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ENVIRONMENTAL IMPACT REPORT

OF A TRAM LINE IN THE GDAŃSK-POŁUDNIE DISTRICT FROM THE "CHEŁM" LOOP THROUGH UL. WITOSA AND UL. NOWA ŁÓDZKA, TO THE "NOWA ŁÓDZKA" LOOP

Ordering party:
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Pages 1-156
Plenipotentiary of the Mayor of Gdańsk
for European Projects
Marcin Dawidowski
15 June 2011, signature……

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ENVIRONMENTAL PROTECTION CONSULTANCY SERVICES
PERFORMANCE OF ENVIRONMENTAL NOISE POLLUTION MEASUREMENTS

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1. SUMMARY IN NON-SPECIALIST LANGUAGE

Subject of study, legal basis

The subject matter of the present environmental impact report is construction and operation of a tram line in the Gdańsk-Południe district, from the 'Chełm' loop, through ul. Witosa and ul. Nowa Łódzka, to the 'Nowa Łódzka' loop.
The scope of the works, in accordance with the Annex IV to the Directive L.85.175.40, covers:
- a detailed description of the current conditions: emission of particulate matter and noise, state of surface and underground waters – including the impact of activities of neighbours;
- a description of the planned investment – a description of physical features of the enterprise and of requirements of usage of the area during each phase of construction/operation, including a description of the main features of production processes, *i.e.* the type and quantity of materials used;
- an evaluation of the type and quantity of expected residue and emissions (water, air and soil pollution, noise, vibrations, radiation etc.) resulting from implementation and operation of the proposed enterprise;
- a description of the aspects of environment which may be significantly influenced by this enterprise, especially of the impact on flora, fauna, soil, water, air, climatic factors, material goods, including architectural and archaeological heritage, landscape, and mutual interactions between these factors;
- a description of possible significant environmental effects of the proposed enterprises resulting from the existence of the investment and use of natural resources, in pollution emissions;
- a description of planned measures intended to prevent, reduce, or where possible to compensate for the significant harmful impact on the environment;
- indication of difficulties (technical deficiencies or lack of specialist knowledge) encountered by the contractor while summarizing the required information.

The planned enterprise is tightly coupled with the simultaneously-occurring construction of ul. Nowa Łódzka. In the present report, the cumulated impact of both investments on the components of the environment in which they can overlap (especially the emission of pollution into the air and noise emissions) has been presented.

The prepared report meets:
- the requirements specified in Annex IV of Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment (OJ. L No. 175, p. 40, with amendments)
- the requirements specified in Article 66 of the Act of 3 October 2008 on providing access to information concerning the environment and environmental protection, participation of the public in environmental protection and on environmental impact assessments of (Journal of Laws No. 199, item 1227, with amendments).

The potential impact on the environment was assessed on the basis of:
- legal regulations in force (parliamentary acts and regulations, acts of local law);
- ZANAT 6.0 – integrated package of programmes for routine calculations of the state of pollution of atmospheric air resulting from the impact of groups of punctual, line and surface emission sources, compliant with the Regulation of the Minister of Environment on the

reference values for certain substances in the air of 5 December 2002 (Journal of Laws 2003, No.1, item 12);
- CADNA A by DataKustik GmbH, a programme for calculation of environmental noise levels;
- data from literature and other available information sources.

In accordance with the Act of 3 October 2008 on **providing access to information concerning the environment and environmental protection, participation of the public in environmental protection and on environmental impact assessments** (Journal of Laws No. 199, item 1227) and the regulation by the Council of Ministers on **the determination of the kinds of projects that may have a considerable impact on the environment and the detailed conditions related to the qualification of projects for drawing up an environmental impact report (Journal of Laws No. 257, item 2573, as amended),** the planned enterprise should be considered as **having a potentially significant impact on the environment,** and an environmental impact assessment for it may be required. The Mayor of Gdańsk in his resolution of 24 June 2009 (ref. WŚ-I-7639/II/86 PS/2009/AN) has declared there is an obligation to prepare an environmental impact assessment for the enterprise under analysis.

The planned investment is not connected with the operation of any installation for which the obtaining of an integrated approval is required, in accordance with the regulation of the Minister of Environment of 26 July 2002 on the kinds of installations which may cause significant pollution in individual natural elements or of the environment as a whole (Journal of Laws, No. 122, item 1055).

The planned enterprise constitutes an element of the "Implementation of the Gdańsk Public Communication Project – stage III" (GPKM III), mentioned in entry 10 of the Annex to the regulation of the Council of Ministers of 12 October 2007 **on the listing of Euro 2012 projects** (Journal of Laws No. 192, item 1385 with amendments). It has been qualified to the VII Priority Axis – "Environmentally-friendly transport" and included on the list of individual projects for the **Operational Programme "Infrastructure and Environment", Action 7.3., "Public transport in metropolitan areas"**, under the number OPI&E 7.3-11.

The project is of a strategic nature because of the significant number of passengers transported, and it complies with the second strategic priority of the National Development Strategy*:* "Improvement of the state of technical and social infrastructure", the third horizontal objective of the National Strategic Reference Framework: "Construction and modernization of technical and social infrastructure of essential importance for increasing Poland's competitiveness", as well as with the main objective of the OPI&E: "Increase of the investment attractiveness of Poland and its regions by development of technical infrastructure, with simultaneous protection and improvement of the state of the environment, health, preservation of cultural identity and development of territorial cohesion".

The figure presented overleaf (source: http://www.gdansk.pl) presents the planned enterprise (indicated with a dark brown line) in the context of other existing and planned tram lines implemented within the Gdańsk Public Transport Project (GPTP). The construction of a tram line along ul. Łódzka, as analyzed in the present report, is currently designated as stage IIIA of the GPTP.

map legend

- Existing tram lines – approx. 50 km long
- Tram lines installed within the GPTP II – approx. 2.8 km long. Route: Al. Armii Krajowej – ul. Sikorskiego – "Chełm" loop
1 - Continuation of a tram line installed within GPTP II. Route: "Chełm" loop – ul. Sikorskiego – ul. Witosa – ul. Nowa Warszawska – ul. Nowa Łódzka – "Jabłoniowa" loop.

2 - Continuation of a tram line installed within GPTP II. Route: “Chełm” loop – ul. Witosa – ul. Nowa Warszawska – ul. Nowa Łódzka – "Nowa Łódzka" loop.
3 - Continuation of a tram line implemented within GPTP II. Route: “Chełm” loop – ul. Sikorskiego – ul. Kadmowa – "Orunia" loop.
3A – Route: Crossroads of ul. Sikorskiego and ul. Małomiejska – "Nowa Łódzka" loop
4 – Route: "Siedlce" loop – ul. Kartuska – ul. Nowolipie – ul. Rakoczego – ul. Bulońska – "Myśliwska" loop
5 – Line in ul. Nowa Wałowa from ul. Jana z Kolna to ul. Siennicka
– Tram lines planned in the target network

“The Development Strategy of the Pomeranian Voivodeship 2020” was adopted by the Pomeranian Voivodeship Assembly in resolution no. 587/XXXV/05 of 18 July 2005. It is an essential strategic document determining the directions for development of the Pomeranian Voivodeship. One of the strategic goals is a safe and efficient transport system. Implementation of the goals mentioned would be made possible by reconstruction of the road and street system of Gdańsk, establishing conditions for effectively facing the challenges of development in the trans-regional and international context.
According to the **“Spatial development plan of the Pomeranian Voivodeship”**, adopted by the Pomeranian Voivodeship Assembly in resolution no. 630/XLVI/02 of 30 September 2002, the transport infrastructure in the integrated regional passenger transport system of the Pomeranian Voivodeship should include integration nodes and transfer stops in the P+R[1], K+R[2] and B+R[3] systems.
In the **“Study of Conditions and Directions of Spatial Development of Gdańsk”**, adopted by the Gdańsk City Council in resolution no. XVIII/431/07 of 20 December 2007, the most important goals of the transport system include:
- development of the city’s street system (including the Gdańsk-Południe district);
- giving priority to rail transport as a basic mode of transport and bus transport as an auxiliary one in public transport;
- organization of modern integration nodes and transfer subsystems of public and individual transport, including P+R, K+R and B+R;
- not increasing the current level of the transfer factor calculated for the public transport, preserving the preference for increase of transfers in the P+R system;
- rationalization of the Śródmieście [Downtown] service system and assorted regions of the Central Zone of Services (CPU) by reduction of individual transport and construction of strategic parking lots in connection with public transport and appropriate economic regulations.

The investment area is covered by local spatial development plans:
- “Ujeścisko I” (1803) – Resolution no. LVI/751/97 by the Gdańsk City Council of 18 December 1998 (Journal of Laws of the Pomeranian Voivodeship [JLPV], 1998, No. 14, item 45), situating ul. Nowa Łódzka and the tram line;
- “Chełm-Łostowice – the area of ul. Świętokrzyska in the city of Gdańsk” (1814) – Resolution no. VI/114/2003 by the Gdańsk City Council of 27 February 2003 (JLPV, No. 66, item 1027).

[1] "Park & Ride" or P+R is a parking lot intended for people who commute from the suburbs of large cities and use public transport. The drivers leave their vehicles in designated places, transfer to public transport and thus they continue on their way to the city centre. The first parking lots of such type were created in Western Europe.
[2] "Kiss & Ride” or K+R – cars drop off passengers and move on.
[3] "Bike & Ride" or B+R – a system which creates opportunities to commute by bicycle and to continue the travel by public transport with or without the bicycle.

The planned enterprise is not in conflict with provisions of the aforementioned plans.
The Gdańsk City Council, in Resolution no. XXXV/1088/2001 of 31 May 2001, adopted an operational plan for the modernization and development of public transport, called the "Gdańsk Public Transport Project". Its main goal has become the progressive and consistent creation of conditions for efficient and safe transport of people and goods, with priority given to public transport and reducing the burden of transport on the natural environment.
Another important goal of the transport policy in Gdańsk is the improvement of travel quality within the city and improvement of external transport links of the city's road system with the national network of motorways, main railway lines and airports. It is presumed that the transport policy for Gdańsk would be subject to the strategy of sustainable development (eco-development). This strategy is the only rational proposal which enables development of the city in the age of rapid increase in the level of motorization, and real dangers for the life of inhabitants and operational quality of the transport system. It also reflects the aspirations of Gdańsk as a European city, and conforms to the strategic assumptions for regional development.

The Gdańsk Public Transport Project, stage III A, discussed in the present "Report…" (construction of a tram line along ul. Łódzka) unambiguously falls in line with the goals presented in documents on a national, regional and local level. The effects to be achieved after the implementation of the investment under discussion, such as better and more efficient use of public transport, prevention of an increase in the number of individual trips in the city centre, protection of the natural environment by supporting pro-ecological transport systems, as well as increases in traffic safety, unambiguously fall in line with the goals of both European Union and national transport policy. The goals of the present investment also achieve the intended effects of actions taken by regional and local (municipal) authorities.
The primary goal of GPTP III A is a distinct improvement in the state of public transport in Gdańsk, mainly by the modernization and development of the environmentally-friendly mode of public transport which is the tram.
The goals at the results level (direct goals) of the project include:
- improvement in quality of public transport service, including reduction of travel time;
- increase in attractiveness of the transport offer and increase in travel comfort;
- increase in attractiveness of inter-district connections;
- increase in the number of passengers using public transport;
- stronger integration of the Chełm district with the Gdańsk-Południe district and with other areas of Gdańsk and the Tricity metropolitan area;
- improvement in the frequency of vehicle circulation;
- improvement in transport availability and increase in attractiveness of areas adjacent to the investment;
- adjustment of the infrastructure to the needs of persons with limited mobility
- improvement in the efficiency of the street network, especially in central areas of the city that are overloaded with traffic;
- reduction of the negative impact of transport on living conditions of the inhabitants;
- improvement of the state of the natural environment.

Location and description of the planned enterprise

The investment will be located in the southern part of Gdańsk, in the area bordered by the following streets:

- from the north – by Al. Armii Krajowej;
- from the south – by the line of ul. Świętokrzyska and ul. Małomiejska;
- from the west – by ul. Łódzka.

map captions

CHEŁM z dzielnicą GDAŃSK POŁUDNIE = CHEŁM with the GDAŃSK-POŁUDNIE district
REJON INWESTYCJI = INVESTMENT AREA
Ujęcie wody "Ujeściska" = "Ujeściska" water intake station
Source: Own study

It covers a wide area from the junction of ul. Nowa Łostowicka and ul. Wilanowska, further towards an existing ravine along ul. Zakoniczyńska, across the junction of ul. Łódzka and ul. Wilanowska, up to the existing ul. Świętokrzyska.
In the direct vicinity of the route of the planned ul. Nowa Łódzka (near the junction of ul. Łódzka and ul. Przemyska), there is the "Ujeścisko" water intake station, consisting of two inactive (since 1989), depleted quaternary deep-water wells. The intake station has only a direct protection zone. It is scheduled for liquidation, although a final decision has not been adopted yet.

The planned enterprise consists in:
- construction of a two-track tram line along with infrastructure, 2.8 km long, from the "Chełm" loop through ul. Witosa and ul. Nowa Łódzka, to the "Nowa Łódzka" loop;
- necessary conversion of existing streets along the planned tram line, along with infrastructure;
- construction of the "Nowa Łódzka" loop with a crossing with the planned ul. Nowa Świętokrzyska, including a parking solution in the future;
- construction of a bus and tram integration node at the "Nowa Łódzka" loop with a ticket sale point and open-access toilets;
- conversion of crossings along the route of the planned tram line;
- ensuring access on foot and by car to existing objects and to the newly-designed tram stop platforms;
- ensuring access routes to the tram stops for the handicapped;
- construction of a rectifier station with a fence, approach road and technical infrastructure;
- construction of engineering objects, including viaducts, overpasses, culverts etc.;
- conversion/construction of gas, heating, water supply, sanitary sewer and rainwater sewer networks.

The planned tram line is an extension of the tram line from ul. 3 Maja to the "Chełm" tram loop, built in 2007.
In the median strip dividing the lanes of ul. Sikorskiego up to the "Chełm" loop, 2 new tram stops will be built.
The planned tram line goes along the left side of ul. Witosa, facing ul. Warszawska, and to the "BP" fuelling station. This solution is common to all 3 variants taken into account.
Near the church, it is planned that the line will pass through a tunnel under a railway of about 4 m in width, while the existing pavement layout will be preserved there. Crossings with ul. Cieszyńskiego, ul. Dragana and ul. Milskiego will be adjusted. New lanes would be introduced to enable safe left and right turns.

Three investment variants, described in detail in the main part of the report, are taken into consideration.

The most important differences between them are:
- VARIANT I – the tram line goes between the lanes of the two-lane ul. Nowa Łódzka. The existing ul. Łódzka is a local road.
- VARIANT II – the tram line goes between the lanes of the two-lane ul. Nowa Łódzka. The existing ul. Łódzka is assumed to be used as one of the lanes.
- VARIANT III – the tram line has been located on the eastern side of the road layout. Ul. Nowa Łódzka is designed as a two-lane road divided by a median strip, with two lanes in both directions. The existing ul. Łódzka is a local road.

The variant chosen for implementation is VARIANT III.

A drainage system will be designed along the track; one of its elements, besides bedding and isolation layers (geotextile fabric), will be a drainage network. It will enable the quick removal and gravity discharge of rainwater from the track to an interceptor, which would be either a newly-designed or existing rainwater sewer network.
Rainwater from the planned parking places at ul. Świętokrzyska, before introduction into the existing collector in the rainwater sewer system, will be pre-treated in a separator of petroleum-derivative substances. The connections of the planned sewer system with the existing collectors will be prepared in accordance with the conditions specified by the network's disposer.
The planned traffic system conflicts with the existing networks:
- water supply;
- sanitary sewer;
- rainwater sewer;
- gas;
- heating.

In case of a lack of possibilities to preserve the required distances between the planned objects and the existing networks as specified by the disposers, the existing pipelines will be subject to conversion at the sections indicated in the technical requirements.
The works connected with the tram line's construction will be divided into the following stages:
- designation of the route;
- disassembly/conversion of objects and clearing of trees interfering with the path of the planned route;
- trenching;
- construction of embankments (at the point where the route is projected to go above the existing area)
- condensation of the original soil or replacement of weak soils;
- laying of geotextile fabric, layer of coarse sand and rubble;
- construction of the track structure.

In the construction phase, consumption of the following is foreseen:
- construction materials: aggregate of varied granulation, concrete elements, steel elements (tracks, railway switches), cables;
- fuel – in engines of transport vehicles and construction machines;
- water – for preparation of concrete mix;
- electric power – work of electric tools, lighting of the construction site.

In the operational phase, consumption of the following is foreseen:
- electric power – supply to the tram line and buildings, lighting of tram stops and parking lots;
- water – sanitary units in buildings, wet cleaning of tram stops and parking lots;
- fuel – in technical service and maintenance vehicles.

Apart from the aforementioned, no consumption of other resources and energy is foreseen, excluding the periods of maintenance and repair works.
Within the operation of the enterprise, actions will be taken connected with:
- maintenance of tram stops, parking lots and buildings to keep them in an appropriate technical condition (including road surfaces, horizontal and vertical signs, lighting, premises etc.);
- care of accompanying vegetation;
- cleaning and maintenance of water supply and sewer networks.
Small repair works in the aforementioned scope are also foreseen.

Characteristics and evaluation of the state of the environment

According to the physical-geographical division by J. Kondracki, the area under analysis is located in the eastern part of the Kashubian Lake District. The region of the enterprise is an area of hummocky moraine upland, formed during the last Vistulian glaciation from sands, in places with an admixture of gravels and tills. The investment under analysis is located within the area of the Main Ground Water Reservoir (MGWR) no. 111 K – Gdańsk Subtrough.
The ground of the area of the analyzed investment is built of quaternary deposits. Uncontrolled anthropogenic embankments and humus sands appear directly at the surface. Their composition is highly varied – they contain fine humus sand, fine sand, loamy sand, humus loamy sand, organic parts and rubble. Ground waters occur in the form of relatively sparse leakages from sand layers within areas of cohesive soils and at their tops. The level of ground water, as well as the quantity and intensity of ground water leakages may vary depending on atmospheric conditions.
In the area of the investment, there are only small bodies of surface water (ponds); the nearest one is located about 200 m to the north-west and about 350 m to the west.
In the area of the planned investment there are no natural protected areas or objects established under the Nature Protection Act. There are no such objects in the closest vicinity of the enterprise as well. The nearest protected area is the "Dolina Potoku Oruńskiego" [Potok Oruński Stream Valley] Nature and Landscape Protected Complex located 0.5±1 km to the north-east from the planned investment. The nearest areas of the Natura 2000 network are "Bunkier w Oliwie" [The Bunker in Oliwa] and "Lasy Oliwsko-Sopockie" [Oliwa and Sopot Forests], about 9 km to the north, and "Twierdza Wisłoujście" [Wisłoujście Fortress] about 9.5 km to the north-east from the investment.
Additionally, there are no objects in the area of the planned investment with significant importance for the cultural and historical heritage of the region.

map

GDAŃSK
Green Areas

Legend:
- state forests
- commune forests
- arable land
- border of the TLP (Tricity Landscape Park)
- border of the [illegible] of the TLP
- water routes
- main roads

Protected areas:
1. "Źródliska w Dolinie Ewy"

2. “Ptasi Raj”
3. “Mewia Łacha”
Other forms of protection of nature:
4. “Dolina Potoku Oruńskiego” Nature and Landscape Protected Complex and the “Murawy Kserotermiczne” site of ecological interest
5. “Dolina Strzyży” Nature and Landscape Protected Complex
6. “Fort Nocek” and “Luneta z Pasikonikiem” sites of ecological interest
7. “Oliwskie Nocki” site of ecological interest

Zatoka Gdańska = Gdańsk Bay

Source: http://www.gdansk.pl

The main source of pollution emissions into the atmosphere for the region of Gdańsk under discussion is increased road traffic (combustion of liquid fuel).
Within the territory of Gdańsk, monitoring of the state of atmosphere is conducted in the ARMAAG[4] network. Generalizing the results of the survey, it can be claimed that the state of the air in Gdańsk is good, except for PM10 particulate matter concentration. For several years PM10 concentration in the Tricity has exceeded acceptable levels, which prompted officials to prepare the “air protection programme for the Tricity metropolitan area”.
On 19 December 2007, the Regulation of the Pomeranian Voivode no. 33/2007 on the air protection programme for the Tricity metropolitan area was issued; the implementation of the enterprise under discussion entirely falls in line with implementation of goals set out in both the air protection programme for the Tricity agglomeration and in the Regulation of the Pomeranian Voivode no. 33/2007 which results from the programme.
On the other hand, analysis of an acoustic map of Gdańsk shows that the greatest sources of noise emitted into the environment is road, railroad and tram transport.
In the area under discussion, vibrations arise at the interface between the wheels of moving road vehicles and the road surface, and are further transferred through the subsoil to the environment: buildings, their equipment and users. The amplitude of vibrations depends significantly on the kind of road surface. The irregularities of the road surface induce vibrations several times stronger than those occurring on an even road, which has a substantial significance for people living near streets exposed to the increased amplitude of vibrations caused mostly by poor condition of roads and considerable traffic of lorries, especially long-haul vehicles. Another problem is vibrations caused by run-down and uneven tram tracks – they are caused not only by passing trams but also by speeding cars, especially lorries that, running over protruding rails and loose concrete slabs, induce vibrations in adjacent buildings. A solution to this problem is to cover the rails with a special elastic resin that would neutralize all vibrations and noise, as well as to replace rails and sleepers with special reinforced concrete structures absorbing the vibrations of heavy trams; in the area of the planned investment, both noise and vibrations caused by the tram loop at Al. Władysława Sikorskiego are minimal because of the usage of modern track structure and vehicles – Bombardiers[5].

[4] Agency of Regional Air Quality Monitoring in the Gdańsk Metropolitan Area (the ARMAAG Fund)
[5] The City of Gdańsk, within the second edition of the GPTP, has decided to purchase three new low-floor trams. A previously-held tender resulted in the choice of a product from a Canadian consortium. The first of three ordered Bombardiers (designated as [1005]) appeared on Gdańsk tracks on the night of 2/3 December 2007. All ordered cars of the NGT6 type serve line 1, linking Śródmieście [Downtown] and Chełm, and line 11 from Wrzeszcz to Chełm.

Determination of direct, indirect, short-term, reversible and irreversible impact on individual elements of the environment and on human health

Emissions in the air

The impact of pollution emissions from the construction works, in view of the location of the planned investment area, will be virtually insignificant for the state of the environment and would not permanently aggravate the aerosanitary condition of the area around the enterprise.

A source of transportation-related pollution emissions will be the process of combustion of petrol and diesel fuel in engines of the vehicles moving in the existing and planned road system and in the area of the parking lots near the "Nowa Łódzka" loop.

Simulation calculations for 2009 and 2015 have established that:

- nitrogen oxides have the greatest impact on the quality of air and will continue to in the future;
- aggravation of the impact would be caused by a predicted significant increase in the number of cars, despite the predicted constant decrease in unit values of emission from automobiles, caused by norms for emissions of exhaust gas from engines which will gradually become stricter;
- emissions of other pollutants – sulphur dioxide, particulate matter, carbon monoxide, aliphatic and aromatic hydrocarbons – despite a relative increase, would not cause any risk of air pollution in the area.

With regard to the impact of pollution emissions from road traffic, the considered variants are very similar to each other and differences between them are virtually insignificant.

Emission of noise, vibrations

In the construction phase, sources of noise will mainly consist of construction machines and equipment such as excavators, bulldozers, compressors, lorry transport etc. Such impact, according to the regulations in force, is not subject to norms. Its spatial range can be assessed as approx. 100 m from the grouping of working construction machines, and the noise emitted into the environment will be partially screened by buildings adjacent to the investment. Works causing a significant emission of noise should be performed at the least sensitive times, *i.e*. between 6:00 am and 6:00 pm.

On the basis of conducted acoustic calculations, cumulated for the tram line and ul. Nowa Łódzka, the following evaluation of the proposed investment and its variants can be formulated:

1. The existing level of noise in the area under discussion is mainly caused by car traffic on the roads located in the area but outside the planned investment (Al. Armii Krajowej, ul. Świętokrzyska, ul. Małomiejska, and further, ul. Warszawska, ul. Witosa and ul. Wilanowska). The noise level significantly exceeds acceptable levels in protected areas. Especially in a relatively large area with detached houses at ul. Świętokrzyska (from the junction with ul. Łódzka), as well as in the area of the school between Al. Armii Krajowej and ul. Witosa, breaches of the limit during the day reach 10 dB. In the area of multi-family housing on the western side of ul. Łódzka, the acceptable level for day and night is exceeded by approx. 5-6 dB. In the area of multi-family housing on the eastern side of ul. Łódzka, the acceptable levels on the facades of buildings are not exceeded. Car traffic at ul. Łódzka has only a local impact on the level of noise, in the surroundings of the aforementioned street in a section from the junction with ul. Warszawska to the junction with ul. Świętokrzyska.
2. Tram noise in the area under discussion is currently negligible and pertains to a relatively small area near the tram loop at Al. Władysława Sikorskiego. In the vicinity of this

avenue, tram noise is significantly lesser (due to the modern structure of tracks and vehicles – the Bombardiers) than car noise.

3. Transport forecasts for 2015 assume a significant increase in car and tram traffic volumes in comparison to the current state for all variants of development of the road and tram network. A large increase in car traffic is predicted especially for Al. Armii Krajowej and ul. Łostowicka. High traffic volume is also predicted in the planned ul. Nowa Łódzka and ul. Nowa Warszawska.
4. The listing of acreage of protected areas where breaches of acceptable noise levels occur or are predicted suggests that the planned investment, regardless of the variant chosen, would cause an increase in acreage of protected areas where acceptable noise levels are exceeded by 5% at day and 7% at night in comparison with the current conditions.
5. There are no significant differences in noise emission between the individual variants. A minimal increase of areas with the highest breaches of noise levels (10-20 dB) may be expected in protected areas in case of the implementation of VARIANT III. The area mentioned would be increased in comparison with current conditions by only about 0.58% in the day and about 0.41% at night.
6. The results of calculations at selected checkpoints also show a lack of significant differences in noise emission between the three investment variants. The differences in the noise level calculated at the checkpoints for each variant are smaller than 2 dB, which makes them imperceptible to inhabitants.
7. From the viewpoint of noise protection, there are no contraindications for implementation of VARIANT III of the investment, which is corroborated by other, non-acoustic arguments.
8. In case of the implementation of VARIANT III, the predicted increase in traffic volume would cause an increase in road noise, but would also cause its shift from the areas where a decrease in traffic volume is predicted following the investment's implementation (e.g. near the old ul. Warszawska) to the vicinity of the planned streets, mostly ul. Nowa Łódzka and ul. Nowa Warszawska. As a result, in the area of multi-family housing on the eastern side of ul. Łódzka, the noise level will increase by about 7-8 dB in the day and about 6-7 dB at night. The acceptable levels for day and night in the aforementioned area will be exceeded by about 4-5 dB. In the area of multi-family housing on the eastern side of ul. Łódzka, as a result of the shift of traffic from the "old" ul. Łódzka to ul. Nowa Łódzka, the increase in the noise level will be insignificant (about 1 dB, *i.e.* imperceptible for an observer).
9. Acceptable noise levels will also be exceeded in the area of detached houses between the old ul. Warszawska and ul. Łódzka, near the planned location of ul. Nowa Łódzka. The amount of the breach on the facade of the building located closest to the planned ul. Nowa Łódzka will be about 10 dB in the day and about 4 dB at night.
10. As a comparison of noise maps for VARIANT III shows, the level of tram noise is significantly lower than car noise along the entirety of the planned route, both for day and night. Results of component calculations of road noise at checkpoints, given in Table 13, also show that tram noise is lower by about 6-12 dB in the day and about 4-9 dB at night in comparison to car noise. Considering the decisive share of car noise in the total road noise level, the maximum theoretical level of road noise reduction obtained only by reductions in tram noise (even in the case of its total elimination) has a maximum value of about 1.5 dB. A potential reduction of tram noise would have practically no impact on reduction of the total road noise.
11. The predicted relatively low level of tram noise would be achieved if the technical condition of the new route and circulating trams were similar to the route and trams serving Al. Władysława Sikorskiego, where emission levels taken into consideration as

input data in noise predictions for the planned tram line were established by means of a survey. To maintain the low level of tram noise, undertakings intended to maintain very good technical condition of tracks and vehicles (*i.e.* in the form of a maintenance plan consistently followed for the track and trams – especially a plan for the polishing of rails and tram wheels) are necessary. It would also be beneficial to shape the planned tram line in such way that the track area and its surroundings would absorb the noise to the highest degree possible, *e.g.* by turning them into grassy areas.

Vibrations will occur during the implementation of the planned enterprise. In many cases, mechanical vibrations are an operational factor, deliberately introduced by constructors into machines or devices as a necessary element for carrying out the desired technological processes, *e.g.* in machines and devices for vibration granulation, separation, compaction, treatment and polishing, as well as fracturing of materials, drilling, boring and grinding, and are caused by the operation of earthwork machines, surface works, road rollers, excavators, loaders, and compactors. The impact of vibrations during construction is limited in time, which significantly minimizes their influence on the environment, and the amplitude of these vibrations, transferred through the ground to buildings, does not usually go beyond the zone of vibrations absorbed by buildings without threatening their structural integrity.
Vibrations during operation of the tram line were limited in the proposed structure by applying a dock rail covering made of rubber profiles, serving to significantly isolate the vibrations and mute noise, as well as providing effective electric insulation of the track, meeting the requirements on protection from stray currents.

Water and waste management
Rainwater sewage occurring during the construction works will be drained into the existing rainwater sewer system or sink into the ground. Rainwater occurring during the construction works will not negatively impact the natural environment. It is recommended to arrange hardened refuelling sites for construction machines and to provide the construction site with absorbents.
Consumption of water during operation of the enterprise will be connected with processes of wet cleaning of street surfaces and cleaning of sewers.
The planned investment will not be a source of domestic and industrial sewage. Rainwater from the area north of ul. Warszawska will be drained into the city's rainwater sewer network, while from the southern part (from ul. Warszawska to the "Nowa Łódzka" loop, including the parking lots) it will be drained into Reservoir no. 4 "Augustowska" created on Potok Oruński stream (about 400 m south from the "Nowa Łódzka" loop).
A new rainwater outlet, with a diameter of 800 PCV, provided with a settler and 100/100-type lamella separator with a nominal flow capacity of 100 dm^3/s and a maximum flow capacity of 1000 dm^3/s, has been designed. When determining the drainage area of this outlet, the projected road system of ul. Nowa Łódzka and the tram line, as well as potential connections to a new rainwater sewer system in the future, have been taken into consideration. For a new rainwater and melt water outlet, a permit required by the Water Law should be obtained.
Additionally, at the rainwater outlets from tram junctions located at the "Nowa Łódzka" loop, NG3 coalescence settlers and separators with a nominal flow capacity of 3.0 dm^3/s (3 items) have been designed.
The planned investment will cause an increase in the quantity of rainwater drained into the interceptor of the municipal sewer system, due to the hardening and sealing of significant areas and construction of a new rainwater sewer system.

Waste management

The predicted quantity of hazardous waste generated during the construction will total up to approx. 10 Mg. Waste emissions from the area of the planned investment will be caused by:
- cleaning processes of settlers and separators of petroleum-derived substances, installed in the investment area;
- renovation and maintenance of new roads and tracks: repair or replacement of damaged elements or surfaces, replacement of lighting, cleaning of tram stops, streets and tracks etc.;
- operation of the rectifier station.
Pollution of the earth masses in the investment area is not expected, due to the manner of management already in effect for this area. It may be used for such applications as terrain levelling at the site, or carried away from the investment area.

Impact on the ground surface, natural and cultural environment, including Natura 2000 areas

The planned investment will have no negative impact on the ground surface, landscape and historical value of the area under analysis during construction. During the investment's implementation, undertakings limiting and eliminating the possibility of occurrence of negative impact should be made. Such actions include:
- performance of construction works in a manner that would prevent pollution by solid and liquid waste;
- usage of environmentally-friendly paints, greases and other chemical substances, according to the regulation of the Minister of Economy of 5 July 2004 on limitations, prohibitions or conditions of the production, trade or use of hazardous substances and preparations and of products containing them (Journal of Laws No. 168, item 1762 with amendments);
- selection of environmentally-friendly construction materials meeting the strength conditions for buildings, according to the regulation of the Minister of Economy mentioned above.

As a part of the investment's implementation, the clearing of trees and shrubs interfering with the planned investment is planned. For the chosen VARIANT III, it is foreseen in total for the construction of ul. Nowa Łódzka and the simultaneously constructed tram line:
- number of trees to be cleared: 207 (including 30 trees due to their poor condition);
- approximate area of shrub groups and undergrowth to be cleared: 22,000 m^2.
The planned clearing has been limited to a necessary minimum, and the trees scheduled for clearing have no significant natural value. They are mostly self-sown.
The trees scheduled to be preserved, situated near the conducted construction works, will be protected during construction, in accordance with the detailed design plans.
Soils and ground waters will be well-isolated from the potential impact of the investment by construction of impenetrable transport surfaces and efficient sewer installations.
No impact of the investment on the quality of waters of Main Ground Water Reservoir (MGWR) no. 111 K – Gdańsk Subtrough is foreseen.
Impact on areas of the Natura 2000 network is understood as undertakings which may significantly aggravate the condition of natural habitats, including plant and animal habitats, or have other negative impact on the species for protection of which these areas have been established. In the identification matrix below, determinations of the probable importance, rank and intensity of impact of the planned investment on areas of the Natura 2000 network located in the vicinity of the planned investment is shown.

Determinations of all probable direct, indirect and secondary impacts of the planned investment on Natura 2000 areas

Size and scale (range) of the enterprise	Long-range, limited to areas adjacent to the planned investment

Appropriation of the area	Does not apply
Distance from Natura 2000 areas	The planned investment is not located in such areas or adjacent to any. The closest areas of the network are: “Bunkier w Oliwie” and “Lasy Oliwsko-Sopockie”, about 9 km to the north, and “Twierdza Wisłoujście” about 9 km to the north-east of the investment.
Resource requirements	Consumption of electric power to supply the tram line and street lighting
Emissions:	
- into the air	A source of air pollution will be low traffic volumes in the area of the planned parking lots, as well as the related emission of exhaust gases (nitrogen, sulphur and carbon oxides and hydrocarbons).
- Noise and vibrations	Sources of noise will be motor vehicles and trams.
- Waste	Operational waste (sediments from separators, spent lamps and electronic elements, urban waste from cleaning of the area) will be generated. Collection only by authorized companies.
Requirements for moving earth masses	Does not apply
Transport requirements	Does not apply
Period of operation	Not specified
Other impact	Does not apply

Description of all probable changes in Natura 2000 areas resulting from:

reduction of the area of habitats	no changes will occur
interference in key species	no interference will occur
fragmentation of habitats or species	no fragmentation will occur
limitation of species density	no limitation will occur
changes in key factors of protective values	no changes will occur
climate changes	no changes will occur

Description of all probable impacts on Natura 2000 areas as a whole, pertaining to:

interference in key connections determining the structure of the areas	no interference will occur
interference in key connections determining the functioning of the areas	no interference will occur

Determinations of significance indexes as results of the effects stated above, in relation to loss, fragmentation, disruption, interference or change of key elements of Natura 2000 areas
No results were stated.

On the basis of the analysis conducted in the present report, it should be stated that no element of the planned investment at the stage of construction and operation will have any significant impact on the species for which the Natura 2000 areas and other areas protected by the law have been established.

Impact on the level of non-ionizing electromagnetic radiation

The functioning of the planned investment will not result in any change of existing conditions as regards the level of non-ionizing electromagnetic radiation.

The plans for the enterprise include no sources of radiation; neither will the activities covered by the project effect an increase in radiation emissions from previously active sources (existing 110 kV power lines in the northern part of the investment, from Al. Armii Krajowej).

Impact on human health and life and on natural resources

The planned enterprise will not significantly increase the negative impact of traffic on the health of people living in the vicinity of the investment. The most important environmental aspect for the comfort of living of the local inhabitants is the emission of noise and waste into the air, which has already been discussed above.

No environmental effects of the proposed enterprise resulting from the use of natural resources (e.g. fuel, energy, food) were stated; the implementation will not cause any significant increase in their consumption.

Variants of the enterprise

The conducted analysis of variants by weighted classification has shown that the ranking of the discussed variants is as follows:

1. VARIANT III
2. VARIANT I
3. VARIANT II.

In view of the above, it has been shown that the most environmentally-friendly variant is VARIANT III, that suggested by the Applicant for implementation. The key deciding factors in the choice of this variant were:

- traffic safety and capacity;
- no significant tree clearing;
- compliance with the spatial management plan;
- degree of acceptance by the local community.

The VARIANT "0" (non-investment) predicts no changes and is connected with costs to be incurred for ongoing maintenance and renovation of the existing road system, for which the planned tram line is intended to be the alternative mode of transport. Other costs will be connected with adjustment of the existing transport system to the requirements regarding the traffic safety for drivers and other road users. This variant is unfavourable from the viewpoint of natural conservation, because it is connected with increased emissions of transport pollution and noise resulting from the inefficient road system.

Impact of the enterprise in the liquidation phase

Ending the installation's operation in a manner which would not cause any risk for the environment will essentially consist in disassembly of the tram line together with the equipment and its transfer to another location (if technically and economically feasible) or in complete disassembly of all objects and devices.

The operational period of the installation has not been determined. Since the future formal and legal requirements in this regard are unknown, in order to liquidate the enterprise it is proposed to assume the formal and legal state resulting from provisions currently in effect of

the Building Code of 7 July 1994 (Consolidated text: Journal of Laws 2006, No. 156, item 1118 with amendments), determining the rights and responsibilities of the participants in the construction process, which include the obligation to obtain:
- a permit for demolition of the liquidated objects;
- agreements, permits or opinions of other authorities as required by special provisions;
- notification of local units of the Inspectorate of Environmental Protection, Sanitary Inspectorate, National Labour Inspectorate and National Fire Service, which can submit their remarks and objections within 14 days of notification.

If required, demolition works will be preceded by analyses of the degree of ground pollution and by preparation of a plan of remedial measures for the area, if the survey results show soil quality norms are exceeded.
Neutralization or recycling of waste (especially of hazardous waste) and its transport to places of final storage will be entrusted exclusively to companies with appropriate permits and authorizations. It will also be possible to conduct such activities using own means and resources, after agreement with the responsible environmental protection authority.
The process of disassembly of technical infrastructure will be conducted with particular caution and under supervision, in order to eliminate potential ground pollution. Elements of sanitary sewer infrastructure will be under special supervision.
Prior to disassembly, the devices and elements of this infrastructure will be emptied and cleaned, and all sediments extracted from them will be removed and subjected to appropriate, environmentally-friendly recycling or neutralization.
The course of the liquidation process will be monitored and documented in accordance with legal regulations in force at the moment of liquidation.

Serious industrial events
The planned enterprise causes no potential threat of environment pollution as foreseen for serious industrial events. The planned investment gives no grounds to qualify it as an investment with an increased or significant risk of event occurrence. Among accidents and incidents which may potentially occur during the construction, operation and liquidation of the enterprise, it is necessary to mention those caused by:
- accidents and incidents during construction and operation of the road, involving vehicles transporting hazardous substances which may cause *e.g.* air, water and ground pollution or fires;
- breakdowns at the parking sites of the aforementioned vehicles;
- inappropriate or insufficient protection of road works and insufficient surveying (*e.g.* of geology or water conditions), which may result in:
    - lowering of the surface of ground water;
    - a possibility of accidents and related leakage of petroleum-derived substances into the environment;
    - a possibility of a local source of fire.

Fire hazards occurring may be eliminated using hand-held fire protection devices or in cooperation with the National Fire Service.

Manners of minimizing of the negative impact of the enterprise on the environment and human health; prevention, reduction or amelioration of the harmful impact

It is proposed to accept the rules stated below, the application of which should reduce the unfavourable impact of the investment on the environment and human health to a minimum:
- systematic inspections of the sanitary and rainwater sewer systems

- handing over waste only to entities possessing appropriate permits;
- observance of the operational procedures specified in instructions (e.g. equipment operation, conduct etc.)
- observance of OHS and fire protection regulations
- placing special emphasis on the matter of training personnel operating the devices and instilling the principles of good technological practice in them.

Additional preventive measures other than those mentioned in the report are not foreseen. Ameliorating measures are not foreseen as well.

Monitoring and limited use zone

Monitoring for the planned investment, both for the period of construction and of operation of the routes, is not foreseen.

According to the requirements of the Environmental Protection Law, the City of Gdańsk should conduct an evaluation of air quality and of the acoustic state of the environment. These tasks are currently being carried out – the ARMAAG air monitoring network and the survey conducted by the WIOŚ [Voivodeship Inspectorate of Environmental Protection]; see also the prepared acoustic map of the city.

There is no need to establish a limited use zone for the investment under discussion.

Third parties

Between 30 January and 9 February 2009, the Department of Development Programmes of the Gdańsk City Hall conducted an information campaign intended to survey the opinion of the local community regarding the expansion of the road system enabling access to the northern districts of Gdańsk, bypassing the Downtown.

On the basis of 164 messages sent to an email address given in announcements, as well as posts in 54 Internet forums (42 posts), the Sociological Research Laboratory of the University of Gdańsk has prepared a listing of opinions and remarks on the proposed variants of the location of the tram line and ul. Nowa Łódzka.

Comment [NDV1]: Tram line and nowa lodzka done together

As for the choice of a variant, there was a quantitative predominance of threads expressing approval for variants II and III. A significant element appearing in all opinions was mention of the large number of parking places by the planned "Nowa Łódzka" loop, which would enable the implementation of the "park & ride" concept which assumes that the inhabitants of suburban regions would travel by their own cars to points where public transport lines are focused, and then commute further to their workplaces in the city centre; another theme was the problem of transit-generated noise in places of residence. Internet users expressed their assumption that such investments must be accompanied by the construction of noise barriers.

In general, no opinions were offered opposing the planned enterprise as a whole, appreciating the necessity of improving the transport structure in this region. Therefore, no significant social conflicts connected with the planned investment are foreseen.

Also, no limitations in the scope of use of the area, technical requirements on buildings and manners of their use are foreseen.

Cross-border influence

Following the analysis conducted of the impact of the planned investment on individual elements of the natural environment and distance from the borders of the Republic of Poland, it has been stated that its implementation and operation will not cause any cross-border influences.

Comparison of the installation with technology meeting the requirements mentioned in Article 143 of the Environmental Protection Law

Usage of substances with low hazard potential
Conducting of the described activity does not foresee the usage of any substances causing hazards for people and environment.
Efficient generation and usage of energy
Consumption of electric power will mainly depend on the working time of devices and manner of their application during the construction works. During operation, it will only be required for street lighting and tram line power supply.
Ensuring rational consumption of water and other resources, as well as materials and fuels
Consumption of water and other resources during operation is not foreseen.
Consumption of fuel will mainly depend on the working time of devices and manner of their application during the construction works.
Application of non-waste and low-waste technologies and possibility of recycling the generated waste
Emission of waste will not occur, except for the content of separator(s) in the rainwater sewer system, as well as spent lighting and electronic devices. Due to their function, it is impossible to avoid the occurrence of such waste.
Type, range and scope of emissions
The analyses conducted show that the impact of the enterprise under discussion, from the viewpoint of environmental protection, will be of a local character.
Application of comparable processes and methods which have been successfully applied on an industrial scale.
Scientific progress
The proposed technologies of tram line construction are commonly applied in the construction of such infrastructure objects throughout the country.

Recommendations
1. There is a requirement to implement works with a particularly high pro-ecological standard. During the implementation and operation of the investment, actions eliminating and limiting the possibility of the occurrence of negative impact should be applied, *i.e.*:
- construction equipment should meet the requirements specified in Directive 2000/14/EC and in the Regulation of the Minister of Economy of 21 December 2005 **on essential requirements for outdoor-use equipment regarding noise emissions into the environment** (Journal of Laws No. 263, item 2202 with amendments);
- during construction and liquidation works it is recommended to pump rainwater away from excavations and discharge it into the existing rainwater sewer installation;
- construction works should be conducted in a manner enabling avoidance of pollution by solid and liquid waste – it is recommended to arrange hardened refuelling sites for construction machines and to provide the construction site with absorbents;
- during construction works, it is necessary to apply environmentally-friendly paints, greases and other chemical substances and select environmentally-friendly construction materials which meet the strength conditions for buildings, according to the regulation of the Minister of Economy of 5 July 2004 on limitations, prohibitions or conditions of production, trade or use of hazardous substances and preparations and of products containing them (Journal of Laws No. 168, entry 1762 with amendments).
2. Works causing significant noise emissions should be performed in the least sensitive time, *i.e.* between 6:00 am and 6:00 pm.
3. In the proposed structure there is a dock rail covering made of rubber profiles, which serves a significant function of isolating vibrations and muting noise, as well as providing effective electric insulation of the track, meeting the requirements regarding protection from stray currents. However, at the detailed design stage, it is necessary to address the materials applied

by the Contractor in order to eliminate or maximally reduce the impact of stray currents on the adjacent steel structures.

7. Specification of direct, indirect, short-term, reversible and irreversible impact on individual elements of the environment and human health

7.1. Impact of the enterprise in the construction phase

The works connected with the tram line's construction will be divided into the following stages:
- designation of the route;
- disassembly/conversion of objects and clearing of trees colliding with the course of the planned route;
- trenching;
- construction of embankments (at the point where the route is projected to go above the existing area)
- condensation of the original soil or replacement of weak soils;
- laying of geotextile fabric, layer of coarse sand and rubble;
- construction of a track structure.

7.1.1. Pollution emissions in the atmosphere

The pollution emitted in the atmosphere, generated during the construction works, consist mainly of:
- exhaust gases of working construction machines – diesel-operated trucks, cranes, excavators, air compressor units etc. (SO_2, NO_X, CO, carbohydrates);
- descending and suspended particulate matter, generated during construction works and by vehicle traffic;
- gases emitted during welding works (CO, NO_X, particulate matter, including particulates of carbon oxides, manganese, silicon, chromium, copper etc.);
- emission of solvents such as xylene, benzene, toluene, during maintenance and painting works;
- emission of carbohydrates, phenols and sulphur compounds during road works – laying of bituminous surface.

These emissions will have an unorganized nature and will be of limited duration. Due to the location of the area of the planned investment, the impact of pollution emissions from the mentioned works will be virtually insignificant for the state of the environment and will not permanently aggravate the aero-sanitary state of the enterprise area.

7.1.2. Noise and vibrations

In the construction phase, sources of noise will mainly consist of construction machines and equipment such as excavators, bulldozers, compressors, lorry transport etc. Such impact, according to the regulations in force, is not subject to norms. Its spatial range can be assessed as approx. 100 m from the grouping of working construction machines, and the noise emitted into the environment will be partially screened by buildings adjacent to the investment.
It should be emphasized that the construction equipment should meet the requirements specified in Directive 2000/14/EC and in the Regulation of the Minister of Economy of 21 December 2005 **on essential requirements for outdoor-use equipment regarding noise emission into the environment** (Journal of Laws No. 263, item 2202 with amendments).
According to the regulations in force, the acoustic impact of the investment on the environment during construction works is not subject to legal regulations regarding noise protection. However, in view of the provisions of Article 6 of the Environmental Protection Law ("*A person who undertakes activities which may have a negative impact on the*

environment is obligated to prevent such impact"), the Investor is obliged to minimize the noise impact by application of devices and machines satisfying Polish norms and regulations on the emission of noise into the environment, and by avoiding the conducting of works connected with significant noise emission at night.

Taking into consideration the limited working time of the equipment and application of modern construction technologies, it can be stated that the noise impact occurring in the disassembly and construction phase will not be burdensome for the inhabitants of the nearest residential buildings. The time of such inconveniences will be limited and temporary. It is recommended to conduct works causing significant emissions of noise in the least sensitive time, *i.e.* between 6:00 am and 6:00 pm.
Regarding the matter under discussion, vibrations will arise during the implementation of track works, and they will be especially connected with the preparation of ground for track routes, including disassembly works – the main noise source will be the work of vibratory hammers. In many cases, mechanical vibrations are an operational factor, deliberately introduced by constructors in machines or devices as a necessary element to carry out the desired technological processes, *e.g.* in machines and devices for vibration granulation, separation, compaction, treatment and grinding, as well as fracturing of materials, drilling, boring, and grinding, and are caused by the operation of earthwork machines, surface works, road rollers, excavators, loaders, and compactors.
The frequency spectrum of these vibrations contains components of between several Hz and several hundred Hz, depending on the type of device. Components with frequencies over 30 Hz are strongly muted by the ground, while components with frequencies not exceeding 20 Hz may transfer even into areas a significantly remote distance from the construction area. The impact of vibrations during construction is of a limited time, which significantly minimizes their influence on the environment, and the amplitude of such vibrations, transferred through the ground to buildings does not usually go beyond the zone of vibrations absorbed by buildings without threatening their structural integrity.
However, works employing vibratory hammers usually cause greater vibrations in the surrounding ground base than those occurring during piling. Application of resonance-free vibratory hammers with a high vibration frequency may significantly reduce the unfavourable impact of vibrations on the surrounding ground and buildings.
The supervision should cover inspections and observations during which the following should be checked:
- compliance of the conditions at the construction site regarding the data on the ground and groundwater with the project's assumptions;
- compliance with the project provisions regarding the sequence and method of implementation of the works;
- scope of potential damage to adjacent buildings, devices or underground installations, in order to identify the damage which could be caused by the conducted works;
- if, according to the project, the levels of groundwater and surface water are critical parameters, they should be reviewed at appropriately short time intervals in order to obtain reliable data reflecting them.

7.1.3. Water and sewage management
Sanitary sewage
No such waste will be generated by the conducted works. During construction works, a sufficient number of portable toilets for construction workers should be foreseen.

Technological and rainwater sewage

The construction works will not contribute to the generation of technological sewage. However, situations may occur when poorly-secured excavations could potentially cause infiltration of oil pollution into the soil (oil pollution is mainly originated by poor sealing of mechanical equipment in operation). Therefore, it is recommended to arrange hardened refuelling sites for construction machines and to provide the construction site with absorbents.
Rainwater sewage occurring during the construction works will be drained into the existing rainwater sewer system or sink into the ground. During the construction works, it is recommended to pump the rainwater away from excavations and discharge it into the existing rainwater sewer installation.
According to Article 124 of the **Water Law** of 18 July 2001 (Consolidated text: Journal of Laws 2005, No. 239, item 2019 with amendments), a permit foreseen by the Water Law is not required for draining rainwater from construction excavations, provided that the range of the depression cone does not exceed the borders of the plot. The performance of excavation works which could cause such situations is not foreseen. If the construction technology foreseen in the construction plan changes the assumption set forth above, the designer should specify the range of the depression cone and, if necessary, apply for a proper permit.
According to Article 19, paragraph 2 of the Regulation of the Minister of Environment of 24 July 2006 **on requirements which should be met during the discharge of wastewater into waters or into the ground and on substances especially harmful for the aquatic environment** (Journal of Laws No. 137, item 984) – the rainwater drained from the excavations can be introduced into the interceptor without treatment.
Rainwater occurring during the construction works will not negatively influence the natural environment, provided that the construction work contractors will appropriately secure the organization of earthworks and apply appropriate supervision over observance of the principles of environmental protection.

7.1.4. Waste management

In connection with the investment's implementation, it is necessary to prepare the construction site and the construction camp. The investment begins with disassembly of existing elements which would not be used in further stages of performance of the construction works. These activities, along with the investment implementation phase, generate wastes which have to be removed from the investment area, segregated as well as appropriately stored and utilized depending on their group and type. On the basis of the Regulation of the Minister of Environment **on the catalogue of wastes** (Journal of Laws no. 112, item 1206), a possibility of occurrence of the wastes listed below during the investment's implementation has been foreseen.

Table 1. The foreseen types of waste during the investment's implementation

Waste Code	Groups, subgroups and types of waste
08 01 11*	waste paint and varnish containing organic solvents or other dangerous substances
08 01 12	waste paint and varnish other than those mentioned in 08 01 11
08 04 09*	waste adhesives and sealants containing organic solvents or other dangerous substances
08 04 10	waste adhesives and sealants other than those mentioned in 08 04 09
15 01 01	paper and cardboard packaging
15 01 02	plastic packaging
15 01 03	wooden packaging
15 01 04	metallic packaging
15 01 05	composite packaging
15 01 06	mixed packaging
15 01 07	glass packaging
15 01 09	textile packaging
15 01 10*	packaging containing residues of or contaminated by dangerous substances

15 02 02*	Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances
15 02 03	Absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02
17 01 01	Waste concrete and concrete rubble from demolitions and renovations
17 01 82	Other unmentioned waste
17 02 01	Wood
17 02 02	Glass
17 02 03	Plastic
17 03 01*	Bituminous mixtures containing coal tar
17 03 02	Bituminous mixtures other than those mentioned in 17 03 01
17 04 05	Iron and steel
17 04 11	Cables
17 06 04	Other insulation material

* - dangerous waste

The predicted quantity of hazardous waste generated during construction will total approx. 10 Mg.

According to the Waste Act, a waste producer is any individual the activity or existence of which causes the generation of waste, and each individual who performs the initial transformation of waste, blending waste or other activities which change the characteristics and composition of the waste. A producer of waste generated as a result of providing services in the field of *e.g.* construction and demolition of objects is the service provider, unless the contract for service provision states otherwise.

Obtaining the appropriate administrative decision regarding waste management depends on the type and quantity of waste generated, and on the manner of its management, *e.g.* during construction. Taking the aforementioned quantities and types of waste generated during the implementation of the analyzed enterprise, the applicant (the performer of works or the investor) will have to obtain a decision confirming the dangerous waste management programme and submit information on the manner of management of non-dangerous waste.

The earth masses from the investment area are not predicted to be polluted, due to the previously applied manner of management of this area. They may be used *e.g.*, for terrain levelling at the site or be removed from the investment area. Because the local spatial development plans do not specify the manner of management of earth masses, it can be specified in a location decision or in a construction permit; in such situation, the provisions of the **Waste Act** of 27 April 2001 (Consolidated text: Journal of Laws 2007, No. 39, item 251, with amendments) do not apply, in accordance with Article 2(2)(1) of the Act.

7.1.5. Impact of the investment on the ground surface, natural and cultural environment

The projected investment will cause no risk of environmental factors to the ground surface, landscape and historical value of the area under analysis during construction. During the investment's implementation, actions eliminating and limiting the possibility of occurrence of negative impact should be applied. Such actions include:

- performance of construction works in a manner enabling prevention of pollution by solid and liquid waste;
- usage of environmentally-friendly paints, greases and other chemical substances, according to the regulation of the Minister of Economy of 5 July 2004 **on limitations, prohibitions or conditions of production, trade or use of hazardous substances and preparations and of products containing them** (Journal of Laws No. 168, item 1762 with amendments);
- selection of environmentally-friendly construction materials meeting the strength conditions for buildings, according to the regulation of the Minister of Economy mentioned above.

As a part of the investment's implementation, the clearing of trees and shrubs interfering with the planned investment is planned. For the chosen VARIANT III, it is foreseen in total for the construction of ul. Nowa Łódzka and the simultaneously constructed tram line:
- number of trees to be cleared: 207 (including 30 trees due to their poor condition)[6];
- approximate area of shrub groups and undergrowth to be cleared: 22,000 m^2.

The planned clearing has been limited to a necessary minimum, and the trees scheduled for clearing have no significant natural value. They are mostly self-sown. Charges for the removed trees will be paid in accordance with the relevant law.

The trees scheduled to be preserved, situated near the conducted construction works, will be protected during construction in accordance with the detailed design.
The area of the planned investment is not subject to preservation maintenance. According to Article 32 of the **Act on Protection and Care of Monuments** of 23 July 2003 (Journal of Laws No. 162, item 156 with amendments), in case of the discovery of objects assumed to be a part of historic heritage during construction works or earthworks, the following should be done:
- all works should be halted which could damage or destroy the discovered object;
- the object and the site of its discovery should be secured using available means;
- the Voivodeship Monument Conservation Officer should be notified, or if this is not possible – the Mayor of Gdańsk.
If the Voivodeship Monument Conservation Officer does not conduct an inspection of the discovered object within 5 days of the receipt date of the notice, the stopped works can be continued.

7.1.6. Impact on the level of non-ionizing electromagnetic radiation

No construction machines and equipment, as well as road transport vehicles, causing emission of electromagnetic, ionizing or radioactive radiation will be used during the investment's implementation. Therefore, during the investment's implementation, radiation levels will not be increased above the existing background levels. Electrical devices used for the implementation of the enterprise should comply with the norms assigned to such devices and meet the CE safety requirements for their operation.
The planned construction works will not influence the level of non-ionizing electromagnetic radiation present in the environment in any manner. It is not foreseen to use construction machines or other devices which would generate electromagnetic fields of a level significant to the environment.

7.1.7. Impact of the enterprise on Natura 2000 areas

Impact on areas of the Natura 2000 network is understood as conducting actions which may significantly aggravate the state of natural habitats, as well as plant and animal habitats, or have other negative impact on the species for protection of which these areas have been established. In the identification matrix below, determinations of the probable importance, rank and intensity of impact of the planned investment on areas of the Natura 2000 network located in the vicinity of the planned investment is shown.

Determinations of all probable direct, indirect and secondary impact of the planned investment on Natura 2000 areas

Size and scale (range) of the enterprise	Local, short-term and temporary range,

[6] For a total of 357 trees within the investment area.

	limited to the investment area
Appropriation of the area	Does not apply
Distance from Natura 2000 areas	The planned investment is not located in such areas or adjacent to any. The closest areas of the network are: "**Bunkier w Oliwie**" and "**Lasy Oliwsko-Sopockie**", about 9 km to the north, and "**Twierdza Wisłoujście**" about 9 km to the north-east of the investment.
Resource requirements	Consumption of fuels and energy by the construction equipment
Emissions:	
- into the air	Sources of air pollution will be mainly exhaust gases from the engines of motor vehicles and machines (excavators, trucks etc.)
- Noise and vibrations	Sources of noise will be mainly construction machines and devices such as excavators, bulldozers, compressors, truck transport etc.
- Waste	Construction waste will be generated, such as rubble, scrap metal, wood, packaging.
Requirements on moving of earth masses	Movement of earth masses obtained from the construction works – it is recommended to use them at the site, *e.g.* for terrain levelling.
Transport requirements	Transport of earth masses from soil replacement (if necessary). EURO norms for motor vehicles regarding emissions into the air, depending on the age of a vehicle
Period of operation	Approx. 2 years
Other impact	Does not apply

Description of all probable changes in Natura 2000 areas, resulting from:

reduction of the area of habitats	no changes will occur
interference in key species	no interference will occur
fragmentation of habitats or species	no fragmentation will occur
limitation of species density	no limitation will occur
changes in key factors of protective values	no changes will occur
climate changes	no changes will occur

Description of all probable impacts on Natura 2000 areas as a whole, pertaining to:

interferences in key connections determining the structure of the areas	no interference will occur
interference in key connections determining the functioning of the areas	no interference will occur

Determinations of significance indexes as results the effects stated above, in relation to loss, fragmentation, disruption, interference or change of key elements of Natura 2000 areas

No results were stated.

On the basis of the above findings, it should be stated that no element of the planned investment at the stage of construction will have any significant impact on the species for which the Natura 2000 areas have been established.

7.1.8. Impact of the investment's implementation on human health and life

Implementation of the enterprise will be mainly connected with risks to the health of the workers conducting the investment's construction works. Therefore:

works connected with the implementation of the investment process in respect of the aforementioned impact include:

- securing the construction site against access by unauthorized persons;
- organization of a social area;
- organization of transport systems enabling the removal of materials necessary for construction of the objects obtained through demolition and transport;
- conversion/demolition of objects colliding with the path of the route;
- construction of the track system;
- conversion of the water and sewage, heating, power and telecommunications networks.

elements of the arrangement which may cause hazards to human health and life:

- the construction works will be conducted in a built-up area, in the direct vicinity of active roads, near residential housing;
- during the entire cycle of works, there is a probability of exposure of elements of underground infrastructure;

hazards predicted during performance of the works and their scale:

- works connected with movement of large-size construction materials (transport, storage);
- possible collisions with active power lines.

Type and scope of instructions given before the beginning of the works:

- preparation of personnel by conducting the preliminary, basic and periodic training required by the Labour Code;
- assessment of the professional risk at work stations and acquainting employees with its results;
- acquainting employees with the principles of road traffic organization in the construction area, especially with the principles of transport of the materials necessary for the implementation of the project;
- acquainting personnel with the contents of the BIOS Plan.

Technical and organizational measures intended to prevent the hazards:

- establishment of the principles of signage and securing of the construction area – special attention should be paid to areas of possible transport/flow of persons not connected directly with the conducted works;
- establishment of the principles of storage and transport of output generated during the demolition works and of construction materials necessary for completion of the project;
- establishment of the principles of road traffic organization in the construction area – a strict designation of parking places and transit routes of vehicles not connected directly with the construction is necessary; this especially applies to the period for demolition works, during which a high traffic volume of heavy transport vehicles should be foreseen;
- for purposes of maintaining order, especially to facilitate ongoing oversight, it is necessary to determine the quantity and type of transport equipment, its necessary parameters, equipment with traffic control signalling elements and its location while parked;

- establishment of the types of scaffolds necessary, principles of their assembly and potential movement – this is very important following intense precipitation, especially that connected with a gale.

It should be emphasized that the investment requires a detailed safety and health protection plan to be prepared by the project management, which should include the types of work causing hazards for safety and health of humans at the construction site, in accordance with the Regulation of the Minister of Infrastructure of 23 June 2003 on information on safety and health protection and safety and health protection plans (Journal of Laws 2003, No. 120, item 1126).

7.1.9. Emissions connected with a serious industrial event

The enterprise under discussion will not constitute an Establishment with an increased or significant risk of occurrence of a serious industrial event as understood by law, *i.e.* under the provisions of:

- the Environmental Protection Act of 27 April 2001 (Consolidated text: Journal of Laws 2006, No. 129, item 90 with amendments);
- the Regulation of the Minister of Economy of 9 April 2002 on types and quantities of hazardous substances, the presence of which at an establishment determine its classification as an establishment with an increased risk or an establishment with a significant risk of occurrence of a serious industrial event (Journal of Laws No. 58, item 535).

There are no hazardous substances whose presence within the area under discussion at the stage of the investment's construction would determine classification of the installation as an establishment with an increased risk in accordance with Tables 1 and 2 of the aforementioned Regulation of the Minister of Economy of 9 April 2002[7].

7.2. Impact of the enterprise in the operational phase

7.2.1. Pollution emissions into the atmosphere

A source of emissions of transport pollution will be the process of combustion of petrol and diesel fuel in engines of the vehicles moving in the existing and planned road system. Movement of vehicles in the streets and parking lots will be a source of emissions into the air of pollutants typical for fuel combustion processes in vehicle engines, such as: nitrogen dioxide, sulphur dioxide, carbon monoxide, aliphatic and aromatic carbohydrates and solid particles.

The main pollutant determining the level of burden from transport arteries is nitrogen dioxide. The predicted quantity of emissions was specified for six pollutants: nitrogen dioxide, sulphur dioxide, carbon monoxide, aliphatic and aromatic carbohydrates, and PM10 particulate matter. Lead and its compounds were excluded from the determination of emissions because its content in the new generation of fuels is negligible.

In order to evaluate the cumulated influence of both planned enterprises (the tram line and ul. Nowa Łódzka) on atmospheric air quality, comparative calculations were performed of the current distribution of pollution concentration (2009), **V0,** and for two variants in 2015 (including the increase in road traffic):

- **V1/V3** – the variants assuming the complete construction of the section of ul. Nowa Łódzka from the junction with ul. Świętokrzyska to ul. Armii Krajowej, with a cross-section of 2 x 2

[7] Both in the phase of construction and potential liquidation of the objects.

lanes along a new route, parallel to ul. Łódzka; ul. Łódzka and a fragment of ul. Warszawska will be preserved as local streets.
- **V2** – the variant assuming the complete construction of the section of ul. Nowa Łódzka from the junction with ul. Świętokrzyska to ul. Armii Krajowej, with a cross-section of 2 x 2 lanes; one carriageway will be led along a new route and the other along the ul. existing Łódzka.

Specification of data for calculations and emission quantities
To determine emissions:
- from surface emitters (parking lots) in the area of the planned "Nowa Łódzka" integration node and in the area of the future ul. Nowa Świętokrzyska;
- from the lanes of ul. Łódzka, ul. Nowa Łódzka, ul. Warszawska and ul. Nowa Warszawska,

the „Software for determining the characteristics of emissions of pollution from internal combustion engines of vehicles in order to assess environmental impact in 2002", prepared by Prof. Zdzisław Chłopek at the request of the National Fund for Environmental Protection and Water Management, has been applied. As is shown by the available data in the literature and by applicable legal requirements for car engine production technologies, which are gradually becoming stricter, the content of the most typical fuel combustion products (nitrogen oxides, carbohydrates, solid particles) is successively being decreased.

An example comparison between the binding European norms, EURO 1 (1993) and EURO 4 (2006) with regard to nitrogen oxides shows that, in the case of EURO 4, they were reduced by about 43% in comparison with EURO 1.
In the case of solid particles the reduction was even greater, by about 94%.
The indicators for the prediction calculations have been determined on the basis of indicators of emission rates resulting from the aforementioned study by Prof. Chłopek (separately for passenger cars and commercial trucks), on the basis of data from the literature (including the aforementioned EURO norms[8]) and the predicted changes in the development of motorization and technology of internal combustion engines.

2009

NO_2	passenger cars –	0.15070 g/km –	$3.753*10^{-4}$ g/s
	commercial trucks –	2.30810 g/km –	0.0156 g/s
SO_2	passenger cars –	0.00457 g/km –	$2.173*10^{-5}$ g/s
	commercial trucks –	0.01176 g/km –	$7.1104*10^{-5}$ g/s
CO	passenger cars –	0.81914 g/km –	0.00576 g/s
	commercial trucks –	0.66655 g/km –	0.00451 g/s
aliphatic C_xH_y	passenger cars –	0.03701 g/km –	$2.668*10^{-4}$ g/s
	commercial trucks –	0.51728 g/km –	0.006126 g/s
aromatic C_xH_y	passenger cars –	0.01185 g/km –	$8.5419*10^{-5}$ g/s
	commercial trucks –	0.12932 g/km –	0.001532 g/s
PM 10	passenger cars –	0.00539 g/km –	$2.0458*10^{-5}$ g/s
	commercial trucks –	0.08825 g/km –	$8.102*10^{-4}$ g/s

2015

NO_2	passenger cars –	0.08505 g/km –	$2.222*10^{-4}$ g/s
	commercial trucks –	0.96621 g/km –	0.00560 g/s

[8] The EURO norms should not be applied to make calculations for moving vehicles, since they specify the emission parameters of a vehicle during its stop at a diagnostic station.

SO_2	passenger cars –	0.00409 g/km –	$1.9451*10^{-5}$ g/s
	commercial trucks –	0.01189 g/km –	$7.163*10^{-5}$ g/s
CO	passenger cars –	0.62109 g/km –	0.00428 g/s
	commercial trucks –	0.36806 g/km –	0.00316 g/s
aliphatic C_xH_y	passenger cars –	0.02767 g/km –	$1.924*10^{-4}$ g/s
	commercial trucks –	0.43373 g/km –	0.00499 g/s
aromatic C_xH_y	passenger cars –	0.00488 g/km –	$3.3958*10^{-5}$ g/s
	commercial trucks –	0.07654 g/km –	$8.823*10^{-4}$
PM 10	passenger cars –	0.00303 g/km –	$1.1484*10^{-5}$ g/s
	commercial trucks –	0.02275 g/km –	$2.037*10^{-4}$ g/s

The assumed state for 2015 included the following parking lots:
- in the area between the integration node (junction of ul. Nowa Łódzka and ul. Świętokrzyska) and ul. Generała Sosnowskiego, designed for approx. 200 passenger cars;
- in the area of the future ul. Nowa Świętokrzyska there will be a provisional parking lot for approx. 120 passenger cars (prior to the completion of ul. Nowa Świętokrzyska).

It has been assumed that:
- the parking lots will function between 6:00 am and 10:00 pm;
- an average vehicle will manoeuvre approx. 250 m in the parking lot;
- the number of vehicles manoeuvring along the route will be respectively 100 (for the parking lot for 200 vehicles) and 60 (for the parking lot for 120 vehicles).

NOWA ŁÓDZKA PARKING LOT – 2015

Pollutant	**Mean emission**	
	[kg/h]	**[Mg/year]**
NO_2	0.0021	0.0124
SO_2	0.0001	0.0006
CO	0.0155	0.0907
aliphatic C_xH_y	0.0007	0.0040
aromatic C_xH_y	0.0001	0.0007
PM 10	0.0001	0.0004

NOWA ŚWIĘTOKRZYSKA PARKING LOT – 2015

Pollutant	**Mean emission**	
	[kg/h]	**[Mg/year]**
NO_2	0.0013	0.0075
SO_2	0.0001	0.0004
CO	0.0093	0.0544
aliphatic C_xH_y	0.0004	0.0024
aromatic C_xH_y	0.0001	0.0004
PM 10	0.00005	0.0003

The currently existing and predicted values of the average daily traffic for the streets under analysis were given in accordance with the study "*Analyses and prognoses of traffic for the Chełm district with the Gdańsk-Południe and Siedlce districts in Gdańsk, Part II",* prepared in 2009 at the request of the Department of Development Programmes of the Gdańsk City Hall by the Foundation for Civil Engineering Development.

These values were calculated using an algorithm compliant with the "Methods of prediction of communication noise" prepared by the PIOŚ Inspectorate of Environmental Protection, Warsaw 1996, which assumes:
- for the day: Q day [p/h] = 0.87*Q [p/24h]
- for the night: Night [p/h] = 0.13*Q [p/24h]
where Q = value of average daily traffic.
The thusly calculated values served to determine the average emissions in the day and at night. The choropleth maps of traffic were used, in turn, to find the predicted values of traffic intensity in the afternoon peak hour, which served to determine the maximum emissions.
Assumptions:
- participation of truck transport in the total number of vehicles moving in the streets currently and in 2015 was assumed as 7.6% in the case of ul. Łódzka (and ul. Nowa Łódzka), and as 5.1% in case of ul. Warszawska (and ul. Nowa Warszawska);
- the traffic intensity was assumed as follows:
    - in the day: 13 h/day
    - during peak hours – morning, commercial and afternoon peak – 3 h/day
    at night – from 10:00 pm to 6:00 am – 8 h/day.

To designate the emissions, the previously specified emission indexes were used. The road emission was converted into appropriate units and multiplied by the average (in the day and at night) and the maximum number of vehicles moving in the streets of the transport route under analysis. In view of the curvilinear path of the streets and requirements of the calculation programme, substitute line emitters were prepared. After the conversions, the following emission values are obtained:

CURRENT STATE, 2009

ul. ŁÓDZKA – length: 1.43 km
Assumed:
- peak hour – 757 P/h
- in the day – 378 P/h
- at night – 57 P/h

2009						
Pollutant	**Day**		**Night**		**Peak**	
	[kg/h]	**[Mg/a]**	**[kg/h]**	**[Mg/a]**	**[kg/h]**	**[Mg/a]**
NO_x	0.1701	0.807	0.0254	0.074	0.3406	0.373
SO_2	0.0028	0.013	0.0004	0.001	0.0055	0.006
CO	0.4365	2.071	0.0653	0.191	0.0742	*.0957*[*]
aliphatic C_xH_y	0.0397	0.189	0.0059	0.017	0.0796	0.087
aromatic C_xH_y	0.0112	0.053	0.0017	0.005	0.0225	0.025
PM 10	0.0063	0.030	0.0009	0.003	0.0127	0.014

ul. WARSZAWSKA – length: 520 m
Assumed:
- peak hour – 972 P/h
- in the day – 485 P/h
- at night – 73 P/h

2009

[*] Possible misprint in the original document (the translator's remark).

Pollutant	Day		Night		Peak	
	[kg/h]	[Mg/a]	[kg/h]	[Mg/a]	[kg/h]	[Mg/a]
NO_x	0.0658	0.312	0.0099	0.029	0.1318	0.1443
SO_2	0.0012	0.006	0.0002	0.001	0.0025	0.0027
CO	0.2046	0.971	0.0308	0.090	0.4101	0.4491
aliphatic C_xH_y	0.0155	0.074	0.0023	0.007	0.0311	0.340
aromatic C_xH_y	0.0045	0.021	0.0007	0.002	0.0090	0.0099
PM 10	0.0024	0.012	0.0004	0.001	0.0049	0.0053

STATE IN 2015

VARIANTS W1/W3

ul. ŁÓDZKA – length: 1.43 km

Assumed:

- peak hour – 422 P/h
- in the day – 211 P/h
- at night – 32 P/h

2015						
Pollutant	**Day**		**Night**		**Peak**	
	[kg/h]	**[Mg/a]**	**[kg/h]**	**[Mg/a]**	**[kg/h]**	**[Mg/a]**
NO_x	0.0459	0.218	0.0070	0.020	0.0917	0.100
SO_2	0.0014	0.007	0.0002	0.001	0.0028	0.003
CO	0.1816	0.862	0.0275	0.080	0.3632	0.398
aliphatic C_xH_y	0.0177	0.084	0.0027	0.008	0.0353	0.039
aromatic C_xH_y	0.0031	0.015	0.0050	0.001	0.0062	0.007
PM 10	0.0014	0.006	0.0002	0.001	0.0027	0.003

ul. NOWA ŁÓDZKA – length: 1.14 km

Assumed:

- peak hour – 2075 P/h
- in the day – 1038 P/h
- at night – 135 P/h

2015						
Pollutant	**Day**		**Night**		**Peak**	
	[kg/h]	**[Mg/a]**	**[kg/h]**	**[Mg/a]**	**[kg/h]**	**[Mg/a]**
NO_x	0.1799	0.854	0.0234	0.068	0.3596	0.394
SO_2	0.0055	0.026	0.0007	0.002	0.0111	0.012
CO	0.7122	3.379	0.0926	0.270	1.4237	1.559
aliphatic C_xH_y	0.0639	0.329	0.0090	0.026	0.1385	0.152
aromatic C_xH_y	0.0122	0.058	0.0016	0.005	0.0244	0.027
PM 10	0.0054	0.025	0.0007	0.002	0.0107	0.12

ul. NOWA WARSZAWSKA – length: 0.6 km

Assumed:

- peak hour – 2262 P/h
- in the day – 1134 P/h
- at night – 169 P/h

2015			
Pollutant	**Day**	**Night**	**Peak**

	[kg/h]	[Mg/a]	[kg/h]	[Mg/a]	[kg/h]	[Mg/a]
NO_x	0.0884	0.420	0.0132	0.038	0.1764	0.193
SO_2	0.0031	0.014	0.0005	0.001	0.0061	0.007
CO	0.4138	1.964	0.0617	0.180	0.8254	0.904
aliphatic C_xH_y	0.0329	0.156	0.0049	0.014	0.0657	0.072
aromatic C_xH_y	0.0058	0.028	0.0009	0.003	0.0116	0.013
PM 10	0.0027	0.013	0.0004	0.001	0.0055	0.006

VARIANT II

ul. NOWA ŁÓDZKA – length: 1.14 km

Assumed:
- peak hour – 2630 P/h
- in the day – 1380 P/h
- at night – 196 P/h

2015						
Pollutant	**Day**		**Night**		**Peak**	
	[kg/h]	**[Mg/a]**	**[kg/h]**	**[Mg/a]**	**[kg/h]**	**[Mg/a]**
NO_x	0.2284	1.084	0.0340	0.100	0.4558	0.500
SO_2	0.0070	4.290	0.0010	0.392	0.0140	0.016
CO	0.9044	0.418	0.1344	0.038	1.8044	1.976
aliphatic C_xH_y	0.0880	0.074	0.0130	0.006	0.1754	0.192
aromatic C_xH_y	0.0156	0.034	0.0024	0.004	0.0310	0.034
PM 10	0.0068	0.032	0.0010	0.002	0.0136	0.014

ul. NOWA WARSZAWSKA – length: 0.6 km

Assumed:
- peak hour – 1917 P/h
- in the day – 877 P/h
- at night – 131 P/h

2015						
Pollutant	**Day**		**Night**		**Peak**	
	[kg/h]	**[Mg/a]**	**[kg/h]**	**[Mg/a]**	**[kg/h]**	**[Mg/a]**
NO_x	0.0684	0.325	0.102	0.030	0.1495	0.164
SO_2	0.0024	0.011	0.0004	0.001	0.0052	0.006
CO	0.3200	1.519	0.0478	0.140	0.6995	0.766
aliphatic C_xH_y	0.0255	0.121	0.0038	0.011	0.0556	0.061
aromatic C_xH_y	0.0045	0.021	0.0007	0.002	0.0098	0.011
PM 10	0.0021	0.010	0.0003	0.001	0.0046	0.005

Determination of the current state of air pollution – pollution background

The pollution background has been determined in accordance with the Regulation of the Minister of Environment of 5 December 2002 **on reference values for certain substances in the air** (Journal of Laws 2003, No. 1, item 12).

The substance background for NO_x, SO_2, PM10 particulate matter and for CO was determined on the basis of the data given by the ARMAAG Foundation (for January 2009, Gdańsk-Szadółki station).
For the remaining substances, the background is considered as 10% of the averaged yearly reference value. The background for the dust fall is considered as 10% of the reference value for the dust fall.

Table 2. Background and reference values for the compounds emitted by moving motor vehicles

Name of pollutant	CAS number	D_1 [µg/m^3]	D_2 [µg/m^3]	Background [µg/m^3]
NO_2 (70)	10102-44-0	200	40	21.6
SO_2 (72)	7446-09-05	350	30	7.6
CO (150)	630-08-0	30,000	–	504
Aliphatic carbohydrates (164)	–	3,000	1,000	100.0
Aromatic carbohydrates (166)	–	1,000	43	4.3
PM10 particulate matter (137)	–	280	40	31.6
Dust fall	–	200 g/m^2 x year		20

The analysis conducted of pollution diffusion does not include the pollution background. An important argument against including the background is the lack of background prediction in 2015. Therefore, the analysis is based on the comparison of impact of the current (2009) and future (2015) management. The calculations will enable a good comparison of the impact of the planned enterprise on the change of the previous impact on air quality.

Division into emission periods and subperiods
The determination of the value of emission in time, required by Pasquill's formula, means that taking the changes of pollution emissions into consideration must be connected with the division of the entire period (a year or winter and summer) into time intervals with constant emission levels. Time intervals determined in this manner are called emission periods. Inclusion of many sources in the calculations, each of which can have a different time distribution of emissions, makes it necessary to establish elementary emission subperiods. This means determination of intervals of the collective impact of many emitters in the same time.
A season is connected only with meteorological data and not with the emission.
A period is connected with the emission of a specific source and not with meteorological data. A single period may belong simultaneously to the first (winter) and second (summer) season.
A subperiod is an elementary time interval in which one or more emitters with a specific emission impact occurs. A subperiod belongs only to one season at a time.
A graphical display is shown below of the determined time of operation of the emission sources which may potentially impact air quality.

diagram
State as of 2009
streets at peak
streets in the day
streets at night

time (subperiod)

Subperiod number	Duration	Relative duration per year
1	1095	0.125
2	4745	0.542
3	2920	0.333

diagram
State as of 2015
streets at peak
streets in the day
streets at night
parking lots

time (subperiod)

Subperiod number	Duration	Relative duration per year
1	1095	0.125
2	4745	0.542
3	2920	0.333

Calculation grid
For the calculations of pollution spread, a grid with a size of 1.100 x 1.100, divided into cells of 50 m has been applied.

Analysis and determination of meteorological conditions assumed for the calculation
The degree of burden of the pollution emitted into the atmosphere depends to a significant degree on meteorological conditions. Horizontal and vertical bulk movement of air impacts the degree of concentration or dilution of the introduced pollution.
For the calculations, the following data from the meteorological station in Gdańsk have been applied:
- height of anemometer: h_a = 14 m,
- average air temperature: 281 K.

Terrain roughness index
The aerodynamic roughness of terrain has been determined on the basis of the Regulation of the Minister of Environment of 5 December 2002 on reference values for certain substances in the air (Journal of Laws 2003, No. 1, item 12). For calculation purposes, after the analysis, the terrain roughness index for the entire area was assumed as z_0 = 0.55.

Analysis of the impact of emission sources on the state of air pollution
Calculations of the state of air pollution
In the analysis of the impact of the emissions from road traffic and parking lots on air pollution, referential methods of modelling of levels of substances in the air included in the Regulation of the Minister of Environment of 5 December 2002 on reference values for certain substances in the air (Journal of Laws 2003, No. 1, item 12) were applied. The Regulation includes a required range of calculations of levels of substances in the air.

Shortened range
If the pre-calculations show that the following conditions are met:

a) for a single emitter or a group of emitters of which a substitute emitter has been created:
$\mathbf{S_{mm} \leq 0.1 \times D_1}$
b) for a group of emitters:
$\mathbf{\sum S_{mm} \leq 0.1 \times D_1}$
c) the dust fall criterion,
the calculations required for this range are complete.
If the dust fall (c) criterion is not met, dust fall calculations in the calculation grid should be performed, taking into consideration the statistics of meteorological conditions in order to check the condition:
$\mathbf{O_p \leq D_p - R_p}$

Full range
If the conditions for the shortened range are not met, one should calculate in the calculation grid the distribution of the maximum concentration of substances, averaged for 1 hour, in the entire area subject to calculations while accounting for the statistics of meteorological conditions, to check if the following condition was met:
$\mathbf{S_{mm} \leq D_1}$
If the calculations above show that, for a group of emitters, the following condition is met:
$\mathbf{S_{mm} \leq 0.1 \times D_1}$
the calculation is complete.

For a group of emitters for which the above condition is not met, or for a single emitter for which the condition specified in the shortened range ($S_{mm} \leq 0.1 \times D_1$) is not met, one should calculate in the calculation grid the distribution of concentrations of substances in the air, averaged for a year, and check if the following condition for average yearly concentrations is met at each point in the area:
$\mathbf{S_A \leq D_B - R}$
Further calculations are not required if the criterion of dust fall is met and there are no buildings taller than one floor in the vicinity of the emitters.
In the case when the dust fall criterion is not met, one should perform the dust fall calculations in the calculation grid, accounting for the statistics of meteorological conditions, to check if the following condition is met:
$\mathbf{O_p \leq D_p - R_p}$
If there are residential or office buildings, as well as buildings of nurseries, kindergartens, schools, hospitals or sanatoriums taller than one floor in a distance from a single emitter or from one emitter of a group, lesser than 10 h, it should be checked if these buildings are not exposed to exceeded reference values of substances in the air or exceeded acceptable values of substances in the air. To this effect, the maximum concentration of substances in the air for the respective heights should be calculated.

<u>The following cases are distinguished:</u>
- when the geometrical height of the lowest emitter in the group is not lesser than height of the last floor of the building Z, the calculation of concentrations is performed for the height Z;
- when geometrical height of the lowest emitter in the group is lesser than height of the last floor of the building Z, the calculation of concentrations is performed for heights changing every 1 m, beginning from the geometrical height of the lowest emitter, to the height:
    - Z, if $H_{max} \geq Z$,
    - H_{max}, if $H_{max} > Z$.

H_{max} means the greatest effective height of the emitter in a group of the heights calculated for all meteorological situations.

All concentration values calculated with regard to buildings located near the emitters cannot exceed the D_1 value.
The frequency of exceeding of the reference values or acceptable levels of substances in the air should be calculated if the concentration values computed in view of buildings located near the emitters exceed the D_1 value, or if the condition of $S_{mm} \leq D_{1\ is}$ not met at each point in the area.
The reference values of substances in the air or the acceptable levels of substances in the air are considered to be kept if the frequency of exceeding of the D_1 value by a concentration averaged for 1 hour is not higher than 0.274% of the time in a year in case of sulphur dioxide, and 0.2% of the time in a year in the case of the remaining substances.

Calculations of levels of substances in the air for emitter groups
According to point 5 of the referential methodology, in the case when the concentration caused by emission of substances from all emitters of the group exceeds the reference value or the acceptable level of substances in the air, the frequency of exceeding $P(D_1)$ is calculated.
Simultaneously, it is assumed that the acceptable frequency of exceeding of the D_1 value is preserved if the calculated 99.8% percentile of 1-hour concentrations $S_{99.8\%}$ is lesser than the reference value or the acceptable level of substances in the air.
The above means that for the substances the concentration of which does not meet the criterion of $S_{1\ max} \leq 0.1 \times D_1$, it is sufficient to verify the following criteria:
$\mathbf{S_{1\ max} \leq D_1}$
$\mathbf{S_{99.8\%} > D_1}$
and
$\mathbf{S_a \leq D_a - R}$

Calculation of distribution of pollution concentration in the air
The calculations have been performed using the ZANAT 6 software prepared according to the referential methods for modelling of levels of substances in the air included in the Regulation of the Minister of Environment of 5 December 2002 **on reference values for certain substances in the air** (Journal of Laws 2003, No. 1, item 12). Calculation of dust fall was abandoned since it was stated that the entire emitted dust consists of PM10 particulate matter. The calculation did not include the secondary emission of dust (from transport). In view of the extensiveness of the data, the tables of calculations are only presented in digital form, on a CD.

The calculations were performed for the following situations:
1) distribution of concentrations of pollution for the current state (2009);
2) distribution of concentrations of pollution for VARIANTS I/III (2015);
3) distribution of concentrations of pollution for VARIANTS II (2015);

The height of the line and surface emitters was assumed for calculation purposes as H=5 m, not as the actual height of car exhaust pipe outlets (from 0.5 m for passenger cars to about 3 m for commercial trucks). The above results from the assumptions for calculation formulas – in this case, of the power-law equation of low to medium wind speed, as well as from the assumption that the pollution concentration at the emission point is infinitely high, as a result of which the concentrations from low emitters are significantly understated in the results, substantially deforming the final result of the concentration and, consequently, the assessment of the impact on air quality.

Calculations of distribution of pollution concentrations – 2009

Results of calculations of the distribution of pollution concentrations made in a calculation grid are synthetically presented in the table below. For each substance, the highest values of the average yearly concentrations calculated in the grid are presented with a background S_{amax}, as well as the highest values of the calculated maximum 1-hour concentrations (without a background) S_{1max}, the 99.8% percentile of 1-hour concentrations (without a background) $S_{99.8\%}$ and the frequency of exceeding of the (1-hour) reference value by a 1-hour concentration (without a background). The calculated values were compared with the criterial values according to the Regulation of the Minister of Environment of 5 December 2002 **on reference values for certain substances in the air** (Journal of Laws 2003, No. 1, item 12), *i.e.*:

$\mathbf{S_{1\,max} \leq 0.1 \times D_1}$

$\mathbf{S_{1\,max} \leq D_1}$

$\mathbf{S_a \leq D_2 - R\ (S_2 + R \leq D_2)}$

and

$\mathbf{P(D_1) \leq 0.2\%}$, whereas the frequency is considered as met if the criterion of $\mathbf{S_{99.8\%\ max} \leq D_1}$ is met.

Table 3. Distribution of pollution concentrations – 2009.

Pollutant	Background	S_{amax} (without the background)	D_2	S_{1max}	0.1 D_1	D_1	$S_{99.8\%\ max}$ $S_{99.726\%\ max\ (SO2)}$	$P(D_1)$
	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]
NO_2 (70)	21.6	1.482	40	63.39	20	200	28.73	0
SO_2 (72)	7.6	0.24	30	1.02	35	350	0.43	0
CO (150)	504	–	–	142.0	3 000	30 000	65.0	0
aliphatic C_xH_y (164)	100.0	0.3	1 000	14.8	300	3 000	6.7	0
aromatic C_xH_y (165)	4.3	0.098	43	4.2	100	1 000	1.9	0
PM 10 particulate matter (137)	31.6	0.55	40	2.36	28	280	1.06	0

Table 4. Distribution of pollution concentrations – 2009 (in free nodes).

Pollutant	S_{amax} (without the background)	D_2	S_{1max}	0.1 D_1	D_1	$S_{99.8\%\ max}$ $S_{99.726\%\ max\ (SO2)}$	$P(D_1)$
	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]
NO_2 (70)	0.649	40	30.88	20	200	15.0	0
SO_2 (72)	0.11	30	0.50	35	350	0.23	0
CO (150)	–	–	40.0	3 000	30 000	33.0	0
aliphatic C_xH_y (164)	0.2	1 000	7.2	300	3 000	3.5	0
aromatic C_xH_y (165)	0.043	43	2.0	100	1 000	1.0	0
PM 10 particulate matter (137)	0.024	40	1.15	28	280	0.55	0

Summary of calculations for current conditions

As a result of the calculations conducted for the distribution of pollution concentrations, the following has been stated:

- in 2009, the reference year, the impact of the planned investment does not cause any significant hazards for air quality, although its share in the level of existing concentrations of NO_x is visible;

- emission of dust, sulphur dioxide, or aliphatic and aromatic carbohydrates does not cause excess of 10% of the reference value for 1-hour concentrations – which also offers proof of the low level of emissions of the aforementioned substances;
- for all substances, the criteria of average yearly concentrations and the $S_{1\ max} \leq D_1$ criteria are met;
- the air quality standards are met;
- emission at free points (residential buildings) meets the requirements set forth in the Regulation of the Minister of Environment of 5 December 2002 **on reference values for certain substances in the air** (Journal of Laws 2003, No. 1, item 12).

Calculations of distribution of pollution concentrations – 2015

The manner of presentation of the results of air pollution dispersion is the same as for 2009.

Table 5. Distribution of pollution concentrations – 2015 (VARIANTS I/III)

Pollutant	Background	S_{amax} (without the background)	D_2	S_{1max}	0.1 D_1	D_1	$S_{99.8\%\ max}$ $S_{99.726\%\ max\ (SO2)}$	$P(D_1)$
	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]
NO_2 (70)	21.6	2.121	40	84.44	20	200	36.76	0
SO_2 (72)	7.6	0.069	30	2.61	35	350	1.14	0
CO (150)	504	–	–	339.0	3 000	30 000	158.0	0
aliphatic C_xH_y (164)	100.0	0.8	1 000	32.5	300	3 000	13.4	0
aromatic C_xH_y (165)	4.3	0.151	43	5.7	100	1 000	2.5	0
PM 10 particulate matter (137)	31.6	0.064	40	2.51	28	280	1.1	0

Table 6. Distribution of pollution concentrations – 2015 (in free nodes, VARIANTS I/III).

Pollutant	S_{amax} (without the background)	D_2	S_{1max}	0.1 D_1	D_1	$S_{99.8\%\ max}$ $S_{99.726\%\ max\ (SO2)}$	$P(D_1)$
	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]
NO_2 (70)	0.620	40	32.47	20	200	15.76	0
SO_2 (72)	0.019	30	1.01	35	350	0.45	0
CO (150)	–	–	132.0	3 000	30 000	63.0	0
aliphatic C_xH_y (164)	0.2	1 000	12.5	300	3 000	5.7	0
aromatic C_xH_y (165)	0.049	43	2.2	100	1 000	1.2	0
PM 10 particulate matter (137)	0.019	40	0.96	28	280	0.47	0

Table 7. Distribution of pollution concentrations – 2015 (VARIANT II)

Pollutant	Background	S_{amax} (without the background)	D_2	S_{1max}	0.1 D_1	D_1	$S_{99.8\%\ max}$ $S_{99.726\%\ max\ (SO2)}$	$P(D_1)$
	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]
NO_2 (70)	21.6	2.323	40	100.41	20	200	43.16	0
SO_2 (72)	7.6	0.071	30	3.08	35	350	1.24	0
CO (150)	504	–	–	397.0	3 000	30 000	171.0	0
aliphatic C_xH_y (164)	100.0	0.9	1 000	38.6	300	3 000	16.6	0
aromatic C_xH_y (165)	4.3	0.159	43	6.8	100	1 000	2.9	0
PM 10 particulate	31.6	0.069	40	2.99	28	280	1.29	0

matter (137)								

Table 8. Distribution of pollution concentrations – 2015 (in free nodes, VARIANT II).

Pollutant	S_{amax} (without the background)	D_2	S_{1max}	0.1 D_1	D_1	$S_{99.8\% max}$ $S_{99.726\% max (SO2)}$	$P(D_1)$
	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]	[µg/m^3]
NO_2 (70)	0.567	40	31.08	20	200	14.74	0
SO_2 (72)	0.012	30	0.96	35	350	0.42	0
CO (150)	–	–	125.0	3 000	30 000	59.0	0
aliphatic C_xH_y (164)	0.2	1 000	12.0	300	3 000	5.7	0
aromatic C_xH_y (165)	0.039	43	2.1	100	1 000	1.0	0
PM 10 particulate matter (137)	0.017	40	0.93	28	280	0.44	0

Summary of calculations for 2015 (VARIANTS I/III and VARIANT II)

As a result of the conducted calculations of the distribution of pollution concentrations, the following has been stated:

- the impact of pollution emissions from road traffic in the case of VARIANTS I/III and VARIANT II is very similar and virtually insignificant;
- despite a significant increase in road traffic (in the case of all VARIANTS), the impact of the analyzed sections of streets and parking lots will not cause any significant risk to air quality, although the presence of NO_x nitrogen oxides in the level of concentrations is visible;
- emissions of dust, sulphur dioxide, or aliphatic and aromatic carbohydrates do not cause excess of 10% of the reference value for 1-hour concentrations – which also proves the low level of emission of the aforementioned substances;
- for all substances, the criteria of average yearly concentrations and the $S_{1\ max} \leq D_1$ criteria are met;
- emission at free points (residential buildings) meets the requirements set forth in the Regulation of the Minister of Environment of 5 December 2002 **on reference values for certain substances in the air** (Journal of Laws 2003, No. 1, entry 12).

Summary and final conclusions

As a result of simulation calculations for 2009 and 2015, it has been established that:

- NO_x nitrogen oxides have the greatest impact on air quality and will continue to in the future;
- aggravation of the impact will be caused by the predicted significant increase in the number of cars, despite the predicted constant decrease in unit values of emissions from automobiles resulting from increasingly strict norms for emissions of exhaust gas from engines;
- emissions of other pollutants – SO_2, PM 10 particulate matter, CO, aliphatic and aromatic hydrocarbons – despite their relative increase will not cause any risks of air pollution in the area.

7.2.2. Emission of noise in the environment

All the calculation results presented in this chapter take into consideration the cumulated impact of the tram line under construction discussed within the present report, and the planned ul. Nowa Łódzka.

The following are presented in the form of maps and tables:

- the basis for preparation of a digital calculation model covering the housing structure of “Wilanowska III” and “Wilanowska IV” neighbourhoods;
- the path of ul. Wilanowska – a roundabout near the junction with ul. Nieborowska and the junction of ul. Wilanowska and ul. Łódzka;
- the current intensity and structure of traffic for ul. Wilanowska;
- “Noise sensitivity map” including the area of two multi-family housing neighbourhoods, “Wilanowska III” and “Wilanowska IV”.

The evaluation of the current condition and the respective variants of the planned investment, based on a comparison of the acreage of protected areas with an excess of acceptable levels, has been expanded by additional calculations at five selected checkpoints located on both sides of ul. Łódzka and ul. Nowa Łódzka, on the building facades at the first line of buildings.
It has been assumed in the prognostic calculations that the surface of the planned road will be a standard smooth bituminous surface. So-called silent surfaces are efficient and economically justifiable as a means of reduction of noise and vibration only at car traffic speed higher than 70 km/h. Other dampening elements applied in the enterprise under discussion (taking into consideration the accumulation of impacts with the tram line) will be:
- road curve parameters selected in such a manner that they should not cause any impediment to the smooth flow of vehicles in traffic;
- a road with a modern structure, without any networks in the carriageway (traverse passages only), and, as a result, without any manholes or covers causing surface unevenness, mainly roadside drains installed in pavements;
- traffic lights at all crossings with coordinated road and tram signalling (so-called “green wave”), with a preferential continuous right-of-way for trams (a signal upon a tram’s departure from a stop will be directed to the traffic lights, inducing a “green wave” for the tram);
- permanent isolating vegetation (hedges) is foreseen on the eastern side of ul. Nowa Łódzka and the tram line.
- jointless rail tracks for trams, provided with greasing devices at the curves and special gaskets muting noise and vibrations;
- the “Nowa Łódzka” loop is depressed about 2.0 m in the terrain – the excavation’s slopes constitute an acoustic screen from the neighbourhood at ul. Sosnowskiego.
It should be noted that the ul. Nowa Łódzka road investment taken into consideration in connection with the Gdańsk-Południe tram line (“Chełm” loop – ul. Witosa – ul. Nowa Łódzka – “Nowa Łódzka loop) is intended to solve specific problems resulting from the forecasted transport needs in the coming years, therefore noise reduction by reduction of speed or by a change of traffic patterns (which would mean a decrease in the route’s capacity) has not been taken into consideration. Interference with the route’s capacity would be contrary to the assumptions of the project.

7.2.2.1. Aim and scope
The aim of the present chapter is to determine and evaluate the acoustic climate in the area of the planned transport investment, covering:
- construction of a two-track tram line, along with infrastructure, from the “Chełm” loop, through ul. Witosa and ul. Nowa Łódzka, to the “Nowa Łódzka” loop;
- necessary conversion of existing streets along the planned tram line, along with infrastructure, including a connection with the node at ul. Łostowicka/Al. Armii Krajowej;
- construction of ul. Nowa Łódzka along with infrastructure;
- construction of the “Nowa Łódzka” loop with a junction with the planned ul. Nowa Świętokrzyska, taking into account a possible future parking lot near the loop;

- construction of a bus and tram integration node at the "Nowa Łódzka" loop;
- construction of a junction of ul. Nowa Łódzka and ul. Nowa Świętokrzyska, along with a junction with the new tram line;
- conversion of junctions along the route of the planned tram line.

Because three different variants of the route of the tram line, as well as three respective variants for the streets under construction/to be reconstructed, were prepared at the planning stage, the acoustic climate for the state following the investment's completion has been determined separately for the three planned variants. In the acoustic climate assessment for the state following the investment's completion, differences in the location of transport routes and different predictions for car traffic of the three planned variants have been taken into consideration.
The calculations of noise level distribution for the acoustic climate assessment have been performed for the entire impact area of the planned investment. To this end, an area of 2,200 × 2,800 m (6,160,000 m^2) has been designated, encompassing the aforementioned impact area and the near vicinity (see noise maps in Annex 4). The noise level calculations have been performed using Cadna A software by DataKustik GmbH, in raster form separately for day and night in respect of the current condition of the entire area under consideration, of the three variants regarded in the plans. The calculation results have been presented in the form of noise maps (see Annex 4). Moreover, on the basis of the analysis of the results obtained, protected areas have been designated in which exceeds the acceptable levels of road noise (*i.e.* car and tram noise collectively) occur both in the current conditions and in the three variants of the planned investment. A comparison of the size of the areas in which exceeds acceptable levels are predicted for the three variants enables a quantitative distinction of differences between the individual variants. Such differences are small, and therefore almost invisible in the graphic presentation on the attached maps.
To further emphasize the quantitative differences between the individual variants regarding the impact of noise on the environment, additional calculations have been performed at five selected checkpoints located on both sides of ul. Łódzka and ul. Nowa Łódzka, on the building facades at the first line of buildings. These checkpoints are designed on the attached noise maps as K1, K2, K3, K4 and K5.
During the performance of the calculations on which the assessment of noise impact on the environment was based, an identical calculation model and calculation configuration were used. The only variables were the parameters of the calculation model, which pertained directly to the individual investment variants (different geometry of the planned routes, different predicted structure and traffic volume on the street sections under discussion). Since the other parameters influencing noise levels were not changed, the differences in the size of the area with excess (regardless of distance from the investment) and in the noise level at checkpoints result from differences in noise emission, which in turn result from the respective variants, so they can be used in their evaluation.
To assess the components of the total level of road noise (*i.e.* the share of road noise and tram noise), calculations have only been made for **VARIANT III**, which, according to the assessment included in the present report, is the most favourable one. The calculation results are graphically presented in the form of separate maps of car noise and tram noise, and the five checkpoints are additionally presented in tabular form.

7.2.2.2. Methodology of calculations
The calculations of the car noise level distribution have been performed using the French *NMBP Routes 96* method. Tram noise has been calculated on the basis of the German *Schall 03* method. In order to calculate the noise emitted from the planned parking lot at the junction

of ul .Nowa Łódzka and ul. Świętokrzyska, the method given by the Bavarian Ministry of Environment has been applied: *Parkplatzlärmstudie – Untersuchungen von Schallemissionen aus Parkplätzen, Autohöfen und Omnibusbahnhöfen sowie von Parkhäusern und Tiefgaragen,* Bayerisches LfU, 4 Aufl., Augsburg 2003. The aforementioned methods are applied by the Cadna A software by DataKustik GmbH, used for calculations in the present study.
Beside the maps of noise level distribution calculated using the aforementioned methods, maps have also been prepared showing the volume of excess in the areas where the acceptable levels of noise set forth in the Annex to the Regulation by the Minister of Environment of 14 June 2007 (see 7.2.2.5), depending on the area's usage, are in force. The maps of exceeding of the acceptable levels were created by subtraction of the binding acceptable levels in the areas protected against the noise from the calculated levels. Calculations were performed for the current conditions, as well as for the three proposed project variants. In these calculations, the information from the sensitivity map, *i.e.* the map showing the areas of the city with varied usage (*e.g.* areas with detached housing, areas with multi-family housing etc.) and prepared during the creation of the Acoustic Map of Gdańsk in 2007, have been used. The sensitivity map has been supplemented with areas of newly-constructed neighbourhoods with multi-family housing: "Wilanowska III" and "Wilanowska IV".
The maps of excess makes it possible to conduct a statistical analysis of the size of the areas in which excess occur for the current conditions and for the forecast variants.

7.2.2.3. Input data for the calculation of car noise levels
To calculate the car noise for current conditions and the three planned variants, data from the study "*Analyses and prognoses of traffic for the Chełm district with the Gdańsk-Południe and Siedlce districts in Gdańsk, Part II",* prepared in 2009 at the request of the Department of Development Programmes of the Gdańsk City Hall by the Foundation for Civil Engineering Development, has been applied.
In particular, data on traffic volume for current conditions from Table Z1.1 of the aforementioned study has been used. For the three planned variants, data from 24-hour choropleth maps of traffic volume predicted for 2015 have been applied.
Moreover, for the remaining street sections located in the area covered by the study (less important from the viewpoint of noise emission), the data on car traffic volumes have been taken from the Acoustic Map of Gdańsk prepared in 2007. In relation to the Acoustic Map, the route of ul. Wilanowska has been updated. In particular, a roundabout near the junction with ul. Nieborowska and the junction of ul. Wilanowska and ul. Łódzka have been included. The current volume and structure of traffic in ul. Wilanowska, necessary for the noise calculations, have been determined within the framework of the present report.
To calculate the noise emitted by the planned parking lot at the junction of ul. Nowa Łódzka and ul. Świętokrzyska, it has been assumed that this will be a parking lot of the P+R type (Park and Ride), with the following number of parking places:
- for the parking lot area located inside the tram loop – 200;
- for the parking lot area located outside the tram loop – 100.

7.2.2.4. Input data for the calculation of tram noise levels
In the area under discussion covering the planned investment, there is currently only a small section of the existing tram line in Al. Sikorskiego (Line 1), with a loop at ul. Witosa. The remaining fragment of the route is located beyond the assumed area for calculations.
Data on the current traffic volume (December 2008) were obtained from the tram timetable:

No.	Tram line section	Traffic volume (one way)		Speed
		Time of day	24	

		6:00 am – 6:00 pm	6:00-10:00 pm	10:00 pm – 6:00 am	hours	[km/h]
1	Al. Sikorskiego	138	35	16	189	50
2	Loop at Al. Sikorskiego	138	35	16	189	15

To calculate the noise level for conditions upon completion of the planned investment, data from the study "*Analyses and prognoses of traffic for the Chełm district with the Gdańsk-Południe and Siedlce districts in Gdańsk, Part II",* prepared in 2009 at the request of the Department of Development Programmes of the Gdańsk City Hall by the Foundation for Civil Engineering Development, have been applied. In particular, choropleth maps of average yearly 24-hour repletions have been used for the current conditions and for 2015 forecasts. The number of tram rides in the respective reference time periods (day: 6:00 am-10:00 pm, and night: 10:00 pm-6:00 am) for 2015, as required by the calculation method mentioned in 7.2.2.2, has been computed assuming proportionality between the increase in repletions and the increase in the number of rides. The number of rides predicted for 2015 is identical for all three planned variants.

7.2.2.5. Values of acceptable levels

In light of the regulations in force in Poland, the equivalent level of sound A in time T, L_{AcqT}, is the most important index for assessing noise in the external environment. Normative values of noise in the environment are set forth in Table 1 of the Annex to the Regulation by the Minister of Environment of 14 June 2007 **on acceptable levels of noise in the environment** (Journal of Laws No. 120, entry 826). Acceptable levels of noise in the environment vary depending on the purpose of the area and the type of noise source (road, railroad, aviation and industrial noises). The acceptable levels of noise in the environment currently in force are shown in Table 9.

Table 9. Acceptable levels of noise in the environment caused by respective groups of noise, excluding noise caused by takeoffs, landings and flights of aircraft and by electric power lines, expressed by the $L_{Acq\ D}$ and $L_{Acq\ N}$ indexes applied to determine and control the conditions of usage of the environment - with a reference period of 24 hours.

No.	Purpose of the area	Acceptable level of noise in [dB]			
		Roads and railroads[1)]		Other objects and activities causing noise	
		$L_{Acq\ D}$ reference time interval of 16 h	$L_{Acq\ N}$ reference time interval of 8 h	$L_{Acq\ D}$ reference time interval equal to 8 consecutive least favourable hours of day	$L_{Acq\ N}$ reference time interval equal to 1 least favourable hour of night
1	a. Sanatorium protection zone A b. Hospital areas outside the city	50	45	45	40
2	a. Detached residential housing areas b. Areas of housing with permanent or frequent presence of children and youngsters[2)] c. Areas of nursing homes d. Hospital areas in cities	55	50	50	40
3	a. Multi-family and collective residential housing areas b. Homestead housing areas	60	50	55	45

	c. Recreational and leisure areas d. Residential and service areas				
4	a. City centre areas in cities of over 100,000 inhabitants[3)]	65	55	55	45

1) Values determined for roads and railway lines are also applied for tram lines outside road lanes and for cable car lines.
2) In the event these areas are not used at night in accordance with their function, the acceptable noise level at night does not apply to them.
3) A city centre area in cities of over 100,000 inhabitants is an area of compact residential housing with a concentration of administrative, commercial and service establishments. In case of cities with districts of over 100,000 inhabitants, a city centre area may be designated in such districts if it is characterized by compact residential housing with a concentration of administrational, commercial and service establishments.
*Source: Regulation of the Minister of Environment of 14 June 2007 (*Journal of Laws *No. 120, item 826)*

7.2.2.6. Calculation results

A. Results of raster calculations
Results of calculations of the noise level distribution for the area under discussion are presented in the form of maps of road noise, understood as the sum of car and tram noise. The aforementioned maps are attached to the present study in Annex 4 as Figures 1a to 16a. Figs. 1a and 2a show the current conditions of the acoustic climate for day and night. In order to verify the calculations for the existing state, a noise survey has also been conducted in this region. The survey report is shown in Annex 5 of the report. Figs. 5a and 6a, 7a and 8a, as well as 9a and 10a, show respectively the maps displaying the predicted daytime and night-time acoustic climate in the area under discussion for the three project variants: for VARIANT I in Figs. 5a and 6a, for VARIANT II in Figs. 7a and 8a, and for VARIANT III in Figs. 9a and 10a.
Moreover, Figs. 3a and 4a show the day and night maps of excess of acceptable levels in protected areas with regard to current conditions, and Fig. 11a and 12a show the maps of excess for VARIANT III. Additionally, supplementary maps of levels of noise emitted only by cars and only by trams at day and at night have been calculated for VARIANT III. They are attached in Annex 4, in Figs. 13a and 14a as car noise maps for day and night, and in Figs. 15a and 16a as tram noise maps for day and night.

B. Results of analysis of the size of protected areas noting exceeding of the acceptable levels
Tables 10, 11A, 11B and 11C show the sizes of the areas in which, according to the calculations, exceeding of acceptable levels in the areas protected against noise occur or are predicted for both current conditions and for the three predicted variants. The protected areas are areas with detached and multi-family residential housing and others subject to special protection, *e.g.* school or hospital areas. Their location is also shown on the attached maps. The total area included in the calculations and shown on the maps, covering both the areas protected against noise and areas where no acceptable levels are defined, amounts to 6,160,000 m^2 (a rectangle of 2,200 × 2,800 m^2). In the aforementioned zone, 2,624,200 m^2 is covered by protected areas (according to the Sensitivity Map prepared in connection with the Acoustic Map of Gdańsk, supplemented by the areas of the "Wilanowska III" and "Wilanowska IV" neighbourhoods).

Table 10. Current conditions. Sizes of the areas protected against noise in the area under discussion for day and night, with exceeding of acceptable levels by magnitude

No.	Magnitude of exceeding of the acceptable level of noise [dB]		Area of the protected areas in m^2 in the respective ranges of exceeding of the acceptable level		Area of the protected areas in % in the respective ranges of exceeding of the acceptable level	
	from	to	Day	night	day	night
1	0	5	548,000	385,800	20.88	14.70
2	5	10	270,300	216,000	10.30	8.23
3	10	15	104,000	9,700	3.98	0.37
4	15	20	10,300	0.00	0.39	0.00
5	20	25	0.00	0.00	0.00	0.00

Table 11A. VARIANT I. Sizes of the areas protected against noise in the area under discussion for day and night, with exceeding of acceptable levels by magnitude

No.	Magnitude of exceeding of the acceptable level of noise [dB]		Area of the protected areas in m^2 in the respective ranges of exceeding of the acceptable level		Area of the protected areas in % in the respective ranges of exceeding of the acceptable level	
	from	to	day	night	day	night
1	0	5	556,800	484,000	21.22	18.44
2	5	10	354,800	261,000	13.52	9.95
3	10	15	117,700	20,500	4.49	0.78
4	15	20	15,700	0.00	0.60	0.00
5	20	25	0.00	0.00	0.00	0.00

Table 11B. VARIANT II. of the areas protected against noise in the area under discussion for day and night, with exceeding of acceptable levels by magnitude

No.	Magnitude of exceeding of the acceptable level of noise [dB]		Area of the protected areas in m^2 in the respective ranges of exceeding of the acceptable level		Area of the protected areas in % in the respective ranges of exceeding of the acceptable level	
	from	to	day	night	day	night
1	0	5	560,800	489,800	21.37	18.65
2	5	10	352,900	268,000	13.45	10.22
3	10	15	119,600	33,400	4.56	1.27
4	15	20	17,400	3,800	0.66	0.14
5	20	25	900	0.00	0.03	0.00

Table 11C. VARIANT III. of the areas protected against noise in the area under discussion for day and night, with exceeding of acceptable levels by magnitude

No.	Magnitude of exceeding of the acceptable level of noise [dB]		Area of the protected areas in m^2 in the respective ranges of exceeding of the acceptable level		Area of the protected areas in % in the respective ranges of exceeding of the acceptable level	
	from	to	day	night	day	night
1	0	5	570,000	499,800	21.72	19.05
2	5	10	370,500	269,600	14.12	10.27
3	10	15	115,400	20,500	4.40	0.78
4	15	20	14,600	0.00	0.56	0.00
5	20	25	0.00	0.00	0.00	0.00

C. Results of analysis of noise levels calculated at five checkpoints

Table 12 shows the road noise level volumes and magnitude of exceeding of acceptable levels as calculated for five checkpoints. The location of checkpoints is indicated in the attached noise maps. The checkpoints are indicated on the noise maps as K1, K2, K3, K4, and K5. The K1 checkpoint is located on the façade of a building in a detached housing area, the remaining ones – on facades of buildings located in multi-family housing areas. Two numerical values on the noise maps near each checkpoint indicate calculated noise levels – the top number is the noise level in the day, while the bottom one indicates the noise level at night.

Table 12. Levels of road noise and magnitude of exceeding of the acceptable level as calculated at the five checkpoints

Checkpoint	Current state				VARIANT I				VARIANT II				VARIANT III			
	Calculated noise level (dB)		Magnitude of exceeding (dB)		Calculated noise level (dB)		Magnitude of exceeding (dB)		Calculated noise level (dB)		Magnitude of exceeding (dB)		Calculated noise level (dB)		Magnitude of exceeding (dB)	
	day	night	day	night	day	night	day	night	day	night	day	night	day	night	day	night
K1	51.2	42.9	–	–	64.9	54.1	9.4	4.1	64.6	54.3	9.6	4.3	65.5	54.5	10.5	4.5
K2	56.0	47.7	–	–	64.3	54.4	4.3	4.4	64.1	54.7	4.1	4.7	63.6	54.0	3.6	4.0
K3	57.2	48.5	–	–	66.7	56.2	6.7	6.2	63.5	54.1	3.5	4.1	64.3	54.5	4.3	4.5
K4	65.4	55.0	5.4	5.0	65.3	54.7	5.3	4.7	66.7	56.6	6.7	6.6	66.3	55.6	6.3	5.6
K5	56.8	47.2	–	–	66.0	55.3	6.6	5.3	60.9	51.8	0.9	1.8	63.9	53.9	3.9	3.6

Table 13 shows the calculated levels of road noise (car and tram noise collectively) as well as the components of road noise (*i.e.* car and tram noise levels separately) for Variant III, which is the most favourable variant according to the assessment included in the report.

Table 13. Levels of road noise for VARIANT III

Components of the level of road noise for VARIANT III						
Checkpoint	Noise level at day			Noise level at night		
	Total level (dB)	Car noise (dB)	Tram noise (dB)	Total level (dB)	Car noise (dB)	Tram noise (dB)
K1	65.5	65.3	52.7	54.5	53.9	45.3
K2	63.6	63.1	54.3	54.0	53.0	47.0
K3	64.3	63.8	55.0	54.5	53.5	47.7
K4	66.3	66.2	52.2	55.6	55.2	44.8
K5	63.9	63.2	55.6	53.6	52.2	48.3

7.2.2.7. Conclusions

Assessing the existing noise level in the area of the planned investment and the noise level after its completion, it should be kept in mind that the lowest difference in noise level noticeable by the human ear in laboratory conditions is 3 dB. In practice, most people notice differences in road noise levels only when they exceed 5 dB. An increase in the noise level of 10 dB is perceptible as a doubling of volume. In general, when assessing the individual variants of the planned investment and possible means of noise reduction, the aforementioned aspects of human hearing should be taken into consideration; their significance lies in the fact that differences in noise levels lower than 3 dB (and in most cases lower than 5 dB) resulting from various implementation variants or by possible means of noise reduction will be unnoticeable for inhabitants.

On the basis of the calculations performed, the following assessment of current conditions and of changes caused by the planned road investment can be formulated:

Current conditions

1. The existing level of noise in the area under discussion is mainly caused by car traffic on the roads located in the area but outside the planned investment (Al. Armii Krajowej, ul. Świętokrzyska, ul. Małomiejska, and further, ul. Warszawska, ul. Witosa and ul. Wilanowska). The noise level causes a significant exceeding of acceptable levels in protected areas. Especially in the relatively large area with detached houses located between Al. Armii Krajowej and ul. Warszawska, in the area of detached housing at ul. Świętokrzyska (from the junction with ul. Łódzka), as well as in the school area between Al. Armii Krajowej and ul. Witosa, the acceptable limits in the day are exceeded by 10 dB. In a relatively large area of multi-family housing, the exceeding also reaches 10 dB. In the area of multi-family housing on the western side of ul. Łódzka, the acceptable level for day and night is exceeded by about 5-6 dB. In the area of multi-family housing on the eastern side of ul. Łódzka, the acceptable levels on facades of buildings are not exceeded. Car traffic on ul. Łódzka has only a local impact on the noise level, in the surroundings of the aforementioned street along the section from the junction with ul. Warszawska to the junction with ul. Świętokrzyska.
2. Tram noise in the area under discussion is currently negligible and pertains to a relatively small area near the tram loop at Al. Władysława Sikorskiego. In the vicinity of this avenue, the tram noise is significantly less (due to the modern structure of tracks and vehicles – the Bombardiers) than the car noise.

Forecasts

3. Transport prognoses for 2015 assume a significant increase in car and tram traffic volumes in comparison to current conditions for all variants of development of the road and tram network. In particular, a large increase in car traffic is predicted for Al. Armii Krajowej and ul. Łostowicka. High traffic volume is also predicted in the planned ul. Nowa Łódzka and ul. Nowa Warszawska.
4. The listing of acreage of protected areas where exceeding of the acceptable levels of noise occur or are predicted suggests that the planned investment, regardless of the variant implemented, would cause an increase in acreage of protected areas where exceeding of acceptable levels of noise of 5% at day and by 7% at night in comparison with current conditions.
5. There are no significant differences in noise emission between the individual variants. A minimal increase of areas with the highest exceeding of noise level (10-20 dB) may be expected in protected areas in the case of implementation of VARIANT III. The aforementioned area would be increased in comparison to the current state by only about 0.58% in the day and about 0.41% at night.
6. The results of calculations at selected checkpoints also show a lack of significant differences in noise emission between the three investment variants. The differences in the noise level calculated at the checkpoints for each variant are smaller than 2 dB, which makes them imperceptible to inhabitants.
7. From the viewpoint of noise protection, there are no contraindications for implementation of VARIANT III of the investment, which is corroborated by other, non-acoustic arguments.
8. In the case of implementation of VARIANT III, the predicted increase in traffic volume would cause an increase in road noise, but also its shift from the areas where a decrease in traffic volume upon the investment's completion is predicted (*e.g.* near the old ul. Warszawska) to the vicinity of the planned streets, mostly ul. Nowa Łódzka and ul. Nowa Warszawska. As a result, in the area of multi-family housing on the eastern side of ul. Łódzka, the noise level will increase by about 7-8 dB in the day and about 6-7 dB at night. The acceptable levels for day and night in this area will be exceeded by about 4-5 dB. In

the area of multi-family housing on the eastern side of ul. Łódzka, as a result of the shift of traffic from the "old" ul. Łódzka to ul. Nowa Łódzka, the increase of the noise level will be insignificant (about 1 dB, *i.e.* imperceptible for an observer).

9. The accepted levels of noise will also be exceeded in the area of detached houses between (the old) ul. Warszawska street and ul. Łódzka, near the planned location of ul. Nowa Łódzka street. The size of the exceeding on the facade of the nearest building to the planned ul. Nowa Łódzka will be about 10 dB in the day and about 4 dB at night.
10. As a comparison of noise maps for the VARIANT III shows, the level of tram noise is significantly lower than car noise along the entire path of the planned route, both in the day and at night. Results of component calculations of road noise at checkpoints, given in Table 13, also show that the tram noise is lower than car noise by about 6-12 dB in the day and about 4-9 dB at night. In view of the decisive participation of car noise in the total road noise level, the maximum theoretical level of road noise reduction obtained only by reduction of tram noise (even in the case of its total elimination) has a maximum value of about 1.5 dB. A potential reduction of tram noise would practically have no effect on the total road noise.
11. The predicted relatively low level of tram noise will be achieved if the technical condition of the new route and circulating trams are similar to the route and trams serving Al. Władysława Sikorskiego, where emission levels, included as input data in the noise predictions for the planned tram line, were established by means of survey. To maintain the low level of tram noise, undertakings intended to maintain a very good technical condition of tracks and vehicles (*e.g.* in the form of a consistently followed maintenance plan for the track and trams – especially a plan for polishing rails and tram wheels) are necessary. It would also be favourable to shape the planned tram line in such way that the track area and its surrounding would absorb the noise to the highest degree possible, *e.g.* by making them grassy areas.

7.2.3. Impact of vibrations on the environment

In case of the investment under discussion, the application of jointless systems and vibroisolation mats is intended to mute the vertical vibrations of materials and transverse vibrations transmitted from the track to the route's surrounding environment. In accordance with the current requirements regarding environmental protection (protection of the environment from the unfavourable impact of means of transport), they are also used in railways (built-in under a rubble bedding layer, or, in the case of beddingless surfaces, laid directly under a concrete substructure slab and at its sides).
Grassy surfaces also constitute an excellent muting element.

7.2.4. Water and sewage management

Consumption of water during operation of the enterprise will be connected with processes of wet cleaning of street surfaces and cleaning of sewers.
The planned investment will not be a source of domestic and industrial sewage.
Rainwater from the area north of ul. Warszawska will be drained into the city's rainwater sewer network, while from the southern part (from ul. Warszawska to the "Nowa Łódzka" loop, including the parking lots) it will be drained to Reservoir no. 4 "Augustowska" located on the Potok Oruński stream (about 400 m south from the "Nowa Łódzka" loop). Calculations of quantities of rainwater from the entire area of the planned investment, for each considered variant, are been presented below.
Rain storm intensity (c=5 years, t=10 min) **I= 172 dm^3/s*ha**

Average runoff coefficient from the area under analysis (transport areas, track, green areas) **ψ = 0.6**

VARIANT I
Area **F = 7.72 ha**
Quantity of rainwater for a rain storm will total:
Q_{max} = 7.72 × 0.6 × 172 = 797 dm^3/s

VARIANT II
Area **F = 8.81 ha**
Quantity of rainwater for a rain storm will total:
Q_{max} = 8.81 × 0.6 × 172 = 909 dm^3/s

VARIANT III
Area **F = 5.70 ha**
Quantity of rainwater for a rain storm will total:
Q_{max} = 5.70 × 0.6 × 172 = 588 dm^3/s

The planned investment will cause an increase in the quantity of rainwater drained into the interceptor of the municipal sewer system, due to hardening and sealing of significant areas and construction of a new rainwater sewer system.
A new rainwater outlet, with a diameter of 800 PCV, provided with a settler and 100/100 type lamella separator with a nominal flow capacity of 100 dm^3/s and a maximum flow capacity of 1,000 dm^3/s, has been designed. When determining the drainage area of this outlet, the designed road system of ul. Nowa Łódzka and the tram line, as well as potential connections to a new rainwater sewer system in the future, have been taken into consideration. For a new rainwater and melt water outlet, a permit as required by the Water Law should be obtained.
Additionally, at the rainwater outlets from tram junctions located at the "Nowa Łódzka" loop, three NG3 coalescence settlers and separators with a nominal flow capacity of 3.0 dm^3/s have been designed.

7.2.5. Waste management
Emissions of waste from the area of the planned investment will be caused by:
- cleaning processes of settlers and separators of petroleum-derived substances, installed in the investment area (waste group code 13 05);
- renovations and maintenance of new transport areas and tracks: repair or replacement of damaged elements or surfaces (waste group 17), replacement of lighting (16 02 13*), cleaning of tram stops, transport areas and tracks etc. (20 03 01 and 20 03 03);
- operation of the rectifier station (16 02 13*).
For devices serviced by external companies (*e.g.* separators, electric and electronic equipment), according to the Waste Act, waste will be processed by the service provider unless the relevant contract states otherwise.

7.2.6. Impact of the investment on the ground surface, natural and cultural environment
The planned investment will have no negative impact on the ground surface, landscape and historical value of the area under analysis during the construction; neither will it violate the foreground exposures of objects with cultural value existing in other parts of the city.
Soils and ground waters will be well isolated from the potential impact of the investment by construction of impenetrable transport surfaces and efficient sewer systems.

In the direct vicinity of the investment there are bodies of surface water in the form of small ponds, located about 200 m to the north-west and about 350 m to the west of the investment. The route does not cross any watercourses throughout its entire length.
In the direct vicinity of the path of the route of the planned ul. Nowa Łódzka (near the junction of ul. Łódzka and ul. Przemyska) is the "Ujeścisko" underground water intake station, consisting of two inactive (since 1989), depleted quaternary deep-water wells with a depth of 101-105 m. The intake station has only a direct protection zone. It is scheduled for liquidation, although the final decision of the proprietor, *i.e.* GIWK (Gdańsk Water Supply and Sewage Infrastructure) has not been taken yet.
The investment area encompasses no areas with environmental value recognized and protected by law.
In the light of the analysis conducted, it can be stated that the planned investment will not cause an increase in the negative impact of the area under discussion on the aforementioned components of the environment.

7.2.7. Impact on the level of non-ionizing electromagnetic radiation
The functioning of the planned investment will not result in any change in the level of non-ionizing electromagnetic radiation from the current conditions.
The design of the undertaking includes no sources of radiation; neither would the activities encompassed by the project result in an increase in radiation emissions from previously active sources (existing 110 kV power lines in the northern part of the investment, from Al. Armii Krajowej).

7.2.8. Impact of the investment on Natura 2000 Special Protection Areas
Impact on areas of the Natura 2000 network is understood as conducting activities which may significantly aggravate the state of natural habitats, as well as plant and animal habitats, or have any other negative impact on the species for protection of which these areas have been established. In the identification matrix below, determinations of the probable importance, rank and intensity of impacts of the planned investment on areas of the Natura 2000 network located in the vicinity of the planned investment is shown.

Determinations of all probable direct, indirect and secondary impacts of the planned investment on the Natura 2000 areas

Size and scale (range) of the enterprise	Long range, limited to areas adjacent to the planned investment
Appropriation of the area	Does not apply
Distance from Natura 2000 areas	The planned investment is not located in such areas or adjacent to any. The closest areas of the network are: "Bunkier w Oliwie" and "Lasy Oliwsko-Sopockie", about 9 km to the north, and "Twierdza Wisłoujście" about 9 km to the north-east of the investment.
Resource requirements	Consumption of electric power to supply the tram line and street lighting
Emissions:	
- into the air	A source of air pollution will be low traffic in the area of the planned parking lots, as well as related emissions of exhaust gases (nitrogen, sulphur and carbon oxides and hydrocarbons).

- Noise and vibrations	Sources of noise will be motor vehicles and trams.
- Waste	Operational waste (sediments from separators, spent lamps and electronic elements, urban waste from cleaning of the area) will be generated. Collection only by authorized companies.
Requirements for moving earth masses	Does not apply
Transport requirements	Does not apply
Period of operation	Not specified
Other impacts	Does not apply

Description of all probable changes in Natura 2000 areas, resulting from:

reduction of the area of habitats	no changes will occur
interference in key species	no interference will occur
fragmentation of habitats or species	no fragmentation will occur
limitation of species density	no limitation will occur
changes in key factors of protective values	no changes will occur
climate changes	no changes will occur

Description of all probable impacts on Natura 2000 areas as a whole, pertaining to:

interference in key connections determining the structure of the areas	no interference will occur
interference in key connections determining the functioning of the areas	no interference will occur

Determinations of significance indexes as results of the effects stated above, in relation to loss, fragmentation, disruption, interference or change of key elements of Natura 2000 areas
No results were stated.

On the basis of the above findings, it should be stated that no element of the planned investment at the operational stage will have any significant impact on the species for which Natura 2000 areas have been established.

7.2.9. Impact of the investment's implementation on human health and life and on natural resources

The planned enterprise will not significantly increase the negative impact of traffic on the health of people living in the vicinity of the investment.
An analysis of pollution spread and an analysis acoustic, conducted as a part of the present report, show that no risk of exceeding of the acceptable standards of air quality and noise level will occur resulting from the operation of the enterprise.
No environmental effects of the proposed enterprise resulting from the use of natural sources (*e.g.* fuel, energy, food) were stated; the implementation will not cause any significant increase in their consumption.

7.2.10. The investment's operation and stray currents

The electric insulation of rails eliminates the occurrence of stray currents and subsequent corrosion of steel elements located near the track. High electric insularity of the pourable sealants and vibroisolation mats, as well as over-rail and under-rail profiles (these materials

should meet the requirements set forth by the norm PN-EN 501222-1:2002) has a particular importance in their application in tram tracks.
Durable and efficient sealing of the rail zone, along with its electric insulation, protects the track structure against the destructive impact of water and provides protection of the route's surrounding areas from the influence of stray currents.
The proposed structure contains a dock rail covering made of rubber profiles, which serves a significant function of isolating vibrations and muting noise, as well as providing effective electric insulation of the track, meeting the requirements regarding protection from stray currents. However, at the detailed design stage, one should address the materials applied by the Contractor in order to eliminate or maximally reduce the impact of stray currents on the adjacent steel structures.

7.3. Analysis of proposed enterprise variants

Road traffic safety

The matters of traffic safety and traffic flow have an essential impact on the shape of the design options selected.
In this respect, the best parameters are achieved by VARIANT III, which ensures a lack of collisions of road and tram traffic along the entire length of ul. Nowa Łódzka. A very good situation in this respect will be insignificantly worsened by construction of a tram line branch towards ul. Jabłoniowa, but even there an asymmetrical design is clearly preferable to construction of a tram line between the lanes of ul. Nowa Warszawska.
The element mentioned above also had a significant impact on the form of the designs adopted for junctions.
The least favourable option in this respect is VARIANT II, which is characterized by the greatest number of junctions, especially in the area of ul. Łódzka, and by connection of internal neighbourhood streets directly to the main high-speed street.
The prepared project has been audited and a point evaluation conducted by the auditor, dr inż. Kazimierz Jamroz.

Summary and evaluation of the variants

The selected variants were analyzed by a weighted classification method[9] using two groups of significant weights, where the factors with greater assigned significance were given the value of 2, and those with smaller significance – the value of 1. The locations were classified and given values on a scale from 1 to 3, *i.e.* from the worst to the best variant, in relation to each of the factors under consideration. The method is both comprehensive, including the environmental data as a whole, and selective. It offers the possibility to show values on a normalized scale, therefore enabling determination of differences in the state of the environment, *e.g.* with or without the investment, for various implementation variants. It is objective with regards to comparisons, yet it is unsuitable for recognizing and interpreting reciprocal impacts, which is not necessary in the case under analysis. The results of the analysis of variants are shown in Table 14.

Table 14. Weighted classification control list for evaluation of the investment variants under discussion

No.	Considered factor	Significance of the factor	Significance weight	Investment variant		
			max = 2	I	II	III
1	Construction cost	single cost supported by credits	2	1.5	1	2

[9] *„Environmental Impact Assessment"*, ed. PADC EIAP Unit, Univ. Aberdeen, NATO *Adv. Sc. Inst. Ser. D: Behav. Soc. Sc*., No. 14.

		and grants				
2	Operational cost	ongoing costs of operation	–			
3	Secondary operation	economic benefit, proximity of users is decisive	–			
4	Operation	operational benefit, amenities	1	2	1	2
5	Reliability of work results	identical technologies of implementation assumed	–			
6	Location	compliance with the spatial management plan	2	2	1	2
7	Legal condition of the area	location of the area in the protected zones	2	3	2	3
8	Availability of land around the location	possibility of future expansion, its ease	1	2	1	2
9	Implementation possibility	problems with land purchase	–			
10	Other operational conflicts	possible collisions with agriculture and housing	–			
11	Social conflicts	degree of acceptance by the local community (chapter 12 of the report)	2	1	3	2.5
12	Safety and capacity of traffic	no collisions of road and tram traffic	2	1.5	1	3
13	Hydrogeological and hydrological conditions	possible infiltration of waste into the aquifer and surface waters	–			
14	Air pollution	impact on the state of air pollution and on the health of local inhabitants				
15	Acoustic conditions	infiltration of noise in the environment	2	1	1	1.5
16	People	impact of the investment on users and local inhabitants (traffic safety and noise)	2	1.5	1	3
17	Fauna	limitation of areas of animal and bird occurrence during the construction and operation; impact on natural habitats	2	3	1	3
18	Flora	size of damage to vegetation and fungi during construction and operation; impact on natural habitats	2	3	1	3
19	Ground surface, climate, landscape	impact of the investment on the ground surface, including movements of earth masses, climate and landscape	–			
20	Material goods, monuments and cultural landscape	impact of the investment on the material goods, monuments and cultural landscape included in the existing documentation, especially in a register or record of monuments	–			
21	Leisure and aesthetic values	degradation of recreational values	1	2	1	2
Sum of the products of values in columns 3 and 4				41	27	52

(the highest value denotes the optimal location)			

1 – worst; 3 – best.
– unclassified due to identical weights for all variants.

Taking into account the environmental impact of individual variants as shown in the present report (summarized in Table 14), especially the impact on:
a) people, plants, animals, fungi and natural habitats, water and air;
b) ground surface, including the movements of earth masses, climate and landscape;
c) material goods;
d) monuments and cultural landscape included in the existing documentation, especially in a register or record of monuments;
e) reciprocal impact between the elements mentioned in points a-d,

the ranking of the variants under consideration is as follows:

1. VARIANT III
2. VARIANT I
3. VARIANT II

In view of the above, it has been shown that the most environmentally-friendly variant is VARIANT III, suggested by the Applicant to be implemented.
The key deciding factors in the choice of this variant, substantiating the above claim, were:
- safety and capacity of road traffic;
- no significant tree clearing;
- compliance with the spatial management plan;
- degree of acceptance by the local community (especially in relation to VARIANT I).

A variant consisting in not undertaking the investment
The service standard of the street system of the Tricity and the Tricity Metropolitan Area is steadily deteriorating. Despite improvements undertaken so far, the dimensions of the overloaded area are constantly spreading and the number of critical junctions increasing. As a result, the time needed to access the central areas and the time of travel between cities is also increasing.
Ul. Łódzka is one of the main transit routes from the southern districts to Śródmieście (Downtown) and Wrzeszcz. Currently, in view of its small capacity and connections with other streets (especially ul. Świętokrzyska and ul. Warszawska), serious traffic difficulties occur on this street, becoming a permanent condition during peak hours. Without new investments intended to improve the capacity of transit routes (construction of new roads and expansion of existing ones, development of alternative routes), such a situation can only deteriorate further.
Construction of a new tram line, together with a two-way, two-lane ul. Nowa Łódzka and the planned ul. Nowa Świętorzyska, is a necessity.

The VARIANT "0" (non-investment) predicts no changes and is connected with costs to be incurred for ongoing maintenance and renovation of the existing road system, as well as adjustment to the requirements regarding traffic safety for drivers and other road users. This variant is unfavourable from the viewpoint of natural conservation, because it is connected with increased emissions of transport pollution and noise caused by the inefficient road system of the existing ul. Łódzka.

7.4. Impact of the enterprise in the liquidation phase

Ending the installation's operation in a manner which would not cause any risk for the environment will essentially consist in disassembly of the tram line together with the equipment and its transfer to another location (if technically and economically feasible) or in complete disassembly of all objects and devices.

The operational period of the installation has not been determined. Since the future formal and legal requirements in this regard are unknown, in order to liquidate the enterprise it is proposed to assume the formal and legal state resulting from provisions currently in effect of the Building Code of 7 July 1994 (Consolidated text: Journal of Laws 2006, No. 156, item 1118 with amendments), determining the rights and responsibilities of the participants in the construction process, which include the obligation to obtain:

- a permit for demolition of the liquidated objects;
- agreements, permits or opinions of other authorities as required by special provisions;
- notification of local units of the Inspectorate of Environmental Protection, Sanitary Inspectorate, National Labour Inspectorate and National Fire Service, which can submit their remarks and objections within 14 days of notification.

If required, demolition works will be preceded by analyses of the degree of ground pollution and by preparation of a plan of remedial measures for the area, if the survey results show soil quality norms are exceeded.

The demolition works will be conducted:

- in accordance with the requirements of safety of people and property;
- in accordance with environmental conservation requirements, *e.g.* after obtaining a decision on waste generation as prescribed by law (in case of works conducted by external companies – after checking if they possess the appropriate permits);
- in accordance with a previously prepared plan of management, recycling and/or neutralization of waste generated during disassembly of technical devices and structures, such as ceramic rubble, scrap metal, insulation fragments, plastic and wooden waste etc.

Neutralization or recycling of waste (especially of hazardous waste) and its transport to the places of final storage will be entrusted exclusively to companies with appropriate permits and authorizations. It will also be possible to conduct such activities using own means and resources, after agreement with the appropriate environmental protection authority.

The process of disassembly of technical infrastructure will be conducted with particular caution and under supervision, in order to eliminate potential sources of soil pollution. Special supervision will cover elements of the sanitary sewer infrastructure.

Before disassembly, the devices and elements of this infrastructure will be emptied and cleaned, and all sediments extracted from them will be removed and subject to appropriate, environmentally-friendly recycling or neutralization.

The course of the liquidation process will be monitored and documented in accordance with legal regulations in force at the moment of liquidation.