

# Environmental Monitoring Program

Ada Tepe Prospect  
of the Khan Krum Deposit, Krumovgrad  
Municipality



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Appendix 2	Location map of the ground water monitoring stations; Location map of the surface water and wastewater monitoring stations;
Appendix 3	Location map of the blasting vibrations impact and noise monitoring points;
Appendix 4	Location map of the soil monitoring points;
Appendix 5	Mine waste monitoring and sampling plan, pursuant to EN 14899 standard.

## LIST OF ABBREVIATIONS

BMMEAD - Balkan Mineral and Mining EAD  
AWS - Automated Weather Station  
BD-EA - East Aegean Basin Department  
As - Arsenic  
Cu - Copper  
IMWF - Integrated Mine Waste Management Facility (IMWF).  
EBRD - European Bank for Reconstruction and Development  
EIA - Environmental Impact Assessment  
EMP - Environmental Monitoring Program  
EMS - Environmental Management System  
EP - Environmental Procedure  
EU - European Union  
EAD - Single Shareholding Company  
Fe - Iron  
LHP - Local Hydrochemical Program  
m - metre  
m<sup>2</sup> - square metre  
m<sup>3</sup> - cubic metre  
m/s - metre/second  
mg - milligram  
Mg - Magnesium  
Mn - Manganese  
MoEW- Ministry of Environment and Waters  
NO<sub>x</sub> - nitrogen oxides  
Pb - Lead  
REWI - Regional Environment and Waters Inspection  
S - Sulphur  
MAC - Maximum Allowable Concentration  
WTP - Wastewater Treatment Plant  
Zn - Zinc  
E - east  
W - west  
N - north  
S - south  
SE - southeast  
SW - southwest



NE - northeast

NW - northwest

## 1. INTRODUCTION

**The Environmental Monitoring Program (The Program) of Balkan Mineral and Mining EAD (BMM EAD or the Company)** has been prepared in connection with the Investment Project Proposal for Mining and Processing of Gold ores from Ada Tepe Prospect, Khan Krum Gold Deposit, and the ongoing EIA procedure in conformity with the Bulgarian environmental legislation and European Directives.

The program is prepared at a project proposal stage, therefore it is subject to mandatory update three months prior to commissioning of the mine site. The program update will enable the modification and confirmation of the suggested monitoring stations in order to be fully compliant with the future working project.

The monitoring of Integrated Mine Waste Facility (IMWF) is included in the Mine Waste Management Plan in compliance with the URA and Chapter Eight of the Regulation on specific requirements for management of waste from exploration, production and processing of underground resources. This program includes as a separate appendix The mine waste monitoring and sampling plan, prepared in conformity with EN 14899 standard.

The main objectives of the monitoring program are as follows:

- Providing reliable measurements of environmental parameters in the mining operations area;
- Collection, reporting and analysis of environmental data;
- Control and prevention of environment pollutions;
- Environmental Management System (EMS) Performance Testing;
- Assessment of EMS efficiency;
- Provision of information to the state authorities and the stakeholders on all environmental issues.

BMM EAD Environmental Monitoring Program includes:

- Weather Monitoring;
- Monitoring of air, including the ambient air quality and non-fugitive emissions from point sources;
- Noise and blasting vibrations;
- Waters - surface water, ground water and wastewater;
- Wastes - mining, processing, hazardous, construction and domestic wastes
- Soils;

- Biodiversity.

## **2. DEFINITIONS**

### **2.1. Environment**

Environment - a complex of natural and anthropogenic factors and components that are interdependent and affect the environmental balance, the quality of human life and the cultural and historical heritage.

### **2.2. Environmental Monitoring**

Environmental monitoring - the collection, evaluation and summarization of environmental data by continuous or periodic monitoring of certain qualitative and quantitative indicators characterizing the state of environmental components and their modification as a result of the impact of natural and anthropogenic factors.

### **2.3. Environmental pollution**

Environmental pollution - a change in the environment qualities resulted from emergence or introduction of physical, chemical or biological factors by natural or anthropogenic sources in the country or abroad, regardless whether they exceed the effective national standards.

### **2.4. Environmental damage**

Environmental Damage - type of alteration of one or more environmental components, which is followed by deterioration of people's quality of life, biodiversity impoverishment or difficult restoration of natural ecosystems.

### **2.5. Impact**

Impact - any environmental impact that can be caused by the implementation of the investment proposal for construction, operation or technology, including impact on the human health and safety, flora, fauna, soil, air, water, climate, landscape, historical monuments and other material assets, as well as the interaction between these factors.

### **2.6. Affected public**

Affected public - the community (one or more individuals or legal entities and their associations, organizations or groups, established under the state legislation) which is affected or has the potential to be affected, or which holds an interest in the procedures of approval of plans, programs, investment proposals or in the decision making for issuance or update of permits as per the regulations or the permit requirements, including the environmental non-government organisations, established under the state legislation.

### **2.7. Allowable Emissions Limit**

Allowable Emission Limit - specific mass of particular substance expressed by the respective specific parameters as concentration and/or level of emissions which cannot be exceeded during one or more preliminary defined time periods. The allowable emissions limits can be determined for specific

groups, classes or categories of substances as well.

#### 2.8. Environmental Quality Standards

Environmental quality standards shall mean the specific requirements under the environmental legislation that must be met at certain time in the environment as allowable limits for harmful substances content in ambient air, standards for quality of waters in the water bodies, standards for quality of other environmental components and standards for allowable limits of the factors, which pollute or damage the environment.

### 3. RESPONSIBILITIES

#### 3.1. Environmental Engineer

The Environmental Engineer shall be responsible for the preparation and implementation of the Environmental Monitoring Program. He/she shall be responsible for the preparation of all monitoring-related documents as protocols, reports, data, etc. to be submitted and/or approved by the competent authorities.

#### 3.2. Manager Environment and Sustainable Development, Bulgaria

Manager Environment and Sustainable Development, Bulgaria shall be responsible for verification and approval of each version of the Environmental Monitoring Program and the documentation related to reporting, prior to its submission to the respective competent authorities or stakeholders.

### 4. WEATHER MONITORING

According to the international conventions and the Bulgarian legislation all industrial operations must have in place a system for control of environmental impact. The weather monitoring is an integral component of that system, as the ambient air is the media where gas and dust emissions disperse.

The weather monitoring is an integral part of the system for control of environmental impact. In the case of opencast mining, the ambient air is the media where gas and dust emissions disperse. The conditions for that dispersion depend on the specific weather parameters which requires awareness of those parameters at all times. In this connection, an automated Weather Station equipped with a radio communication will be built and commissioned.

The Weather Station will send real time data about the major weather components.

#### 4.1. Location of the Weather Station

The weather station site will be set up near the open pit. (Appendix 1).

#### 4.2. Monitoring parameters and frequency

- Temperature and humidity of air;
- Atmospheric pressure;

- Wind velocity and direction;
- Amount and intensity of precipitation;

All parameters will be measured **24 hours** and data will be automatically recorded.

#### 4.3. Measurements and Equipment

It is planned to purchase an automated weather station MS&E-3RD (or a similar), that is designed for professional applications in the field of meteorology, environmental protection and other activities related to monitoring of the main weather components: air temperature, relative humidity, air pressure, wind velocity, wind direction, amount and intensity of precipitation. It is used for remote measurements in cases when the distance between the station and the data receiving point vary from a few hundred meters to a few hundred kilometers. It operates in real time mode as the communication with the receiving center is made by means of digital data exchange via VHF radio channel. This type of station may operate not only as stand-alone system but also in a network with 64 weather stations on one radio channel. Data collection from the stations in the network is fully automated. The reliable operation is assured for ambient air measurements of minus 25 ° C to plus 60 ° C and relative humidity up to 99% (without condensation). The picture below shows similar weather station.



*Example of AMC MS&E-3RD weather station*

#### 4.4. Reporting

- Weekly reports:
- All weather data shall be used for preparation of: monitoring and design works, the blasting works plans including wind speed and direction, IMWF water balance and the open pit.

## 5. MONITORING OF AMBIENT AIR

### 5.1. Air Pollution Sources

#### 5.1.1. Area sources

CO, NO<sub>x</sub>, SO<sub>2</sub>, CH emissions and dust from area sources which are subject to control and monitoring can be classified as:

- Emissions generated by vehicle transport and moving on roads outside the mine site;
- Emissions generated load handling activities related to the mining and storage of ore, waste rock, low grade ore and the related mobile equipment operation.
- *Blasting operations - instant release of pollutant in the air, twice per week.*

#### 5.1.2. Emissions from Point Sources

The point sources generate mainly dust emission. PM10 measurement is envisaged at the crusher.

### 5.2. Type and frequency of ambient air monitoring

Measurements of the air quality will be carried out under the Regulation 7 on the Assessment and Management of the Ambient Air Quality (Regulation 12/15.07.2010 on the Emission Limits for Sulphur Dioxide, Nitrogen Dioxide, Fine Particulates, Lead, Benzene, Carbon Monoxide and Ozone in the Air, promulgated in the SG, issue 58/30.07.2010, effective as of 30.07.2010; Regulation 2 on the maximum allowable surface pollution of open areas - total dust (\* comparison was made against the norms set in Regulation 2, since no other applicable norms are in place in the current regulations).

Ambient air monitoring of the points listed in Table 5-2 will be carried out ***at least once a year during the dry period of the year*** by the Executive Environment Agency (EEA) or any other accredited laboratory.

The parameters measured are: NO, NO<sub>2</sub>, SO<sub>2</sub>, H<sub>2</sub>S, O<sub>3</sub>, NH<sub>3</sub>, CO, CH<sub>4</sub>, non-methane hydrocarbons, PM10 - dust and weather parameters: temperature, relative humidity, air pressure, wind velocity, wind direction.

Table 5-1: Ambient air monitoring				
Place of measurement	No.	Points	Parameters	Intervals
town of Krumovgrad, 32 Saedinenie st.	1	1	According to the listed above	At least once a year
Pobeda Village	2	1		

Soyka Village or Varhushka Village	3	1		
Chobanka Village	4	1		
Kupel Village	5	1		

*\*Map including all points' locations is presented in Appendix I*

BMM EAD will carry out internal monitoring of dust concentrations in ambient air at the populated areas, as presented in Table 5-2. The monitoring comprises measurements of particulate matter - PM 10 and deposited dust.

Place of measurement	Points	Parameters		Frequency / Duration	
	No.	PM 10 mg/m <sup>3</sup>	Dust deposition	PM 10 mg/m <sup>3</sup>	Dust deposition
town of Krumovgrad (including residential district Izgrev	AA 01	Yes	Yes	Continuous	Continuous
Pobeda Village	AA 02	Yes	Yes	Continuous	Continuous
Soyka and Varhushka Villages	AA 03	Yes	Yes	Continuous	Continuous
Sinap Village	AA 04	Yes	Yes	Continuous	Continuous
Kupel Village	AA 05	Yes	Yes	Continuous	Continuous

*\*Map including all points' locations is presented in Appendix I*

5 mobile dust meters are envisaged for measuring the dust concentration in the ambient air (PM10). The measurement method will be nephelometric as this would allow real time (mg/m<sup>3</sup>) measuring of ground-level dust concentrations for a short period of time (days to weeks).

The deposited dust (expressed in mg/m<sup>2</sup>) will be measured using four (5) pieces of fixed equipment (graduated funnel). The deposited dust measured at points near the dust sources and settlements for a total of 45 days within at least two years (from the equipment installation) till the end of the mine life.

### 5.3. Analytical Methods

The external monitoring will be carried out using the standards and methods within the laboratory's scope of accreditation.

Internal dust measurements of PM10 will be based on the EN 12341 standard.

### 5.4. Measurements and Equipment

Air measurements will be carried out by:

- EEA or any other accredited laboratory

- Internal dust measurement equipment:

- mobile dust meter;
- measuring instrument for sediment dust.

Information on the parameters of the internal measurement instruments will be included in this monitoring program prior to commencement of site construction and after their purchasing.

### 5.5. Reporting

- EEA results will be presented in protocols according to a internal laboratory format.
- Internal monitoring results will be presented in protocols according to a internal format of the Company.
- Those protocols will be prepared in two identical copies: for the Company and for EEA and REWI - Haskovo.
- The summarized version of the conducted analysis will be available at the PR Department (Info Centre).

## 6. MONITORING OF NON-FUGITIVE EMISSIONS FROM POINT SOURCES IN THE AMBIENT AIR

### 6.1. Emission sources

The crusher is a non-fugitive emissions point source.

The location of this point is shown in Appendix 3.

### 6.2. Frequency and Type of Measurement

In connection with requirements under Regulation No 6/26.03.1999 on the Terms and Procedures for Measuring Harmful Substance Air Emissions from Sites with Point Sources, SG issue 31/1999, internal regular measurements shall be carried out in compliance with the information presented in Table 6.1.

Table 6-1: Monitoring of non-fugitive emissions from point sources				
Emission sources/	internal code No.	Points	Parameters	Intervals
Crushing section	EAP 01	1	Dust	Biyearly

*\*Map of this point is presented in Appendix 1*

The mass flow rate of harmful substances in the dust and gas emissions does not exceed the limits specified under Art. 43 and Art. 44 of Regulation 6/26.03.1999 on the Terms and Procedures for Measuring Harmful Substance Air Emissions from Sites with Point Sources, prom. in SG

31/6.04.1999, therefore it is subject to internal regular measurements at least once every two consecutive years.

The Company will perform internal measurements by an accredited laboratory, at least once per year.

**Gas flows (waste gases)** parameters will be determined as follows:

- Geometric size of the gas duct where the sampling takes place, mm;
- Average speed, m/sec;
- Temperature, °C;
- Manometric mode, mmHg
- Oxygen content, total %.

**Parameters of ambient air** determined during measurements:

- Air Temperature, °C;

Barometric pressure, mmHg

### **6.3. Methods of analysis used by the accredited laboratories**

The external monitoring will be carried out as per the standards and methods within the laboratory's scope of accreditation.

### **6.4. Measurement and Instrumentation**

The measurement will be carried out by an accredited laboratory.

Measurements of the harmful substances' emissions in the production gases will be taken after the treatment facility and before the exhaust facility.

### **6.5 Reporting**

- The results from the internal regular measurements shall be recorded in a template protocol according to the requirements under Regulation 6/26.03.1999.
- Protocols shall be prepared in three copies, as two of them shall be submitted to REWI-Haskovo and the Executive Environment Agency.
- Report on the measurements of environmental media shall be prepared in compliance with art. 39 of the Regulation and requirements under the European Pollutant Release and Transfer Register and submitted to REWI no later than one month after completion of the measurements. The report shall be prepared in soft and hard copies and submitted to the Director of REWI for approval.
- The internal measurements results shall be stored for eight years and submitted to the competent authorities on demand.

## 7. NOISE MONITORING

### 7.1. Types and sources of noise

#### 7.1.1. Industrial

- Crushing and grinding;
- Belt conveyors;
- Blast operations;
- Mobile equipment.

#### 7.1.2. Transport and haulage noise

- Mining equipment;
- Site supply with materials, transportation of concentrate, etc.

### 7.2. Type and frequency of ambient air monitoring

Measurements were carried out according to Regulation 6/26.06.2006 on the Environmental Noise Indicators of Time-Dependent Levels of Discomfort, Environmental Noise Limits, Methods for Assessment of Noise Levels and Negative Effects of Noise on Human Health.

Measurements of environmental noise in settlements is carried out on annual basis by the EEA or any other accredited laboratory at the points listed in Table 7-2. The parameters measured are: equivalent noise level. The general industrial noise at the Company site will be measured.

BMM EAD will apply its in-house monitoring at the same points.

Table 7-2: Noise monitoring				
Point No.	Place of measurement	Points	Parameters	Intervals
1	Krumovgrad - residential district Izgrev	1	Equivalent noise level (dBA)	Once a month
2	Soyka Village	1		Once a month
3	Varhushka Village	1		Once a month
4	Pobeda Village	1		Once a month
5	Kupel	1		Once a month
6	Bitovo Village	1		Once a month

*\*Map including all points' locations is presented in Appendix 3*

The monitoring shall be performed when the site facilities operate at peak capacity during the day and the night and in compliance with the Methodology for Measurement of the Total Sound Power Emitted into the Environment from an Industrial Operation and Measurement of the Noise Levels at the Point of Impact. The measurement will be carried out by an accredited laboratory.

### 7.3. Measurements and Equipment

The measurement will be carried out by an accredited laboratory by using the standards, methods and equipment of the accredited laboratory.

BMM EAD will perform internal measurements by means of mobile sound-level meter and hand-held acoustic analyzer.

### 7.4. Reporting

- EEA results will be presented in protocols according to a internal laboratory format.
- Those protocols will be prepared in two identical copies: for the Company and for EEA and REWI - Haskovo.
- The monitoring results in accordance with Art. 23 of Regulations 2/05.04.2006 on the Work of the National Environmental Noise Monitoring System.

## 8. WATER QUALITY MONITORING

### 8.1. General

The major water body receiving waste waters - process water from the process water reservoirs (in case water discharge is required) and treated domestic effluent is Krimovitsa River – Category II receiving stream.

In 2001 BMM EAD started the construction of water monitoring stations network for characterization of the condition of surface water and groundwater in the Ada Tepe area. Boreholes we carried out for environmental monitoring of groundwater. Over the years, some of them were damaged and others are not suitable for the purposes of this investment proposal.

It is envisaged that the monitoring network will include:

- Surface waters including receiving streams - 9 stations;
- Groundwater - 17 stations;
- Wastewater - 2 stations;

### 8.2. Emission sources

**Process water** - water generated by the open pit drainage and the IMWF seepage. Both streams will report to the Raw and Process Water Reservoir. Fresh water will be added to it in order to replenish water loss. Water from the Process Water Reservoir will be discharged into Krumovitsa River via pipeline.

**Domestic effluent wastewater** – generated by the showers, office premises and canteen. Domestic effluent wastewater will be discharged into Krumovitsa River after treatment in the domestic wastewater treatment plant located at the Process Plant area.

**Storm water** - site runoff from snowmelt and rainfall. Storm water will be directed to IMWF drainage channels and discharged into Krumovitsa River.

### 8.3. Local Water Monitoring Program (LWMP)

Regular monitoring for assessment of water quality in the Ada Tepe area will be conducted at 32 stations.

Samples are analyzed in terms of various parameters in order to characterise the type and level of impact on the water quality as a result from the Company mining operations. Measurement of flow and static water levels at the monitored points will be performed in addition to the assessment of the quality properties of the water samples.

Table 8-1 shows the monitoring stations including their location, geographic coordinates and monitored parameters.

Таблица 8-1: Water monitoring stations					
Station No.	Type	internal code No. BMM EAD	Parameters	Sampling frequency	Note
1	Surface Waters	ESW 01	Temperature, LWMP	Once a month	Krumovitsa River - initial (at the Kessebir starter stream and Egrechka River confluence point) - background monitoring station
2	Surface Waters	ESW 02	Temperature, LWMP	Once a month	Krumovitsa River - 200m after the waste water discharge from Ada Tepe area - background monitoring station
3	Surface Waters	ESW 03	Temperature, LWMP	Once a month	Krumovitsa River prior to confluence with Kaldzhik valley - background monitoring station
4	Surface Waters	ESW 04	Temperature, LWMP	Once a month	Krumovitsa River after confluence with Kaldzhik valley - background monitoring station.
5	Surface Waters	ESW 05	Temperature, LWMP	Once a month	Kessebir starter stream - prior to confluence with Egrechka River - background monitoring station.
6	Surface Waters	ESW 06	Temperature, LWMP	Once a month	Egrechka River - prior to confluence with Kessebir starter stream - background monitoring station.
7	Surface Waters	ESW 07	Temperature, LWMP	Once a month	Buyuk Dere - prior to confluence with the Krumovitsa River - background monitoring station.
8	Surface Waters	ESW 08	Temperature, LWMP	Once a month	Kaldzhik Dere valley - at the bridge in Pobeda Village - background monitoring station.
9	Surface Waters	ESW 09	Temperature, LWMP	Once a month	Kaldzhik Dere - prior to confluence with the Krumovitsa River - background monitoring station.

Таблица 8-1: Water monitoring stations

Station No.	Type	internal code No. BMM EAD	Parameters	Sampling frequency	Note
10	Groundwater	EGW 01	Water level	Once a month	The monitoring station is set up in Kaldzhik Dere valley and covers groundwater running towards the Krumovitsa River, including the watershed of the entire west area of Ada Tepe.
			Chemical composition	4 times per annum	
11	Groundwater	EGW 02	Water level	Once a month	The station will be similar to station EGW 01 and will be used for monitoring of water levels. In case of pollution, the station will carry out chemical composition sampling.
12	Groundwater	EGW 03	Water level	Once a month	The monitoring station is set up in Kaldzhik Dere valley and covers groundwater running towards the Krumovitsa River, including the west slope watershed of the deposit.
			Chemical composition	4 times per annum	
13	Groundwater	EGW 04	Water level	Once a month	The station will be similar to station EGW 03 and will be used for monitoring of water levels. In case of pollution, the station will carry out chemical composition sampling.
14	Groundwater	EGW 05	Water level	Once a month	The monitoring station is set up on the west slope of Ada Tepe and covers groundwater running towards Kaldzhik Dere valley from the west slope watershed of the deposit.
			Chemical composition	4 times per annum	
15	Groundwater	EGW 06	Water level	Once a month	The monitoring station is set up a dry river bed and covers groundwater running towards the Krumovitsa River from the entire SW sector of Ada Tepe.
			Chemical composition	4 times per annum	
16	Groundwater	EGW 07	Water level	Once a month	The monitoring station is set up on the slope before Krumovitsa River gravels and covers groundwater flowing SW after the mining waste facility.
			Chemical composition	4 times per annum	
17	Groundwater	EGW 08	Water level	Once a month	The monitoring station is set up on the southwest slope after the mining waste facility and together with EGW 07 cover groundwater flowing SW after the mining waste facility.
			Chemical composition	4 times per annum	

Таблица 8-1: Water monitoring stations

Station No.	Type	internal code No. BMM EAD	Parameters	Sampling frequency	Note
18	Groundwater	EGW 09	Water level	Once a month	The monitoring station is set up on the west slope after the mining waste facility and cover groundwater flowing W after the mining waste facility.
			Chemical composition	4 times per annum	
19	Подземни води	EGW 10	Water level	Once a month	The monitoring station is set up between the open pit and the mining waste facility and covers groundwater south of the open pit.
			Chemical composition	4 times per annum	
20	Groundwater	EGW 11	Water level	Once a month	The monitoring station is set up east of the open pit on the east slope and covers groundwater flowing southeastward to the Krumovitsa River
			Chemical composition	4 times per annum	
21	Groundwater	EGW 12	Water level	Once a month	The monitoring station is set up in the east of the mining waste facility and covers groundwater flowing eastward after the facility towards Krumovitsa River
			Chemical composition	4 times per annum	
22	Groundwater	EGW 13	Water level	Once a month	The monitoring station is set up east of the open pit at the lower stretches of the east slope and covers groundwater flowing southward to the Krumovitsa River
			Chemical composition	4 times per annum	
23	Groundwater	EGW 14	Water level	Once a month	The monitoring station is set up in the east beneath the mining waste facility and covers groundwater flowing eastward after the facility towards Krumovitsa River
			Chemical composition	4 times per annum	
24	Groundwater	EGW 15	Water level	Once a month	The monitoring station is set up southeast beneath the mining waste facility and covers groundwater flowing southeastward after the facility towards Krumovitsa River
			Chemical composition	4 times per annum	

Таблица 8-1: Water monitoring stations

Station No.	Type	internal code No. BMM EAD	Parameters	Sampling frequency	Note
25	Groundwater	EGW 16 - An abstraction well	Water level	Once a month	The monitoring station is set up northeast of the open pit at the lower stretches of the east slope and covers groundwater flowing northeastward to the Krumovitsa River
			Chemical composition	4 times per annum	
26	Groundwater	EGW 17	Water level	Once a month	Set up north-northeast of the open pit at the lower stretches of the slope and covers groundwater flowing northeastward to the the Krumovitsa River. The borehole is self-discharging and the local residents have equipped it with iron pipes for watering purposes. The rusted pipes may have contaminated the samples.
			Chemical composition	4 times per annum	
27	Wastewater	EWW 06	Temperature, LWMP,	once a week	Collection sump at the open pit - the quality of water will be monitored as it will be returned back into process during the flotation and the gravity separation.
28	Wastewater	EWW 05	Flow rate	Continuous	South collecting sump of the IMWF - the quality and quantity of water will be monitored as it will be returned back into process during the flotation and the gravity separation.
			Temperature, LWMP	once a week	
29	Wastewater	EWW 04	Flow rate	Continuous	North collecting sump of the IMWF - the quality and quantity of water will be monitored as it will be returned back into process during the flotation and the gravity separation.
			Temperature, LWMP	once a week	
30	Wastewater	EWW 03	Flow rate	Continuous	Raw and Process Water Reservoir - process water quality and quantity will be monitored in view of the fact that the technology is water quality sensitive.
			LHP	once a week	
31	Wastewater	EWW 01	Chemical composition	On a monthly basis	Domestic wastewater treatment plant - entry point. Water quality and quantity will be monitored, as they are important in the subsequent biological treatment process.
32	Wastewater	EWW 02	Chemical composition	On a monthly basis	Domestic wastewater treatment plant - inlet. Data on the quantity and quality of water being treated will be monitored.

Appendix 2 presents the locations of the monitoring stations.

## 8.4 Type and frequency of monitoring

### 8.4.1. Continuous monitoring

The program envisaged continuous monitoring of water discharged from the raw and process water reservoir

and the outlet of the domestic wastewater treatment plant. Discharge pipelines will be equipped with metering devices that will measure the current amount and total amount of discharged water.

#### 8.4.2. Regular monitoring

Wastewater to be discharged in the Krumovitsa River will be sampled and assayed by the Company's on-site lab in accordance with Table 8-2. This will be analysed at least once a month by an accredited laboratory.

Table 8-2: Chemical analyses of wastewater		
Station №	Parameters analyzed	Intervals
25 Domestic wastewater treatment plant - outlet	pH, BOD <sub>5</sub> , COD, HB, total P, total N	Once a week by the Company's on-site lab;  Under the Discharge Permit but at least once a month by an accredited laboratory
30 Raw and Process Water Reservoir	pH, electrical conductivity, HB, COD, content of petroleum products, SO <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub> , As, Pb, Cr (VI), Fe, Hg, Ni, Zn, Cd, Cu, Mn	Once a week by the Company's on-site lab;  Under the Discharge Permit but at least once a month by an accredited laboratory
from 26 to 29 inclusive	pH, electrical conductivity, HB, COD, content of petroleum products, SO <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub> , As, Pb, Cr (VI), Fe, Hg, Ni, Zn, Cd, Cu, Mn	Once a week by the Company's on-site lab;  twice per year by an accredited laboratory

Surface water and groundwater in the Krumovgrad region will be analysed under Table 8-3.

Table 8-3: Chemical analyses of surface water and groundwater		
Station №	Parameters analyzed	Intervals
from No.1 to No.9 inclusive	pH, electrical conductivity, COD, HB, concentrations of Cu, As, Fe, Mn, Zn, Al, Ni, NH <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub> , SO <sub>4</sub> , PO <sub>4</sub> , Cl, Cr (VI)	Once a week by the Company's on-site lab;
from No.1 to No.26 inclusive	pH, total hardness, electrical conductivity, permanganate oxidation, NH <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub> , F, SO <sub>4</sub> , Na, Ca, Mg, Cl, PO <sub>4</sub> , petroleum products, NH <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub> , F, SO <sub>4</sub> , Na, Ca, Mg, Cl, PO <sub>4</sub> , Cu, As, Fe, Ni, Cd, Pb, Se, Cr (VI), Al, Zn, B, Sb, Mn, Hg.	Once a week by the Company's on-site lab;

Fresh water abstraction well in the Krumovitsa gravels (the Kessebir starter stream).	pH, total hardness, electrical conductivity, permanganate oxidation, NH <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub> , F, SO <sub>4</sub> , Na, Ca, Mg, Cl, PO <sub>4</sub> , petroleum products, NH <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub> , F, SO <sub>4</sub> , Na, Ca, Mg, Cl, PO <sub>4</sub> , Cu, As, Fe, Ni, Cd, Pb, Se, Cr (VI), Al, Zn, B, Sb, Mn, Hg.	Once a week by the Company's on-site lab;  Under the Discharge Permit but at least once a month by an accredited laboratory.
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The static water levels of groundwater in stations No.10 to No.26 will be monitored on a monthly basis.

Water stations from all stations will be sent for analysis by an accredited laboratory on an annual basis as a minimum.

### 8.5. Analytical requirements and method

#### 8.5.1. Instrumentation used

- Photometer

The photometer has filters for measuring the standard absorption of a light beam with simultaneous recording of all wavelengths.

Light source: Tungsten halogen lamp

Overall system control is carried out by using standard solutions with a certain content.

- Thermal reactor
- Analytical scales
- Samples oven
- Sand bath
- Vacuum pump
- Combined pH meter equipped with electrodes for measuring conductivity, redox potential and dissolved oxygen.

#### 8.5.2. Reagents

All reagents used are P.F.A. (pure for analysis).

#### 8.5.3. Method

Water shall be analysed under the following Bulgarian National Standards:

- BNS 3424/81 Method for determination of pH;
- BNS EN 27888/00 Determination of electrical conductivity (ISO 7888:1985);
- BNS 3775/87 Method for determination of total hardness;
- BNS 3413/77 Determination of oxidation;

- BNS ISO 7150-1/02 Determination of ammonia; Stage 1: Manual spectrometric method;
- BNS EN ISO 10304-1/09 Determination of dissolved anions by liquid chromatography of ions. Stage 1: Determination of bromides, chlorides, fluorides, nitrates, nitrites, phosphates and sulphates (ISO 10304-1:2007); ETC V3I1/7.2.3-9/02;
- BNS EN ISO 6878/05 Determination of phosphorus. Spectrometric method with ammonium molybdate ISO 6878:2004);
- BNS 15398/81 Method for determination of sodium;
- BNS ISO 6703-1/02 Determination of cyanide. Stage 1: Determination of total cyanide;
- BNS EN ISO 1483/07 Determination of mercury. Atomic absorption spectrometry;
- BNS EN ISO 11885/09 Determination of selected chemical elements by means of ICP-OES (ISO 11885:2007);
- BNS 12578/75 Determination of natural uranium content;
- BNS EN ISO 9377-2/04 Determination of hydrocarbon petroleum index. Stage 2: Solvent extraction and gas chromatography method (ISO 9377-2:2000).

## 8.6 Regulatory requirements

- Waters Act (prom. in SG, issue 67/1999).

Art. 130, par. 2 The persons, including Water and Sewerage Services Providers, owners or users of treatment plants, shall perform laboratory analyses and monitoring of the treatment plants' operation and record the results from the analysis and the monitoring under Art. 174 .

Art 174, par. 2 "Persons under par.1 shall store the measurements data for a period of 5 years.

- Wastewater and groundwater monitoring shall be performed in accordance with the requirements of Chapter 6 of Regulations 5/23.04.2007 on Water Monitoring effective as of 05.06.2007, issued by the MoEW, promulgated in SG Issue 44/ 5.06.2007.
- Regulation 6/09.10.2000 on Emission Limits for Harmful and Hazardous Substances in Waste Water Discharged in Water Bodies. (SG 93/2000).
- Regulation 7 on Parameters and Reference Values for Assessment of the Quality of Running Surface Waters prom. SG issue 96/1986).
- Regulation 9 on the Drinking and Household Water Quality prom. SG issue 30/2001).

## 8.7. Reporting

- The results from the internal regular measurements will be submitted to BD-EA Plovdiv and REWI Haskovo under the requirements of Art. 174 of the Waters Act.
- Record of the water quantities used from the fresh water abstraction well and the decant

waters discharged into the Krumovitsa River will be submitted to the East Aegean Basin Department according to the requirements under the future permits;

- Protocols from groundwater samples' chemical analyses will be submitted to the East Aegean Basin Department within 45 days from the year end.

## 9. WASTE MONITORING

### 9.1. Waste sources

29 types of wastes will be generated as a result of the present and future operations and ancillary activities on Company's site: 12 industrial wastes, 10 hazardous wastes, 2 of medical origin, 5 construction wastes and domestic waste. There are 3 types of Mining Wastes that are within the scope of Directive 2006/21/EC (wastes outside the scope of the WMA).

Wastes generated during the construction and operation of the site.

#### A/ Hazardous Waste

- Spent hydraulic oils
- Mineral-based non-chlorinated engine, gear and lubricating oils
- Oil filters
- Brake fluids
- Antifreeze fluids
- Batteries
- Wiping cloths, and protective clothing contaminated by dangerous substances
- Waste insulating and heat transmission oils
- Fluorescent tubes and other mercury-containing waste
- Packaging containing residues of dangerous substances

Waste oils will be collected and stored in closed steel drums or plastic containers that will be returned to the oil supplier.

All types of hazardous wastes will be stored in enclosed storage facility with concrete flooring, located in the storage area of the site prior to submission to a contracted entity licensed under the WMA.

Wastes from oil and mud traps will be stored in the traps until their capacity is filled and submitted to further treatment to a licensed contracted entity. Hazardous medical waste will be stored in the medical care centre. Clothes contaminated with oils will be stored in the central store.

A contract for wastes treatment will be concluded with a Company certified for waste management activities and licensed for handling of scrap metals. A contract shall be concluded with the oil supplier in the event that it has not established practice for subsequent utilisation of oil wastes, a contract with a company for utilisation of electrical and electronic equipment wastes and submission and acceptance of fluorescent and mercury lamps for treatment; a contract with a company for treatment and transportation of interceptor sludges.

Wastes of medical origin shall be transported for treatment to the nearest medical wastes treatment facility.

#### B/ OPERATIONAL WASTE

- Excess earth and rock material
- Mixed construction waste
- Iron and steel
- Wood
- Dust from treatment of the exhaust from ore crushing
- Dust bags
- Scrap
- Ferrous metal filings and turnings
- Discarded rubber belts
- Discarded electronic and electrical equipment; Sludges from treatment of domestic wastewater; Mixed construction wastes will be generated from renovation/rehabilitation of buildings across the minesite;

Wastes will be collected in dedicated places and containers located at the process plant. Containers will meet the requirements for separate collection of packaging wastes.

Operational waste will be temporary stored at a store yard constructed under the requirements for collection and sorting of waste.

Non-hazardous medical waste will be temporary stored in the medical care centre.

Electronic equipment will be temporary stored in a enclosed storage facility prior to submission to companies licensed for subsequent treatment of electrical and electronic equipment.

#### B/ MINING WASTE

The construction of the open-pit and the mining waste facilities will generate typical mining waste: top soil and other soil and rock material as part of the overburden removal. The mining and processing operations will generate waste rock and process tailings.

According to the provisions of the URA art. 22 d, par. 3: Whenever a waste-generating activity is subject to an EIA according to the provisions of the Environment Protection Act, the waste management plan under art. 22c, par. 2 becomes an integral part of the Investment Project. In this regard, we provide the Mining Waste Management Plan of Balkan Mineral and Mining EAD (BMM EAD). **A Sampling Plan is presented in Appendix 9 of the Mining Waste Monitoring Plan, developed in compliance with Standard EN 14899, pursuant to EC Resolution of April 30, 2009 (2009/360/EO) and Mining Waste Monitoring Plan;** The Sampling Plan is an integral part of this Environmental Monitoring Program.

#### C/ SOLID DOMESTIC WASTES

Municipal wastes will be generated over the construction and operation stages of the project (mine, process plan and associated project infrastructure). Solid domestic wastes will be generated from packaging:

- Paper and cardboard packaging
- Glass packaging;
- Metallic packaging
- Plastic packaging
- Inert construction materials.

Domestic wastes will be collected in containers. Domestic wastes collection and removal from site will be carried out by a licensed company.

## 9.2. Frequency and Type of Measurements

The quantity of the generated industrial and hazardous waste is determined by weighbridge. The quantities are reported in the Waste Log Book on a monthly basis.

Chemical analysis of waste oils will be carried out by companies interested in the oils subsequent treatment. Analysis will include determination of suspended solids and water content.

Domestic and construction wastes generated on the site of BMM EAD will be of standard type and will not be subject to chemical analysis. Their quantity will be determined by the number and the volume of transported containers.

## 9.3. Reporting

Reporting of the waste management activities complies with Regulation 9/28.09.2004 on the Procedures and Formats for Submission of Information about Waste Related Activities (prom. in SG, issue 65/2004). Annual reports on the generated industrial or hazardous waste are submitted to the REWI - Haskovo and the Krumovgrad Municipality.

## 9.4. Regulations

- Waste Management Act (prom. SG, issue 86/2003. )
- Regulation on the Requirements for Treatment and Transportation of Industrial and Hazardous Waste (SG 29/1999)
- Regulation 9/28.09.2004 on the Procedures and Formats for Submission of Information about Waste Related Activities (prom. SG issue 65/2004).

## 10. SOILS MONITORING

The values of analysed parameters in individual forest sites vary significantly depending on the specific combination of soil forming factors. No pollution or acidification, salinisation, or other anthropogenic impacts on the Ada Tepe soils have been identified. Certain forest soils in the Ada Tepe area contain elevated concentrations of arsenic, chromium and nickel due to the naturally elevated metal background. Despite the prevalence of favourable conditions for high soil resistance to anthropogenic impacts such as soil solution pH and content of clay and organic matter, the soils are

considered sensitive to impacts. The elevated concentrations of heavy metals and metalloids has raised the sensitivity of these soils to acidification, which could increase the mobility of metals to other media. The forest soils at Adá Tepe are a potential source of pollution to other media due to the elevated levels of certain heavy metals in them.

Compared with the systems for monitoring the condition of ambient air and surface water and groundwater, soil monitoring is relatively limited and underdeveloped. Soils are less dynamic and less expressed buffer system than air and water. Frequent sampling and analysis of soil samples is not necessary for tracking the changes in soil quality. Soils vary spatially and in depth, which requires the application of a specific system of sampling. In addition, the soils accumulate the adverse impacts from anthropogenic activities (for example: accumulation of pollutants, compounds causing acidification and/or salinisation that has direct or indirect impact on other environmental components that are in contact with them) for an extended period of time. Therefore it is assumed that the regular monitoring of soil quality at present is as necessary as for the other components of the environment. In order to achieve more thorough characterization of the soils adjacent to the future mine site and assessment of the potential impact, the points will be determined prior to commencement of the operation

### 10.1 Frequency and type of soils monitoring

Soils monitoring will be carried out by a contractor. The contractor will perform sampling and analyses biyearly as per Company's request. Intensive soil monitoring is envisaged prior to the construction stage - during soil removal and its storage at a soil material stockpile. This will provide sufficient data for the soils, mostly for the arsenic, chrome and nickel elevated concentrations in the natural terrain.

Generally, the accredited laboratory will perform the following activities:

- Sampling at the predetermined points;
- Pollutants concentrations analysis of the soil samples;
- Sampling of concomitant vegetation and predominating cultivated plants located at the monitoring points;
- Toxic elements contents analysis of the vegetation samples;
- Analyses of the condition of soils and vegetation;

During the mine operation the points shown in Table 10-1 will be monitored. The parameters measured are:

- pH
- Arsenic (As)– mg/kg;
- Cadmium (Cd) – mg/kg;
- Copper (Cu)– mg/kg;
- Nickel (Ni) - mg/kg;
- Lead (Pb) - mg/kg;
- Zinc (Zn) - mg/kg;

**Table 10-1: Soil Monitoring**

internal BMM EAD code No.	Place of measurement	Points	Parameters	Intervals
ESS 01	Approx. 100 m north of the mine, close to the old tourist lodge building.	1	pH, As, Cd, Cu, Ni, Pb, Zn	Biyearly
ESS 02	Approx. 200 m east of the mine, close to Chobanka hamlet.	1	pH, As, Cd, Cu, Ni, Pb, Zn	Biyearly
ESS 03	Approx. 400 m east of the IMWF, towards Kupel hamlet.	1	pH, As, Cd, Cu, Ni, Pb, Zn	Biyearly
ESS 04	Approx. 100 m south of the process plant.	1	pH, As, Cd, Cu, Ni, Pb, Zn	Biyearly
ESS 05	Approx. 300 m west of the Runoff Reservoir, near the road between Pobeda hamlet and Ada Tepe mine site.	1	pH, As, Cd, Cu, Ni, Pb, Zn	Biyearly
ESS 06	Approx. 200 m west of the mine, between Pobeda hamlet and Soyka hamlet.	1	pH, As, Cd, Cu, Ni, Pb, Zn	Biyearly

*\*Map including all points' locations is presented in Appendix 4*

## 10.2 Methods of analysis

ISO 10390:1994 Method for determination of pH;

ISO TR 11046:1994 Method for determination of petroleum products;

BNS ISO 14869-1/02 Method for determination of copper;

BNS ISO 14869-1/02 Method for determination of arsenic;

BNS ISO 14869-1/02 Method for determination of cadmium, lead and zinc;

BNS ISO 14869-1/02 Method for determination of iron;

BNS БДС 11261:2002 - Determination of total nitrogen content;

## 10.3 Sampling

Sampling shall be carried out by the contractor under a contract.

Samples will be taken from areas adjacent to the IMWF, the open pit, the process plant, the crusher and from background areas.

### Quantity:

The necessary analyses will require the taking of about 1 kg of soil (estimated for air-dry mass). It is recommended that the quantity is sufficient for long-term storage in order to carry out subsequent analyses on demand or to perform comparative analyses in cases some of the methods are changed in future.

### Sampling depth:

The soil sampler takes samples at two different depths according to an established method. Profile samples are taken from different levels (soil floors).

### 10.4. Reporting

- Results from the measurements carried out by the contractor shall be recorded in protocols according to a template.
- These protocols shall be prepared in two copies and shall be stored at the Company.
- Copies of the protocols shall be submitted to REWI - Haskovo.

## 11. MONITORING OF BLASTING VIBRATION IMPACT

### 11.1. Sources of blasting vibration

Blasting operations during open pit mining by means of charging drill holes and subsequent detonation.

### 11.2. Type and frequency of the blasting vibration impact monitoring

In compliance with:

- Future blasting operations plan for open pit mining from Ada Tepe prospect during the respective calendar year (BOP for a year);
- Annual permit for blasting operations and instructions issued by the District Labour Inspection Directorate on the basis of a BOP - for a year;
- Safety Rules Applicable to Blasting Operations, Sofia 1997 - Art. 141

Continuous monitoring of blasting vibration impact will be carried out. 24-hour or regular monitoring will be performed with future Company's instrumentation at the points shown in 13-1.

Table 13-1: Monitoring of blasting vibration impact			
Place of measurement	Points	Parameters*	Intervals
Soyka hamlet	1	PPV, f	24-hour monitoring
Pobeda hamlet	1	PPV, f	
Kupel	1	PPV, f	
Process Plant (admin. building)	1	PPV, f	As planned or measurements taken upon a complaint lodged

\* Note: PPV - peak particle velocity, f – frequency

\*Map including all points' locations is presented in Appendix 3

The exact location of the measurement points is determined on the basis of:

- least possible chance for actuation of the instrumentation by secondary (outside) sources;
- maintenance possibilities;
- prevention of vandalism;
- protection from harsh climatic factors.

In order to verify the internal measurements the Company will invite an external company *at least once per year*. The company will measure the following parameters:

- Peak particle velocity - PPV mm/s;
- acceleration – a, m/s<sup>2</sup>;
- displacement – U, μm;
- frequency – f, Hz.

### **11.3. Instrumentation**

Measurements will be performed by means of seismographs, as some of them will be fixed-mounted at the continuous monitoring stations and those for regular monitoring (for example when responding to a received signal) will be mobile.

### **11.4. Measurements and Equipment**

Blasting vibration impact measurements will be performed by BMM EAD with own instrumentation. Once a year the Company will use the services of licensed company for measurement and submission of protocols for confirmation.

### **11.5 Reporting**

- Results from the measurements carried out by the contractor shall be recorded in protocols according to a template.
- The results from the internal blasting vibration impact measurements shall be recorded in protocols, according to a template set in the instrumentation software.
- These protocols shall be prepared in two copies and shall be stored at the Company.
- Copies of the protocols shall be submitted to REWI - Haskovo.

## **12. PROVISION OF INFORMATION**

All monitoring data are kept with the Environmental Management Department.

Report on the implementation of the Company Environmental Monitoring Program will be submitted to RIEW - Haskovo. Relevant information on the part of the monitoring plan concerning the monitoring of water and the reports on quantitative and qualitative condition of waters will be

submitted to East Aegean Basin Department - Plovdiv under the requirements of the legislation and the permit conditions. Besides all measurements data, the report includes analysis of environment media status and the trends for a potential change of this status as a result of BMM's operations.

The following data will be submitted to REWI - Haskovo:

- The Waste Monitoring Results and the Report on the implementation of the Company Waste Management Program - by the end of March;
- Results from the monitoring of harmful substances emitted in the air under Regulation No 6/26.03.1999 on the Terms and Procedures for Measuring Harmful Substance Air Emissions from Sites with Point Sources, SG issue 31/1999;
- Results from the monitoring of noise and blasting vibrations impact.

Information on the monitoring of all environmental components will be available at the Company's Information Centre. This information will be available on demand to all stakeholders by means of measurements results, tests, observations, etc. Upon request the information may be provided with analyses, forecasts and explanations.

**This Environment Monitoring Program will be updated three months prior to commencement of Ada Tepe mine site and will be in compliance with the prepared Mining and Processing Working Project.**