

# EXECUTIVE SUMMARY

## 1.0 INTRODUCTION AND BACKGROUND

### Scope of the Report

This report presents a Mine Reclamation and Closure Plan (MRCP) for LMMPL Limestone Mine Project, Meghalaya. The mining lease area (Latitudes  $25^{\circ} 11' 25''$  N and  $25^{\circ} 12' 00''$  N and Longitudes  $91^{\circ} 37' 28''$  E and  $91^{\circ} 38' 01''$  E) located in East Khasi Hills, Meghalaya, covers 100 ha of land leased from Village Darbar of Nongtraï. The Limestone mining is proposed to be carried out over a period of 53 years. The scope of the present report therefore will be to focus on Mine Reclamation Strategy and a closure plan including physical reclamation, rehabilitation of disturbed area, future management of identified problems (drainage, water and waste management etc.), followed by a monitoring programme, schedules of operation and cost etc.

### Reclamation Principles

The reclamation principles suggested are expected to help towards planning:

- Long term stability of slopes and surface material,
- Safety issues relating to open pits, shafts, subsidence,
- Management of physical characteristics, toxicity of tailings or waste rock which may constraint re-vegetation,
- Management of potential acid drainage as a consequence of oxidation of sulfides contained in the ore or wastes, and
- Cost of on-going and post decommissioning rehabilitation, including socio-economic aspects

### Care and Maintenance and Closure Rehabilitation Options

On the cessation of mining a process of decommissioning and a follow up programme of reclamation / rehabilitation should start. Once the design of reclamation is successfully implemented, appropriate care and maintenance rules are to be framed for long term benefit of the local community.

Post-mining reclamation of site for other uses has been considered. Problems associated with surface mining such as groundwater seepage, disruption of aquifers, down-slope damage etc. have also been enlisted for suggesting mitigative measures.

To prevent degradation of air quality, proper blasting practice and watering of haulage roads have been planned. By a process of sediment control the water quality standard in the downstream surface water flow will be maintained. The re-vegetation plan is expected to enhance wildlife habitat in the post-operative period in a phased manner.

### Approach, Limitations / Definition

The methodology for mining has been selected on the basis of professional analysis of the survey data and best standard use. The Environment Management Plan following the EIA study aims at delivering results of best practices. Keeping in view a policy to support the protection, maintenance and rehabilitation of natural habitat, the proposed project has been designed in an area, which does not involve critical natural habitat. Care has been taken to promote economically viable and environmentally sustainable water management in the project area. Since no population is going to be evicted from the proposed mining project area the issue of resettlement does not arise. However, the approach of the proposed project positively affirms and ensures that indigenous people benefit from the project out-put by way of provision of better educational, health care and other community oriented services.

### **Project Description**

The project to mine Limestone in Nongtraï area has been based on extensive topographical and geological survey, surface sampling and drilling. The lease area of 100 ha lies on the western side of Umiam river valley, about 2 Km. Northwest of village Shella bazar. It is approachable from the capital city of Shillong by road (109 km). The mining will be carried out at 90m RL, with a projected 2.0 million tonnes of limestone production per year; the life of the mine has been calculated at 53 years. The bench height is estimated at 10m, ultimate pit bottom at 90m RL, overall pit slope 45<sup>0</sup>; the gradient of haul road is calculated at 1 in 16 for working benches and 1 in 10 for ultimate pit. There is a statutory barrier of 7.5m from lease boundary (inside); protection distance from sinkhole is 100m.

The method of mining would be open cast and fully mechanized. Drilling would be done by 115mm diameter Hydraulic drills, blasting by ANFO and slurry explosive, excavation by 4.5 cum hydraulic excavators and transporting would be done by 35 tonne class rear dump trucks. The material will be transported to the cement factory by 17.5 km long covered conveyor belt system.

The lease area will be practically devoid of any over burden; only clay may be found to occupy the cavities in the lease area. The clay material is proposed to be used to supplement other clays with low Fe<sub>2</sub>O<sub>3</sub> or even sand stone to be used as corrective material.

The project has been cleared by the State Govt. of Meghalaya, local Durbar and the Ministry of Environment and Forest, Govt. of India on the basis of Mine plan, Environmental Impact Assessment report and Environment Management Plan.

## **2.0 LEGISLATIVE, BEST PRACTICE STANDARD AND CORPORATE CONSIDERATION**

### **Legislative Requirement**

The mining project during pre-operational phase, operational phase and post-operational phase are to be governed by the following legal instruments:

- i. The Water (Prevention and Control of Pollution) Act, 1974 and Rules, 1975.
- ii. The Forest (Conservation) Act, 1980 and Rules, 1981.
- iii. The Air (Prevention and Control of Pollution) Act, 1981 and Rules, 1982.
- iv. The Environment (Protection) Act and Rules, 1986.

- v. The Environment Impact Assessment Notification, 1994 amended till date under EPA, 1986.
- vi. The Factories Act and amendments, 1948, 1987.
- vii. The Public Liability Insurance Act, 1991.
- viii. The National Environment Tribunal Act, 1995.
- ix. The Environmental Standard Notification, 1993, 1996.
- x. The Hazardous Waste (Management and Handling) Rules, 1989 amended 2000.

Besides the environment related laws, mines and minerals legislations pertaining to environment related issues may also be considered for the present purpose. These include:

- i. Mines and Minerals (Regulation and Development) Act, 1957.
- ii. Mine Act, 1952 and Rules, 1953.
- iii. Mineral Concession Rules, 1960.
- iv. Mineral Conservation and Development Rules, 1958.
- v. Prohibition of Mining Operations in Ecologically Fragile Areas.

Details of the above mentioned legislative requirements are given in the Annexure I

### **World Bank Policies and Guidelines**

A list of most important policies and guidelines are given below (Environment Department, The World Bank, update no. 22, March 1998):

**OD 4.01 Environmental Assessment (EA):** Policy and procedures for EA, whereby potential impacts are taken into account in selecting, site planning, and designing projects.

**OP/BP/GP 4.02 Environmental Action Plans:** Policy to encourage and support borrowers to prepare, implement, and maintain environmental action plans, which should be reflected in Bank operations.

**OP/BP 4.04 Natural Habitats:** Policy to support the protection, maintenance, and rehabilitation of natural habitats. The Bank does not finance projects that involve the conversion of designated critical natural habitats.

**OP 4.07 Water Resource Management:** Policy to promote economically viable, environmentally sustainable, and socially equitable water management.

**GP 4.11 Cultural Property:** The Bank's general policy regarding cultural properties is to assist in their preservation and avoid significant damage or elimination of irreplaceable cultural property.

**OD 4.20 Indigenous Peoples:** Policy to ensure that indigenous peoples benefit from development project, and the projects' potentially adverse effects are avoided or mitigated.

**OD 4.30 Involuntary Resettlement:** Policy and procedure on Bank staff and borrower responsibilities towards displaced persons in operations involving involuntary resettlement.

### **Corporate Statements**

The corporate environmental policy of Lafarge is based on concept of sustainable development and revolves around the following main themes (Lafarge and the Environment, March 2000):

- Regulation: Respect local laws, standard and regulation; set-up own internal standard to correspond with internationally recognized criteria.

- Environmental Technologies: Develop and use clean technologies, better pollution control for efficient reduction of pollutants.
- Sparing Use of Natural Resource: Re-use of by-products and residual wastes for raw material.
- Research and Renovation: Invest in advancement of clean technologies and promote research for better environmental management at every phase of product's life cycle.
- Risk Reduction: Assess potential hazards and risks at every installation to ensure effective prevention from accidental pollution.
- Training and Evaluation: In service training and periodic evaluation of environmental performance to attain the objective of proper management.
- Setting Demanding Standards: Lafarge Standards are at least as stringent as international regulation.
- Communication: Establish effective communication with all stakeholders.
- Assessment and Result: Internal assessment, at least once in a year, to be carried out to reach the objectives.

### **Best Practice Standards**

According to GSR 801 (E), EPA, 1986, dated Dec. 31, 1993 the State Pollution Control Boards are to follow the guidelines for enforcing the standards specified under Schedule IV as given below:

1. In case of limekilns of capacity more than 5 tpd and up to 40 tpd, the particulate matter emission shall be within 500 mg/Nm<sup>3</sup>.
2. In case of stone crushing units, the suspended particulate matter contribution value at a distance of 40 m from a controlled, isolated as well as from a unit located in a cluster should be less than 600 µg/Nm<sup>3</sup>.

These units must also adopt the following pollution control measures:

- Dust contaminant cum suspension system for the equipment.
- Construction of wind breaking walls.
- Construction of the metalled roads within the premises.
- Regular clearing and wetting of the ground within the premises.

### **Environmental and Social Management**

Mining and its related activities fall into the following categories:

- Exploration
- Extraction and disposal of waste rock, and so forth
- Ore processing and plant site operations
- Tailings containment, treatment and disposal
- Infrastructure, access and energy
- Construction work camps and operational town site

The following measures will be taken for environmental and social management in the project area:

## **Air Quality Management**

In India ambient air quality data should show that the concentrations of SPM, SO<sub>2</sub>, CO and NO<sub>x</sub> are within the stipulated CPCB standards. The proposed mining operations and related activities are expected to add to the levels of air borne particulate matters. However, the addition of gaseous pollutants due to the proposed activities is expected to be relatively low under controlled operation.

### ***Controlling Dust Levels***

Dust would be generated during mining, crushing operations, and also during handling and transportation of the material. The proper control measures would be taken up in the major areas of operation as follows:

#### ***Mine***

- Dust suppression systems (water spraying) will be adopted at
  - Faces/sites while loading;
  - Use of sharp teeth for shovels;
- Dust extraction systems will be used in drill machines;
- Use of sharp drill bits for drilling holes and drills with water flushing systems (wet drilling), to reduce dust generation will be ensured.

#### ***Stock-piles***

- Mist sprays will be provided at appropriate places for preventing dust pollution during handling and stockpiling of mined material.

#### ***Haulage***

- Regular water spraying will be carried out on haulage roads during transportation of limestone up to conveyor belt system by water sprinklers.
- Transfer points shall be provided with appropriate hoods/chutes to prevent dust emissions.
- Dumping of limestone should be done from an optimum height (preferably not too high) so as to reduce the dust blow.

#### ***Crusher***

- Crusher will be provided with “Bag Filters” to arrest any dust emission. The dust emission level will be kept within the prescribed standard of 150 mg/Nm<sup>3</sup>.
- Water sprinkling system will be provided to check any fugitive emissions from the crushing operation.

### ***Belt Conveyor***

Close conduit type conveyor belt will be used for transportation of crushed material to the Cement plant at Chattak, Bangladesh. The belt and idlers will be maintained in proper condition so as to avoid spillage of material and prevent any fugitive emissions.

### ***Greenbelt***

Even with the various dust suppression measures in place, dust generated from mine faces, are difficult to control. Therefore, in addition to the above mitigative measures, it is proposed to have green belt in and around the mine site, crushing, loading and unloading facilities, corridor of belt conveyor route and in abandoned mine area during the reclamation process.

It is expected that plants with 10m, 20m and 30m height can reduce dust pollution by 50%, 70% and 80% respectively. A combination of these, with appropriately selected species would be planted depending on the requirements and the extent of the problem.

### ***Controlling CO Levels***

The concentration of CO in the ambient air was below detectable limits during pre-mining period at all the air quality monitoring locations. Expected increase in the CO concentration is very low as CO emissions from mining operations are less, compared to other pollutants. Heavy and light vehicles are the major sources of CO in the mine. All vehicles and their exhausts would be well maintained and regularly tested for pollutant's concentration.

### ***Controlling NOx Levels***

NOx emissions in the mine mainly occur during blasting operations. However, controlled blasting would be required in the present mining operations. The only other source of NOx would be due to vehicular emissions, which will be controlled appropriately.

### ***Occupational Health & Safety Measure to Control Dust Inhalation***

Use of dust masks would prevent inhalation of RPM thereby reducing the risk of lung diseases and other respiratory disorders. Regular health monitoring of workers and villagers from nearby areas in the impacted zone (-1 km from the core zone) will be carried out.

### ***Noise Pollution Control***

To keep noise generation in control, latest sophisticated technology and equipment have been considered. Drills, loaders, dumpers etc with larger capacities will be acquired to reduce the number of operational units at a time, thereby reducing the noise generating sources.

The equipment systems will include cabins to ensure that the operators and other work persons, in and around the operating equipment, have comfortable workstations. To keep the ambient noise levels within the permissible limits of 75 dB(A), appropriate measures would be adopted.

### **Control of Ground Vibration & Fly Rocks/Boulders**

As only controlled blasting would be involved, there would be no major ground vibrations that would need to be specially regulated.

### **Land Management**

Land degradation is one of the major adverse impacts of open cast mining in the form of excavated voids and also in the form of waste dumps. Land reclamation plan must, therefore, be implemented simultaneously with the mining activities.

### ***Land Reclamation***

The land reclamation shall be carried out with an emphasis on plantation. At any point of time the area under disturbance shall be kept at minimum. The disturbed land including the area disturbed due to excavation, dumping, construction of haul roads, ramps, structures etc would be fully reclaimed before finally abandoning the mine.

Every mined out area shall be fully reclaimed within five years of completion of mining operations in a phased manner.

### **Hydrology, Hydro geology & Water Quality**

Surface water will be pumped from the Phlangkaruh River to meet the requirement for the mine and its infrastructure. A pump is proposed to be install for meeting the water requirement, both for industrial and domestic usage. No ground water extraction will be needed for the mining operation. So the possibility of lowering ground water table is nil.

### **Water Quality**

The potential impact on the surface water quality is likely to be due to higher load of suspended solids. Source of suspended solids would be:

- Wash off from limestone Dumps
- Oil Spillage from Maintenance Workshops
- Effluent from Mine Infrastructure
- Impact of Polluted Water

Management strategy for each of the above four areas are worked out and given.

### **Ecology and Biodiversity**

Ecological surveys in the core zone and buffer zone, reveal no exceptional features of wildlife interest. The surveys were based on the following seven evaluation criteria.

**Table-1:** Ecological Criteria & Observations

Land use	Extent of modification by man. The area is classed as semi natural agricultural land.
Size	The land taken for the proposed mining is not large in the context of the surrounding.
Diversity	A number of different floral species present. But the higher vertebrate species composition is poor.
Rarity	There is no endemic, rare or threatened species in the proposed mining area.
Proximity	There are no Reserve forest, Wildlife sanctuary, National Park or Biosphere Reserve within the core or buffer area.
Potential value	Ability to improve, possibly with active management is foreseen. After restoration of mining area will increase habitat condition.
Intrinsic appeal	Species weightage for more popular species. There are no exceptional species present.

LMMPL authority's proposals include number of measures to restore the disturbed area and also improvement of the habitat. Under the afforestation plan, it is proposed to develop a green belt around the mining area. The green belt not only adds up as an aesthetic feature, but also acts as a pollution sink. The plantation will ensure a stabilisation, provide aesthetic feature, help in noise reduction and enhance the quality of habitat for wildlife.

### **Social Issues and Management**

The impacts of social related issues can be listed under following categories:

- Resettlement issues
- Effects on indigenous people

- Loss of livelihood
- Induced developmental issues
- Effects on aesthetics and landforms
- Noise issues

Each of the above issues has been addressed in the detail MRCP from appropriate management point of view.

### **3.0 MINE RECLAMATION AND CLOSURE PLAN**

#### **Reclamation Objectives and Land Uses**

The first step in a successful reclamation programme is to decide the post reclamation land use. In this case it is considered appropriate to convert the land under a cover of dense vegetation, keeping in view of the following:

- Area is rich in vegetation and further plantation would match with the exiting environment;
- Trees promote precipitation and prevention of erosion and help to the stabilization of slopes. They absorb CO<sub>2</sub> and contribute oxygen resulting purification of air.

Keeping the above in view, the land reclamation shall be carried out with an emphasis on plantation/afforestation. At any point of time, the area under disturbance shall be kept in minimum. This shall be achieved by ensuring reclamation of excavated area, concurrently with mining activities by reducing the gap between the first damage (mining) and the first repair (reclamation) to the bare minimum. Therefore, the ongoing reclamation work plan through a process of afforestation is likely to ensure stabilization of the mine area. The plant species have been carefully selected for soil binding and prevention of erosion.

#### **Soil Conservation Measures**

To prevent soil erosion, wash-off of dump-fines and down-slope damages from failure of rock piles located on steep slopes, the following measures shall be adopted:

- Provision of garden drain
- Provision of toe drain with suitable baffles
- Provision of stone paved chutes
- Provision of check dams
- Construction of contour trenches at 2 m intervals
- Construction of retention wall around stockpile

#### **Socio Economic Consideration**

The proposed mine area covers 100 ha and space required for the office, workshop, crusher and colony is estimated as 12.55 ha. A corridor 25-40m wide along the proposed conveyor belt (17.3km) will require 7.2km land in a linear distance will be in Indian Territory.

No home or dwelling units lie in any of the any land required for the above purposes. As such, the project would not result in any displacement of population who would have required to be provided with rehabilitation or compensation. The mine area (100 ha) and area for crusher and workshop belong to the community of village Nongtraï for which LMMPL has undertaken 35 years renewable land lease agreement with the village council.

Nearest villages in the area (buffer zone) are: Phlangkaruh (about 1km to the South), Shella Bazaar (about 2km to the SouthEast) and Pyrkan village (1.5 to the South-Southeast).

### **Compensatory Arrangement for Nongtraï village Community**

As a compensatory arrangement against the lease of land for mining operations LMMPL will pay to the village council (locally known as Durdar) Rs. 5/- per tonne of limestone extracted from mine site for its export to the cement plant in Bangladesh. Based upon of 2.0 million tonnes per annum of limestone exported (i.e. 7000 tonnes per day), it is estimated that the village Durbar will receive Rs. 10 million per annum.

The Durbar with the assistance of the socio-economist proposes to allocate 30% (i.e. Rupees 3.0 million per annum) of the income generated from the mine to community based projects such as education, health, and infrastructure development projects. The remaining 70%% (i.e. Rupees 7.0 million per annum) will be distributed equally among the households of the village, so the villagers will get additional income of Rs. 51,000 per year during the project.

### **Socio Economics after Closure**

After the mining period the workforce will be managed in the following way:

- Management people will be transferred to other mining site of the company
- Skilled workforce will be transferred in other mining site or may take voluntary retirement with economic benefit from the company
- Semi-skilled and unskilled workforce will take voluntary retirement with economic benefit from the company.

The buildings and structures, which are constructed during the mining operation period will be retained and handed over to the local community for the community use purpose, these are:

- Mine office for the use of Social infrastructure for the community purposes
- Ware house for the use of Cottage Industry
- Workshop for generation power using Diesel Generator.
- Connecting roads will be retained for public use.

## **Tailing Dam, Open Pits, Dumps and Stockpiles**

### ***Tailing Dams & Dumps***

No wet processing is envisaged and therefore no tailing dam is envisaged throughout the life of the mine.

### ***Stockpiles***

In order to ensure continuous despatches, a buffer stockpile is planned. In the initial 2-3 years during the developmental and stabilising phase, the stockpile will carry about 250,000 tonnes of limestone and subsequently a pile of about 100,000 tonnes will be maintained. At the end of the life of the mine, all the remaining stocks will be despatched, thus leaving no dump formation.

## **Accommodation, Roads, Processing Plant and Ancillary Facilities**

### ***Open Pits, Accommodation (Colony), Roads, Crusher Plant & Service Areas***

To reduce the time gap between land disturbance and reclamation, an excavation schedule is shown in Table 2.

**Table- 2 :** Annual Schedule of Excavation

<b>Year</b>	<b>Limestone excavated (tonnes)</b>	<b>Year</b>	<b>Limestone excavated (tonnes)</b>
1 <sup>st</sup>	0	6 <sup>th</sup> -10 <sup>th</sup>	10,000,000
2 <sup>nd</sup>	1,527,000	10 <sup>th</sup> -15 <sup>th</sup>	10,000,000
3 <sup>rd</sup>	1,950,000	15 <sup>th</sup> -20 <sup>th</sup>	10,000,000
4 <sup>th</sup>	2,050,000	20 <sup>th</sup> -25 <sup>th</sup>	10,000,000
5 <sup>th</sup>	2,035,000	25 <sup>th</sup> – 53 <sup>rd</sup>	57,958,000

All areas, i.e. pit area, service areas, crusher area, etc. would be separated by a suitable vegetative belt, to reduce the migration of pollutants. Afforestation would also be done along out-of-pit service roads and building with planting started at the beginning of mine operation in a planned way. A landscape planner would be contracted to plan and improve the aesthetics of the area. The reclaimable area available during mining and final mine closure phases are shown in Table 3.

**Table- 3 : Reclamation %age of Disturbed Area/Other Areas Planned for Afforestation**

Period (Year)	Area disturbed for mining (Ha)	Disturbed area available for reclamation (Ha)	Cumulative Reclaimable Area as % of Cumulative Disturbed Area	Afforestation Area Planned (Ha)		
				Undisturbed within lease	Around the Lease *	Colony #
0-10	64.0	7.1	11%	5.0	10.5	2.0
11-20	16.0	2.2	11%	-	-	-
21-25	4.0	2.4	14%	-	-	-
25-53	11.0	83.3	100%	-	-	-
Final	95.0	95.0	100%	5.0	10.5	2.0

\* Around the lease area on the eastern side and the southern side (excluding the area covering the sink hole) of the lease boundary, green belt is assumed to be developed for a width of 50m., covering a total area of approximately 5.3 ha. Net area for afforestation outside green belt will be 107.2 ha.

### **Acid Rock Drainage Management**

As the water coming out at Phlangkaruh is alkaline, no separate provision for management of acid rock drainage is made. As such, no acidic run-off is envisaged on account of mining.

### **Rehabilitation of Disturbed Areas**

The Restoration plan has been prepared keeping in view the land use changes that will occur due to mining operation in the area. The objectives of the restoration plan include:

- To reclaim the mined out areas by planting trees which are indigenous in nature;
- To provide a green belt around the periphery of the mine areas, crushing, loading and unloading points & conveyor belt corridor to combat dispersal of dust in the adjoining areas;
- To protect the erosion of the soil;
- To conserve moisture for increasing ground water recharging;
- To restore the ecology of the area;
- To restore aesthetic beauty of the locality;
- To meet the requirement of fodder, fuel and timber of the local community;

### **Selection of Appropriate Species**

Species have been selected and restoration programme developed in order to ensure a diverse and robust poly culture forest is developed after mining. Species that are native to the area have been given preference. At the same time the species which have dust tolerance have also been focused on; growth rates of the species have also been considered, as the area needs to be covered very quickly. The area is also full of lime stone and will be uneven after completion of mining, and the base is likely to have residual lime stone and be devoid of any top- soil and nutrition. As such the species which can survive in such adverse conditions have been selected.

## **Availability of Area for Restoration**

A total of 5 hectares comprising twin sink holes immediately south west of the mining area having rich flora is proposed to be retained as such and protected as per original mining plan.

Out of balance 95 ha of mining pit area, an area of 0.3 ha will be utilised for roads and 1.7 ha will be utilised stockpile. Thus the balance area of 94.7 ha are available for restoration in phased manner. The approved mining plan notes that, up to the end of 25<sup>th</sup> year, 11.7 ha of land is available for afforestation from the years 1<sup>st</sup>, 10<sup>th</sup>, 20<sup>th</sup> and 25<sup>th</sup> year while 83 ha is said to be available at the end of 53<sup>rd</sup> year. It is presumed that some area will be available in between the period from 25<sup>th</sup> to 53<sup>rd</sup> years and as such small areas of 12.97 ha have been proposed to be afforested at 30<sup>th</sup>, 35<sup>th</sup>, 40<sup>th</sup>, 45<sup>th</sup> and 50<sup>th</sup> year. The balance area of 70.03 ha are proposed to be planted in the 53<sup>rd</sup>, 54<sup>th</sup> and 55<sup>th</sup> years as it will be difficult to raise plantation on such a vast area during one year.

The northern and western portion of the mine areas are currently have good vegetation with 20-30% crown density while the eastern and southern portion are have density of 10-20%. A green belt is proposed to be developed on the eastern side and on southern side for mine lease to a width of 50m (7.5 m within lease area and 42.5 m outside lease area). This will add an additional area of 7.3 ha for afforestation.

Further in the colony area, workshop & ware house area, afforestation is to be done with ornamental and shade tree species.

## **Nursery**

As there is no Forest Department nursery in the area, there is no possibility of obtaining the desired seedlings. As such, a nursery is proposed to be established by the Mining Company. Land for nursery is being already negotiated at three different areas around the proposed project area.

An area of 0.3 ha will sufficient for the required nursery. The area should be as close as possible to the plantation site. Necessary steps will be taken to use good quality seeds; two year old tall seedlings will be planted for afforestation. Regular weeding, cleaning and howing of seedlings and application of oil cakes will be carried out to boost up the growth.

## **Planting Technique**

### **Soil Work**

The mine-area is almost devoid of any topsoil. Hence the soil will not be available after mining. Further after mining it is expected that the excavated area will be having some lime stone block.

The excavated area left out after mining is to be terraced and contour bunding is to be done with the rubbish (stone dust) and boulder particles at the site preferably at 10m interval. Planting pits of size 45cm x 30cm at the top, 30cm x 30cm at the bottom and 45cm deep are to be dug at 2m apart lines and 2.5m apart in line in staggered manner. No pits should be dug

along contour bund, which will be used for sowing seeds and planting broomstick shrubs and bamboos. As the area is expected to be full of limestone in the bottom strata, the help of drill machine may be resorted to in some cases, where it is not possible to dig the planting pits manually. The planting pits are to be filled up with good imported earth mixed with cow-dung in 3 : 1 proportion. If it is difficult to procure cow-dung, then same may be replaced by leaf compost, which may be prepared at the nursery site.

All the plantation and nursery works are to be done under the direct supervision of a senior and experienced forest ranger who may be taken on deputation from the State Forest Department.

1. The forest should be maintained as protection forest.
2. Collection of fodder and fuel wood to the local people may be allowed at a nominal cost to be decided by the Village Darbar.
3. Only dead, dying and diseased trees may be removed to meet the need of the timber to the local people.
4. Picnic/Tourism may be developed and allowed to the general people under certain terms and conditions with a levy of certain fees.

## **Water and Waste Management**

### **Management of Natural Water Resources**

The mitigative measures, which will be adopted to minimize the impact of mining on the water resources of this area, are:

- Blasting activities will have to take care on the sinkholes, cracks and fissures in the site.
- Effort must be taken to avoid face collapse at these cracks and fissures during excavation and drilling activities.
- Leak proof containers shall be used for storage and transportation of oil or grease to prevent surface water contamination. The floor of oil/grease handling area and workshops will be kept effectively impervious and any wash-off from those areas will be drained through impervious drains, collected in specially constructed pit and treated in the Effluent Treatment Plant (ETP), appropriately, before releasing for final discharge.

To prevent degradation and maintain the water quality during rainy season, the proposed control measures that will be adopted to check the mine runoff into natural streams are:

- Construction of garland drains around freshly excavated, dumped areas, haul roads, so that flow of water with loose material can be prevented. The mine water shall be passed through specially constructed catch pits to arrest any loose materials being carried away with water.
- Peripheral bunds will be created on the outer edge of abandoned benches before reclamation, so as to minimize any surface runoff by storm water.

- To prevent formation of gullies in the bench slopes, a water gradient of about 1 in 200 shall be kept at every bench towards inside of the bench.
- Small check dams will be provided to the natural streams that will be used for convey of rainwater from the garland drains.
- The belt conveyor will be properly covered and maintained leak proof to prevent spillage during rain.
- To prevent any pollution of surface or groundwater, the sewage will be properly drained through underground impervious drains to an appropriately designed Sewage Treatment Plant (STP).
- The surface water bodies around the mine, crushing/loading plant and other infrastructures will be regularly tested and appropriate control measures will be applied in case of any pollutant detected above the prescribed limit.

### **Estimate and Management of Wastewater/Effluent Generated**

The mining operations will generate wastewater of approximately 50 m<sup>3</sup>/day, which will be treated in an Effluent Treatment Plant (ETP) provided at the mine location and will be reused for spraying on the haul roads and development of green belt.

Approximately 40 m<sup>3</sup>/day of domestic wastewater will be generated from the township, which can also be used in plantation after treatment in a Swage Treatment Plant (STP) provided near the township.

### **Management of Solid Waste**

It can be expected that this mine being devoid of overburden and some clay being restricted only in the crevices. The quantity of the clay is expected to be almost negligible. Approximately, 0.10 to 0.15 tons/day of sludge from the treatment plant of wastewater will be generated from the Activated Sludge Process (ASP). This sludge is anticipated to be rich in nitrogen and phosphorous and can be utilized as manure for the plantation.

Solid waste generated from Sewage Treatment Plant (STP) after treating the waste from the residential area will also be dumped in the waste dump area. Domestic solid wastes that will be generated from the proposed mine site township include kitchen waste, sanitary napkins, vegetable residuals, fish scales, bones etc. The township will contain approximately 20 families. Considering 5 persons per family, generating 0.4 kg of solid waste per person per day (i.e. 2 kg per family per day) the estimate of domestic solid waste generation from this township will be 40 kg/day, which will be disposed off through local siyem (Durbar) by way of decomposition, sanitary land filling.

## Monitoring Programme

Reclamation monitoring is an inherent requirement of mine decommissioning and closure plan and it includes constant inspection of the following:

- Restoration of land surface (drainage, slope, stability),
- Re-vegetation (cover, type, vigor) and
- Groundwater (recovery, quality).

The schedule and duration and parameters to be monitored are given in Table 4.

**Table-4 :** Monitoring schedule and Parameters

Sl. No.	Description of Parameters	Schedule of Monitoring
A.	Air Quality (SPM, RPM, CO, SO <sub>2</sub> , NO <sub>x</sub> )	
1.	In the vicinity of the mine	One sample over 24 hours continuous duration, once a week throughout the year.
2.	Within the mine	One sample over 24 hours continuous duration, twice in a week throughout the year.
3.	In the surrounding areas covering three locations 120° apart, close to the nearest habitation.	One sample over 24 hours continuous duration, twice in a week throughout the year.
B.	Water Quality	
1.	Water stored in the mine area	Twice a week for selected parameters like, pH, TSS, TDS, COD, BOD and oil and grease. The detailed analysis should be carried out once in three months.
2.	Surface and ground water quality in the vicinity of the mine area for water potability conforming to drinking water standard IS: 10500:1991.	Once in three months.
C.	Ambient Noise Level	Quarterly
D.	Inventory of flora	Once in two years in the project monitoring area.
E.	Soil quality	Once in year on all reclaimed area and adjoining villages.
F.	Socioeconomic condition of local population – physical survey.	Once in two years.

In the present project management, a monitoring system for the above parameters will be installed. Monitoring results will also form the basis for adoption of appropriate treatment process and up gradation of treatment facilities developed in due course of time.

## **4.0 WORK PROGRAMME, BUDGET AND SCHEDULE**

### **Ongoing Reclamation**

Appropriate reclamation work will be taken up during operational period in the phased manner to reduce the impact of mining. The following reclamation work will be taken up during mining operation:

- Soil Conservation measure
- Afforestation programme in phased manner
- Reclamation of pile after flushing and/or neutralizing (slope and vegetative cover)
- Solid waste management
- Air and sound pollution measure
- Management of water quality & Wastewater treatment
- Social related issues (Compensation, income generation opportunity, influx of migrants, cultural conflict, etc.)

### **Site Configuration at Cessation of Mining**

At the cessation of mining, a deep depression will be created on the slope of the hill. The elevation of the crest of top bench will be 180m, while the elevation of the toe of the bottom most bench will be 90m. The overall pit slope (line joining the crest of all the abandoned benches) will be about 45 degrees. The surface area of the bottom most bench will be approximately 825m (EW) x 835m (NS) = 688875 m<sup>2</sup> or 69 Ha. The abandoned bench slopes need to be battered to a gentler slope. At the end of mining, the entire floor and the crest areas of the bottom most pit will be available for afforestation.

### **Decommissioning and Closure Facilities & Proposed Action**

A closure plan for the industrial area and the associated infrastructure including the ROM Stockpile area, crusher, workshop, colony and other miscellaneous facilities is described below:

The unwanted structures will be removed and the corresponding area graded, topsoiled and seeded. The remaining buildings will be handed over to Nongtraï /Shella Durbar for community use.

### **Fall Back Strategies**

The entire infrastructure in the industrial area will be retained for further use if LMMPL decides to continue mining activities in adjacent area and obtains necessary permissions from various government agencies as per applicable Acts.

### **Schedule Of Operation and Cost**

The schedule of operation for decommissioning and its related costs are estimated in Table 5.

**Table- 5 :** Schedule of Operation for Decommissioning & its Cost

<b>Task</b>	<b>Operation</b>	<b>Cost Basis</b>	<b>Cost (Rs)</b>
A	Dismantling of Explosives Magazine	Dozing: 10 hrs @ Rs 800/hr; Carry away Rubbish 10 truckloads = Rs 10000	18,000
B	Dismantling of crusher (including crushing plant, substation and ancillary buildings)	Dismantling will be part of disposal sale of crusher, so no cost is assumed; Dozing: 100 hrs @ Rs 800/hr; Carry away rubbish 10 truck loads = Rs 10000	90,000

### **Management Supervision**

The Management Supervision plan includes:

- Monitoring objectives,
- Monitoring schedule, and
- Effective implementation.