NON-TECNICAL SUMMARY

INTRODUCTION

The EIA aims at supporting the design and implementation of an open pit project for mining copper ore at the site Ilovitza. The planned site for the open pit, Ilovitza, is located at the slopes of the Ograzden Mountain, very near to the villages of Ilovitza and Shtuka, in the municipality of Bosilovo. The project proposal is submitted by the project investor DPPU ‘Phelps Dodge Vardar’ DOOEL – Skopje.

The project represents an investment in a new facility for mining copper ores and production of copper concentrate – a ‘greenfield’ investment. The implementation of the project will create significant socio-economic benefits for the local population and the wider region.

This Environmental Impact Assessment (EIA) was developed by “Rudplan” DOOEL – Strumitza.

The initial geological research at the site Ilovitza was carried out by expert teams from the Institute of Geology – Skopje, and later by the company ‘Phelps Dodge Vardar’ DOOEL from Skopje within a wider range of 15 km².

In 2004, the company ‘Phelps Dodge Vardar’ DOOEL from Skopje started detailed geological research at the concession site Ilovitza, within a range of app. 15 km² including the concession site which is the subject of the EIA.

Since 2004 to date, the company ‘Phelps Dodge Vardar’ DOOEL from Skopje has carried our comprehensive research activities at the said site by way of terrain recognition, studying of alterations, litho-geochemical research, etc. For these activities the company engaged world renowned experts who, together with professionals specialized in such type of pits, assessed that the Ilovitza site bears a potential for porhyric deposit of copper and gold.

For the research conducted to date, ore reserves have been calculated according to two methods: the block method and the method of parallel cross-sections.

According to the calculations done with the block method, the following ore reserves have been established: 153,940,800 tons of reserves of B Category containing 0.189% copper, 0.27 g/t gold and 41,002 kg silver, i.e. copper equivalent of 0.349% and a total of 290,843 tons of copper metal; 304,820,880 tons of reserves of C1 Category with 0.184% copper, 0.28 g/t gold and 86,661 kg silver, i.e. copper equivalent of 0.354% and a total of 560,241 tons of copper metal. The total ore quantity according to the block method is 458,761,680 tons B+C1 reserves containing 0.186% copper, 0.28 g/t gold and 127,664 kg silver, i.e. copper equivalent of 0.352% and a total of 851,084 tons copper metal.

According to the calculations done with the method of parallel cross-sections, the following ore reserves have been established: 116,688,000 tons of reserves of B Category containing 0.208% copper, 0.31 g/t gold and 36,394 kg silver, i.e. copper
equivalent of 0.395% and a total of 242,205 tons of copper metal; 320,617,700 tons of C1 Category with 0.177% copper, 0.25 g/t gold and 81.219 kg silver, i.e. copper equivalent of 0.329% and a total of 567,685 tons of copper metal. The total ore quantity according to the method of parallel cross-sections is 437,305,700 tons B+C1 reserves containing 0.185% copper, 0.27 g/t gold and 117,613 kg silver, i.e. copper equivalent of 0.347% and a total of 809,890 tons copper metal.

Loss during operation is assessed at 3%, and ore dilution also at 3%. It should be stressed that mineralization penetration rate is high and it is extremely homogeneous. Research drill work completed to present confirms that the Ilovitza concession area has the potential for a large-scale porphyry deposit of copper/gold.
PLANNING AND OBTAINING A CONSENT DECISION

The project proposal for constructing an open pit for mining copper ores is included in Annex 1 to the “Regulation on determining projects and criteria on the basis of which the need for conducting an environmental impact assessment procedure is established” (Official Gazette of the Republic of Macedonia no. 74/05).

The authority in charge of carrying out the EIA procedure is the Ministry of Environment and Physical Planning (MEPP), which has informed the operator ‘Phelps Dodge Vardar’ DOOEL - Skopje about the need to prepare an EIA and has determined the scope of the EIA.

The project's environmental impact assessment study and its scope were developed in line with the Decision declaring the need for environmental impact assessment of the "Ilovitza Copper and Gold Open Pit" project, issued by the Ministry of Environment and Physical Planning (Annex 1 to the EIA) and will be subject to issuing a Decision Granting Consent for the implementation of the project, in accordance with the Law on the Environment (Official Gazette of the Republic of Macedonia no. 53/2005, 81/05, 24/07, 159/08, 83/2009, 47/2010, 124/10, 51/11).
PROJECT GOALS

The environmental impact assessment of the "Ilovitza Copper and Gold Open Pit" project in the Municipality Bosilovo aims at defining, describing and assessing direct and indirect impact on human health and environmental media such as biodiversity and its elements, soil, water, air, climate, landscape, underground environment, natural locations, mineral diversity and the mutual influence of all these elements.

The EIA addresses the stages of construction, operation and completion of the project. It also addresses alternative options as concerns technology and locations employed by the project, including the “Zero” option, i.e. the project non-implementation option.

The EIA provides recommendations for reducing the environmental impact and for solving the possible environmental problems that could result from the implementation and the closure of the project, thus providing for the protection of the human health and the environment and for sustainable development of the municipality of Bosilovo.
DESCRIPTION OF THE PROJECT LOCATION

The Municipality of Bosilovo is located in the southeastern corner of Macedonia and one portion of it lies in the middle of the Strumitza field, whereas the other portion rises up to the Ograzhden Mountain peak. The municipality covers an area of 150 km² and lies at an elevation of 250 m above sea level. The municipality has 15 settlements including the municipal centre of Bosilovo: Turnovo, Radovo, Ilovitza, Shtuka, Sekirnik, Borievo, Monospitovo, Robovo, Ednokukjevo, Petralintzi, Saraj, Gecherlija, Drvosh, Hamzali, and Staro Baldovtzi.

The municipality borders the municipalities of Berovo (to the north), Strumitza (to the southwest), Vasilevo (to the northwest), and Novo Selo (to the east). The geographical location of the municipality is very good. It is located only 7 km from the largest urban centre in the region, the town of Strumitza. The M-6 highway connects both municipalities, and it also connects the municipality of Bosilovo with the border crossing with Bulgaria. The regional road to Berovo crosses the municipality and continues via the Ograzhden Mountain and the Maleshevski Mountains, completing the east ring road.

The concession area is located on the slopes of the Ograzhden Mountain, in the vicinity of the Ilovitza and Shtuka villages. The area is connected by paved road to Berovo, Vinitza and Delchevo. The nearest railway head is the railway station in Gevgelija at around 50 km.

Presentation of the climate characteristics and corresponding meteorological indicators

Due to the specific geographic location, the municipality of Bosilovo features two zone climates: Submediterranean, which partly overlaps with the Eastern-continental climate – their overlapping gives the region a special mark – long hot summers with high daily temperatures and lower annual quantity of precipitation, lower winter temperatures and occurrence of wind in all directions.

In terms of sun heat, there is a long period of sunny days during the year including high intensity of illumination (there are around 230 sunny days during the year). The sun radiance lasts approximately 2377 hours per year. There are approximately 20 foggy days per year.

Daily temperature during winter falls below 3°C, and during summer it rises above 40°C.

The average annual relative humidity in the last three years is 73%. It is lowest in July – 59% and in August – 61%, and highest in December – 85% and in January 85%.

As a result of the submediterranean influence and the influence of the continental climate, the climate conditions in the municipality features lower quantity of precipitation and lower winter temperature. In terms of precipitation, annually, it varies between 330 mm/m² and 884 mm/m². The pluvial regime, i.e. the
precipitation is one the most important elements of the regional climate. The quantity, distribution and intensity of precipitation have significant influence on the condition of the top soil, composition and condition of the vegetation, physical and chemical properties of the soil as well as migration of the potential pollutants or erosion.

The distribution of precipitation within the wider region around the Illovitza concession area is irregular and it is more intense in the higher zones. The average annual quantity of precipitation during the last three years amounts to 651.5 mm. The maximum precipitation occurs in March and June during the spring season as well as in September and October during the autumn season. The minimum precipitation occurs in July, August and November.

Most frequent are the northwestern and southwestern winds, and less frequent are the northern and southern warm wind.

Flora and fauna with particular focus on endangered species

The Illovitza concession area is represented by a combination of several types of biomes such as the biome of steppes and wooded steppes (Pontic-Caspian steppes – PKS), the biome of Sub-Mediterranean-Balkan forests (SMBF) and the biome of Balkan-Middle European forests, that are overlapping. The domination of Sessile Oak forests is evident.

The biome of the Pontic-Caspian steppes and wooded steppes (PKS)

At the said site, this biome type is represented in the areas that are not forested, in the east part of the locality. It is probable that these steppes are anthropogeneous i.e. that they were created through exploitation of the forests and deforestation for cattle and livestock pasture.

The most characteristic plant species that make this biome recognizable are: Stippa pennata (feather grass), Stippa capillata, Festuca vallesiana и Festuca sulcata, Poa bulbosa, Andropogon ischaemum, Phleum phleoides, Iris pumila (dwarf iris) and other.

Most represented fauna includes: grasshoppers (Poecilimon ornatus and Omocestus rufipes and other), butterflies (Pyrgus sidae, Zerynthia polyxena, Iphiclides podalirius, Leptidea sinapis, Euchloe ausonia and other), herpetofauna (Lacerta taurica, Elaphe quator-lineata sauromates and other), birds (Alauda arvensis, Corvus frugilegus, Lanius minor and other), mammals (Citellus citellus, Spalax leucodon).

Bats that are encountered in this area come here from the surrounding biotopes to feed or in the course of migration (daily or seasonal), and include: Rhinolophus ferum-equinum, Rhinolophus hipposideros, Rhinolophus euryale and other.

Biome of the Sub-Mediterranean-Balkan Forests (SMF)

This biome is located at the border area of this site and is in contact with steppe terrains. The main type of biotic community are the xerothermal forests (dryforests)
where the trees are quite apart (open type), so that the growth of shrubs and grasses is enabled.

Characteristic plant species in this biome are: *Quercus pubescens* (downy oak), *Quercus conferta* (Hungarian oak), *Carpinus orientalis* (plain hornbeam) and other.

The fauna is mostly represented by: grasshoppers (*Omocestes minutus*, *Euchortipus declivus*, *Docistaurus brevicollis* and other), butterflies (Lepidoptera) (*Carcharodus flocciferus*, *Timelicus lineola*, *Piers rapae* and other), herpetofauna (*Testudo hermani*, *Lacerta trilineata*, *Ablepharus kitaibeli* and other), birds (*Parus lugubris*, *Dendrocopos syriacus*, *Muscicapa semitorquata* and other), mammals (*Dryomis nitedula*, *Apodemus flavicollis*, *Glis glis* and other).

Bats that can be seen in this area are almost the same bats as in the PKS because, as already mentioned, these are open type forests and pure biomes i.e. closed forest systems could be rarely seen.

*Bioe of the Balkan-Middle European Forests (BMEF)*

BMEF cover an area the center of which is located in the north-west part of the Balkans Peninsula and the east regions in the mountain roots of the Alps. The central part of these forests is located in the low mountain roots regions; in the south-east they form a 500-800m wide plateau, which is usually located above the Sub-Mediterranean-Balkan forests in the mountains.


The fauna is mostly represented by: grasshoppers (*Gomphocerus rufus*, *Chortipus biguttulus*, *Odontopodisma decipiens* and other), butterflies (Pygus malvae, *Lycaena tityrus*, *Calophris rubi* and other), herpetofauna (*Triturus cristatus*, *Rana dalmatina*, *Anguis fragilis* and other), birds (*Phylloscopus sibilatrix*, *Parus coeruleus*, *Phoenicurus phoenicurus* and other), mammals (*Barbastella barbastellus*, *Capreolus capreolus*, *Clethrionomus glareolus* and other).

*Protected areas and natural rarities*

An interesting natural resource in the municipality of Bosilovo is the famous Monospitovo swamp covering an area of 400 ha and located near the village of Monospitovo. It is around 12 km as the crow flies from the Illovitza concession area. The Monospitovo swamp, as a national interest location, is mentioned in the Strategy and action plan on biological diversity of Macedonia (Ministry of environment and spatial planning, 2004). This national strategy assumes the revitalization of the Monospitovo swamp as part of the protected areas system, encouragement of the traditional use of biodiversity and ecotourism, implementation of research projects, etc.
The Monospitovo swamp has been included in the Spatial Plan of Macedonia (valid until 2020) in the protected areas system. There are ongoing activities carried out by the Ministry of environment and physical planning to draft a law on proclaiming the Monospitovo swamp as a protected area in the category of natural monuments. The average elevation of the Monospitovo swamp is around 210 m, the lowest point being at 202 m, and the highest at 240 m.

**Cultural, historical, and archaeological heritage**

There is no evidence of archaeological location or protected cultural heritage in the broader area of the Ilovitza property.

**Density of population and social-economic factors**

The broader area represents the rich agricultural flatland of the Strumitza field. The villages of Shtuka and Ilovitza are located in its eastern corner. Strumitza, Bosilovo, Novo Selo and Bansko are the most representative settlements in this region, i.e. in the Strumitza valley which accommodates 75 settlements.

The total population of the Strumitza region is over 100,000 inhabitants, organized into four municipalities (Strumitza, Vasilevo, Novo Selo and Bosilovo). The villages of Shtuka and Ilovitza have 1500-2000 inhabitants each and they belong to the municipality of Bosilovo.

In accordance with the statistical data of the 2002 Census, the municipality of Bosilovo has 14,260 inhabitants in 16 settlements. The total number of households is 3,661, and the total number of dwelling places is 4,036. The average number of household members is 3,90, whereas the average density of population in the municipality is 88 inhabitants per km².

**Presentation of geo-morphological, hydrological, pedological, geological, hydro-geological and seismic characteristics of the area**

**Geo-morphological characteristics of the area**

Given that the concession area is located on the slopes of the Ograzhdem Mountain, it is wavy, with well developed orography, i.e. hills and hillocks stretching towards the Strumitza valley. The most significant hills in the area are: Krvavichevo – 895 m, Chukar – 823 m, Gradište – 588 m, Domus Gaber – 577 m, Burchovitza – 437 m, Kremen Chuka – 473 m, Gjurgjev Proletnik – 638 m and some other specific elevations. The lowest elevations in the area are the watersheds of Shtuchka River - 310 m and Ilovichka River (Jazga) approximately 320 m, near the villages of Shtuka and Ilovitza. The entire orography is wavy with rounded peaks and deeply cur ravines.

**Hydrological characteristics of the area**

The area of approximately 35 km² investigated by “Phelps Dodge Vardar” DOOEL between 2004 and 2008 has a well developed hydrography. Ilovichka and Shtuchka
River are the most distinctive – they are aqueous during the whole year. They drain the aforementioned area. Their watercourses are generally directed north-northeast to south-southwest. Both rivers, including their confluents flow into the Strumitza River, which is a right confluent of the Struma River in Bulgaria.

The rich hydrography created favorable conditions for construction of the Ilovitza dam which is used for water supply of the villages of Ilovitza, Shtuka, Turnovo, Radovo, Bosilovo, Sekirnik and Borievo as well as for irrigation of arable land in part of the Strumitza field. The dam is located 2 km east of the village of Ilovitza.

The Ilovitza dam (supplying the local water supply line Ilovitza) has a capacity of 420,000 m$^3$ and covers an area of 0.5 km$^2$. Around 90 ha of arable agricultural land are irrigated using the water from the Ilovitza dam. The dam fills with water from the Ilovitza River which, during rainstorms, fills the dam with vast quantities of alluvium as there are no terraces to stop the inflow of this material. As the dam fills with alluvium, its capacity decreases over time

**Pedological characteristics of the area**

The soil in Macedonia mainly changes from lower flatland and valley areas to higher mountain zones.

The soil at the base of mountains occupies a large area – the delluvial soil is widespread. This soil originates from accumulation of eroded material carried by the small mountain rivers. This soil is not fertile and it is usually not used as arable land, but it could be used for growing fruits, vine, watermelons and other plants. It could be found mainly along the edge line of Polog, Strumitza-Radovish, Kochani, Berovo, and other valleys.

The forest areas in the mountains are mainly occupied by brown soil rich in humus. This soil hosts natural oak, beech and wintergreen forest. At higher zones, especially at the mountains of the eastern-Vardar group, the rank soils are spread above the brown soils. These are also rich in humus and they usually host natural grass vegetation, i.e. grassland.

The Strumitza region is characterized by several soil types in accordance with their composition and properties. Skeletal soils are widespread in the mountain part (at the valley edge), next, there are the delluvium and the salt soils, and alluvium could be found at the lowlands and at the central part of the valley. They cover an area of around 11,520 ha and they are one of the basic conditions for the well developed farming in the area.

The entire Strumitza region consists of a mountainous part where skeletal and flatland soils are mainly found, including the alluvial, loam, and carbonate type of soils. Large portion, i.e. 46% of the arable land, belongs to the flatland relief found at an elevation of 250-300 m and these are of primary significance for the farming in the region. These include the areas along the watercourse of the rivers of Strumitza, Trkanja, and Kriva. The rest of 52% of the land belongs to the hillside, and 2% to the hill relief. The soil type of the Strumitza region distinguishes the way of land use by
the farming subjects. Out of the total land area of 32,319 ha, 87% belong to the arable land mainly represented by plough land and gardens.

The favorable climate and quality soil in the Strumitza region are a major development potential. This region is one of the most active agricultural regions in the Balkans. In the seventies, the region was the largest producer of grain and industrial cultures, mainly poppy, tobacco, sesame, sugar beet, etc. After the construction of the “Turija” and “Vodocha” dams and the related irrigation systems, more profit-making cultures were introduced, such as the early garden-stuff which is consumed fresh and is also used for industrial processing.

Almost the entire area of the Strumitza field is pedologically tested. Around 26,000 ha are suitable for irrigation and are covered with alluvium and deluvium.

Regional geology

Ilovitza concession area is located in the Serbo-Macedonian massif, on the southern slopes of the Ograzhden Mountain, north of the Strumitza trench. The geology of the area is mainly represented by old metamorphic rock, ruptured by granite, and all ruptured by Tertiary vulcanite.

Tectonics and seismic activity of the area

The topography is morphologically diverse, a result of the tectonic movements that occurred before the so called “middle Oligocene”. The occurrence of feldspar at the Ograzhden Mountain (Ograzhden feldspar quarry) took place in presence of intensive K₂O substance, a component of Na₂O granite, including high-temperature gaseous-liquid solutions, during lower Cretaceous, which ranks the deposit in the metasomatic types. The flatland part of the area, i.e. the field part used as agricultural land, originated during Pliocene when waters from the Strumitza valley lake retreated; this area is part of the same valley.

In terms of regional geotectonic location, the Ilovitza deposit belongs to the Serbo-Macedonian Massif and the Serbo-Macedonian metalogenic zone, a belt whose geological composition is built by late Proterozoic to Paleozoic metasediments and granitoid.

The Serbo-Macedonian metallogenic province is generally oriented NNW-SSE and is positioned in the central parts of the Balkan Peninsula. It stretches between Dinarides-Hellenides to the west and Carpathians-Balkanides to the east. It stretches south of the Alps, on the territory of former Yugoslavia, and spreads over parts of southwestern Bulgaria, Greece, and western Turkey.

The immediate zone of the Ilovitza deposit, as well as the wider area of the Municipality of Bosilovo is not a high risk zone in terms of strong seismic events. In accordance with the seismologic maps of Macedonia for different return periods (Source: Institute of earthquake engineering and engineering seismology) presented on fig. 3.18-3.21, the Ilovitza deposit zone (as well as most of the Municipality of Bosilovo region) belongs to the zones where there is a possibility of earthquakes.
with a maximum intensity of 7-8 degrees by the European Macroseismic Scale MCS-64.

**Geological setting**

Ilovitza is one of several porphyry systems of eastern Macedonia and northern Greece associated with volumetrically-minor exposed magmatic complexes (Red Ridge/Osogovo, Kadica, Dvorishte, Macedonia; Skouries, Greece), as distinct from both Tertiary porphyry-related mineral systems within larger volcanic fields (Lece, Serbia; Plavitza, Macedonia), or large, altered volcanic fields which lack significant mineral occurrences (Petroshnitza, northern Macedonia).

Alteration and mineralization at Ilovitza are hosted in a roughly circular altered intrusion and intrusive breccia complex of probable Tertiary age, emplaced in lower Paleozoic granite. The lower Paleozoic granite is locally weakly foliated, coarsely porphyroblastic, and forms a roughly northwest-elongate body some 4 kilometers by 12 kilometers in size intruding Precambrian mica schist and gneisses of the ‘Serbo-Macedonian Massif’.

**Hydro-geological characteristics of the deposit and the wider area**

Based on the geological setting and structural type of rock mass porosity, the following water-bearing areas have been distinguished in this region:

- Water-bearing area with intergranular porosity;
- Water-bearing area with fissure porosity;
- Water-bearing area in the neogene complex.

In accordance with the hydrodynamic characteristics of these water-bearing areas, the following types of springs are represented:

- Phraetic wells (wells with a free level of underground waters);
- Artesian and sub-artesian wells (wells with pressurized level of underground waters).

In accordance with their hydro-geological functions, the rock masses could be distinguished into:

- Hydro-geological collectors;
- Hydro-geological conductors;
- Hydro-geological complexes;
- Hydro-geological insulators.
PRESENTATION OF THE CURRENT ENVIRONMENTAL CONDITIONS

Air Quality

At the level of the Bosilovo municipality, the air quality is satisfactory, i.e. a larger-scale entity that would influence the air quality to a larger extent is not present. There are no large industrial facilities or other installations that would pollute the air in the municipality.

The municipality of Bosilovo is not included in the air quality monitoring under the monitoring programs at the level of the Republic of Macedonia. Air pollution from traffic is a result of the use of liquid fuels, the combustion of which releases: nitrogen oxides, sulfur dioxide, carbon monoxide, carbon dioxide, dust, aldehydes, lead and organic acids. The level of emissions in the air from mobile sources depends not only on the level of activity, but also, indirectly, on the quality of the fuels used and the age structure of the vehicles. However, air pollution from traffic is not a serious problem in the rural areas, but it is created due to the intensive movement along regional and national roadways. Traffic frequency is higher on the highway Strumitza-Novoselo, which passes through three settlements in the municipality: Bosilovo, Turnovo and Sekirnik, and is 12 km long in total. A ring road is planned to be constructed that would allow for reduction of exhaust gasses, as this is an international highway.

The most air pollution in the municipality comes from household heating practices of the local population, where most households use firewood and coal for heating. These, when burned, release dangerous elements such as: (carbon dioxide, sulfur dioxide). The total annual quantity of consumed firewood by the local population (number of households 3,661) amounts to app. 40,000 m$^3$. The quantity of used firewood is almost the same every year as only a small number of households use other heating fuels (oil and suchlike).

Another, small-scale problem causing air pollution is the non-controlled burning, i.e. setting on fire of the communal waste dumps, in particular during the summer period, which makes the agricultural activities more difficult in the areas gravitating towards the location where the waste is dumped.

In general, the condition of the air in the municipality of Bosilovo is satisfactory and shows no signs of worsening.

The site planned for the construction of the copper and gold open pit is located in an unpopulated mountainous area. In light of this and due to the fact that there is no measuring data for certain air pollutants for the wider region, it could be assumed that the air quality in the areas covered with the project has not suffered, mostly due to the nature of the terrain and the distance from the main air polluters – the industrial facilities and the main traffic infrastructure in the region.

Noise in the environment in the area concerned

Due to the nature of the terrain and the forms of land usage, the project area, according to the level of noise protection, can be categorized as I (first) degree area.
Based on the distance of the main noise emitters, it could be concluded that in the project area the noise levels are within the range of ambiental levels and the maximum allowed levels, without intensive continuous presence of noise from anthropogeneous sources and activities.

**Water quality**

The Ilovitza reservoir is among the most important water facilities in the municipality (supplies drinking water for the regional waterworks Ilovitza), has a volume of 420,000 m$^3$ of water and covers an area of app. 0.5 km$^2$. This reservoir is used to water app. 90 ha arable agricultural land in the surroundings of the settlements Ilovitza and Shtuka. The reservoir feeds with water from Ilovicka River which, when rain is heavy, fills it with large deposits as there are no cascades built in the reservoir to stop the deposits. Thus, the useful volume of the reservoir is reduced due to the deposited material.

The Strumitza River and the Turia River are larger water streams in the municipality of Bosilovo. Strumitza River flows through the central part of the Strumitza Field and flows into Struma River – Republic of Bulgaria, while Turia River flows out of the Turia reservoir and also flows into Strumitza River near the village of Turinovo. Smaller rivers are: Ilovichka River, which comes from the Ograzden Mountain and fills the reservoir Ilovitza and then flows into Turia River, but most of the year is a dry riverbed; Shtuchka River comes from the Ograzden Mountain, passes by the village of Shtuka and flows into Strumitza River. Smaller streams in the municipality are: Azmak, which passes by the villages Gecherlia and Petralintsi and carries atmospheric water into Turia River, and Drvoshka River, which flows through the village of Drvosh, but throughout the year is a dry riverbed and serves more as a drainage channel when there are heavy rains.

Based on the 2006 Annual Waters Report of the Ministry of Environment and Physical Planning, it can be concluded that the average monthly discharge of Strumitza River is very close to the multi-annual discharge of the river for the period 1960-1995. The same trend has been noted in the past years as well. In the recent years (2002-2006) Strumitza River has been among the most highly polluted water streams. Water quality in this river is monitored at one measuring point - Novo Selo. The assessed water quality for this river, in the course of the reviewed years, is classified as V – IV class.

According to the Regulation on classification of waters in the water streams according to catchment area, Strumitza River and Turia River should be classified as third category, and the waters of Ilovichka River and Shtucka River as second category.

The biggest problem in the municipality of Bosilovo is the non-existence of sewers with treatment stations, in all settlements of the municipality. The local population solves the wastewater problem with septic tanks, which exist in large numbers (app. 3,500). These septic tanks significantly pollute the underground waters.

The regional waterworks Ilovitza is built on the territory of the municipality of Ilovitza,
supplying water for a total of seven settlements: Bosilovo, Turnovo, Ilovitza, Shtuka, Borievo, Sekirkik and Radovo, with a total of 8,298 inhabitants. Water is treated with an ozonator in a water factory located near the Ilovitza reservoir. The settlements Monospitovo and Drvosh, with a total of 2,502 inhabitants, have their own waterworks supplying drinking water, but are facing water quality issues and lack of water during summer periods because the wells are drying up.

**Physical and chemical characteristics of surface waters at the Ilovitza locality**

A detailed description of the physical and chemical characteristics of surface waters at the locality Ilovitza is given in Chapter 4.3.5 of the EIA.

**Quality of soil**

The region of the municipality is hilly and mountainous, represented by skeletal and flatland soils, alluvial soils, loam soils, brown forest soils and carbonate soils. Most of the arable land belongs to the plains that are situated at altitude of 250 meters and are most important for the agricultural activity in the municipality. This land is spread along the river basins of Strumitza River and Turia River. The remaining land is dominated by hilly and mountainous landscape. Such soil characteristics determine the use of the land in the municipality by the farmers and other agricultural entities. Hence, out of the total agricultural land, the major part (87%) is arable land dominated by ploughed land and gardens.

Compared to the data on total arable land in 1996, in 2007 the arable land has decreased for 30%. Such a decrease has occurred as a result of the shift of the labor force from one industry to another, the conversion of land from agricultural into construction land, migration, etc.

**Eco-geochemical research of the soils at the Ilovitza site**

A detailed description of the physical and chemical characteristics of the soils at the locality Ilovitza is given in Chapter 4.4.1 of the EIA.

**Waste management**

The current practice of solid waste disposal on the entire territory of the municipality of Bosilovo is not in compliance with the Law on Waste Management, i.e., in most settlements the waste is disposed by the population at sanitary and technically inappropriate locations, thus creating illegal dumps.

The total amount of waste produced by each inhabitant of the municipality is approximately 1 kg per day. This assessed quantity of waste consists of municipal, other non-hazardous and inert waste. Waste is collected and transported by JPKD (public utility) Ograzden from Bosilovo, established in 2005. According to data from 2007, the total quantity of collected waste from all inhabitants in the municipality amounted to 5,204 tons. Waste generated from commercial entities reached 250 tons per year. Commercial entities include public institutions, shops, kiosks, etc. Their number and scale of operation has not changed in the recent years. Hence,
the total generated waste in the municipality of Bosilovo amounts to 5,454 tons/year. According to type, waste is categorized as municipal and other non-hazardous waste.

*Impact of the Quality of the Environment on the Quality of Life and Human Health*

Overall, it can be concluded that particular impact on human health resulting from pollution of the environment has not been determined. The main health risks identified are primarily the quality of life, due to lower living standard (lower social status of the population, in more general terms) and the low level of health education.
DESCRIPTION OF MAIN PROJECT ALTERNATIVES REVIEWED BY THE PROJECT DEVELOPER

According to Macedonian and European legislation, the development of Environmental Impact Assessment should involve different project alternatives.

In all investment projects in the mining and mineral processing area, the combination of unique geological setting and environment in the Ilovitza region, and the socio-economic factors and precondition determine the location and volume of activities. The factors taking into account the geological setting have no alternative and therefore the consideration of possible alternatives in terms of geological setting is out of the scope of EIA.

Mining Method Alternatives

According to BAT, there are two common methods that can be used to mine the deposit - open pit mining and underground mining (*BREF Code MTWR, section 2.1*).

The operation of Ilovitza open pit is compliant with the BAT requirements. The deposit will be developed by open pit mining, given the relatively low grade of payable minerals as well as the relatively shallow mineral occurrence. The ore production will be carried out using drilling and blasting, followed by extraction and haulage of the blasted tonnage (ore and overburden). At present the material will be drilled and blasted on 15 m benches. The blasted tonnage will be loaded by and electric hydraulic back-pull shovels serving Caterpillar off-road dump trucks.

The conceptual study assumes combined internal haulage, i.e. the ore and overburden from the active working areas will be hauled to the deepest active bench. Ore/overburden chutes will then deliver the ore/overburden to the crushers and belt conveyors using the gravity as a moving factor.

The belt conveyors will haul the ore to the crushing section (ore stockpile), and the overburden to the waste rock. A front-end loader will deliver ore from the ore stockpile to the feed hopper of the jaw crusher. A belt conveyor will deliver the crushed ore to the feed bins in the Process Plant section.

The oxide ore containing increased grades of gold and low grades of copper will be stockpiled on a separate pad for further processing. New technologies will be used to treat the oxide ore so that the payable minerals are recovered in a cost-effective and environmentally friendly way.

The additional necessary mining equipment will include drill rigs, a bulldozer, a grader, water tank trucks and other auxiliary vehicles. ANFO type explosives will be used – a mixture of ammonium nitrate and 6 % of diesel by weight.

Processing Alternatives

There are two possible alternatives for ore processing:
• Option 1: Processing of the sulphide ore to copper concentrate containing gold, silver, and molybdenum as the end product based on a combined flowsheet of flotation and gravity separation;
• Option 2: In addition to Option 1, Option 2 includes processing of the oxide ore to end metals (so-called dore bullion) based on a cyanide leaching process for extraction of Au and Ag.

The evaluation of processing alternatives prioritizes Option 1 - Processing of the sulphide ore to copper concentrate containing gold, silver, and molybdenum as the end product based on a combined flowsheet of flotation and gravity separation without the use of cyanides.

The cyanide leaching option provides better recovery of gold from the oxide ore. However, given the specific location and region conditions as well as the expected negative public opinion, this option is considered unsuitable in terms of environmental protection.

Alternatives for Mine Waste Management - Flotation Tailings and Waste Rock

Two options for disposal of mine waste (flotation tailings and waste rock) from the operation of the Ilovitza open pit are considered and they both meet the BAT requirements (BREF Code MTWR, sections 2.4.2 and 2.4.4). These options are:

• Option 1: Co-disposal of waste rock and tailings within a single footprint (IMWF – an Integrated Mine Waste Facility);
• Option 2: Separate disposal of mine waste - subaqueous (below a pond surface) deposition of the flotation tailings in a TMF and waste rock stockpiling.

The evaluation of mine waste management alternatives prioritizes Option 1 based on the obvious advantages of Integrated Mine Waste Facility as an environmentally friendly method of mine waste co-disposal (flotation tailings from the processing facility and waste rock – overburden. However, given the limited space at the Ilovitza concession area due to the specific area topography, and the vast amount of waste ore and tailings expected to be produced over the life of mine, Option 2 is the only possible option at this point of project analysis – this is because the total amount of mine waste cannot be disposed on an integrated mine waste facility. These options will be thoroughly reviewed and analysed in the detailed engineering and planning stage of the project in order to determine the final waste management option.

Siting Options for the Project Facilities

In accordance with the alternatives for methods and sites for disposal of mine waste and methods for ore concentration, two alternatives for the location of the main sub-areas of the investment proposal can be considered.

• Option 1 with separate sites for a process plant, a waste rock stockpile, a tailings management facility (TMF) and an abstraction well for raw water supply to meet process demands;
• Option 2 with separate sites for a doré gold production facility, a waste rock stockpile, a flotation TMF and a water storage dam for raw water supply.

According to the analysis (see sections 5.1.1.2.1 and 5.1.1.2.2 of the EIA), Option 1 is the most suitable alternative. The entire area required for the implementation of the proposed development is state controlled forest fund land with only a few parcels of paddock and agricultural land. The closure and rehabilitation stage will extend to all disturbed lands.

However, given the project volume and the intention to cost-effectively mine the payable minerals, it is of utmost importance to take additional land that is not included in the concession area which is subject to the EIA, both in the construction and the operational stage of the project. Part of the additional land required for the project activities belongs to the neighboring concession area located south of the present concession area. It is owned by the same concessionaire, Phelps Dodge Vardar DOOEL – Skopje.

**Options for Water Supply and Reduction of Water Use**

Two options for water supply have been studied:

- Option 1 – a fresh water abstraction well in the Ilovichka River watershed;
- Option 2 – water supply from a storage dam.

Option 1 considers installation of a proprietary fresh water abstraction well in the Ilovichka River watershed. This option requires that additional hydrological and hydrogeological surveys are carried out in order to establish whether this activity will derogate existing water capacity of Ilovichka River, which will directly impact the water supply of Ilovitza dam and surrounding settlements connected to the local water supply line.

The economic, social and environmental assessment and the data from hydrological and hydrogeological studies to be carried out should show if the abstraction well option is more suitable and if it should be given priority for detailed designing.

According to Option 2, the raw water supply to the site will come from collection and storage of runoff from the Ilovitza catchment area into a small storage dam which will normally be self-filling from the catchment areas with occasional abstractions from the Ilovichka River. Additional surveys are required in order to establish the most suitable sitting option for the storage dam that is closest to the Ilovitza site. Also, it should be established if the Ilovitza catchment is big enough to maintain the water balance of the Ilovitza facilities and if the storage dam would have the capacity to ensure water supply to the project.

**“Zero” (No action) Alternative**

The “Zero” alternative means that the Ilovitza project would not operate. That means the economic benefit from the mining and mineral processing at Ilovitza would not be accomplished.
The "zero" ("no-action") alternative is associated with the following principal potential socio-economic impacts:

- Loss of significant macroeconomic benefits to the Municipality of Bosilovo and the Government.
- Loss of revenues to the governmental and municipal budgets.
- Deterioration of living standards of the population and supply of social services.
- Continued migration undermining the sustainable development and the outlook for the local economy.

The "zero" alternative is not only an unrealistic option for the development of the region, but it would also cause significant losses and limitations on the economic development, fiscal revenues, direct and indirect employment, living standards and income, development of local economy and continued migration. Provided that all environmental, economic and social commitments are met, the Company's project will become the "engine" driving the development of the region and its future sustainability. Based on the analysis and assessment of the impacts on the environmental media and human health, the compliance of the proposed mining and processing methods with the BAT, and the social justification of the benefits from the project implementation, there is sufficient reason not to recommend selection of the "zero" alternative.
PROJECT DESCRIPTION – DESCRIPTION OF THE TECHNOLOGICAL PROCESSES AND THE ANCILLARY ACTIVITIES

The project proposal anticipates mining, processing and beneficiation of copper ore with values of gold, silver and molybdenum in the Ilovitza deposit in the vicinity of the villages Shtuka and Ilovitza, in the municipality of Bosilovo. It is expected that 10 million tons of copper ore will be mined annually.

The main project activities include:

- Setting up a soil stockpile, removing the surface humus material from the construction works zone and disposal of the humus in the soil stockpile;
- Construction of the infrastructure – roads, electricity and water supply, telecommunications, storage areas, etc.
- Construction of a plant for processing and beneficiation of the ore into a copper concentrate;
- Construction of facilities for mine waste disposal – mine waste facility for waste rock and flotation tailings;
- Setting up a copper ore pad where the copper ore will be processed by way of flotation;
- Setting up an oxide ore pad for material with higher value of gold and lower content of copper, to be treated with new technologies for extraction of payable minerals;
- Surface mining of copper ores (drilling, blasting, loading and haulage operations);
- Processing of the mineral resource into copper concentrate with grades of gold, silver and molybdenum as a final product;
- Mine waste disposal.

Production process. Main process stages

The process has the following main stages:

- Drilling and blasting of the rock;
- Loading and haulage of the blasted material;
- Ore crushing and grinding;
- Flotation;
- Mine waste disposal.

Final product. Quantitative and qualitative characterization

The quality of the final product will depend on the efficiency of the recovery of the payable metals (copper, gold, silver, molybdenum), as well as on the market demands and the further processing options available (smelter).

The annual expected production is 140,000 tons of copper concentrate containing 9.55% copper, 1.16 g/t gold, 82.96 g/t silver and small quantities of molybdenum that need to be determined with more precise additional analyses.
Waste Rock and Tailings Characterisation. Mine Waste Management

The mining and processing operations will generate waste rock from mining and flotation tailings during mineral processing.

Flotation Tailings Management Facility

Flotation tailings is waste material rejected during the beneficiation process in the flotation plant after the payable minerals have been extracted from the ore feed. Approximately 178 million tons of flotation tailings are expected to be generated during the life of mine. The flotation tailings will be dewatered prior to their disposal in the flotation Tailings Management Facility.

The flotation Tailings Management Facility (TMF) will serve to deposit wastes from the flotation process. The tailings will be delivered as slurry for deposition into the TMF. The Tailings Management Facility at the open pit Ilovitza will be sited in an area of app. 330 hectares, and will have a capacity of app. 108 million m³.

Waste rock stockpile

Mining operations at the Ilovitza open pit will generate mine rock without any economic grades of copper, gold, silver and molybdenum. This material is classified as waste rock generated in the process of access to the ore body. The rocks are mainly granite, granodiorite and dacite. Approximately 875 million tons of waste rock are expected to be generated during the life of mine. The waste rock stockpile will be sited on an area of approximately 338 ha, and will have capacity of 306 million m³, which is sufficient capacity for depositing the anticipated quantity of waste rock.

Soils stockpile

Prior to construction, all areas planned for construction or mining will be stripped of topsoil, which will be stockpiled for further use in the closure and rehabilitation stage. For this purpose, a soil stockpile with an area of 20 ha will be set up. The stockpiled soil will be used in the rehabilitation stage. It will be used to stockpile soil removed in the construction stage from the areas where the open pit is planned to be sited, from the areas where the plants for mineral processing and ore beneficiation are planned to be sited, and from the areas where the remaining mining facilities and the waste rock and flotation tailings waste facilities are planned to be sited.

Infrastructure

The infrastructure includes construction of the main processing and ore beneficiation plant, warehouses/storage areas, water and power supply, telecommunications network, wastewater treatment system, etc.

Main construction works include construction of:

- Main processing and ore beneficiation plant;
- Fuel storage area - two (2) tanks for diesel fuel;
• Reagents storage area;
• Electro-mechanical service shop;
• Car wash;
• Roads.

Raw and other materials, natural resources and energy sources

A detailed description of the raw materials, the other materials, the natural resources and the energy sources that would be used in the construction, operation and closure and rehabilitation stages of the project is given in Chapter 6.4 of the EIA.

The project will require supply of sufficient quantities of raw materials for the construction, operation and closure and rehabilitation of the open pit, the processing and ore beneficiation plant, the Tailings Management Facility and the associated infrastructure.

The main construction materials needed in the construction stage (bricks, concrete, cement, lime, structural steel and steel sheets, reinforcement bars, window/door framework, glass etc.), and the fuel needed for the construction equipment will be procured in quantities and quality as specified in the project construction documentation.

The main raw material that will be used in the project, in the operation stage, is the ore from the Ilovitza open pit. Based on the obtained qualitative and mineral analyses of the ore samples from the Ilovitza deposit, the following mineral composition was determined:

a) ore minerals: chalcopyrite; chalcocite; bornite; covelline; pyrite; sphalerite; galena; free elemental (native) gold; molybdenite; magnetite; martite; hematite; rutile; leucoxene; limonite; malachite;

b) waste rock minerals: quartz, silicates; carbonates.

The following materials will be used in the mining and processing of the raw material from the Ilovitza open pit so as to obtain a final product (flotation concentrate): potassium amyl xanthate, sodium silicate (water glass), dithiophosphate, frother, flocculant, calcium oxide, steel grinding balls, explosives and blasting consumables, water (fresh and recycled), fuel.

Recommended explosive for blasting of the rock is the ANFO explosive (a mixture of ammonium nitrate and 6% of diesel by weight).

Main energy resources to be used are electric power and diesel fuel. Electric power needed for processing of 10,000,000 tons of ore per year is assessed at 670 GWh/year. Electric power needed for processing of 1 ton of ore is assessed at app. 67 kWh. Diesel needed for processing of 10,000,000 tons of ore per year is assessed at 67,000,000 liters/year. Diesel needed for processing of 1 ton of ore per year is assessed at 6.7 liters. Sulfur contents in the diesel fuel should be under 0.035%.
ENVIROMENTAL IMPACT ASSESSMENT

Climate changes

In principle, mining of metallic mineral ore does not fall under the category of important emitters of pollutants that impact the greenhouse effect and thus does not contribute to climate change. Exception to this are the solid particles, that is the dust sized under 10 µm, the emission of which, in case control measures are not fully implemented, could be related to almost all operations, including the production, processing and storing of the raw mineral feed.

A more significant effect could be expected in terms of microclimate changes at the site due to changes in the terrain orthography and in terms of changes in the natural conditions (depressions, elevations, lake construction, etc.)

Project analysis drew the following conclusions with respect to climate change consequences from the implementation of the project:

• Emissions of greenhouse gases and dust that could be significant in terms of climate change are not expected in any stage of the project implementation, whereas increased concentrations of greenhouse gases and dust can occur only in extreme cases and in the zone in the immediate vicinity to the sources.
• Significant changes in the microclimatic characteristics of the region that could lead to creation of new ecosystems and emergence of new species of flora and fauna are not expected.
• During normal operation on the site, formation of photochemical smog is not expected beyond the complex parameter.

Air

Fugitive emissions (construction stage)

Air pollution at the project site during project construction will result from:

1. Discharging exhaust gases into the atmosphere from internal combustion engines of the equipment employed in the construction works and haul operations at the construction site. The main pollutants that will be discharged in the air are CO, NOx, SO2, HC and dust. These emissions are fugitive and will depend on the number and type of employed equipment during the construction and the working stations regime.
2. Dust particles that were emitted in the air during excavation works, earth filling works, loading/unloading and haulage at the construction sites. Such dust emissions are fugitive and will largely depend on weather conditions (wind, humidity, temperature, resilience of the atmosphere), the characteristics of soil particles, the maintenance of roads and many other conditions.

Internal combustion engines emissions (construction stage). In the construction stage, the following construction and haul equipment will be employed: excavators, loading trucks, bulldozers, trucks. These emissions are dispersed in time and space.
Hence, significant concentrations that would lead to deterioration of the air quality are not expected.

**Dust emission during excavation-earth filling and haul operations (construction stage).** In light of the fact that dust emissions resulting from mining and construction works, and construction of buildings, mean significant earthworks on a large territory, i.e. at the open pit site, at the primary beneficiation plants and at the tailings management facility, it could be expected that in critical conditions such emissions would significantly intensify.

In order to define the dispersion zone, Annex 2 to the EIA elaborates a dust dispersion model in critical conditions, during construction stage. The defined model is analyzed with DISPER 5.2., a specialized software application of Canarina Environmental S.A. The received results clearly point to the fact that the possible recipients, i.e. the nearest inhabited areas, are outside of the impact zone, even in cases of extreme conditions such as high-velocity winds and no control measures.

**Emissions from stationary sources (operational stage).** The only stationary source of emissions is the steam boilers for providing heat and hot water. The main polluters that are expected to be emitted from the steam boilers facility are: CO, SO₂, NOₓ, soot. When the combustion process is well regulated, most indicators could be expected to be within the maximum allowed concentration range. In order to reduce air emissions from the hot water boiler room, the facility should operate exclusively on low sulfur fuel oil – 0.5% S. In case of indications of increased emissions of pollutants from the boiler room, to achieve maximum allowed concentration we recommend use of higher quality fuel and adjustment to the combustion process, and ultimately, installation of wastewater treatment plants.

**Fugitive emissions (operational stage)**

**Excavation.** Almost all emission sources during excavation of mineral material, including drilling, blasting, loading, hauling and unloading, are considered fugitive sources. During these processes, if appropriate control measures are not applied, significant quantities of dust, nitrogen oxides, carbon dioxide, carbon monoxide and other pollutants could be emitted. Taking into consideration the planned dynamics of the operations and the recommended emission factors for the emissions in each individual operation, Annex 2 to the EIA presents a detailed analysis of the expected aeropollutant emissions at annual level. The analysis covers the expected critical operating parameters for a maximum pit capacity of 10,000,000 t/year and real efficiency of the protective measures.

**Primary processing.** Primary ore processing is also related to dust emissions as main pollutant. Namely, during all activities in the ore crushing and grinding installations, easily dispersed solid particles are emitted in the air at the vibrating screens and the technological junctions of the transfer (haulage) points. Because of that, all crushing and grinding installations should be equipped with dust suppression systems, and/or should be appropriately ventilated so as to minimize material loss and pollutant emissions. The projection for the emissions from primary processing is defined in detail in Annex 2 to the EIA.
**Beneficiation/Flotation.** The process of flotation beneficiation of the useful components is mostly conducted in a water medium, so that there shouldn't be significant fugitive emissions under a normal technological operating regime of the main copper beneficiation plants and the ancillary installations and facilities. Still, the main reagents that are being used for ore processing are classified as hazardous substances – xanthates, dithiophosphate, diesel fuel and other. In case of mishandling of these reagents or in case of an incident, toxic substances could be discharged in the air. Therefore, production processes for reagents should be fully automated and all measures to minimize the effects from these substances should be taken under the project. Also, it is necessary to develop a detailed emergency response plan. All shipments of hazardous substances should include Information Sheets containing data on their chemical composition, toxicity, instructions for management of incidents, etc.

**Transportation and storage of the concentrate.** Due to the fine granular texture of the material (0.08 mm average diameter for the copper concentrate), dust could easily be raised when handling the material or mobilizing it at airflow speed of over 4 m/s. Therefore, the concentrate should be handled in a confined space, and loading should be done directly from the silos. Transport should be conducted only with loading trucks equipped with covers. Due to the usually low emissions during these operations, such emissions were not taken into consideration when making the assessments and the dispersion model.

**Storing flotation tailings at the Tailings Management Facility (TMF).** So as to prevent fugitive dust emissions from the surface of the Tailings Management Facility in the air, it is necessary to minimize dry surfaces such as the tailings dam and the dry beaches. The project documentation should anticipate dam construction technology that would allow for constant moisturizing of the active parts of the dam (use of spigots for the thickener overflow) and maintaining a constant water mirror. Where necessary in the Tailings Management Facility, spraying systems should be installed for controlled watering. For this facility, particularly important is the complete implementation of a staged rehabilitation that would dully and fully rehabilitate all completely constructed parts in line with the mine waste management plan and the general concept of closure and rehabilitation.

**Waste rock disposal.** The surface mining technology generates significant quantity of waste rock that must be removed during excavation of the useful mineral material. Barren rock mass is deposited at the waste rock stockpile. Because massive rock material is deposited at the waste rock stockpile, the eolian erosion is at minimum and, except in the unloading stage, major emissions are not expected. Consequently, these emissions were not additionally analyzed nor included in the dispersion models in Annex 2.

In light of the fact that in all above described analyses and conclusions dust is prevailing as a pollutant, Annex 2 to the EIA elaborates a dust dispersion model in critical conditions, in the operation stage. The defined model is analyzed with DISPER 5.2., a specialized software application of Canarina Environmental S.A. Analyses show that such emissions are, even in critical conditions, clearly localized in the open pit area, and the expected concentration (22 µg/m³) of respirable dust in
the inhabited zone and the surrounding agricultural land does not exceed the maximum allowed concentration prescribed with the national legislation. Hence, it could be concluded that emissions, in particular dust emissions, can be appropriately controlled by strict application of the requirements related to construction and operation of the project facilities, and thus comply with the statutory requirements on air quality. In addition, installation of a monitoring system for measuring real-time pollutant quantities will allow for a quick response and timely application of incident remedial measures.

**Haulage (transport) operations.** So as to define the dispersion zone for CO and NO\textsubscript{x} as the most characteristic pollutants related to haulage operations in the operation stage of the project (total for road and internal traffic), Annex 2 elaborates dispersion models in normal conditions. The defined models are analyzed with DISPER 5.2., a specialized software application of Canarina Environmental S.A. The defined models indicate expectation of low concentrations for CO (expected 0.0142 µg/m\textsuperscript{3} <<< maximum allowed concentration 10 mg/m\textsuperscript{3}) and NO\textsubscript{x} (expected 0.138 µg/m\textsuperscript{3} <<< maximum allowed concentration 200 µg/m\textsuperscript{3}); hence, we can conclude that the emissions of these pollutants in the operation stage will not reduce the air quality neither on local nor on regional level.

**Fuel tanks.** Emissions in the air are related to fuel evaporation from the tanks, to unloading the cisterns and loading the equipment, as well as to fuel spillover, and depend on the type of tanks and the conditions under which they are kept. If these facilities are constructed and operated in line with the statutory requirements for construction and operation of fuel tanks, emissions will be reduced to minimum and will be insignificant with respect to air quality. Fuels to be used in the open pit area must be certified for contents of lead, sulfur and other substances harmful to the environment. According to European standards, sulfur contents in the diesel fuel should be under 0.035%.

In general terms, expected changes in air quality in the area that was subject to research may be assessed by comparison with the total emissions of particular pollutants in the period preceding and following the implementation of the project.

Such a comparison shows that after the implementation of the project, increase in the emitted quantities of sulfur, nitrogen and carbon oxides is not expected, whereas in extreme conditions temporary increase of emitted dust quantities with generally local dispersion is possible.

Upon closure of the mine, termination of the plants operation and completion of the biological rehabilitation, the emissions of harmful substances in the air will cease.

**Waters**

**Surface waters**

Construction activities by their nature cause ground disturbance, and deforestation and devegetation can also result in increased soil erosion and runoff carrying sediment. Elevated suspended solids sediment in rivers and streams is usually
detrimental to the ecosystems as it can blanket the river/stream beds and vegetation and reduce light perception. During dry months there is little tributary flow to carry sediment, and in wet months rivers are generally high in sediment loads during periods of higher energy and flows, but these loads are largely diluted by the large flow. Nevertheless, the potential sediment loads will be reduced as much as possible to minimize the impact of the project on the environment.

One of the important environmental problems arising during mining in metal ore deposits, and that could arise during mining in the Ilovitza open pit is the “acid rock drainage”. This problem is associated to sulfide ore bodies that are mined for mineral feed of lead, zinc, copper and gold, but also for other minerals, including coal. The most important sources of such drainage are the waste rock stockpiles and the tailings management facilities.

The sites planned for the tailings management facility and the waste rock stockpile inevitably impose the need for regulation and dislocation of the river beds of Shtucka and Ilovichka (Jazga) rivers. The parameter of the tailings management facility completely occupies the lower course of Shtucka River. Therefore, the water of Shtuchka River should be captured in the upper course of the river and redirected outside of the Tailings Management Facility’s parameter and beyond the possible impact of the acid rock drainage. In addition, one segment of the waste rock stockpile zone interrupts the riverbed of Ilovichka (Jazga) River in the upper course of the river. The riverbed of Ilovichka (Jazga) River should be regulated in a way to allow uninterrupted discharging of the river into the Ilovichanka reservoir, while at the same time avoiding the zone of possible impact from the acid rock drainage from the waste rock stockpile.

Part of the project needs for fresh water will be served by collecting surface runoff which will be collected in a runoff pond, thus reducing to minimum the need for fresh water from external sources. It is expected that 98% of the project’s annual needs for water will be served by way of water recycling. Thus, the project’s impact on the natural water streams regime and on the other water users in the surrounding area will be insignificant.

As concerns sewer and sanitary wastewater, with different treatment schemes they could be discharged in category II recipient. If sewer and sanitary wastewater is treated independently, it would be most appropriate to use the so called ‘combined facilities’ with biological treatment that could be obtained by way of a complex procurement.

**Groundwaters**

The construction of the individual facilities is not expected to have any impact on the ecology of the groundwaters. Any possible impact will be short-term and without cumulative effect.

The processing waste (tailings pulp), after the ore flotation and the thickening, will be transported to the Tailings Management Facility for settling of the solids from the remaining liquids. There are no technological reasons under the project to change
the ecology of the groundwaters in the process of mining considering that the project needs for fresh water will be satisfied with runoff at the project site and supplemented with an abstraction well (option 1) or water collection dam (option 2).

The TMF and the waste rock stockpile foundation and the outer slopes must ensure protection of the soil and surface and groundwaters that is equivalent to the protection of a bedrock with a permeability of \(1 \times 10^{-9}\) m/s or lower (for non-hazardous wastes). If the permeability of the bedrock is higher than the required level, a min. 1m thick layer of clay material must be established.

The groundwater monitoring system, which needs to be set up, will provide the necessary information on the groundwater status over the operation stage of the project facilities.

The proposed activities and methods for closure of the project facilities, as well as the terrain rehabilitation, do not suggest any disturbance of the groundwaters status. The groundwater monitoring systems will provide the necessary information on the status of the closure and rehabilitation process.

**Lands and soils**

The project encompasses construction and operation of production facilities and construction and operation of an open pit, waste rock stockpile and a Tailings Management Facility. The expected impact on the soil in the project area will come from the following sources: excavation and earth filling works in the construction stage, exhaust gasses emissions from industrial activity, the waste rock stockpile and the Tailings Management Facility, surface waters in non-rehabilitated areas, waste rock and reserve concentrate stockpiles, and wastewater and solid waste facilities. These activities are linked to the time of construction of the facilities, as well as to their operation and closure and rehabilitation.

Project implementation, with the construction of a waste rock stockpile, Tailings Management Facility and industrial plants means using mainly forest fund land. The Tailings Management Facility is expected to cover an area of app. 330 ha, whereas the waste rock stockpile is expected to cover an area of app. 338 ha. Industrial plants would cover about 40-50 ha.

The degree of impact is expected to be directly reflected only onto the forest fund land. Impact on the agricultural land fund will be indirect and insignificant. Most of the necessary land for project implementation is in forest land.

Overall, the impact on soil in the construction stage will come directly from construction works and dust emissions from construction and installation activities, only at the projected Ilovitza open pit site.

The impact of mining on soil and land in neighboring terrains depends on the characteristic climatic conditions and in particular the characteristic inversions and wind regime. The characteristic airflow regime at the Ilovitza site is a precondition for
negative impact on the vegetation in the adjacent areas, and for the biological rehabilitation.

The Tailings Management Facility will be built with the necessary insulation that prevents infiltration of polluted waters. Risk of forest and agricultural land pollution through air emissions from the Tailings Management Facility is not anticipated as isolation band of free natural land will be established.

The waste rock stockpile will also be built with the necessary insulation layer which would prevent the penetration of polluted water into the surrounding soils. Erosion in waste rock stockpiles, as a source of possible impact on the surrounding soils, is a serious problem. The main reason for this phenomenon is the lack of adequate drainage control. It is therefore essential to design drainage control measures that will cope with the expected rainfall.

Fugitive sources of air pollution will be the exhaust gases from the internal combustion engines, dust from haul operations, loading and unloading activities, gases from blasting activities and dust emissions from the surface of the Tailings Management Facility. Of these pollutants, the quantity of dust and its impact is of essential importance. This impact will not change soil properties considering the presence of certain heavy metals in the soil at the site and will therefore have no adverse effects. Negative impact or cumulative effect on the forest fund land is not expected.

Impact from wastewaters is also not expected. It is expected that 98% of the mining water (processing, drainage and waste) will be recycled back into the process so that there will be no free leakage into the surrounding recipients; and the qualitative composition of the waters that would potentially be discharged will be strictly controlled, thus avoiding impact on surface and groundwaters that could affect the soil.

During the operation of the facility, industrial (mine) and municipal waste will be generated. With ensured application of the management procedures and the operating guidelines on waste treatment and transportation, the soil fertility and properties are expected to remain unaffected.

Forecast on impact on soil and rehabilitated facilities due to construction, operation and closure of the facility is that direct, indirect and negative influences altering fertility and soil properties are expected to be minor and in line with the recommendations stated in the EIA.

The impact of the open pit, the Tailings Management Facility, the waste rock stockpile and the industrial plants on the environment and the soil in the region is due to using forest land - mostly land with low value for construction of an open pit, tailings management facility, waste rock stockpile, industrial plants and roads on the project site.
The forestation of the edges of the Tailings Management Facility, the waste rock stockpile, the industrial plants and the roads, will have no negative effect on the adjacent land and land use.

**Landscape**

The landscape of the entire territory will not be significantly changed, although there will be some changes in the landscape structure of the terrain at the project site. The development of the project will significantly change the physical appearance of the project site by creating devegetated terrestrial forms with clearly protruded slopes. The landscape structure and functions will change – the structure will change from horizontal to vertical and will impact the rock body, topography, soil and vegetation.

As a result of the irreversible change that will completely destroy the present structure of the terrain, the landscape will be degraded. The degraded technogenic landscape will have a completely changed structure and its ability to produce resources will be completely lost.

Indirect changes, mainly to the landscape’s biocomponents of the adjacent territories, but will be observed, but will remain resilient to functional changes. The primary impact on the landscape will be local, of visual-aesthetic nature. The rehabilitation of the site will change the visual perception and aesthetics of the landscape and will restore some of its functions. The negative impact of the project development will include physical occupation of the land, devegetation and distortion of the quality of the environmental media.

**Protected areas and natural rarities**

Project implementation will not directly affect the region’s network of protected sites because of the relatively large distance from these sites (Monospitovsko Blato). Certain indirect impact is possible and may appear under certain weather conditions (northern wind, incidents).

**Biodiversity - flora, fauna, ecosystems and diversity of ecosystems**

During the construction and operation of the facilities, a limited number of plantlife in the project sites will be destroyed. Upon closure of the facilities, vegetation can be restored. Therefore, it is necessary to develop a detailed rehabilitation plan that will be implemented in stages, during the construction, operation and closure of the project. During construction, unnecessary clean up of old hollow trees should be avoided to preserve existing day shelters of bats. Unnecessary removing of grass and shrubs should also be avoided so as to preserve habitats where bats feed.

During project operation, and upon strict application of the planned technologies under which the content of harmful substances in the air and in the water will be kept within the maximum allowed concentration, negative impact on the flora and the vegetation in adjacent territories is not expected. Analysis and evaluation of the possible effects show possible changes in surface invertebrates resulting from substitution of the edaphic and the aedificatory conditions in the environment. With
respect to hydrocenoses (surface and ground), improved species structure is expected, as the primary water pollution with changed basic hydro parameters - pH, hardness and chemical composition, will be prevented during the operation period due to the fact that production water will completely be reclaimed back into the process.

During the three stages of the project implementation, biotic monitoring should be carried out in two main directions: to track changes in the biodiversity and to monitor the content and accumulation of toxic substances and chemical elements. Research to determine changes in biodiversity should take a whole year. The two monitoring directions are aiming at: determining possible changes and their strength and course. Direct as well as indirect and cumulative effects must be monitored. The monitoring can help avoid unexpected disasters and incidents, which would have had terminal and irreversible impact on the invertebrate fauna.

Potential negative impact on invertebrate fauna depends mainly on sudden changes in the environment, the production control and the compliance with the technological regime.

During project implementation, several ecosystems will be partially or completely transformed, thus slightly reducing the diversity of ecosystems on the project territory. The biotic components of the ecosystems at the Tailings Management Facility, the waste rock stockpile and the soils stockpile will be destroyed in a moderate to a great degree. The distortion of the ecosystems in these areas will be permanent. After the closure of the facilities and the technical and biological rehabilitation, new ecosystems can be formed.

**Mineral resources and diversity**

Certain amount of mineral associations, certain volume of ore mass and optimum amount of waste rock mass as components of the ore body of the Ilovitza deposit will be extracted, which is inevitable in activities of this kind.

Optimum planning of the measures to be taken during the construction and the operation of the mine is a must, in light of minimizing the amount of overburden to be removed, the contents of various mineral associations and, at the same time, achieving the projected annual production volumes of raw material.

In order to preserve characteristic samples that will represent the mineral diversity of the area, we propose establishment of reference collections of rock, mineral and other specimen, including mineral associations from the Ilovitza open pit, to be kept by the relevant institutions such as museums, universities, research organizations and other.

**Cultural, historical and archaeological heritage**

Within the project’s area, there are no significant archaeological sites and localities with cultural heritage that would pose limitations on the planning of project activities. Therefore, impact on the archaeological cultural heritage is not expected during
project implementation. However, if during implementation of the construction and mining stages artifacts are determined to exist or there are indications that there is potential archaeological wealth at the location, works will be stopped, the location where the cultural and archaeological wealth was found will be fenced and the Cultural Heritage Protection Office under the Ministry of Culture will be timely informed so as to undertake research and conservation activities at the location to preserve the artifacts.

**Waste**

A detailed description of the types and quantities of waste generated during the construction and operation of the project, the method of collection, transport, reuse and disposal, the description of the types of hazardous materials to be used and their classification and toxicological characterization are presented in Chapter 7.2 of the EIA.

**Projections for levels of noise, vibration and ionizing radiation in the environment**

Emissions of noise in the environment during project implementation are related to the three project stages - construction, operation and closure and rehabilitation.

The construction equipment to be used for excavation, earth filling of the excavated areas, concreting, assembly, haulage etc. will be the main source of noise in the environment during the construction stage.

Noise level equivalent to 90-95 dBA can be expected in the immediate vicinity of the equipment.

In order to define noise levels in the wider area, including the nearest recipients (the villages of Ilovitza, Shtuka and Sushitza), a complex model (Annex 3) of expected noise levels has been developed by way of approximation of existing and new noise sources. The model of expected noise levels in the construction stage is based on assumptions about critical conditions, i.e. maximum intensity of the sources, minimum sound suppressing factors in the area and optimal weather conditions for sound spreading. These parameters were analyzed with CUSTIC 3.2., a specialized software application of Canarina Environmental S.A., in line with the ISO 9613 sound dispersion model.

The estimated equivalent noise levels within the perimeter of the project activities during the construction stage meet the standards for all noise indicators and are lower than the basic noise levels of the recipients. Hence, noise sources in the construction stage are not prevalent in the area subject to analysis, and construction works are not expected to cause discomfort for the population in the inhabited areas adjacent to the project site.

The equivalent noise levels from vehicles in the construction stage will depend on the number of cycles and the moving speed of the vehicles. The expected levels of noise from haul activities were defined with a separate model developed for the
operation stage, as critical conditions and maximum haul activities are expected in this stage.

The entire mining equipment to be used in the operation stage will be new and in accordance with the EU requirements on harmful noise emissions that apply to outdoor equipment. Noise level equivalent to 93-95 dB (A) can be expected near operation facilities and equipment, in the operation stage.

Noise levels emitted into the environment from the processing and beneficitation plant will depend on the noise emitted from the processing equipment and the sound suppressing capacity of the external walls. Comparative data from similar facilities indicate that noise levels near processing and beneficitation plants are within the 60-67 dBA range.

The mining waste rock will be deposited in the waste rock stockpile. Dozers and transportation lines will be the main noise sources in this zone. Noise level equivalent to 65-90 dBA can be expected in the vicinity of the operating equipment.

In order to define noise levels in the wider area, including the nearest recipients (the villages of Ilovitza, Shtuka and Sushitz), a complex model (Annex 3 to the EIA) of expected noise levels in the operation stage has been developed by way of approximation of existing and new noise sources. The model of expected noise levels in the operation stage is based on assumptions about critical conditions, i.e. maximum intensity of the sources, minimum sound suppressing in the area and optimal weather conditions for sound spreading. These parameters were analyzed with CUSTIC 3.2., specialized software application of Canarina Environmental S.A., in line with the ISO 9613 sound dispersion model.

Delivery of concentrate, supplying necessary materials for operation and mineral processing and beneficitation, and delivery of supplies will be conducted with heavy trucks transiting along the roads in the open pit site and the local roadways: the Strumitza-border crossing Novo Selo highway and the new highway branch heading towards the open pit, connecting at the village of Sushitz.

Given the relatively high intensity of traffic expected in the operation stage, high levels of noise from haul operations can be expected. Therefore, even in the planning stage, the new corridor is away from the potential recipients. In order to define noise levels from transport operations in the wider area, including the nearest recipients (the villages of Ilovitza, Shtuka and Sushitz), a model of expected noise levels has been developed (Annex 3) by way of approximation of the expected traffic. The model of expected noise levels from transport (haul) operations is also based on assumptions about critical conditions, i.e. maximum intensity of traffic, minimum sound suppressing factors in the area and optimal weather conditions for sound spreading. These parameters were analyzed with CUSTIC 3.2., a specialized software application of Canarina Environmental S.A., in line with the ISO 9613 sound dispersion model. Based on this model, the expected noise levels from transportation operations in both the construction and the operation stages were analyzed. Analyses show that equivalent levels of traffic noise range from 35 to 55 dBA at the edges of the road, whereas at distance up to 200 m from the road axis.
they do not exceed 18.34 dBA. These values fully satisfy the allowed noise levels prescribed by law, and it can be concluded that the impact of noise from transport (haul) operations during the construction and the operation of the mine will be insignificant.

All noise levels in the operation stage are lower than the standard for night noise of 45 dBA. The expected equivalent noise levels in the operation stage are lower than the current levels of noise in the environment (<32 dBA) of the recipients and will not prevail in their environment, so it can be concluded that noise in the operation stage will not constitute a pollution factor. Still, the staff that will be performing the work in the project activities zone will be directly affected by the noise emissions. Noise is a significant factor in the working environment.

Noise emissions in the environment during the closure and rehabilitation stage are expected to be of similar tonality, but considerably less intensive than noise emissions during construction; hence, additional analysis and modeling for this stage were not carried out.

Blasting operations will generate a specific type of noise – immediate noise with high intensity in the form of energy wave the level of which will depend on the blasting method. Blasting noise will be short-term (several seconds), depending on the size of the blasting area and the number of blast holes detonating at the same time. The calculation of the assumed parameters for the Ilovitza and Shtuka sites shows a momentary maximum linear sound pressure of 103 dB, and of 97 dB for the Sushitz site. However, thus determined sound pressure levels do not take into account the geometry of the pit (which is deepening) and the natural obstacles, i.e. the sound suppressing factors in the area. Consequently, we can conclude that the sound pressure level at the said sites will be significantly below the described values because of the strong sound suppressing effect that is mostly due to the contour of the pit.

As concerns blasting operations, the expected maximum vibration speed will be 0.28 mm/s at the Shtuka and Ilovitza sites and 13 mm/s at the Sushitz site. The calculated expected maximum speeds at nearby residential/commercial sites are significantly below the allowable. Consequently, a conclusion can be drawn that the proposed blasting operations in the prospective open pit will not cause vibrations that would have negative impact on the environment.

No activities at any stage of the project will constitute a source of ionizing radiation in the environment.

**Health and hygiene aspects**

The health risk assessment and analysis of the population and the workers during the construction, operation and closure and rehabilitation of the open pit Ilovitza, the health of the population in the region and the preventive measures for health protection of the population and the workers are presented in detail in Chapter 7.3 of the EIA.
The socio-economic situation of the municipality and sustainable development as project implementation outcome

Major negative effects on the environment and the human health will be associated with: increased areas of land to be used for production operations, increased organized and fugitive emissions of gas and dust, even though statutory requirements will be met, and the accumulation of a larger quantity of mining and solid waste (municipal, hazardous and other types of waste).

The major positive effects of the project implementation include: creation of new jobs, providing sufficient financial resources and securing the independence of the municipality from the state budget, and application of the best available techniques and technologies which would influence production competitiveness.
ASSESSMENT OF ENVIRONMENTAL RISKS AND POSSIBLE ENVIRONMENTAL IMPACT IN CASE OF ACCIDENTS

The project assumes production and processing of copper ore to copper concentrate containing gold, silver and molybdenum. The general risks associated with the production process are as follows:

- Risk of accidents and use of hazardous substances;
- Risk of road-haulage accidents;
- Risk of interruption or damage to the process or objects;
- Risk of natural disasters;
- Risk of accidents as a result of physical impact.

Prevention measures and emergency response include preparation of an emergency response plan. A detailed emergency response plan that would provide public health safety, protection of environmental media and sustainable development of the municipality of Bosilovo and the region as a whole should be developed in addition to the construction projects for the mineral processing facility. The emergency response plan should be developed in compliance with the prescribed requirements and should follow the principle “Raising Awareness and Preparedness for Emergencies at Local Level” (APELL for Mining).

Apart from these, accident prevention and mitigation plans for the basic processing installations – open pit, mineral processing facility, chemical laboratory, tailings management facility, and industrial area should also be developed and approved.

Emergency response plans should be developed by the chief engineers and unit managers, agreed upon with the head of the rescue service and acknowledged by the company CEO. Emergency response plans should be studied by and agreed with the municipality of Bosilovo in order to carry out joint activities in emergency situations.
PROPOSED MEASURES FOR ENVIRONMENTAL PROTECTION

The “Ilovitza open pit” project could operate in compliance with the basic measures to prevent the negative impact on the environment and public health set forth in the EIA. These measures have been prepared and generally follow the directions of the following documents: “EC Project Directive on Mine Waste Management (2003) 319, Final Version of 02.06.2003”, the related comparative document containing directions for “The Best Available Techniques on Mining Activities Tailings and Waste Rock Management (BREF code MTWR)”, the comparative document containing directions for “The Best Available Technologies for Non-Ferrous Metals”. Also, these measures comply with the valid laws and regulations governing the mining and environmental protection in the Republic of Macedonia. The measures have been planned for the basic project stages – planning, construction, operation, and rehabilitation. Also, the effect of use of the recommended measures has been estimated.

Air

The measures that will minimise the emissions from pit operations and the dust and fume emissions from blasting include:

- Use a suitable and efficient blasting method, and explosives that generate smaller quantities of toxic fume;
- Ensure personnel health and safety at work when exposed to a potential risk of explosive environment, in compliance with legislation and bylaws (law on occupational health and safety, “Official Gazette of the Republic of Macedonia”, No. 92/07);
- Focus on provision of personal protective equipment to employees - dust and gas masks, hearing protection, helmets, work clothing and footwear, gloves;
- Ensure monitoring of emissions of fumes and dust after blasting to enable assessment of the health risk to employees and residents of neighboring settlements – Ilovitza, Shtuka, Sushitza.
- Apply regular sprinkling-based dust suppression to minimise dust levels in the air in the active areas where mining operations take place – pit operational areas, industrial facilities and the haulage links between them. Roads must be sprinkled consistently at regular intervals;
- Maintain a protective green belt around roads and operational areas, and rehabilitate redundant roadways;
- Ensure supervision of dust control in the crusher and process plant, including control over the operating condition and functioning of the sprinkler and/or dust collection systems;
- Factor the local meteorological features into the blasting schedules in view of limiting the impact on the nearby villages;
- Ensure that haulage vehicles are not overloaded with bulk material and/or final product, and that they have a cover securely fastened over top;
Waters

1. Any project involving use of water bodies and/or abstraction of water may proceed only after issuance of the relevant permits.
2. A water monitoring network must be established to cover both surface and ground water, and the water abstraction systems adjacent to the project site.
3. Due to the high public interest, the monitoring project should be discussed with the local community to clarify any and all issues before its submission and also during its preparation.
4. All components of the recycling water system such as collecting sumps, pipework and pumps should be maintained in good operating condition.
5. It is recommended to undertake an additional site water supply survey focusing on the siting of the proprietary abstraction well or water collection dam and to ensure the facility is adequately protected against the torrential flows of the surrounding rivers.
6. The watercourses of Ilovichka (Jazga) and Shtuchka River should be adequately regulated; their watercourses should be directed outside the mining operation zones which would not be affected by possible acid rock drainage from the waste rock and the tailings management facility;
7. Collection channels should be sitted around the waste rock and the tailings management facility to collect and direct the acid rock drainage to the processing facility.

Project Geology

1. Strict compliance with the legal requirements pertaining to protection of the geological environment and primarily:
   • Law on mineral resources (Official Gazette of the Republic of Macedonia, No. 24/07, 88/08, 52/09, 6/10, 158/10, 53/11);
   • The Book of rules on the contents of geological documentation required for conducting detailed geological exploration (Official Gazette of the Republic of Macedonia, No. 138/07);
   • The Book of rules on the classification and categorization of solid minerals and keeping evidence (Official Gazette of Yugoslavia, No. 53/79);
   • The Book of rules on the contents of mine designs (Official Gazette of the Republic of Macedonia, No. 128/07);
   • The Book of rules on the technical prescriptions for surface mining of mineral deposits (Official Gazette of Yugoslavia, No. 4/86 and 62/87);
   • The Book of rules on the technical prescriptions for surface mining of construction rock (decorative rock), technical rock, sand, and gravel and processing of construction rock (Official Gazette of Yugoslavia, No. 11/86);
   • Other technical regulations on mining and geology.
2. Strict compliance with the Life of Mine Plan and the annual mining and processing projects and the mine closure and rehabilitation projects.
3. Additional ABA testwork and metal leaching tests on tailings samples to confirm the tailings properties.
Soils

- Removal of topsoil where possible and placement of the soil material on a dedicated stockpile to enable its re-use for rehabilitation purposes
- Strict movement of construction equipment and haulage vehicles on the planned roads.

Biodiversity

Project construction

- Keep construction works within the respective design footprints. Do not disturb areas outside the approved construction site footprints;
- Vehicles must drive only on approved roads that have clear and permanent signage. Traffic is not allowed off the approved roads and courses to the construction sites;
- Supervise implementation of construction and engineering works to ensure maximum protection of natural vegetation and habitats;
- Ensure that the following impacts are minimised as much as practically possible during project construction: soil stripping and removal, removal of ecotonic communities (transition areas between forest and grassland, plane and hill), grass and brush clearing;
- Employ efficient dust control measures across the project site, especially on the new courses (not having hard surfaces), and prevent pollution on the roads from oils, fuel and hazardous chemicals;
- Prevent spillage of fuels and oils from the construction equipment during project construction and operation;
- Avoid unnecessary clearing of old hollow trees to preserve the existing day-shelters of bats;
- Avoid unnecessary clearing of grass and brush vegetation to preserve the existing feeding habitats of bats;
- Provide training to the personnel engaged in project construction and subsequently in project operation and maintenance of equipment and infrastructure to raise their awareness of the impact mitigation measures.

Project Operation

- Ensure no blasting occurs outside the approved schedules as part of the Mine Life Plan and the annual mining and processing projects;
- Restrict all traffic of vehicles, mobile equipment and people to the roadways designated for the respective project activities;
- Fire blasts during the daytime hours only;
- No disposal of any household waste that could attract animals;
- Observe fire safety rules and regulations, and do not use fire for vegetation clearing.
Project closure

- Implement the rehabilitation measures as set out in the Closure Plan after shutdown of operations;
- The selection of plant species for biological rehabilitation must be harmonised with the native vegetation. No invasion of alien plant and vegetation species in the protected areas. Use of native species for rehabilitation always when possible;
- Technical rehabilitation of disturbed areas for revegetation (planting of grass and tree vegetation, fertilizer application and watering) and active aftercare over the first 3 years to ensure a full vegetation cover develops;
- Ensure suitable agricultural rehabilitation (ploughing, harrowing, seed-sowing, rolling, mineral fertilizer application and watering) of disturbed areas designated for agricultural use (mostly roads) and active aftercare over a 5-year period to restore land productivity.

Waste

Project construction

- The contracted construction company must arrange contract delivery of the generated hazardous wastes to persons or companies that hold a permit for transport, temporary storage, re-use and/or treatment (detoxification) of wastes under the Law on waste management (Official Gazette of the Republic of Macedonia, No. 68/04, 71/04, 107/07, 102/08, 134/08 and 09/11) or an IPPC Permit;
- In case of accidental (uncontrolled) spillage of oil or other pollutants, any contaminated soil and rock must immediately be removed and hauled to a suitable waste disposal site that is permitted to accept such wastes;
- The soil material removed from the pit and the other sites must be placed on a designated soil stockpile;
- The waste rock from overburden removal (during initial development of the pit) must be stockpiled within the waste rock facility footprint;
- The wastes generated from the construction and engineering works must collected separately and kept in temporary storage areas until removal from the site for subsequent treatment;
- Mineral-based non-chlorinated hydraulic oils and mineral-based non-chlorinated engine, gear and lubricating oils must be collected in a manner that enables their recycling – in closed, chemically resistant and spill-proof containers that are properly labeled and stored indoors;
- Only vehicles and mobile equipment in good operating condition must be used to transport hazardous and process wastes on and out of the construction site;
- Solid household waste must be hauled and disposed of on a landfill that is permitted to accept such wastes.
Project Operation

• The mine waste from the open pit and the process plant must be transported directly to the designated disposal facility;
• Waste oil must be collected in a manner that enables their recycling – in closed, chemically resistant and spill-proof containers that are properly labeled and stored;
• Wastes must be collected in a structured manner in compliance with the environmental regulations;
• Access to drums/containers for hazardous wastes must be restricted to authorized personnel only;
• Only vehicles and mobile equipment in good operating condition must be used to transport hazardous and process wastes on and out of the site;
• Transport of hazardous wastes - only in closed steel drums/containers;
• Waste shipment for treatment/detoxification must be contracted out only to companies that are certified or holders of an IPPC permit for waste handling for treatment;
• Fluorescent tubes and other mercury-containing waste must be stored separately from other waste types, on a temporary storage site where sulfur must be available at all times.

Hazardous Substances

The oil of the mining equipment (excavators and drill rigs) must be changed using a service vehicle equipped with an oil-changing unit. The oil-changing unit is be connected to the excavator/drill rig oil/lube system via Euro connectors. The oil is recharged/replaced by extracting the waste oil and pumping fresh oil in via the Euro connectors. Filters must be encapsulated in steel casings. The waste oils must be stored in compliance with the legal requirements until shipment by a contracted company that is certified or a holder of an IPPC permit for waste oil treatment.

Heavy equipment must be provided with an oil pressure relief system to prevent spillage of oil in case of a hose failure. The excavator (shovel) must be provided with a centralized lubrication system that is completely sealed to prevent any grease spills.

Only suitable fuel pumping equipment must be used for equipment refueling to minimise the risk of spills and pollution.

Noise

Project Construction and Operation

• Carry out construction works during the daytime hours only;
• Ensure good organisation on the site to reduce the duration of environmental noise impacts;
• Set a vehicle speed limit of 30 km/h when driving through or past residential areas;
• Surveillance monitoring of the noise levels from the crusher that reach Ilovitza, Shtuka, and Sushitzha villages at nighttime. If the noise limits are reported to be exceeded, a noise screening structure should be set up west and south of the crusher in the direction of the villages. A suitable approach is to construct a bund from unused rockfill and earthfill materials. Such a structure is easy to rehabilitate at the closure stage and blends well in the landscape.

**Cultural, historical, and archaeological heritage**

There are no significant discovered or undiscovered archaeological areas or locations of cultural heritage within the project location which would be an obstacle to the development of project activities.

If during project construction or operation artefacts or indications of potential archaeological sites are discovered, the project work will be stopped at the discovery sites; those sites will be fenced, and the Cultural Heritage Directorate at the Ministry of Culture will be notified; Teams of archaeologists will be brought to the site to carry out the investigation and conservation processes.

**Health and Hygiene Aspects**

**Preventive Measures for Protection of Personnel Health**

The following key requirements to occupational health and safety may be listed:

• All excavator and bulldozer operators should wear ear protection;
• Workers should use anti-vibration safety gloves and mats;
• Appropriate protection should be provided to keep hands dry and warm during cold periods;
• Fans should be installed in the cabins of excavators and bulldozers during the warm summer days;
• Workers should be provided with workwear that is appropriate for the season;
• Personnel should undergo regular medical checkups for early identification of work-related diseases.

All preventive care requirements must be complied with in relation to potential health risks, namely:

• Excessive dust levels involve a risk factor for the development of lung diseases due to the irritating effect of dust, e.g. rhinitis, chronic bronchitis and similar complications, and also for the development of occupational dust-related pathology.
• Implementation of all technical and medical preventive measures will be of utmost importance for employee health protection;
• Compliance with all technical requirements for general vibrations in bulldozers and heavy trucks must be achieved;
• An ergonomic work/rest schedule must be implemented;
A shift-based work cycle demands promotion of certain healthcare measures and ergonomic work/rest schedule for the workers on site including the crusher section;

All preventive measures need to be implemented to ensure employee health and safety by delivery of equipment operating safety instructions;

Ensure employee protection against risks of exposure to chemical reagents at work, especially when working with flotation reagents.

**Preventive Measures for Protection of Public Health**

Based on industrial hygiene experience, the major factors that are potential health risks for the population in areas of open pit ore mining, hauling, crushing, flotation, and tailings disposal, are related to:

- Noise and vibrations;
- Air emissions of dust and exhaust from vehicles;
- Potential pollution of soils, surface and ground water.

The current project is very similar to the existing operational mining and quarrying projects because it involves open-cut mining and primary (flotation) processing of the mineral resource. This type of operation has a typically intensive operational cycle of mining and processing of large resource tonnages to produce concentrate of sufficient quantity that ensures cost-efficiency of the project. That involves extraction of large volumes of rock material, frequent blasting, consumption of relatively large amounts of explosives, continuous site operation (24/7), generation of large quantities of mine wastes, etc. The project proposal considers a relatively small-scale open pit operation with not more than two blasts per week. This substantially minimises the risk to the health of the workers and the local public.

1. The main sources of *noise and vibration emissions* are the open pit operations including ore handling and the crushing operations. The hilly topography of the region is not conducive to free propagation of high equivalent noise and vibration levels. The Investor must implement noise mitigation measures to reduce impact on human health:

   - The explosive charges must be calculated and designed to ensure compliance with the requirements for flyrock safety distance from the blast. That would not only limit the noise generation within the region as a result of the reduction in the mining and throughput tonnage, but also have a positive health effect from the reduction of the dust and exhaust emissions to the adjacent villages.
   - The noise protection should be considered and planned separately taking account of the applicable noise limits, the local topography, the type of the site/area subject to protection, its location relative to the noise source, and other factors. The Book of rules on the limit values of environmental noise levels (Official Gazette of the Republic of Macedonia, No. 147/08) sets out the limits for the environmental noise levels which should not be exceeded in areas differentiated in accordance with the degree of noise protection (Table 4.5 of the EIA).
2. In terms of **dust and exhaust/fume pollution**:  

- The Investor should perform monitoring of dust (PM$_{2.5}$; PM$_{10}$ and total dust) and gas (sulphur and nitrogen oxides) levels in the air prior to commissioning and during project operation. The monitoring should cover nearby settlements including the municipal centre of Bosilovo;  
- Regular cleaning and maintenance of the on-site and off-site roadways will considerably lower the concentration of dust including fine particulates in the ambient air;  
- Sprinkling of the operational areas and site roadways must be scheduled in dry and windy conditions;  
- The existing woodlands must be preserved as much as practically possible. Green belt protection should be considered around project roadways and operational areas.

3. **In terms of the health risk of soil, surface water and groundwater pollution**:  

From hygiene point of view, it is especially important that:  

- The watercourses of Ilovichka (Jazga) and Shtuchka River should be adequately regulated; their watercourses should be directed outside the mining operation zones which would not be affected by possible acid rock drainage from the waste rock and the tailings management facility;  
- Collection channels should be sitted around the waste rock and the tailings management facility to collect and direct the acid rock drainage to the processing facility;  
- Monthly monitoring of the groundwaters upstream and downstream of the tailings management facility and waste rock and of the Ilovichka and Stuchka rivers water quality.

**Plan for Implementation of the measures for prevention, reduction and mitigation of environmental impacts**

The plan includes the operational project phases – construction, operation, mineral processing, waste and flotation tailings disposal. Its primary focus is on:  

- Daily control on the operation of heavy equipment: excavators, trucks, dozers, graders, front loaders, etc. in order to prevent contamination of project area with oil derivatives;  
- Dust control in dry weather conditions by sprinkling the operational areas of the open pit, waste rock stockpile and roadways between them, where the roadways must be sprinkled on a regular basis;  
- Regular monitoring of nitrogen oxide and dust levels after blasts near the open pit and in the adjacent villages;  
- Use of wet drilling systems in order to suppress the dust emissions, including the particles smaller than 10 µm;
• Regular monitoring of trucks loaded with ore and overburden in order to prevent the spillage of material during haulage within the mining operations zone;
• Compliance with the mine waste management and treatment procedures and prevention of waste disposal on the mine site by other operations or companies.

The plan will be updated on a regular basis during the mine operation in order to take into consideration any new specific conditions which might occur at the open pit.

The compilation of the proposed key measures for prevention of negative impacts on the environment and public health as well as the Plan for implementation of those measures is presented in detail in the EIA.
MONITORING AND CONTROL SYSTEM

So as to satisfy the statutory requirements for internal monitoring, and thus allow for efficient and cost-effective successful implementation of the planned tasks, it is necessary to develop an appropriate monitoring program that would be part of the Environmental Management System (EMS).

When designing the monitoring program, it is necessary to take into consideration a number of factors. The factors include climate diversity, ecosystems, land utilization and topography. Social factors should also be considered in the design and the monitoring as they have significant impact on the management of the environment.

The investor should plan for monitoring during all stages of project implementation – construction, operation and closure and rehabilitation.

The scope of the Environmental Monitoring Program for the open pit Ilovitza covers:

- Weather monitoring;
- Air monitoring including air quality and fugitive (not organized) emissions from point sources;
- Monitoring of noise and vibrations from blasting;
- Waters monitoring – surface waters, groundwaters and wastewaters;
- Waste monitoring – mining waste, waste from processing of mineral raw material, hazardous waste, construction waste and municipal (household) waste;
- Soils monitoring;
- Biodiversity monitoring.

The Environmental Monitoring Program is available in full detail in Annex 10 to the EIA. The position plan for monitoring stations is presented in Annex 11 to the EIA.
INFORMATION ABOUT TECHNICAL DEFICIENCIES AND NON-EXISTENCE OF APROPRIATE EXPERT KNOWLEDGE AND SKILLS OR ABOUT INABILITY TO COLLECT APROPRIATE DATA

The following deficiencies and/or uncertainty of data arose during the elaboration of the EIA:

• All technical parameters associated with the project construction, mining, processing and beneficiation of ore, as well as the disposal of mine waste are in the conceptual phase. Detailed technical documentation for these parameters does not exist. Hence, all analyses and consultations related to these project stages were done based on assumptions, or by applying different assessment methods and using comparable data from similar operations worldwide.

• The current situation of the environmental parameters (air, water, soil quality) in the area subject to assessment is not familiar in detail, considering that in the described area there are no monitoring stations for regular monitoring of these parameters.

Based on the forgoing, a conclusion can be drawn that it is necessary to apply the 'principle of precaution' to all activities for which data is lacking. For those cases for which there is not enough data, authors suggest the development of additional analyses or separate EIAs.

Nevertheless, with respect to the scope and type of activities that were assessed, it could be concluded that there were no deficiencies that could adversely impact the scope and the content of the study, and that existing data is, in general, sufficient for the elaboration of the EIA.
PROJECT JUSTIFICATION

The Ilovitza Copper and Gold Open Pit project lays down acceptable requirements for the feasibility of the project and the protection of the environment during the operation. The open pit will be located on a relatively small area, the ore will only undergo primary processing at the project site, with acceptable beneficiation of the important metals into copper concentrate containing gold, silver and molybdenum as a final product for further treatment. The project anticipates an effective and environmentally-friendly method for stockpiling mine waste that includes depositing waste rock in a dedicated waste rock stockpile and flotation tailings in a Tailings Management Facility (TMF). The proposed solutions and measures will reduce the emission levels that influence the environment and the local communities, significantly under the maximum allowed concentrations.

The majority of the work force under the project is planned to come from the local communities (90% of the workers are expected to come from the municipality of Bosilovo). After the completion of the operations at the Ilovitza open pit, the local staff will represent highly qualified potential for employment in the mining industry throughout the country.

The expected positive effects from the project are mainly related to the problematic areas in the municipality. The realistic views of the people in the municipality of Bosilovo take into consideration the circumstances i.e. there aren't serious prospects in near future for overcoming the economic stagnation and the region is dependent on agriculture. A significant investment such as the planned Ilovitza open pit project would have a direct positive economic effect and will create conditions and help in providing resources for further development of other industries.

Non-implementation of the project is not only an unrealistic option for the development of the region, but will also lead to significant loss and limitation of economic development, fiscal revenues, direct and indirect employment, living standards and income, local economic development and migration.