

BUNDER DIAMOND MINE

EXECUTIVE SUMMARY

1.1 Project Location and Project Description

1.1.1 The project for mining Kimberlite Ore and separation of diamonds, is located in Chhatarpur district of the State of Madhya Pradesh. M/s. Rio Tinto Exploration India Pvt. Ltd., have been granted, the Mining Lease by Govt. of Madhya Pradesh under Rule 22(4) of Mineral Concession Rules 1960

1.1.2 The proposed 954 ha lease area is located in Forest area of Bakswaho Protected Forests. The area is characterised by undulating topography with a few minor ridges and valleys. The height above MSL varies from 406 mRL to 466 mRL

1.1.3 The proposed lease area does not have any perennial water courses. The drainage of the area follows dendritic pattern flowing in all directions. All most all rain water falling on the Surface flows down the slopes and to outside lease area.

1.1.4 The Bunder Diamond deposits / ore bodies are isolated occurrences in the Bundelkhand Plateau. The litho units of the area consist of Sedimentary formations of Vindhyan Supergroup underlain by Bundelkhand Granite Gneiss.

1.1.5 The detailed exploration in the area was carried out by the company starting from reconnaissance in 2004. The morphology of diamond ore bodies and the variability of diamond occurrences required high density drilling and sampling. The samples collected need to be processed in a small scale processing plant to separate diamonds. The company has established a 10 tph bulk samples processing plant nearby non forest land. The present deposit contains less than one carat of diamond per tonne of kimberlite ore. One carat is only 200 Milligrams.

1.1.6 The first stage exploration involved collection of sediment samples from streams / nallas for analysing indicator minerals. After pursuing anomalies on the ground, first concealed outcrop of kimberlite pipe was identified in May, 2006. A total of four kimberlite ore bodies have been located in the proposed lease area and four outside.

1.1.7 The identification of ore bodies was followed by Trenching and drilling, for investigation of the Atri, the largest ore body spread over a surface area of 16.6 ha. The trenching and pitting was followed by drilling 63 H_Q size holes to understand the ore body structure, its extent on sides and depth. This was followed by drilling of 23 large dia (203.2 mm) holes, to collect bulk samples, to a depth varying from 200 m to 350 m, to evaluate the grade of the deposit.

1.1.8 The Atri ore body was explored and data collected was processed through computer model to calculate reserves. The results showed that Atri ore body has qualitatively two parts, identified as Atri North and Atri South. The reserves and tonnage calculated upto depth of 345 m. or 100 mRL is as under:

Reserves		
Ore body	Tonnes (Mt)	Grade Carrots per tonne)
Atri South	41.56	0.78
Atri North	12.14	0.13
Total	53.70	0.63

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1.1.9 It is proposed to mine the reserves by mechanised opencast method upto a depth of 345m or 100mRL. The opencast pit will be 920 m dia with bench height of 10m. The bench slopes will vary from 40° to 45° while overall pit slope will be 40°.

1.1.10 It is proposed to have separate dumps for overburden / waste and soil; within proposed lease area. Both overburden / waste and ore will be blasted, loaded by shovels and taken to respective storage area / dumps by dumpers.

1.1.11 The mine will have capacity of 7.15 Mtpa of ore with maximum of 16Mt of overburden / waste being extracted in the year. However, ore processing plant will have capacity of 5 Mtpa.

1.1.12 Mineral Processing

- a) The flow-sheet for ore processing was designed by outside consultants, our experience of running the mines at three sub-continent and a bulk Sample Processing Plant established at the site, as soon as the exploration was started. The process involves Primary, Secondary and Tertiary Crushing, followed by scrubbing, screening, degritting and desliming. The ore will then be taken to Dense Media Separators in two sizes. The final recovery of diamonds will be by magnetic separation, followed by X-Ray, acidisation and recycling of tailing.
- b) The coarse rejects will be utilised for construction of embankments within the tailing pond and the boundary of the tailing pond. The fine processed kimberlite rejects will be taken to tailings pond.
- c) The processing plant will not discharge any liquid effluent to surface water courses or ground. All the liquid effluent will be discharged to the tailing pond.

1.1.13 The mine will have all required site services including, workshops, store and warehouses, HT electric substation, High speed diesel storage, explosive magazines, water supply and a number of mine offices. The facilities include a Helipad, outside lease area in non forest land, as raw diamonds are proposed to be transported to its marketing destination by air.

1.1.14 The life of opencast mine of Atri Pit is only 13 years. The life will increase by another 10-12 years when Angiras and surrounding deposits are explored and found suitable for exploitation. The Atri deposit persists below 100 mRL. The same will be explored and if found economical, an underground mine is proposed.

1.1.15 As the initial life of the mine is only 13 years, the colony proposed will provide suitable accommodation with all amenities. The colony will be constructed on non-forest land outside the lease area.

1.2 Description of the Environment

1.2.1 The 954 ha lease area is fully in Bakswaho Protected Forest. There is neither any village or settlement or even a building or a hut in the core zone.

1.2.2 The company has already applied for diversion of whole of 954 ha of the Forest land. All the infrastructure required for Mining Operations will be constructed within the proposed lease area.

1.2.3 The buffer zone or study area is spread over two districts namely Chhatarpur and Sagar. There are 62 Census villages in the study area, out of which only 57 are inhabited. There is not even a medium scale industry in the buffer zone.

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1.2.4 As per census data 2001, the total area of 62 villages is 42,480 ha. Out of this 13, 266 ha is forest land. However, adding Protected and Reserved Forests, the forest area of buffer zone comes to over 22, 800 ha.

1.2.5 Hydrogeology and Ground Water

- a) There are no perennial water courses in the proposed lease area. One of the seasonal water courses in the southern part flows over the Atri kimberlite pipe and will have to be diverted.
- b) The drainage of the buffer zone area is controlled by Sira and Suku rivers in the North. Both of these rivers are perennial. There are only 18 ponds in the area, as surveyed in 2011.
- c) Although area is covered by sedimentary Vindhyan formations, the yield of water, even from deeper tubewells, is 20m³ – 50m³ per day, which is low.
- d) The ground water table in the area is variable, but mostly between 5 and 10 m below ground level. The Bakswaha Tahsil of Chhatarpur District is declared semi- critical by the Central Ground Water Authority. Hence, a detailed hydrogeological study of the area was carried out by dividing the same in four assessment units, namely 10 km radius buffer zone, 0-5 km radius buffer zone, Kalidahar nalla watershed and the core zone. The study indicated that the existing ground water development in all these four areas was in safe category, below 45%.
- e) The mine will pump 0.46 MCM of water per year, which is less than annual recharge through rainfall over the lease area
- f) The diversion dam cum reservoir constructed on the seasonal nalla on the southern part of the lease area will have sufficient capacity to provide 5.86 MCM of water per year to meet the industrial requirement of water of the Mine.

1.2.6 Climate

- a) The climate of the area is marked by hot summers and cold winters. The maximum temperature is usually above 40°C during summers, while minimum temperatures are usually below 13°C during months of November – March. The relative humidity varies from 25% to 90%.
- b) The rainfall data for period of over 40 years was available, from Bakswaha a tahsil town located within buffer zone. Although the average rainfall during this period was nearly 1055 mm, yearly fluctuations are very wide ranging from 429 mm in 2007 to 1675 mm in 1999. Such wide fluctuations are typical of Bundelkhand region. The maximum rainfall recorded in any 24 hr period varies widely from about 42 mm to 393 mm.
- c) The wind velocity and wind roses were not readily available from nearby Meteorological stations. The wind velocities in 13 week monitoring period December 2010 to March 2011, shows about 20% calm periods. The wind velocity was below 5 kmph for 40% of total time. The wind direction, were from all sixteen directions. But, about 30% to time wind direction is from SSW, SSE, NW and WNW.

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1.2.7 Air quality was monitored at 12 locations. The area having undulating topography and with variable forests, the locations of air quality monitoring stations were carefully selected. Except for two / three stations located on near State / National Highway, all the air quality parameters were low, as found in rural areas, bereft of any industry. The average values of PM₁₀ and PM_{2.5} are well below annual average limit at nine out of twelve stations. The values of sulphur dioxide and Nitrogen oxide very 1/6th to 1/4th of prescribed limit. Dust fall rates were low, at 11.0 t per sq km per month at village Nimani. It was higher near the State Highway, being 44.3 t to 44.3 t per sq. km. per month.

1.2.8 The water quality was monitored for seven surface water sources, three shallow ground water and three deeper tube wells. A sample was also collected from effluent water from Bulk Sample Processing Plant (BSPP). Overall the quality of water samples was quite good and unaffected by any pollutants except coliforms found in surface water and shallow ground water samples.

1.2.9 The noise levels were monitored at 12 locations. Day time noise levels were below 50dB(A) at nine locations. At remaining three location noise levels varied from 54.3 dB(A) and 59.7 dB(A). The night time noise levels below 45 dB(A) at nine locations.

1.2.10 Soil quality was monitored at five locations and tailing pond of BSPP plant. The soils of five locations had medium fertility. The tailing pond sample did not have any harmful components.

1.2.11 Bio-diversity

- a. The whole of proposed lease area is in Protected Forests. The 10 km radius buffer zone is also covered by forests to an extent of 50% or 22800 ha . There are no National Parks or Sanctuaries or any eco-sensitive zone within 50 km boundary of the lease area.
- b. A flora-fauna survey of core zone and 10 km radius buffer zone was undertaken by Prof. M.L. Naik, accredited FAE for Ecology and Bio-Diversity by QCI – NABET.
- c) The area still have good forest in patches. However, large tracts of forests are severely impacted due to anthropological pressures. The people living in the villages of the area are dependent on forests for a minimum of two to four months in a year for their livelihood.
- d) There are no endangered or endemic species of flora in the area. On the other hand the weed Lantana has spread over large part of core zone and a significant part of buffer zone. Among tree species Madhuca Latifolia is very prominent and is extensively found around villages.
- e) However, the area has fairly good variety of fauna including seven species listed in Schedule I of Wild Life (Protection) Act, 1972. These are Indian Gazelle, Chowsingha, sloth Bear, Leopard, Monitor Lizard, Indian rumped vulture and Peacock. A conservation plan for these species is included with this document.

1.2.12 A traffic survey carried out in 2011, indicated that except for the State Highway connecting Damoh with Chhatarpur and passing through Bakswaha, traffic on other roads was low to moderate.

1.3 Anticipated Environmental Impacts and Mitigation Measures

1.3.1 The mine will be a mechanised opencast mine. The mine will work kimberlite upto a depth of 345 m by opencast method, in the first stage.

1.3.2 The overburden / waste will be dumped in the lease area. A tailing pond will also be there in the lease area. Thus out of 954 ha. forest land, over 800 ha. will be utilized for Mining and allied operations. The post mining landuse of the area is forestry except for nearly 350 m deep Atri pit, which will be converted into a water body.

1.3.3 The impact on water Regime will be moderate. Two main seasonal water courses in the proposed lease area will be arrested by constructing embankments, one for diversion and other for forming tailing pond. The water from diversion dam will be utilized for the mine. Over 90% of water requirement of the project, estimated at 16050 m³ per day, is for processing of ore.

1.3.4 The Impact on ground water

The impact on ground water will be moderate the existing water use for four assessment zones is less than 45%. This will marginally increase going upto 48%. Thus it will still remain below the safe limit of 70%.

1.3.5 Impact on Water Quality

Quality of water courses outside the lease area will not be affected, as no liquid effluent will be discharged to ground or surface water courses, inside or outside lease area. The effluent water from BSPP Plant was tested and was found within prescribed limits except for fluoride and grease. There is some concern regarding acid mine water due to pyrites found in shale of thickness upto 150. These shales are 70 m to 150 m below surface. If acid water is formed it will be neutralised at source itself.

1.3.6 The ambient air quality may be affected due to large quantity of overburden and ore handled. However, impact on population will be marginal as there are no villages within two km of the mine or processing plant.

1.3.7 Blasting will be regularly carried out at this mine. However, there are no villages within two km of mining area and delay detonators will be used for blasting. Hence there will be no problem due to blasting vibrations or noise.

1.3.8 The bio diversity of flora and fauna will be affected due to cutting of forest within 954 ha. lease area. The management has already started to control the lantana weed in cooperation with forest department. The Management also proposes to assist forest department for plantation of those areas of buffer zone, where tree density is poor.

1.3.9 The quantum of mineral going out from mining area will be less than 1000 kg. per year. The diamonds will be airlifted. Hence impact of traffic will be limited.

1.3.10 Mine Closure Plan

Except of 61 ha. area of Atri Pit, the post mining landuse of proposed lease will be forestry. The Angiras deposit if found economically viable will be worked prior to Atri opencast pit is completed so that overburden and waste from Atri can be used for backfilling the Angiras pit. The Angiras pit will be biologically reclaimed.

The reclamation of Atri Pit can only be planned after investigations, the economical viability of working deposit beyond 345 m by underground method.

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1.4 Environmental Monitoring Programme

1.4.1 The environmental Monitoring Programme proposed below, has been designed considering the fact that the proposed lease area is in Protected Forest and there are no villages even one household, not only in lease area, but also within one km of lease boundary

- a) Monitoring PM₁₀ and PM_{2.5} at four locations, once in six months for eight hour. If any of the monitored values are within 10% of prescribed limits, the monitoring will be repeated at that location for continuous 24 hrs.
- b) Water Quality from the reservoirs created by arresting two seasonal water courses will be monitored every month during rainy season and one month after. These Sources will be monitored again during February–March, or three months after withdrawal monsoons, whichever is earlier.
- c) The ground water sources of two nearest villages in buffer zone will be monitored once a year for parameters pH, total dissolved solids, total hardness, Fluorides and Coliforms
- d) Noise levels will be measured once a month at 8 to 10 locations which will include villages of Sagouriya and Hirdepur.
- e) Blasting vibrations will be monitored during blasting trials. It may not be necessary to monitor blast vibrations after that, as there are no villages within 2 km of mine working.

1.4.2 The collection and analysis of samples for air quality and water quality will be outsourced. Noise Levels will be monitored departmentally.

1.5 Additional Studies

1.5.1 Besides Public Consultations, a study of Social Impact Assessment was undertaken in 15 surrounding villages and in Bakswaha town. A detailed Flora/Fauna survey of proposed lease area and 10 km radius buffer zone was also carried out and is reported earlier in para 1.2.11.

1.5.2 The Socio-economic survey was carried in all the villages within 3.5 km of lease boundary. In addition, Bakswaha, the Tahsil town was also included. The 2001 Census data for these villages was collected and analysed. In order to update data the company has carried out house to house survey in the fifteen villages in 2009, which was analysed. A sample survey was carried out at in Bakswaha NP, during which 286 families over 15 wards were surveyed.

1.5.3 A socio-economic survey report has been prepared after analysing data including results of Focus Group Discussions (FGD). The survey data was utilized to draw out a Corporate Social Responsibility Programme. The company has carried out various activities during last 7-8 years. These include Education, community health, water resources management and development, livelihood promotion, Agriculture etc. Till 31.12.2012, the company has spent 6.84 crores on these activities. It is proposed to spend 5.61 crores during the year beginning 01.01.2013

1.5.4 The total expenditure of Rs. 22.5 crores on capital account and Rs. 7.5 crores on revenue account is proposed during first five years. Details of major headwise, expenditure are provided in this report.

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1.6 Project Benefits

1.6.1 The mine will be a first major industry in the district. Its impact has already been felt since starting of prospecting operations in 2004. The condition of subsidiary roads leading to and around the proposed project area has improved considerably.

1.6.2 As a responsible international corporate, the company has initiated several projects in the area as listed in para 11.5.3 above. Some positive impacts have already been felt in the surrounding villages.

1.6.3 The company will employ 461 persons for the project, out of which 14 are unskilled and 85 are semiskilled. The company has already initiated programmes of training so that against these jobs locals can be employed. The total employment is expected to go upto 800. Besides these direct employment, the outsourced jobs will also create employment opportunities for local people.

1.6.4 The company proposes to spend substantial amounts for CSR activities, details of which are described para 10.4 of this document.

1.7 EMP / Environment Management Plan

1.7.1 The Plan for Monitoring is already detailed in para 11.4 above.

1.7.2 The mine will be a mechanized opencast mine and under Metalliferous Mines Regulations, 1961, will have full time Mine Safety Officer, with specified qualifications and experience. He will be given charge of management of Environmental aspects of opencast pit.

1.7.3 The company has a qualified person incharge of Environment, almost since beginning of prospecting operations. He will be incharge of Environmental Management of the balance lease area and buffer zone including plantation, dust suppression measures outside the mine and monitoring of Environmental Parameters as prescribed by the MoEF / State Pollution Centre Board. He will also be responsible for sending periodical reports prescribed under permission granted by MoEF, State Pollution Control Board and Forest Department. He will also be responsible to bring to the notice of 'Chief Executive' of the Mine any deficiencies noticed including actions required to be taken.

1.7.4 He will also be responsible to convene a half yearly meeting of all project officials to discuss status of Environment.
