+780	387+830	325+770	385+360
330+150	387+770	326+400	387+830
330+920	388+290	328+760	387+770
332+250	389+080	330+150	388+290
333+920	389+320	330+950	389+080
334+290	389+290	332+260	389+320
337+040	392+530	334+600	389+290
347+730	392+600	337+070	392+540
347+690	394+010	347+760	392+600
348+940	393+970	348+940	394+010
350+780	395+430	350+760	393+970
361+880	395+470	352+590	395+430
362+080	395+740	353+430	395+470
367+880	396+520	362+000	395+940
369+960	397+140	362+130	397+140
374+780	397+110	367+870	397+110
374+850	397+630	369+250	397+650
375+940	397+660	374+780	397+620
375+980	398+800	374+850	398+800
376+850	399+050	375+980	399+020

-	399+680	375+960	399+710
-	-	-	399+680

- It is suggested not to harden the sides of the reservoirs (or to support them naturally). They should have easy gradient which would favor plant settlement around the reservoir
- Exact location and parameter will be determined during preparation of building design. Change of reservoir location is allowed by +/- 100m.
- It is also allowed not to build some reservoir if detailed hydrological calculations will indicate that they are not necessary since the estimated amount of drained water will not disturb the water flow in the reservoir to which they are directed.
- Near the structures functioning as crossings for small and medium-sized animals (km” 324+985, 362+041, 374+815, 382+272, 398+903, 301+583, 315+800, 317+926, 353+432, 384+000, 385+464, 387+800, 392+570, 393+895, 395+750) to maintain adequate widths and entrances to the crossings in the presence of retention-infiltration reservoirs it is necessary to use one of the following solutions:
  - 1) move the reservoir away in relation to the crossing (bridge) edge at least 75 m (in this case the reservoir can be fenced)
  - 2) if the above solution is not possible (because of e.g. motorway boundaries) the reservoir in this location should not be built (if hydrological calculations allows that)
  - 3) if it is not possible not to build the reservoir for hydrological reasons, then it is necessary to leave the reservoir unfenced (but its edge cannot be closer than 20 m from the crossing edge) – in this case it is necessary to use very mild slope of the edge and densely plant the edges with vegetation. The fence will, in this case, be led between the motorway edges and will join smoothly with the anti-glare screens on the crossing.
- in Motorway Service Areas (MSA), Motorway Maintenance Depots (MMD), Ramp Toll Plazas (RTP) and Tolling Stations (TS) the following method of waste water management is suggested:
  - wastewater contaminated with petroleum derivatives flowing from the construction site near gas stations, service and technical control stations – pretreatment in separators
  - waste water from parking places for vehicle transporting hazardous material – discharge to leak-proof container is necessary where, if need be, it will be possible to neutralize the wastewater,
  - municipal wastewater – discharge by sanitation drains to biological sewage treatment plant,
  - other waste water with little contamination – pretreatment in sediment/sand traps.
- Road administration office is obliged to obtain waterpermits to build and modify water facilities and to enter the sewage to waters and ground.
- The effectiveness of the proposed solutions will be verified by post-implementation analysis

**5.2.3. Impact on the noise climate**

- Forecast prepared for the areas located along the planned motorway indicate that 821 buildings will be within negative sound effect range. It is necessary to apply sound barriers that will limit the negative impact on the buildings connected with using the motorway. Construction of sound barriers had been proposed. The parameters of the barrier are given in the table below:

Sound barrier number corresponding to the number in Appendix 6	Sound barrier length [m]	Sound barrier height [m]	Sound barrier type	Estimated starting point of the screen
1	200	6.00	Adsorbing	399+000
2	160	6.00	Transparent	398+800
3	370	6.00	Adsorbing	398+450
4	770	6.00	Adsorbing	399+000
5a	310	5.00	Adsorbing	398+450
5b	170	5.00	Adsorbing	398+270
6	665	6.00	Adsorbing	395+630
7	350	5.00	Adsorbing	395+280
7a	340	5.00	Adsorbing	392+240
7b	120	5.00	Adsorbing	392+240
7c	160	6.00	Mixed	392+240
8	75	5.00	Transparent	392+250
9	70	6.00	Transparent	392+250
10a	60	5.00	Transparent	392+200
10b	320	6.00	Mixed	392+100
10c	320	5.00	Adsorbing	391+770
11	700	5.00	Adsorbing	389+400
12	440	6.00	Adsorbing	388+960
12a	1100	4.50	Adsorbing	387+100
13	505	5.00	Adsorbing	384+630
14	180	4.50	Adsorbing	383+500
15	900	5.00	Adsorbing	382+600
16	1155	6.00	Adsorbing	378+970
17	865	6.00	Adsorbing	376+080
17a	160	5.00	Adsorbing	375+920
18	1180	6.00	Adsorbing	388+950
19	700	5.00	Adsorbing	385+400
20	760	6.00	Adsorbing	384+640
21	2230	5.00	Adsorbing	381+990
22	595	4.50	Adsorbing	379+420
23	840	6.00	Adsorbing	377+740
24	430	4.50	Adsorbing	376+790
25	710	6.00	Adsorbing	376+080
26	295	5.00	Adsorbing	375+780
27	170	4.50	Transparent	375+450
28	100	4.50	Transparent	375+400
29	100	4.50	Transparent	375+400

29a	565	5.00	Absorbing	368+250
30	2525	5.00	Absorbing	365+730
31	860	6.00	Absorbing	364+140
32a	1045	5.00	Absorbing	361+880
32b	685	6.00	Absorbing	361+190
32c	275	6.00	Absorbing	360+900
33	410	4.50	Absorbing	360+480
35	755	4.50	Absorbing	357+100
36a	170	5.00	Absorbing	355+900
36b	415	5.00	Absorbing	355+470
37	185	5.00	Absorbing	354+450
38a	490	6.00	Absorbing	353+950
38b	750	5.00	Absorbing	353+200
38c	420	6.00	Absorbing	352+550
38d	455	5.00	Absorbing	352+120
38e	295	5.00	Absorbing	351+780
38f	270	6.00	Absorbing	352+050
39	445	5.00	Absorbing	351+030
40	330	4.50	Absorbing	350+700
41	1000	5.00	Absorbing	373+820
42	925	6.00	Absorbing	372+740
43a	745	6.00	Absorbing	371+780
43b	435	6.00	Absorbing	371+330
44a	360	5.00	Absorbing	365+450
44b	50	5.00	Absorbing	365+380
45	480	4.50	Absorbing	364+470
46	660	5.00	Absorbing	363+230
47a	510	6.00	Absorbing	361+160
47b	145	6.00	Absorbing	361+000
48	1825	4.50	Absorbing	358+980
48a	475	6.00	Absorbing	358+500
49	660	5.00	Absorbing	357+020
50	360	4.50	Absorbing	356+650
51a	140	5.00	Absorbing	355+900
51b	420	5.00	Absorbing	355+470
52a	185	5.00	Absorbing	354+450
52b	495	5.00	Absorbing	353+950
53	635	5.00	Absorbing	352+540
54a	65	5.00	Absorbing	352+090
54b	1045	5.00	Absorbing	351+030
55	580	4.50	Absorbing	350+570
56	225	5.00	Absorbing	350+570
57	880	6.00	Absorbing	349+980

58	1885	6,00	Absorbing	348+080
59	465	5,00	Absorbing	347+610
60	485	5,00	Absorbing	350+400
60a	305	6,00	Absorbing	350+090
61	2150	6,00	Absorbing	347+940
62	425	5,00	Absorbing	347+540
62a	250	5,00	Absorbing	347+550
62b	235	5,00	Absorbing	347+430
63	745	5,00	Absorbing	346+480
64	745	6,00	Absorbing	346+480
65	805	5,00	Absorbing	344+970
66	640	4,50	Absorbing	345+140
67	1055	6,00	Absorbing	343+400
68a	1660	5,00	Absorbing	342+820
68b	620	5,00	Absorbing	342+170
69a	390	5,00	Absorbing	342+800
69b	540	5,00	Absorbing	342+240
69c	325	4,50	Absorbing	341+630
70	555	4,50	Absorbing	339+670
71	645	5,00	Absorbing	338+660
72	825	5,00	Absorbing	338+290
73	725	5,00	Absorbing	337+300
74	600	4,50	Absorbing	335+810
74a	580	5,00	Absorbing	334+400
74b	550	5,00	Absorbing	334+500
75	445	4,50	Absorbing	333+800
76	420	4,50	Absorbing	333+700
77a	335	5,00	Absorbing	332+340
77b	260	5,00	Absorbing	332+070
78	585	5,00	Absorbing	331+740
79	945	4,50	Absorbing	330+500
80	760	5,00	Absorbing	330+540
81a	555	5,00	Absorbing	328+230
81b	280	5,00	Absorbing	327+940
82	405	5,00	Absorbing	328+230
83	130	5,00	Absorbing	328+100
84a	380	5,00	Absorbing	325+540
84b	120	5,00	Absorbing	325+410
85a	100	5,00	Absorbing	324+770
85b	460	5,00	Absorbing	324+300
86a	190	5,00	Absorbing	324+770
86b	435	5,00	Absorbing	324+330
87	325	4,50	Absorbing	321+320

88	150	5,00	Adsorbing	319+100
89	110	5,00	Transparent	319+100
90	80	5,00	Transparent	319+050
91	620	5,00	Mixed	319+050
92a	105	6,00	Adsorbing	319+040
92b	380	6,00	Adsorbing	318+650
93a	110	5,00	Adsorbing	319+040
93b	400	5,00	Adsorbing	318+620
94	315	4,50	Adsorbing	316+820
95a	25	6,00	Adsorbing	316+080
95b	365	6,00	Adsorbing	315+700
96a	150	5,00	Adsorbing	316+070
96b	425	6,00	Adsorbing	315+650
97	1145	6,00	Adsorbing	313+420
98	1155	6,00	Adsorbing	313+420
99	1120	6,00	Adsorbing	311+700
99a	370	5,00	Adsorbing	311+420
99b	220	4,50	Adsorbing	311+400
100	1125	6,00	Adsorbing	311+750
100a	400	5,00	Adsorbing	311+470
101	895	5,00	Adsorbing	310+800
102	220	5,00	Mixed	310+800
103	1440	5,00	Adsorbing	309+850
104	735	5,00	Adsorbing	309+950
104a	570	4,50	Adsorbing	309+380
105	475	5,00	Adsorbing	308+200
106a	80	6,00	Adsorbing	307+640
106b	400	6,00	Adsorbing	307+230
107	510	6,00	Adsorbing	307+110
108	210	4,50	Adsorbing	305+800
109	160	5,00	Transparent	305+980
110	165	6,00	Transparent	306+020
111	230	6,00	Transparent	306+020
112	700	5,00	Adsorbing	305+550
113	660	5,00	Adsorbing	305+550
114a	190	4,50	Adsorbing	305+980
114b	520	4,50	Adsorbing	305+450
115a	260	6,00	Adsorbing	306+000
115b	155	5,00	Adsorbing	305+820
116	465	4,50	Adsorbing	305+130
117	460	5,00	Adsorbing	304+670
118a	300	5,00	Adsorbing	304+650
118b	300	5,00	Adsorbing	304+330

119	1270	5,00	Adsorbing	302+820
120	700	5,00	Adsorbing	302+600
121a	155	5,00	Adsorbing	302+170
121b	590	5,00	Adsorbing	301+570
122	635	5,00	Adsorbing	301+180
123a	100	4,50	Adsorbing	300+760
123b	275	4,50	Adsorbing	300+420
124a	240	5,00	Adsorbing	300+750
124b	415	6,00	Adsorbing	300+320
125	600	5,00	Adsorbing	298+900
126	125	5,00	Adsorbing	299+400
126a	575	6,00	Adsorbing	298+820
127a	295	5,00	Adsorbing	298+210
127b	350	6,00	Adsorbing	297+850
128	380	6,00	Adsorbing	297+850
128a	175	5,00	Adsorbing	297+670
129a	275	5,00	Adsorbing	296+900
129b	880	5,00	Adsorbing	296+000
130	675	5,00	Adsorbing	296+190

*It is advisable that the sound barrier in section located on a viaduct is transparent. It is possible to change the type of filling material (to transparent) on condition that proper sound climate conditions are provided. In places with entrances for service vehicles it is advised to build sound barriers in the form of walls.*

- The height of sound barrier should not be lower than that indicated in the table above. Detailed instruction as to the type of material, construction, length and height should be done at the technical project stage. The barriers should be constructed during the motorway construction.
- All sound barriers were designed to function in the worst possible noise conditions in the time span for 2035 after completion of the motorway.
- It is possible to change the length of the barriers by +/- 10% and to change their location by +/- 50 meters. These changes are allowed in cases when their introduction will make the proposed barriers ineffective.
- Sound analysis showed that in more than 20 cases there are single buildings under protection located at small distance from the motorway (in some cases two buildings). Due to small distance from the noise source (the motorway) to ensure effective protection it is necessary to build sound barriers in a long section. In such cases constructing a sound barrier might be less profitable than buying the property within the range with above-the-limit sound values.
- For 26 buildings located at small distance from the motorway and considering heavy traffic congestion (forecast for 2025) it is not possible to maintain the limit values (after the application of barriers). It is advised to buy these properties before starting the motorway construction.
- The list of the buildings for purchase is shown in the table below.

Table 5.2. List of buildings for which building a sound barrier might not be profitable as well as for which there are no technical possibilities of protection against above-the-level sound values

Number of the noise barrier corresponding to the number in Appendix No 6	Location of residential buildings in relation to the motorway [km] and their distance from the road edge (in brackets [m])	Length of the noise barrier [m]	Height of the noise barrier [m]	Description of the situation and the proposed solution
129a, 129b the right side	296+840 (30)	275, 880	5.0, 5.0	Due to lack of technical solution to prevent the noise, the estate must be bought
127a, 127b the right side	297+950 (30)	295, 350	5.0, 6.0	The residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The estate must be bought and the noise barrier must be shortened by 250 m, till 298+100 and lower it to 5m high
128, 128a the left side	298+070 (55)	380, 175	6.0, 5.0	The proposed noise barrier will protect two residential houses. It must be considered it is not better to buy the properties.
126, 126a the left side	299+200 (50)	125, 575	5.0, 6.0	At the post-implementation analysis stage it must be checked if the residential houses will be within the noise range with levels above limit values or decide whether it is more economical to buy the properties or provide additional protection.
124a, 124b the right side	300+700 (25)	240, 415	5.0, 6.0	Two residential houses are within the noise range with levels exceeding limit values at night despite using noise protection. The properties must be bought
123a, 123b the left side	300+740 (40)	100, 275	4.5, 4.5	Due to lack of technical solution to prevent the noise, the estate must be bought
122 the right side	301+400 (170) 301+450 (115)	635	5.0	The proposed noise barrier will protect two residential houses. The third house, closest to the motorway according to the owner will be changed into non-residential because a new residential house had been built. It must be considered it is not better to buy the two properties instead of building the barrier.
110, 111, 115a, 115b the right side	306+050 (90, 360)	165, 230, 260, 155	6.0, 6.0, 6.0, 5.0	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage they are on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the properties or provide additional protection.
107 the right side	307+500 (55)	510	6.0	At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estate or provide additional protection.

106a, 106b the left side	307+560 (35) 307+560 (60)	80, 400	6.0, 6.0	The residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The estate must be bought
				At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estate or provide additional protection
105 the right side	308+500 (195)	475	5.0	The proposed noise barrier will protect one residential house. It must be considered if it is not more economical to buy the estate.
104, 104a the left side	309+650 (145)	735, 570	5.0, 4.5	The proposed noise barrier will protect many residential houses, it must be considered it is not better to but one estate which will help eliminate barrier Nr 104a. Other buildings will still have effective protection.
103 the right side	310+550 (40)	1440	5.0	The residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The estate must be bought
99 the right side	312+150 (35)	1445	6.0	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage they are on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the properties or provide additional protection.
100 the left side	312+220 (40)	1470	6.0	At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estate or provide additional protection.
98 the left side	314+080 (40) 314+160 (40)	1155	6.0	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage they are on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the properties or provide additional protection.
97 the right side	314+150 (40)	1145	6.0	At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estate or provide additional protection.

95a, 95b the right side	315+960 (80, 100)	25, 365	6.0, 6.0	The proposed noise barrier will protect two residential houses. It must be considered it is not better to buy the properties.
96a, 96b the left side	316+000 (60, 130)	150, 425	5.0, 6.0	The proposed noise barrier will protect two residential houses. It must be considered it is not better to buy the properties. If the barrier is built, at the time of the report, one building will be on the verge of limit value for noise level and at post-implementation analysis stage it will be necessary to check if the building is not within the noise range and decide about buying the property.
the left side	316+800	-	-	At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the property or provide additional protection.
94 the right side	316+950 (165)	315	4.5	The proposed noise barrier will protect one residential house. It must be considered if it is not more economical to buy the property.
93a, 93b the left side	318+940 (25)	110, 400	5.0, 5.0	The residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The property must be bought
91, 93a the left side	319+100 (340)	620, 400	5.0	At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the property or provide additional protection.
87 the right side	321+420 (105)	325	4.5	The proposed noise barrier will protect one residential house. It must be considered if it is not more economical to buy the property.
the right side	322+850	-	-	At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the property or provide additional protection.
86a, 86b the left side	324+670 (35)	190, 435	5.0, 5.0	The residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The property must be bought

85a, 85b the right side	324+700 (35)	100, 460	5.0, 5.0	The residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The property must be bought
82, 83 the left side	328+300 (60)	405, 130	5.0, 5.0	The proposed noise barrier will protect one residential house. It must be considered if it is not more economical to buy the property.
75 the right side	334+050 (510)	445	4.5	The proposed noise barrier will protect one residential house. It must be considered if it is not more economical to buy the property.
74a, 74b the left side	334+600 (140)	580, 550	5.0, 5.0	The proposed noise barrier will protect one residential house. It must be considered if it is not more economical to buy the property.
74 the left side	336+110 (60)	600	4.5	The proposed noise barrier will protect one residential house. It must be considered if it is not more economical to buy the property.
the right side	338+350 (270)	-	-	At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the property or provide additional protection
70 the left side	339+940 (180)	555	4.5	The proposed sound barrier will protect two residential houses. It must be considered if it is not more economical to buy the property closer to the motorway. The other one will be on the border of limit noise values in 2025.
69c the right side	341+810 (215)	325	4.5	The proposed noise barrier will protect one residential house. It must be considered if it is not more economical to buy the property.
67 the right side	344+000 (70)	1055	6.0	The proposed noise barrier will protect one residential house. It must be considered if it is not more economical to buy the property.  If the barrier is built, at post-implementation analysis stage it will be necessary to check if the building is not within the noise range and decide about buying the property.
66 the left side	345+500 (230)	640	4.5	The proposed noise barrier will protect one residential house. It must be considered if it is not more economical to buy the property.
64 the left side	346+780 (60)	745	6.0	The residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The property must be bought

62, 62a, 62b the left side	347+560 (165, 35 from S8)	425, 250, 235	5.0, 5.0, 5.0	The proposed noise barriers will protect one residential house. It must be considered if it is not more economical to buy the estate.
58, 59 the right side	348+100 (105) 348+300 (105) 348+300 (125) 348+480 (65)	1885, 465	6.0, 5.0	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage they are on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estates or provide additional protection. The residential houses will be within the noise range with levels exceeding limit values at night despite using noise protection. The estates must be bought
61 the left side	348+650 (80) 349+580 (75)	2150	6.0	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage they are on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estates or provide additional protection.
58 the right side	348+820 (85)	1885	6.0	The residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The estate must be bought
60, 60a the left side	350+250 (90) 350+280 (110) 350+370 (160)	485, 300	5.0, 6.0	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage they are on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estates or provide additional protection.
39, 40 the right side	351+100 (200)	445, 330	5.0, 4.5	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage they are on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estates or provide additional protection.
the left side	353+500 (265)	-	-	At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estate or provide additional protection.
37, 38a the right side	354+400 (75)	185, 490	5.0, 6.0	At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estate or provide additional protection.

48a the left side	358+730 (65)	475	6.0	The residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The property must be bought
47a, 47b the left side	361+190 (70)	510, 145	6.0, 6.0	The residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The property must be bought
32a, 32b the right side	361+660 (65) 362+520 (50)	1045, 685	5.0, 6.0	At the post-implementation analysis stage it must be checked if the two residential houses (at the time of the report stage they are on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the properties or provide additional protection.
				One building will be within the above-the-limit range for noise values at night despite using sound barriers. The property should be bought.
31 the right side	364+400 (215) 364+600 (70) 364+600 (70)	860	6.0	It must be considered whether it would be more profitable to buy three buildings (possibly two properties) or to build the barrier which is not quite effective in the case of one residential building.
the left side	370+150 (360)	-	-	At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the property or provide additional protection.
42 the left side	373+160 (160) 373+280 (60)	925	6.0	If the sound barrier is built, according to forecast at the time of the report, one building will be within the limit-value range for noise. At the post-implementation analysis stage it will be in the above-the-limit sound value zone and t must be decided either to build more sound barriers or buy the property.

24, 25, 26 the left side	376+400 (45) 376+580 (65)	430, 710, 295	4.5, 6.0, 5.0	Two residential houses will be within the noise range with levels exceeding limit values at night despite using noise protection. The properties must be bought
				At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estate or provide additional protection
17, 17a the right side	376+440 (55)	865, 160	6.0, 5.0	One residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The property must be bought.
23 the left side	378+160 (50)	840	6.0	At the post-implementation analysis stage it must be checked if the residential house (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estate or provide additional protection
16 the right side	379+480 (55) 379+500 (55) 379+700 (50)	1155	6.0	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estate or provide additional protection
				One residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The property must be bought
22 the left side	379+800 (375)	595	4.5	The proposed noise barriers will protect one residential house. It must be considered if it is not more economical to buy the property.
12a the right side	387+320 (180) 387+950 (245)	1100	4.5	The proposed noise barriers will protect two residential houses. It must be considered if it is not more economical to buy the properties.
18 the left side	389+100 (55)	1175 (675)	6.0	One residential house will be within the noise range with levels exceeding limit values at night despite using noise protection. The property must be bought
18 the left side	389+690 (35)	1175	6.0	The property must be bought because it is technically impossible to protect the house against the noise – the barrier should be shortened by 500m to km 389+600 and length 677 m.

10a, 10b, 10c the left side	392+190 (80)	100, 280, 320	5.0, 6.0, 5.0	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estate or provide additional protection
7a, 7b, 7c, 8 the left side	392+250 (250)	340, 120, 160, 75	5.0, 5.0, 6.0, 5.0	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide to provide additional protection
6, 7 the left side	395+900 (70)	665, 350	6.0, 5.0	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide to provide additional protection
1, 2, 3 the right side	398+580 (45) 398+710 (55)	200, 160, 370	6.0, 6.0, 6.0	Residential houses will be within the noise range with levels exceeding limit values at night despite using noise protection. The properties must be bought
4 the left side	399+300 (60)	770	6.0	At the post-implementation analysis stage it must be checked if the residential houses (at the time of the report stage it is on the limit value threshold for noise level at night) will be within the noise range with levels above limit values or decide whether it is more economical to buy the estate or provide additional protection
<b>LEGEND</b>				
Green color – buildings for which at the post-implementation analysis stage it must be checked whether it is necessary to build protection				
Red color – buildings which must be bought because despite using noise protection it is not possible to maintain limit noise values				
Yellow color – buildings whose buy-up must be considered for economical reasons – such a solution might turn out to be cheaper than construction and operation of the sound barriers which were proposed to protect against above-the-limit noise				

- The analysis of the forecast results for equal sound volume after applying sound barriers indicates that they will be an effective protection for the residential housing areas against above-the-limit noise levels. The buildings within the noise range (and not designated for purchase or post-implementation evaluation) after applying the additional protection will be adequately protected against the traffic impact on noise climate.
- The rest of the buildings requiring noise protection like schools, kindergartens and allotment gardens or cemeteries will have adequate protection after constructing the proposed sound barriers.
- The effectiveness of the proposed noise protection should be verified at the post-implementation analysis stage.

#### **5.2.4. Vibration impact**

- To avoid construction damage while building the motorway the following measure should be taken:
  - before starting road works technical survey of all buildings within the planned zone of dynamic effects should be conducted; the survey should include description and photo report of all the damages to buildings existing before starting the works
  - before starting construction works it should be determined what types of vibrating rollers will be used and based on that the impact range of dynamic effect should be estimated – some of the machines generate less vibration; in places where the works will be done close to buildings it is advisable to use rollers with lower negative impact range,
  - if the estimated dynamic effects will reach the buildings beyond the motorway, measures should be planned to protect these buildings in cases when the building project does not include means for protection of these buildings.
- At the preparation stage of the motorway it is necessary to conduct comprehensive studies and diagnostic analysis including thorough assessment of the technical condition of buildings in direct vicinity of the motorway and related facilities. Evaluation of technical condition will facilitate building evaluation during and after completing the motorway. Thus it will be possible to determine real impact. Where necessary, essential building protection will have to be provided.
- It is advisable to monitor the impact – by means of vibration measurements. This monitoring should refer especially to the stage at which vibrating rollers are used.
- During construction vibration may occur when pile for the planned trestles and viaducts are built. To eliminate vibration impact it is advisable to construct pile in the housing areas by using technology that does not generate vibration.

#### **5.2.5. Impact on the atmospheric air**

- Based on the conducted analyses and forecast it was established that there is a possibility of exceedance of limit values for analyzed substances – sulphur dioxide and nitrogen dioxide. But only the above-the-limit values for nitrogen dioxide may go beyond the motorway boundary.
- Because of relative uncertainty of the conducted analyses it will be necessary to measure NO<sub>2</sub> and SO<sub>2</sub> concentrations along the analyzed section as part of post-implementation analysis.
- Greenery strips were proposed for implementation along the motorway which will limit the spreading of pollutants to adjacent lands.
- The motorway will take over part of the traffic from parallel sections of national roads No 1, no 8 and No 14 thus reducing pollutant emission and improving the air quality along the roads in question.
- The motorway will cause an increase in traffic on the alternative (to the motorway) section of NR No 91 which will result in larger pollutant emission in this section.

### **5.2.6. Impact on the animated nature**

- The analyzed motorway crosses local, national and international animal migration pathways
- To minimize the negative barrier effect caused by the motorway crossings for animals should be included in the project. The proposed measures minimizing the impact of motorway A1 on wild fauna were planned in order to reduce negative effects of the ecological barrier created by the motorway.
- In all places where overpasses are planned local changes (widening) in location decisions will be necessary to build these structures according to the recommended parameters (width and access slopes on the structures).
- The plan includes 13 crossings for large animals, with 6 overpasses (viaducts – “green bridges”) and 7 underpasses – bridges, viaducts and trestle along the motorway.

No	Location	Type of structure	Measurements
PZDzd 1	km 303+103	Underpass (trestle bridge) combined with local road for large animals. It is recommended to finish the trestle bridge no earlier than km 303+200	$h \geq 5 \text{ m}$ $d \geq 150 \text{ m}$ $c \geq 1.5$
PZDzd 2	km 324+985	combined underpass for large animals – bridge over Wolbórka	$h \geq 5.0 \text{ m}$ $d \geq 50.0 \text{ m}$
PZDg 1	km 333+130	overpass for large animals	$d \geq 50.0 \text{ m}$
PZDzd 3	km 362+041	underpass for large animals combined with watercourse – bridge over Dąbrówka	$h \geq 4.5 \text{ m}$ $d \geq 18.0 \text{ m}$ $c \geq 1.5$
PZDzd 4	km 369+555	underpass for large animals combined with watercourse (ditch)	$h \geq 3.5 \text{ m}$ $d \geq 18.0 \text{ m}$ $c \geq 1.5$
PZDg 2	km 370+600	overpass for large animals	$d \geq 50.0 \text{ m}$
PZDzd 5	km 374+815	combined underpass for large animals – bridge over Kamionka	$h \geq 4.5 \text{ m}$ $d \geq 18.0 \text{ m}$ $c \geq 1.5$
PZDg 3	km 380+670	overpass for large animals	$d \geq 50.0 \text{ m}$
PZDzd 6	km 382+272	combined underpass for large animals – bridge over Widawka	$h \geq 4.0 \text{ m}$ $d \geq 20.0 \text{ m}$ $c \geq 1.5$
PZDg 4	km 394+650	overpass for large animals	$d \geq 50.0 \text{ m}$
PZDg 5	km 396+730	overpass for large animals	$d \geq 50.0 \text{ m}$
PZDg 6	km 397+400	overpass for large animals	$d \geq 50.0 \text{ m}$
PZDzd 7	km 398+903	combined underpass for large animals – bridge over Warta	$h \geq 5.0 \text{ m}$ the structure should end no earlier than km 399+100

- To minimize the motorway impact on the medium-sized ungulates (and partially on small mammals and amphibians) there are 23 crossings planned – 2 overpasses and 21 bridges and viaducts along the motorway. The crossings in most cases (10 structures) are combined – bridges over rivers or smaller streams and passages for agricultural roads (dirt track and field roads)

No	Location	Type of structure	Measurements
PZSzd 1	km 301+583	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.5 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$
PZSzd 2	km 308+350	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.5 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$
PZSzd 3	km 315+800	underpass for medium sized animals (combined with watercourse)	$h \geq 3.5 \text{ m } d \geq 8.0 \text{ m } c \geq 0.7$
PZSd 1	km 317+926	underpass for medium sized animals	$h \geq 3.5 \text{ m } d \geq 8.0 \text{ m } c \geq 0.7$
PZSd 1	km 322+500	underpass for medium sized animals	$d \geq 30.0 \text{ m}$
PZSd 2	km 327+830	underpass for medium sized animals	$d \geq 30.0 \text{ m}$
PZSzd 4	km 345+965	underpass for medium sized animals (combined with watercourse)	$h \geq 3.5 \text{ m } d \geq 8.0 \text{ m } c \geq 0.7$
PZSzd 5	km 353+432	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.0 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$
PZSzd 6	km 357+750	underpass for medium sized animals (combined with watercourse)	$h \geq 3.5 \text{ m } d \geq 8.0 \text{ m } c \geq 0.7$
PZSzd 7	km 359+770	underpass for medium sized animals (combined with watercourse)	$h \geq 3.0 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$
PZSzd 8	km 364+190	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.5 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$
PZSd 2	km 372+500	underpass for medium sized animals	$h \geq 3.5 \text{ m } d \geq 8.0 \text{ m } c \geq 0.7$
PZSzd 9	km 378+330	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.5 \text{ m } d \geq 8.0 \text{ m } c \geq 0.7$
PZSzd 10	km 382+900	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.5 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$
PZSzd 11	km 384+000	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.5 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$
PZSzd 12	km 385+464	underpass for medium sized animals (combined with watercourse)	$h \geq 3.5 \text{ m } d \geq 8.0 \text{ m } c \geq 0.7$
PZSzd 13	km S387+800	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.5 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$

PZSzd 14	km 389+944	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.5 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$
PZSzd 15	km 392+570	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.5 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$
PZSzd 16	km 393+895	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.5 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$
PZSzd 17	km 395+750	underpass for medium sized animals (combined with watercourse)	$h \geq 3.5 \text{ m } d \geq 8.0 \text{ m } c \geq 0.7$
PZSzd 18	km 398+330	underpass for medium sized animals (combined with watercourse)	$h \geq 3.5 \text{ m } d \geq 8.0 \text{ m } c \geq 0.7$
PZSzd 19	km 399+290	underpass for medium sized animals (combined with agriculture road)	$h \geq 3.5 \text{ m } d \geq 10.0 \text{ m } c \geq 0.7$

- There are 87 crossings for small animals and most structures and combines – animal crossing combined with culverts for small watercourses (mainly melioration and drainage ditches).

No	Location	Type of structure	Measurements
PZM 1	km 296+641	crossing for small animals combined with watercourse/ditch	$h \geq 1.5$ m $d \geq 2.0$ m
PZM 2	km 297+140	crossing for small animals	$h \geq 1.0$ m $d \geq 1.5$ m
PZM 3	km 299+041	crossing for small animals combined with watercourse/ditch	$h \geq 1.5$ m $d \geq 2.0$ m
PZM 4	km 300+025	crossing for small animals combined with watercourse/ditch	$h \geq 1.5$ m $d \geq 2.0$ m
PZM 5	km 301+364	crossing for small animals combined with watercourse/ditch	$h \geq 1.5$ m $d \geq 2.0$ m
PZM 6	km 301+786	crossing for small animals combined with watercourse/ditch	$h \geq 1.5$ m $d \geq 2.0$ m
PZM 7	km 302+085	crossing for small animals combined with watercourse/ditch	$h \geq 1.5$ m $d \geq 2.0$ m
PZM 8	km 302+540	crossing for small animals combined with watercourse/ditch	$h \geq 1.0$ m $d \geq 1.5$ m
PZM 9	km 304+200	crossing for small animals	$h \geq 1.0$ m $d \geq 1.5$ m
PZM 10	km 307+067	crossing for small animals combined with watercourse/ditch	$h \geq 1.5$ m $d \geq 2.0$ m
PZM 11	km 309+300	crossing for small animals	$h \geq 1.0$ m $d \geq 1.5$ m
PZM 12	km 310+095	crossing for small animals combined with watercourse/ditch	$h \geq 1.5$ m $d \geq 2.0$ m
PZM 13	km 310+800	crossing for small animals	$h \geq 1.0$ m $d \geq 1.5$ m
PZM 14	km 311+875	crossing for small animals	$h \geq 1.0$ m $d \geq 1.5$ m
PZM 15	km 312+675	crossing for small animals combined with watercourse/ditch	$h \geq 1.5$ m $d \geq 2.0$ m
PZM 16	km 313+682	crossing for small animals combined with watercourse/ditch	$h \geq 1.5$ m $d \geq 2.0$ m
PZM 17	km 317+381	crossing for small animals combined with watercourse/ditch	$h \geq 1.5$ m $d \geq 2.0$ m

PZM 18	km 318+551	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 19	km 320+086	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 20	km 323+158	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 21	km 323+894	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 22	km 324+911	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 23	km 325+170	crossing for small animals	$h \geq 1.0 \text{ m}$ $d \geq 1.5 \text{ m}$
PZM 24	km 325+492	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 25	km 326+352	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 26	km 328+738	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 27	km 330+183	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 28	km 330+717	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 29	km 332+295	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 30	km 332+527	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 31	km 333+897	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 32	km 337+037	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 33	km 338+930	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 34	km 339+365	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 35	km 340+555	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 36	km 340+970	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$

PZM 37	km 341+205	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 38	km 341+477	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 39	km 342+700	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 40	km 343+610	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 41	km 344+497	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 42	km 345+216	crossing for small animals combined with watercourse/ditch (Rakówka)	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 43	km 348+915	crossing for small animals combined with watercourse/ditch (Strawa)	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 44	km 350+230	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 45	km 351+287	crossing for small animals combined with watercourse/ditch (Strawka)	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 46	km 352+588	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 47	km 353+970	crossing for small animals	$h \geq 1.0 \text{ m}$ $d \geq 1.0 \text{ m}$
PZM 48	km 355+178	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 49	km 356+515	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 50	km 359+223	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 51	km 360+450	crossing for small animals	$h \geq 1.0 \text{ m}$ $d \geq 1.5 \text{ m}$
PZM 52	km 361+750	crossing for small animals	$h \geq 1.0 \text{ m}$ $d \geq 1.5 \text{ m}$
PZM 53	km 362+530	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 54	km 362+900	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 55	km 363+477	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$

PZM 56	km 364+883	crossing for small animals combined with watercourse	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 57	km 366+290	crossing for small animals	$h \geq 1.0 \text{ m}$ $d \geq 1.5 \text{ m}$
PZM 58	km 366+645	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 59	km 367+912	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 60	km 368+746	crossing for small animals	$h \geq 1.0 \text{ m}$ $d \geq 1.5 \text{ m}$
PZM 61	km 369+230	crossing for small animals combined with watercourse/ditch	$h \geq 1.0 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 62	km 371+740	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 63	km 373+044	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 64	km 373+465	crossing for small animals combined with watercourse/ditch	$h \geq 1.0 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 65	km 373+835	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 66	km 374+318	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 67	km 375+965	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 68	km 376+860	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 69	km 378+030	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 70	km 378+500	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 71	km 379+854	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 72	km 380+147	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 73	km 381+200	crossing for small animals	$h \geq 1.0 \text{ m}$ $d \geq 1.5 \text{ m}$
PZM 74	km 381+440	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$

PZM 75	km 382+152	crossing for small animals	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 76	km 382+500	crossing for small animals	$h \geq 1.0 \text{ m}$ $d \geq 1.5 \text{ m}$
PZM 77	km 385+340	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 78	km 386+550	crossing for small animals	$h \geq 1.0 \text{ m}$ $d \geq 1.5 \text{ m}$
PZM 79	km 387+000	crossing for small animals	$h \geq 1.0 \text{ m}$ $d \geq 1.5 \text{ m}$
PZM 80	km 388+304	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 81	km 389+304	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 82	km 394+840	crossing for small animals	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 83	km 395+450	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 84	km 396+830	crossing for small animals	$h \geq 1.0 \text{ m}$ $d \geq 1.5 \text{ m}$
PZM 85	km 397+125	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 86	397+640	crossing for small animals combined with watercourse/ditch	$h \geq 1.0 \text{ m}$ $d \geq 2.0 \text{ m}$
PZM 87	399+690	crossing for small animals combined with watercourse/ditch	$h \geq 1.5 \text{ m}$ $d \geq 2.0 \text{ m}$

- There are 42 crossings for amphibians planned

No	Location	Type of structure	Measurements
PP 1	km 309+375	crossing for amphibians – 3 culverts in locations: 309+400, 309+350, 309+250	$h \geq 0.75$ m $d \geq 1.0$ m
PP 2	km 323+550	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 3	km 328+280	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 4	km 328+390	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 5	km 332+275	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 6	km 338+175	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 7	km 339+025	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 8	km 339+155	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 9	km 339+940	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 10	km 345+845	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 11	km 346+075	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 12	km 349+620	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 13	km 350+995	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 14	km 354+540	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 15	km 359+438	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 16	km 361+520	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 17	km 361+850	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 18	km 362+160	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m

PP 19	km 363+650	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 20	km 364+550	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 21	km 366+800	crossing for amphibians – 4 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 22	km 366+985	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 23	km 367+270	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 24	km 367+400	crossing for amphibians – 4 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 25	km 368+110	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 26	km 370+220	crossing for amphibians – 4 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 27	km 371+453	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 28	km 374+665	crossing for amphibians – 3 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 29	km 374+940	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 30	km 379+800	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 31	km 379+975	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 32	km 380+110	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 33	km 383+850	crossing for amphibians – 1 culvert (partially sunk into the ground)	$h \geq 0.75$ m $d \geq 1.0$ m
PP 34	km 395+095	crossing for amphibians – 3 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 35	km 395+263	crossing under the eastern embankment by a viaduct WD(L) 335 – 2 culverts at km 0+380 and 0+460	$h \geq 0.75$ m $d \geq 1.0$ m
PP 36	km 395+400	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 37	km 395+850	crossing for amphibians – 3 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m

PP 38	km 396+100	crossing for amphibians – 2 culverts at km 396+080, 396+120	$h \geq 0.75$ m $d \geq 1.0$ m
PP 39	km 398+200	crossing for amphibians – 1 culvert	$h \geq 0.75$ m $d \geq 1.0$ m
PP 40	km 398+670	crossing for amphibians – 3 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 41	km 399+190	crossing for amphibians – 3 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 42	km 399+440	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m
PP 43	km 399+565	crossing for amphibians – 2 culverts at 50-meter distance	$h \geq 0.75$ m $d \geq 1.0$ m

- The general rule to adopt is that the width of the crossings (culverts) for medium-sized animals combined with watercourses should be  $\geq 3$  times the width of the watercourse but not smaller than 2.0m.
- Detailed instructions on animal crossings are included in the report on environmental impact in Chapter 10.6 *Protection of animated nature*.
- The optimal method to limit animal mortality is to use protection fencing. The analyzed section of the motorway will be fenced along the whole route.
- The fencing will also funnel the animals to the crossing areas. To ensure efficiency of such fencing the following conditions must be met:
  - the fencing must run close to the road edge with minimal interference with the adjacent areas;
  - if the road runs in a pit then the fencing must be situated by the pit edge at a distance not smaller than 1 m from the edge;
  - if the road runs on an embankment then the fencing must be situated by the bottom of the embankment;
  - protection fencing must combine smoothly with screens on the ground and access of the overpasses for animals;
  - protection fencing must be closely joined with the front of the underpasses for animals;
  - in places with culverts for small animals, amphibians and watercourses the fencing must be closely joined with the front of the culvert or run directly over the culvert inlet.
- To get maximum efficiency of the proposed fencing the following parameters are suggested:
  - minimum height – 240 cm for forest areas and meadow-sylvan areas, 220 for other areas;
  - fencing made of metal netting with metal posts;
  - the netting must have variable mesh sizes – getting smaller towards the bottom;
  - the netting must be dug in to the ground to at least 30 cm deep;

- solid footing of the posts facilitating big tension and vertical stability of the structure – the recommended deviation from the perpendicular should not exceed 1 cm;
  - the spaces between post should not be bigger than 300 cm
  - the fencing should run along straight lines or with mild curves which means that the angle of the straight sections cannot be bigger than  $15^{\circ}$
  - if the fencing crosses haul and agriculture roads reaching the motorway, there should be entrance gates, preferably with automatic gate closer.
- in the selected sections of the motorway (table below) and 100 m (to each side) from the axes of all crossings and culverts, the fencing must have additional protections functioning as protective-funneling fencing for small animals (especially amphibians). These fencing is not necessary in sections with small-sized fencing at the culverts for amphibians. The fencing in question might be made of plastic filled plates or netting with mesh diameter  $< 0.5$  cm at least 50 cm above the ground. The plates or netting must also have the edge at least 5-cm wide, bent in the “outside” direction of the road. The plates or netting must closely adjoin to the ground and must be solidly anchored. That is why it is recommended to dig the lower edged of the posts at least 10 cm deep into the ground. These structures can be built in the motorway fencing.

Location	Type of structure	Measurements
km 300+753 - 303+103	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 303+103 - 303+680	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 306+280 - 307+068	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 308+150 - 308+550	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 309+050 - 309+550	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 310+533 - 310+987	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 311+700 - 313+071	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 313+071 - 314+032	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 319+012 - 320+120 (at interchange „Romanów along external ramp lanes)	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 321+800 - 324+150	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 324+769 - 329+300	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 332+150 - 333+695	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 338+025 - 339+440	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 339+685 - 340+181	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 340+181 - 341+978	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 345+645 - 347+555	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 348+325 - 348+915	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 349+601 - 350+350	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 350+833 - 351+290	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 354+466 - 354+640	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 355+100 - 355+895	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 357+071 - 358+200	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 358+725 - 359+672	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 361+168 - 362+900	funnel fence for amphibians and small mammals	$h \geq 0,5$ m

km 363+300 – 365+000	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 365+444 – 375+233	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 375+850 – 377+150	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 379+680 – 380+670	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 380+670 – 382+900	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 382+900 – 384+000	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 387+760 – 388+636	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 389+104 – 389+944	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 390+927 – 392+320	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 394+300 – 399+742	funnel fence for amphibians and small mammals	$h \geq 0,5$ m
km 0+335 – 0+550 (on both sides) eastern embankment of viaduct WD(L) 335	funnel fence for amphibians and small mammals	$h \geq 0,5$ m

- It is recommended to build screen by all crossing for small and medium-sized animals, that is about inlets of underpasses for animals
- The screens should be built above inlets of underpasses for animals (preferably close to the road edge) spread on 50 m from the crossing axis, in both directions;
- Special attention must be drawn to the seeding material used – its condition, proportion between over and underground parts, habits and the planting process itself. It is best to do the planting in early or late spring with cuttings with covered roots and to continue maintenance. Correct planting of the roadside greenery will ensure higher level of success with the cuttings and lower maintenance requirements.

### 5.2.7. Impact on the landscape

- it is recommended to plant tall greenery (trees) and medium greenery (bushes) according to the project developed for the purpose of the motorway location decision. Small corrections are possible, connected with project advancement. This is when the detailed location of the greenery will be established and the greenery plan will be drawn. At this stage of the project the proposed planting will be verified in terms of construction road machines, road safety and motorway exits to service roads.
- It is recommended that Motorway Service Areas situated in Wzniesienia Łódzkie National Scenic Park be blended with the landscape by planting greenery related to the woodlot tree stands occurring in the Park.

- It is recommended to use species listed in the report on environmental impact chapter 10.7 *Landscape protection* for planting
- Sound barriers should be made in natural colors
- It is recommended to plant climbing plants around sound barriers to make them more blended with the landscape.

### **5.2.8. Waste management**

- Waste generated at the construction stage belonging to group no 17 – waste generated in construction sites, remodeling and demolition of buildings and road infrastructure. While building sections of the motorway different amount of waste of the same categories will be generated. At the moment it is impossible to determine amount and quality of waste to be generated when building the motorway.
- The removal and management of the waste generate during construction will be the responsibility of the contractors carrying out the works.
- Waste generator can contract the waste management to other waste owner. Some waste, including run-offs from road modification and renovation can be managed on site – in connection with road construction.
- Waste that cannot be used for construction but can be used for other purposes (excluding disposal) can be given by the waste owner to natural persons or organizational units.
- During construction works the site should be cleaned on a regular basis with special attention paid to materials that can have negative effects on the adjacent areas (propellants, grease and their containers, tar products – if they are used)
- No waste adversely affecting the environment should get into the environment if the construction works are conducted in accordance with the provisions of the working plans and specifications and in compliance with the report on environmental impact.

### **5.3. Critical failures and accidents**

The motorway will take over most of the traffic (mainly transit traffic) from the existing national roads No 1, No 8 and No 14. It will minimize the risk of critical accidents. The risk of critical failure on the motorway is small – thanks to limited access, grade-separated intersections, right parameters (mild curves, good visibility) and protections such as rigid safety fences and sound barriers.

### **5.4. Impact on human health connected with the road safety**

At the moment the transit traffic runs though the existing national roads. Complete access, non-standard parameters, pedestrians and bikers leads to frequent accidents. Once motorway A1 is completed the existing road network will be relieved which will have a positive effect on the road safety. It will also contribute to decrease air pollution and improvement of noise climate on these roads and adjacent areas.

It will be impossible to buy fuel in the section from km 259-km 253/258 (almost 100km) because there are no Motorway Service Areas of category higher than I with a gas station. This might be dangerous to the road safety. To minimize the risk it will be necessary to upgrade the MSAs inside the section in question:

- MSA “Wiśniowa Góra Zach.” – km 316+500 (the western side), from category I to III
- MSA Wiśniowa Góra Wsch.” – km 316+500 (the eastern side), from category I to III

After such modifications the distance between the gas station will be 40-57 km which will improve driving comfort and road safety.

### **5.5. Guidelines for post-implementation analysis and monitoring**

Post-implementation analysis once the motorway is in operation aim to verify the impact forecast and determine the efficiency of proposed protection measures.

For the analyzed section of motorway A1 the post-implementation analysis is conducted to evaluate rain and melt water contamination discharged into recipients prior to pretreatment and air protection at the road boundary.

## **6. CONCLUSIONS**

Based on the analysis conducted for the purpose of this report it can be stated that motorway A1 is a necessary project. Traffic forecast shows that the motorway will take most of the traffic generated on national roads No 1, No 8 and No 14. Decrease in traffic will improve noise climate, road safety, smaller air contamination and reduced risk of critical failures in the areas in the vicinity of these roads.

The motorway will take about 1311 ha of agricultural and waste lands. It will not significantly influence the lands, species and habitats of the Natura 2000 network. Analyses showed that the most detrimental effect will be deterioration of noise climate, air pollution in the adjacent areas and interference with animal migration pathways.

Having considered the protective measures proposed in this report:

- anti-noise protection (barriers, property buy-up)
- building crossings for animals
- drainage and pretreatment system for run-offs
- planting greenery

**it is found that the planned motorway A1 in section from interchange “Stryków I km 295+850 (without the interchange) to the border of łódzkie/śląskie provinces km 399+742.51 will not have a significant impact on the environment.**

**The project will not significantly affect the species and priority habitats and will not, in any way, interfere with the Natura 2000 areas.**