

EXECUTIVE SUMMARY

Introduction

The European Agency for Reconstruction commissioned an Environmental Impact Assessment (EIA) of the Tamnava West Mine in the Kolubara coal district on behalf of EPS – Electric Power Industry of Serbia as owner of the mine. The EIA study was commissioned to assist such a development project by providing due diligence information required for the national regulatory process as well as for potential international investors.

The Kolubara mining district is located in the Republic of Serbia, approximately 40 km to the South - SouthWest of Belgrade. The area has been extensively mined since the 1950's and the mines, power plant and associated infrastructure are the main employers for the local community with the remainder of the local economy based on agriculture.

The study area is known as Tamnava West and forms the western margin of the Kolubara coal basin. The area is predominantly rural with the exception of the Tamnava East mine that borders the study area, the associated mining infrastructure and the Kolubara A power plant.

Description of proposed development

The Kolubara field produces lignite, a light variety of coal used as fuel in the power generation industry and for domestic heating. The actual production rate is about 25 million tonnes per year for the whole Kolubara field with approximately 5.2 million tonnes per year for the Tamnava West mine. Operations at Tamnava West started in 1996.

The proposed upgrade of the Tamnava West mine is in response to a plan to boost energy production in Serbia as part of the post war reconstruction effort. The Tamnava West field has been identified by specialist sector studies (see Annex 1) as the preferred coal mine and therefore plans to boost its production from the current 5 million m³ per year to approximately 12 Million m³ per year have been drawn, together with plans to streamline the power generation processes that depend on the coalmine. To this effect, a new power station is scheduled for completion in the near future (Kolubara B), that is expected to replace the current Kolubara A unit.

Land Take

The current operational area at Tamnava West is 2.5 km² and is going to increase as a result of the proposed operations with a total of 4.6 km² required by the year 2005, 7.3 km² by 2010 and about 12 km² by 2020. Four villages will be totally or partially affected by the operations and will have to be resettled. The villages are inhabited by approximately 1300 people. In addition to residential land and property the proposed mining operations will require the compulsory purchase of approximately 2000 hectares of agricultural land and/or uncultivated land.

Water Management

The mine expansion will require the diversion of two watercourses: the river Kladnica and the Duboki stream, a tributary of the River Kladnica. The proposed mining operations will take place primarily below the water levels of the aquifers that occur above and within the coal seams. Therefore, substantial dewatering and drainage will be required as a key component of the mine design.

Tamnava West Field

Equipment needs

In order to achieve the coal output stated above it is necessary to install a new excavator-belt conveyor-spreader (EBS) system by 2004. From 2008 the seams of coal will start to branch off in the southern section of the mine and it will therefore be necessary to include another EBS system for the removal of interbedded bands as their thickness is expected to increase substantially.

The Power plant

The thermal power plant "Kolubara B" is currently under construction and is not part of the environmental impact assessment summarised in this report. It is situated to the North of the Tamnava West Field, in the vicinity of the coal loading station that serves the Tamnava East and Tamnava West fields.

The plant output will be 2x320 MW and will have a net thermal efficiency of 34%. On this basis and based on the lignite properties, its fuel consumption will be between 7 and 7.5 million tonnes per year.

Environmental and Socio Economic Aspects associated with proposed project

This study identifies and analyses the main environmental and social aspects of the project and discusses the means through which these aspects will be managed so that adverse impacts can be mitigated.

Direct aspects of the project are as follows:

- Land take and change of land use
- Resettlement of local population
- Employment
- Noise and dust nuisance
- Coal dust damage to crops
- Disruption of the natural land drainage
- Disruption of regional hydrogeological balance
- Landscape

In addition to the direct aspects associated with the project, additional activities will take place as a result of, or in association with the mine development. These include the construction and operation of the Kolubara B power plant, and the upgrade of the electricity distribution system from the plant. The coexistence of the projects gives rise to cumulative aspects, the most significant of which are listed below.

- Air quality
- Greenhouse gases emissions
- Water use and Water quality
- Access to energy and boost of national economy

Project Alternatives

The Tamnava West mine development project is directly linked to the demand for lignite coal from the current Power plants in the region and primarily to the supply to the Kolubara B plant. No strategic alternatives to the development of the Tamnava West mine are possible if the Kolubara B power plant is to be built and fired on lignite coal.

Tamnava West Field

A feasibility study regarding the Serbian coal supply strategy was carried out in January 2002 by DMT and is attached as Annex 1. The study analysed three mining districts and selected the Tamnava West mine as the most feasible and economically efficient mines to supply the Serbian power generation industry in the years to come.

A selection of technical alternatives for the development of the Tamnava West field have also been evaluated and the full analysis is enclosed in Annex 2.

The evaluation of technical alternatives focused on the identification of techniques that could optimise the extractive process, improve the quality of the mine coal and valorise the secondary mineral commodities associated with the coal.

Environmental Baseline

Geomorphology

The Tamnava area is characterised by modest relief dissected by meandering watercourses. The relief of this territory is mainly the result of fluvial erosion and denudation processes that have given rise to extensive plateaus incised by the river valleys. The Kolubara River is the main watercourse in the area and it has created a wide alluvial plain.

Geology

The Kolubara Basin tectonic structure is typical of a transition zone between folded systems associated to orogenic events (the Dinaric range to the south and west) and an old continental structure (the Pannonian plain to the North and NorthEast).

Two main stratigraphic units occur in the area: the bedrock, and the “basin”. The coal measures occur in the “basin” unit and consist of alternations of lignite deposits and “interbeds” that generally consist of grey sand, calcareous sands and clays and clay.

Hydrogeology

The Kolubara Basin hosts a number of confined aquifers in different rocks types that contain substantial groundwater reserves. Unconfined aquifers also occur, primarily in association with the alluvial deposits and the regional watercourses.

Groundwater analyses for the period 1975–1984 show groundwater quality before mining. They show an elevated concentration of iron and manganese. As a result, the groundwater can be utilised for drinking purposes only if adequately treated and for that reason a water treatment plant was established near the village of Kalenic.

Surface Waters

The study area covers the central and lower course of the Kolubara River and its tributaries. The main tributaries in this area are the River Pestan, River Turija, River Kladnica, River Tamnava, River Vranicina and River Ub. The rivers in the Kolubara basin are mostly of torrential type, with great seasonal variability of flow.

In the Tamnava West area the main watercourse is the River Kladnica. It crosses the Tamnava West field from South-West to North-East. The main tributary of the River Kladnica is the

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Duboki Potok stream, a small watercourse that flows in a SouthWest – North-North East direction through the Tamnava West field.

The River Kladnica water, as well as Tamnava West field drainage water from the collector have been analysed according to the Tamnava West field monitoring program. The Institute for the Protection at Work, against Fire and Environmental Protection of Belgrade has performed the analyses in October 2001. The results showed concentrations of ammonia, iron and nickel above the Maximum Permissible Value both upstream and downstream of the wastewater discharge point.

Soils

Several soil types occur in the Tamnava West area and are discussed below.

- Alluvial soils: very fertile by nature although flooding adversely affect the potential for these soils to be used for agricultural purposes.
- Para-podzol and similar soils: most dominant soil type and therefore its agricultural potential is of significance to the economy of the entire area.
- Podzol: less fertile than previous types but still valuable for agricultural use.

Soil contamination in the Kolubara filed and specifically in the Tamnava West area can occur as a result of the following processes:

- Deposition of airborne particulate emitted from thermal power plants and mining operations;
- Use of fertilisers in agriculture;
- Mixing topsoil with overburden.

Land Use

In the Tamnava West area land is mainly used for agricultural purposes with patches of forest vegetation mainly along the banks of the River Kladnica and the Duboki stream.

Landscape

The landscape of the study area was once rich of forests and is now considerably modified with only few patches of forests remaining, mainly along riverbeds. The recent mining activities in the Tamnava area have caused additional effects on the landscape with changes in the overall topography of the active mines and the diversion of rivers.

The districts that belong to the municipalities of Lazarevac and Lajkovac, have valuable landscape features associated with the distribution of cultivated fields, orchards, meadows and pastures.

Cultural heritage

Several important archaeological sites have been revealed through the ongoing mining operations in the Kolubara region and in the Tamnava fields. The expansion of the Tamnava West mine will expose three additional important archaeological sites the existence of which is already known. These sites are located in the proximity of the village Mali Borak

In the Kolubara basin and particularly in the Tamnava West Field there are also some interesting buildings with many elements of traditional architecture. The most important of those old traditional houses are in the village of Kalenic and Mali Borak.

Tamnava West Field

Climate

In the Kolubara region the climate has mainly continental characteristics with warm and wet summers and cold winters. The coldest month is January with an average temperature of 0.3°C and the warmest month is July with 20.7°C. The data show that the average annual rainfall recorded near the Tamnava West field are rather low (588.3 mm). The highest values are recorded in July. Humidity levels are high throughout the year and particularly during winter months. The average annual humidity for the period 1984–1990 is 77%. The prevailing winds from East, East-South-East, South-East and South-South-East directions have the highest average velocities in spring, autumn and winter, whereas in summer North-West and North-North-West winds have the highest average velocities.

Air quality

The main air pollution sources in the general Kolubara area are the Thermal Power Plants “Nikola Tesla A”, “Nikola Tesla B”, “Kolubara A”, the Heating Plant “Kolubara” and the already open mine-fields, which are located within a range of 6 to 25 Km from the Tamnava West Field. The principal air quality parameters of concern are sulphur dioxide (SO₂) and suspended particles (TSP). SO₂ concentrations were very high in wintertime and particularly in September, October and January.

Noise

The main potential noise sources in the Tamnava West Field are the Ibarka Magistrala Highway with its traffic, the Overnovac – Tamnava railway and the mining operation in the open pit mine. The results of monitoring carried out within the mine area show that in many working places the noise exceeded the regulatory limits for working places established by Serbian regulation.

Flora, fauna and ecosystem

Over 70% of the territory in the Kolubara basin is cultivated and the natural vegetation is limited to patches of forest, marsh meadows and wet meadows.

The dominant wild animal species in the Kolubara region are rabbits (*Oryctolagus cuniculus*), foxes (*Vulpes vulpes*), deer (*Cervus elaphus*) and does (*Capreolus capreolus*) although the latter do not generally occur in the Tamnava West area. The bird communities include migratory birds such as swallows (*Hirundo rustica*) and storks (*Ciconia sp.*). The most dominant breeding species are quails (*Coturnix coturnix*) and pheasants (*Phasianus colchicus*).

Fish communities strongly depends upon the quantity and quality of water in rivers and streams. In the Kolubara River there are several species: chub, whitefish, pike, more rarely carp and very rarely catfish.

On the basis of the Environmental Protection Law, a protected area has been established in the Municipality of Lazarevac, near the Ibarska Highway. This area is rich with Pendunculate oaks (*Quercus robur*) and ash trees (*Fraxinus oxycarpa*).

The Law on Hunting protects the animal species that inhabit this area. Pursuant to the law some species may be protected by permanent prohibiting against hunting or by restricting it to hunting seasons.

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It is not currently known whether any of the above species occur in the Tamna West area as no seasonal faunal surveys have been carried out in the area.

Socio-economic aspects

The study area is characterised by low population density, low urbanisation level and small size villages. During the 50s and 60s the Kolubara basin has experienced serious depopulation trends as a result of the strong tendency to migrate to the main urban centres. This trend was compensated and even reversed due to the operation of the Kolubara minefields that offered employment opportunities especially for younger population.

Typical holdings are in the Kolubara region of 6-7 hectares per household and most households own one or two parcels. One of these usually contains the household's home, barns, stables and other buildings while the other is used for farming. Some households also own small patches of private pastures and forest, particularly in the area along the Kladnica River.

The main economic factor in the Kolubara region is coal production and processing and power generation that triggered industrial development and changed the economic structure of the whole area.

Employment rates vary considerably in the major cities of the region. The rate of employment in the industrial sector is 16.5%, two times higher than the republic's average rate (8.1%). In the community of Lazarevac in particular, the industrialisation level is 3.2 times higher than the republic's average (26%).

Agriculture is also an important sector in this area: more than 70% of the area is occupied by cultivated land, but only 30% of the population is employed in this sector.

Infrastructure and traffic

Although situated relatively near the country's capital, the Tamna West Field area is not crossed by the principal axes of the national transportation network with the main North South motorway being located almost 50 kilometres to the west.

The local transportation network is fairly well developed as it is considered satisfactory for the communication between the villages and inhabited areas in the region.

With regard to the main rail network, the area is very near the Belgrade-Bar railway that runs along the Vreoci-Lazarevac strip. Both Power Plants "Nikola Tesla" A and B are connected with local railway networks, thus enabling the continuous supply of coal.

Environmental Impacts*Geology and geomorphology*

The most significant effects of the mining operations will be related to the alterations to the geomorphology of the whole mine area (topography, drainage and vegetation).

Hydrogeology

Potential negative impacts on groundwater are related to modification of groundwater quality and/or the hydrogeological regime. The main effects of the proposed operations on groundwater are as follows:

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- Dewatering of the aquifers K 1, K 2 and M within the intervention area;
- Exposing the aquifer P to potential infiltration of contaminants by removing the confining layers (coal and interbeds) that overlay the aquifer;
- Partial dewatering of the groundwater aquifers in the area surrounding the mine;
- Creation, in the long term, of new hydrological and hydrogeological conditions in the exploited areas.

Surface waters

The hydrological network in the Tamnava West area will be profoundly altered by the proposed operations. The main activity that will result in direct impacts is the diversion of the R. Kladnica and the associated construction of a water reservoir and pumping station

The main consequences of the proposed river diversion works are as follows:

- Creation of an artificial river with continuous operational requirements (pumping) for its flow;
- Extensive civil engineering works required to build the reservoir and loss of current marshy habitat that will be underwater after completion of the reservoir;
- Loss of riparian habitat along the current course of the R. Kladnica.

Potential negative impacts on surface water quality could be related to:

- discharge of untreated or insufficiently treated wastewater.
- contamination of surface runoff from auxiliary mining activities as a result of spillage or leakage of fuels and lubricants
- contamination of surface runoff from the ash and slag waste derived from the future Kolubara B plant that is planned to be disposed of within the Tamnava West site.

Soil quality

The following impacts on soils are predicted:

- Deterioration of the existing topsoil structure during the mining operations.
- Contamination of the topsoil as a result of precipitation of dust and other airborne pollutants;
- Overloading the arable topsoil with nutrients inside and outside the mining area;
- Loss of arable topsoil due to infrastructure installations like roads, railway system, water channels industrial areas, etc

Contamination of soil could also occur as a result of ash disposal practices within the Tamnava West mine.

Landscape

The impacts to the landscape associated with the proposed mining operations will be very significant considering the changes of topography, drainage and vegetation, which directly affect the visual appearance of the area and therefore the amenity value of the landscape. The long term duration (>20 years) of the impacts and the only partial restoration that is possible to achieve, add to the severity of the impacts.

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Cultural heritage

Positive impacts are often associated with activities that enable the recovery and preservation of archaeological heritage. Nevertheless, the mining operations may also prove to be damaging to archaeological findings located in the way of mining work progress.

Important examples of traditional architecture in Kalenic and Mali Borak may also be adversely affected by the proposed development if relocation of the structures is not carried out or is not feasible.

Air quality

The most significant impacts to air quality will be associated with the emission of dust particles as a result of excavations and materials handling. Observations made in the mines indicated that the dust could be a problem during dry periods. Dust is expected to cause problems mainly to the employees working in the mine as well as to the inhabitants of the communities immediately adjacent to the active mining area.

The dispersion modelling that was carried out as part of this study clearly indicates that significant impacts are anticipated in the working mining area. In the greater area of the mine and specifically in the residential areas, especially Kalenic, Skobalj and Radljevo, the predicted levels of suspended particulates decrease largely and do not exceed the regulatory limits.

Hence, mining activities will only affect the ambient air quality of the worksite. As a result, appropriate measures will be followed in order to ensure that there will be no adverse impact in the proximity of the mine site and especially to site personnel.

Noise

Significant noise emissions will be associated with the operation of the mining equipment and could have significant impacts for the communities located near the mine. Noise associated with the rail operations could also add to the nuisance.

Flora, fauna and ecosystems

The mining operations at Tamnava West will result in the removal of all natural habitats currently present over the mine area and in the temporary disruption of agricultural activities. As the mining operations progress, the mined out areas, to the North of the active mine front will be restored through backfilling with overburden and waste material and re-cultivated to restore the overall ecological balance of the area. Specific mitigation measures (see following section) will be developed to ensure that the biological and landscape character of the area is re-created through the preservation of topsoil, the planting of indigenous plant species and the creation of lacustrine or riparian forest habitats to reflect the current species mix.

The mining operations will result in most forms of animal life abandoning the Tamnava West area, with the possible exception of avian species, small rodents and reptiles that may adapt to the changing habitat. Avian species may however be positively affected by the creation of the new reservoir and the wetlands that will inevitably form at its edges. These could in fact provide a suitable habitat for migratory birds and provide additional habitat for the existing populations.

Fish species will be adversely affected as a result of the waterworks associated with the diversion of the R. Kladnica and the construction of the new reservoir.

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The Tamnava West mine does not encroach any protected areas or sensitive ecosystems and no rare species of flora or fauna occur in the natural habitats of the site. On this basis no significant impacts other than the impacts to flora and fauna mentioned in the previous sections are expected.

Socio-economic aspects

The most significant social impacts will be associated with the relocation of the populations of the four villages affected by the mining development.

Positive social impacts will occur as a result of the creation of employment in the local area and, at a broader level, as a result of the economic benefits that will be associated with increased power generation in Serbia.

Public health hazards could be associated with mining activities. The typical causes of possible health effects are associated with the failure to implement mitigation measures with regard to noise and air emissions abatement and, with regard to site workers, inadequate use of respiratory or ear protection equipment, where required. These impacts should be adequately mitigated if the mine operates in accordance to its stated procedures and if adequate monitoring is carried out.

The proposed expansion of the mining activities will bring positive impacts to infrastructure that is either missing in the area or is unsuitable to serve the needs of the local industry and population. The issues below are those that will benefit from the proposed project:

- Solid waste management
- Potable Water supply
- Waste water collection, transfer and treatment
- Telecommunications, electricity distribution networks etc.
- Transportation Network

Environmental and social mitigations*Geology and geomorphology*

No mitigation measures are considered practical with regard to impacts to the local geology.

Monitoring activities will however be required before and during the operation of the Tamnava West mine to assess geotechnical seismic conditions that could trigger hazardous process within the mine.

Hydrogeology and groundwater quality

In order to improve the existing situation and to carry out the measures for restoration and recovering the hydrogeological conditions, it is necessary to apply a set of mitigation measures, which are presented below.

- A detailed hydrogeological study to design a suitable dewatering system for the Tamnava West mine and to assess any further mitigations required to avoid adverse impacts to groundwater and groundwater users;
- Ongoing groundwater Monitoring system, to validate the hydrogeological models and to assess the hydrogeological impacts of the mining operations.

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Surface hydrology and surface water quality

The mitigation measures to address the impacts to the hydrological network should include the a detailed hydrological study of the area to enable the sound design of the river diversion works and any required inlets in existing or new watercourses as well the overall hydraulic implications of the proposed lakes and reservoirs planned for the study area.

To mitigate potential adverse impacts to surface water quality, a monitoring program is required (see Chapter 7, Action Plan) as well as suitable measures to control the mine drainage, effluents generated within the mine buildings and any other liquid discharges that may take place.

In addition, significant engineering work is required at the Wastewater treatment plant to cater for the added drainage that may result from the expansion of the Tamnava West operations.

Finally, taking into account that part of the depleted area of Tamnava West will be used as a waste disposal site additional studies should be carried out to ensure that no surface water contamination occurs as a result of leakage of noxious liquids from the backfilled mine.

Soil quality

The proposed mitigation measures to minimise adverse impacts to soil quality consist of the following activities:

- Monitoring soil quality whilst being stored and prior to re-use to evaluate the need for enrichment.
- Separating topsoil for re-cultivation.

Landscape

The design and implementation of a landscape mitigation plan consisting of a detailed restoration design for the entire mine area is recommended to ensure that the progressive restoration of the mine is carried out and that restoration includes the development of amenity features such as forest, lakes, water courses etc.

Cultural heritage

EPS is responsible for reporting new archaeological finds that are exposed by the mine excavation operations. This practice is the most effective mitigation measure to ensure the assessment and preservation of any significant archaeological monument.

As an additional measure it may be appropriate to initiate an archaeological investigation well in advance of the mining activities in areas that are expected to be rich in archaeological findings such as the area surrounding the school and church in Skobalj.

The relocation of above ground structures of cultural or ethnographic importance is currently being examined by EPS and the Institute for the Protection of Cultural Monuments. Any recommendations from such studies should be implemented.

The creation of a museum of national architecture and heritage or “ethnic park” should be evaluated to provide the framework for the presentation of traditional values of the local population.

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Air quality

The mitigation measures that are recommended to minimise adverse impacts associated with emissions of airborne pollutants to the atmosphere are aimed at providing an adequate air quality monitoring system, the application of good operating practices related to earthworks, material conveyance systems, loading/unloading procedures, road haulage and storage/dumping facilities. In addition, the provision of dust control techniques is recommended.

Noise

Mitigation measures should be implemented to ensure the protection of both workers and nearby residential properties from detrimental effects associated with noise generated by mining activities. This would include monitoring within the mine as well as in the nearby residential areas, noise reduction measures for individual items of plant and machinery, the provision of acoustic shields, physical barriers or enclosures as well as personal protective equipment for the mine workers.

Flora, fauna and ecosystems

Mitigation measures to compensate the adverse impacts associated with the loss of natural habitats and fertile soils relate to the progressive restoration of the mine and management of the habitats that will be created as part of the restoration programme.

It is recommended that an initial botanical survey of the entire Tamnava West field is undertaken to assess in detail the botanical associations and identify any sensitive species that are worthy conservation through seed collection or transplanting. Based on the botanical composition on the natural habitats and the ratio between natural habitats and agricultural land a progressive re-cultivation plan should be designed.

A seasonal faunal survey should also be carried out in the natural habitats of the area to assess the presence and significance of animal populations thus enabling the understanding of potential impacts and means of mitigation.

Socio-economic Mitigations

Impacts to the population are primarily connected with the need to relocate four local villages and their residents. The mitigation of this will be achieved through the implementation of a resettlement action plan, a draft of which is enclosed in Annex 6. At the mine level, EPS will strengthen its capacity to implement the resettlement programme by establishing a social communication unit in the mine office.

The creation of new employment will also mitigate social impacts and at the same time minimise inequalities among different sections of the population. Special attention will be given to farmers who will be forced to early retirement through the land expropriation, since it is particularly difficult for them to find alternative employment. Other social groups that need special treatment are:

- young people,
- long-term unemployed,
- unskilled workers and people with limited education,
- women, and
- migrant population.

Tamnava West Field

The mine should also develop and implement a Health Management plan with the objectives of monitoring the health of its employees and nearby residents and developing suitable mitigation measures if health risk factors are identified. In addition to the generic provisions to be included in the Health Management Plan the mine should develop and implement safe working procedures and undertake training programmes, inspections and reward/penalty schemes to enforce safe working practices in all aspects of the mining operations.

Since only positive impacts to infrastructure are expected as a consequence of the Tamnava West mine development, no mitigation measures are proposed. In fact the proposed infrastructure upgrades can be considered a social mitigation measure to offset impacts associated with relocation of people and disruption of communities through the provision of improved sanitation and community services.

Although no significant impacts are expected with regard to the transportation network some mitigation measures are proposed to ensure that even small disturbances do not cause prolonged nuisance to the local community. Such measures would be summarised in a traffic management plan, to be prepared by EPS.

Environmental Action Plan

The findings of this EIA study indicate the need to better characterise a number of environmental and social aspects and to develop a system to implement mitigation measures before, during and after the operation of the Tamnava West mine. The activities required to adhere to the commitments expressed in this EIA study can be divided in four categories:

Public Consultation: Dialogue between EPS and the local population should be furthered to manage the land expropriation and relocation issues as well as to gather feedback with regard to the community expectations in relation to the Tamnava West mine development.

Detailed design and surveys: the mining operations are at an early stage of design and significant detailed work will be required to finalise the approach to some of the most critical activities on the path of the mine development. Similarly, in order to fulfil the commitments regarding the implementation of an integrated land restoration programme, scientific surveys are still required.

Development of Environmental Management System (EMS): the EMS will be a management tool to ensure that the environmental and social mitigation measures as well as the ongoing monitoring activities are seamlessly integrated in the mine operations. The EMS will include a series of plans (water management plan, solid waste management plan, traffic plan, monitoring plan, health and safety management plan, community liaison plan, etc) addressing in detail the needs and obligations of the mine operations with regard to the key environmental and social issues.

Environmental Monitoring: monitoring will be carried out throughout the operation of the mine to review and document the mine's environmental performance.