

# **BIODIVERSITY IMPACT ASSESSMENT REPORT**

## **Biodiversity:**

Biodiversity, as defined by the 1992 Convention on Biological Diversity, refers to the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.

## **Biodiversity Impact Assessment**

Biodiversity impact assessment can be defined as a decision-support tool to help biodiversity-inclusive development planning and implementation. It aims at ensuring that development proposals integrate biodiversity considerations and are legally compliant, and include mechanisms for the conservation of biodiversity (with the aim of no net loss of biodiversity), result in sustainable use of biodiversity resources, and provide fair and equitable sharing of the benefits arising from use of biodiversity.

The overall objective of the biodiversity assessment is to optimise the biodiversity outcome of plan, programme or project development. In order to achieve this, the proposal in question needs to be informed by the current state of biodiversity and the potential assets derived from biodiversity in the area. Provided that the necessary knowledge base on the current state of biodiversity in the area exists the assessment can then predict potential impacts of the proposal on biodiversity, which in turn allows for its revision in order to minimize impacts on biodiversity and/or realize opportunities; the overall objective being no net biodiversity loss.

## **Effectiveness in Biodiversity Impact Assessment**

Biodiversity impact assessment processes need to take into consideration several aspects:

- Fulfillment of legal requirements;
- Effective integration, communication and access to scientific knowledge; and
- Integration of biodiversity aspects with a variety of other concerns during the planning process.

## How to assess impacts on biodiversity?

The full range of factors that cause changes in biodiversity is considered:

- **Direct drivers of change**, which can be identified and measured, include the following

Groupings: (i) changes in land use and land cover, (ii) fragmentation and isolation, (iii) extraction,

Harvest, or removal of species, (IV) external inputs such as emissions, effluents, chemicals,

(v) Disturbance, (VI) introduction of invasive, alien and/or genetically modified species, (vii)

Restoration.

- **Indirect drivers of change** which can in turn influence the direct drivers, include (i)

Demographic, (ii) economic, (iii) socio-political, (iv) cultural and (v) technological processes or interventions.

## Challenges to Biodiversity Impact Assessment

- Constraints on potential opportunities for biodiversity enhancement during development

Resulting from the minimalist conservation/protection approach of the assessment directives.

- Existing shortcomings in public consultation effectiveness;

- Discrepancies, lack of standards and accessibility issues with regards to biodiversity (spatial) data;

- Lack of complete and up-to-date fundamental biodiversity data;

- Conservation objectives and site management plans are often incomplete or rudimentary;

- Inadequate range and availability of biodiversity and taxonomic

- The inconsistent quality of individual assessments; and

## **INTRODUCTION OF THE PROJECT**

It is a new mine spread over an area of 70 ha in village Lumshnong of District East Jaintia hills, Meghalaya. This ML area is agriculture & waste land and 4.82 ha of forest patches land. The proposal is to mine limestone mineral at the rate of 9,00,000 MTPA by open cast mining mechanized method involving drilling and blasting. The ROM from the mine will be taken to the company's cement plant of 3000TPD capacity.

## **METHODOLOGY**

Ecological study has been made to know the forest types, flora and faunal composition of the study area which were computed and compared with the satellite and information from other sources like BSI, ZSI, relevant forest department (Wildlife Department) and local NGO's. Subsequently through extensive field survey, forest types, flora and faunal composition of the study areas were computed and compared with the satellite and other information. The various ecosystems, vegetation, communities, faunal habitats prevalent in the study area were identified though Quadrant method with Random Sampling Technique was adopted to know distribution pattern of the plant species and faunal characteristics both in core and buffer zone. All the plant species in a quadrant of 10 x 10 size at an interval of 500 mtr from the core of the mine in all four directions were recorded. A line transect was laid for entire area of 10 Km to divide 500 mtr segments. Thus randomly distributed quadrants were laid for ecological assessment. The detailed species characteristics like frequency, abundance & density were computed.

### **Frequency:**

The frequency of individual species is the number of times the species occurs in the sampling quadrant. It is actually represented as a percentage calculated as follows:

$$\text{Frequency} = \frac{\text{No. of quadrants in which the species occurred}}{\text{Total no. of quadrants studied}} \times 100$$

It reflects the probability of encountering the species within the sampled area.

**Density:**

Density is the measure of dense in the distribution of an individual species within a given area Density of a species is defined as the average number of the species per quadrant and calculated as follows:

$$\text{Density} = \frac{\text{Total no. of individuals of the species}}{\text{Total no. of quadrants used in sampling}}$$

**Abundance:**

It reflects how evenly one species is distributed within the sampling area. Abundance of a species is defined as the number of individuals per quadrant and calculated as follows:

$$\text{Abundance} = \frac{\text{Total no. of individual of the species}}{\text{No. of quadrants in which the species occurred}}$$

In faunal studies, attempts were made for abundance computation by census techniques. Observation on feeding, breeding and nesting habitats on selected animals were attempted. Evidence of migratory routes was also investigated.

Recording of rare and endangered plant and animal species were also made. The detailed floristic composition of entire area under study is given in subsequent sections.

The floral pattern in the study area has been studied in detail. The project area is covered by forest having moderate density of tree growth predominated by scanty shrubs and bushes. Most of them are dry deciduous type. Mainly the regional flora and fauna is found in the study area. The local species are proposed to plant during afforestation. So biodiversity of the area due to the project shall be maintained. There are reserved forests within the study area. The study area does not contain any eco-sensitive zone like National park.

## ECOLOGICAL PATTERN

The project site (core zone) as well the buffer zone area was surveyed to assess the ecological status.

## FLORA IN CORE ZONE

Core zone has scanty vegetation with few trees of *Terminalia catappa*, *Toona ciliata*, *Artocarpus heterophyllus* sps. Phyto sociological analysis is given below.

Phyto-sociological analysis of emergent tree, small tree & shrubs, herbs and juvenile tree species of mine lease area are given below in table below.

### Phyto-sociological analysis of trees:-

Name of Species	Density	% frequency	RD	R dom	RF	IVI
<i>Terminalia catappa</i>	1.5	60	19	18.518	24	61.037
<i>Musa paradisiaca</i>	1.0	50	11	10.989	17	38.645
<i>Syzygium cumini</i>	0.5	30	5.5	5.494	10	20.989
<i>Artocarpus heterophyllus</i>	0.9	40	9.9	9.890	13	33.114
<i>Toona ciliata</i>	2.3	60	25	25.74	20	70.549

### Phyto-sociological analysis of shrubs, herbs and juvenile trees:-

Name of Species	Density	% frequency	RD	R dom	RF	IVI
<i>Aroides</i> sp.	1.2	50	5.9	5.911	7.5	19.285
<i>Arundina graminifolia</i>	1.4	70	6.9	6.897	10	24.240
<i>Baliospermum montanum</i>	0.8	50	3.9	3.941	7.5	15.344
<i>Bidens biternata</i>	2.8	60	14	13.793	9	36.541
<i>Bidens pilosa</i>	1.2	40	5.9	5.911	6	17.792
<i>Leea indica</i>	0.6	30	3	2.956	4.5	10.388
<i>Leea</i> sp.	2.4	60	12	11.823	9	32.600
<i>Mimosa himalayana</i>	3.2	100	16	15.764	15	46.452
<i>Morinda angustifolia</i>	1.8	60	8.9	8.867	9	26.689
<i>Salamona</i> sp.	0.6	20	3	2.956	3	8.896
<i>Saurauia</i> sp.	2.3	60	11	11.330	9	31.615
<i>Clerodendrum viscosum</i>	0.3	20	1.5	1.478	3	5.940
<i>Eupatorium odoratum</i>	1.7	50	8.4	8.374	7.5	24.211

The number of shrubs, shrubby climbers and tree saplings together was total of 13 species found. The mining lease area was dominated by mainly some shrubs and weedy species. The density values for different species of shrubs varied from 3.2 to 0.3. Maximum density value

shows in *Mimosa himalayana* followed by *Bidens biternata* and *Saurauia* sp. The IVI value recorded the highest in *Mimosa himalayana* (46.45) and least in case of *Clerodendrum viscosum* (5.94). The stand density in the case of herbaceous species like *Saurauia* sp was maximum. This area was also dominated by species which can survive in dry and harsh condition.

## FAUNA IN CORE ZONE

During study period only birds and few mammals, were seen, however as per the discussion with local people fauna found in core zone are given below:

Zoological Name	Common Name	Schedule Status
<i>Cannomys badius badius</i>	Bamboo Rat	Schedule V
<i>Callosciurus erythraeus erythraeus</i>	Squirrel	US
<i>Crocidura attenuata rubricosa</i>	Grey Shrew	US
<i>Herpestes edwardsii</i>	Indian Grey Mongoose	Schedule II
<i>Mus booduga</i>	Field Rat	Schedule V
<i>Rattus rattus brunneusculus</i>	Black Rat	Schedule V
<i>Suncus murinus Griffith</i>	House Shrew	US

## Birds

Zoological Name	Common Name	Schedule Status
<i>Acridotheres tristis tristis</i>	Indian Myna	IV
<i>Bubo flavipes</i>	Tawny Fish Owl	US
<i>Scolopax rusticola rusticola</i>	Wood Cock	US

<b>Zoological Name</b>	<b>Common Name</b>	<b>Schedule Status</b>
<i>Alcedinidae</i>	Kingfisher	Schedule IV

### **Reptiles**

<b>Zoological Name</b>	<b>Common Name</b>	<b>Schedule Status</b>
<i>Calotes versicolor</i>	Garden Lizard	US
<i>Chameleon sp.</i>	Chameleon	Schedule II Part I

### **FLORA IN BUFFER ZONE**

The vegetation of the buffer zone is broadly classified as tropical evergreen forest with elements from tropical moist deciduous and subtropical forest vegetation. Forest in buffer zone is Narpuh Reserve Forest (10 Km, SE). The forests within 10 km radius have three distinct strata, viz., (i) Upper canopy layer with dominance of emergent trees, (ii) Sub-canopy layer with dominance of small trees and pole size trees, and (iii) Under canopy layer with dominance of shrubs, herbs and juvenile trees. The details of species available are given below:

#### **Details of Species available**

#### **LIST OF FLORAL SPECIES**

<b>List of plants found nearby Township</b>	<b>List of plants found in Lumshong – Umlong sector</b>
<b>Trees</b>	<b>Trees</b>
<i>Albizia lucida</i>	<i>Actinodaphne obovata</i>
<i>Bauhinia purpurea</i>	<i>Ailanthus grandis</i>



<i>Bridellia</i> sp.	<i>Aralia armata</i>
<i>Callicarpa arborea</i>	<i>Ardisia nerifolia</i>
<i>Citrus</i> sp.	<i>Bambusa tulda</i>
<i>Ficus elmeri</i>	<i>Bauhinia purpurea</i>
<i>Litsea</i> sp.	<i>Bischofia javanica</i>
<b>Herbs/Shrubs</b>	<i>Caryota urens</i>
<i>Ageratum conyzoides</i>	<i>Castanopsis tribuloides</i>
<i>Bidens pilosa</i>	<i>Cinnamomum obtusifolium</i>
<i>Clerodendrum viscosum</i>	<i>Citrus</i> sp.
<i>Eupatorium odoratum</i>	<i>Elaeocarpus</i> sp.
<i>Fagopteris auriculata</i>	<i>Exbucklandia populnea</i>
<i>Hedychium</i> sp.	<i>Ficus</i> sp.
<i>Maesa indica</i>	<i>Litsea citrita</i>
<i>Malastoma malabathricum</i>	<i>Lirsea sebifera</i>
<i>Oxalis corniculata</i>	<i>Litsea salacifolia</i>
<i>Polygonum chinense</i>	<i>Litsea</i> sp.
<i>Rhynchoetecum ellipticum</i>	<i>Macranga denticulate</i>
<i>Solanum torvum</i>	<i>Macropanax disperma</i>
<i>Thysanolaena maxima</i>	<i>Persea</i> sp.
<i>Trevesia palmate</i>	<i>Pithecellobium</i> sp.
<i>Triumfetta pilosa</i>	<i>Quercus lancifolia</i>
<i>Urena lobata</i>	<i>Quercus spicata</i>

	<i>sapium baccatum</i>
<b>Climber &amp; epiphyte</b>	<b>Trees</b>
<i>Ficus</i> sp.	<i>Sarcosperma griffithii</i>
<i>Hoya</i> sp.	<i>Shima</i> sp.
<i>Mikania macrantha</i>	<i>Syzygium</i> sp.
<i>Porana paniculata</i>	<i>Trema orientalis</i>
<i>Raphidophora decursiva</i>	<i>Vitex</i> sp.
	<i>Travesia palmate</i>
<b>List of Shrubs/Herbs found in Lumshong – Umlong sector</b>	
<i>Ageratum conyzoides</i>	<b>Climber/Epiphyte</b>
<i>Ardisia nerifolia</i>	<i>Aeschynanthus</i> sp.
<i>Bidens biternata</i>	<i>Agapetes</i> sp.
<i>Boehmeria glomerulifera</i>	<i>Asplenium nidus</i>
<i>Calamus leptospadix</i>	<i>Byttneria aspera</i>
<i>Carax cruciata</i>	<i>Calamus leptospadix</i>
<i>Clerodendrum</i> sp.	<i>Lygodium flexuosum</i>
<i>Commelina</i> sp.	<i>Microsorium</i> sp.
<i>Crassocephalum crepidioides</i>	<i>Mikania macrantha</i>
<i>Cyathula prostrate</i>	<i>Scefflera venulosa</i>
<i>Eupatorium odoratum</i>	<i>Smilax</i> sp.
<i>Forrestia</i> sp.	<i>Thunbergia grandiflora</i>
<i>Hedychium</i> sp.	

<i>Leea</i> sp.	
<i>Maesa</i> sp.	
<i>Morinda angustifolia</i>	
<i>Musa</i> sp.	
<i>Osbeckia</i> sp.	
<i>Pinanga gracilis</i>	
<i>Polygonum chinense</i>	
<i>Rungia</i> sp.	
<i>Tabernaemontana divericata</i>	
<i>Thysanolaena maxima</i>	
<i>Rungia</i> sp.	

#### List of plants found in Lumshnong - Tongseng sector

<b>Trees</b>	<b>Herbs/Shrubs</b>
<i>Ailanthes grandis</i>	<i>Ageratum conyzoides</i>
<i>Albizia</i> sp.	<i>Alpinia</i> sp.
<i>Anthocephalus chinense</i>	<i>Amaranthus</i> sp.
<i>Bauhinia purpurea</i>	<i>Aroides</i> sp.
<i>Callicarpa arborea</i>	<i>Arundina graminifolia</i>
<i>Cinnamomum bezolghota</i>	<i>Begonia</i> sp.
<i>Cyathea</i> sp.	<i>Blachnum</i> sp.
<i>Cynometra polyandra</i>	<i>Boehmeria</i> sp.
<i>Dalbergia</i> sp.	<i>Carax cruciata</i>
<i>Dendrocalamus hamiltonii</i>	<i>Chenopodium</i> sp.
<i>Duabanga grandiflora</i>	<i>Clerodendron colebrookianum</i>
<i>Elaeocarpus aristatus</i>	<i>Clerodendron viscosum</i>

<i>Elaeocarpus</i> sp.	<i>Coffea</i> sp.
<i>Englegardtia spicata</i>	<i>Coleus</i> sp.
<i>Ficus</i> sp.	<i>Dracena</i> sp.
<i>Gmelina arborea</i>	<i>Elatostema</i> sp.
<i>Grewia</i> sp.	<i>Erigeron Canadensis</i>
<i>Hevea brasiliensis</i>	<i>Eupatorium odoratum</i>
<i>Hibiscus macrophyllus</i>	<i>Fagopteris auriculata</i>
<i>Hydnocarpus kurzii</i>	<i>Ferns</i> sp.
<i>Magnolia hodgsonii</i>	<i>Leea indica</i>
<i>Mallotus tetracoccus</i>	<i>Leea</i> sp.
<i>Oroxylum indicum</i>	<i>Licuala peltata</i>
<i>Pandanus</i> sp.	<i>Ludwigia octovalis</i>
<i>Premna milleflora</i>	<i>Mimosa himalayana</i>
<i>Prunus acuminate</i>	<i>Musa</i> sp.
<i>Pterospermum acerifolium</i>	<i>Osbeckia crenata</i>
<i>Pterospermum lancifolium</i>	<i>Oxyspora</i> sp.
<i>Sapium baccatum</i>	<i>Phrynium capitata</i>
<i>Saurauia</i> sp.	<i>Phrynium pubenervae</i>
<i>Spondius pinnata</i>	<i>Polygonum chinense</i>
<i>Streospermum chelenoides</i>	<i>Pteris</i> sp.
<i>Terminalia bellerica</i>	<i>Saccharum spontaneum</i>
<i>Terminalia myriocarpa</i>	<i>Salamona</i> sp.
<i>Tetrameles nudiflora</i>	<i>Saurauia</i> sp.
<i>Toona</i> sp.	<i>Scoperia dulcis</i>
<i>Villebrunea frutescens</i>	<i>Sellaginella</i> sp.
<i>Xerospermum</i> sp.	<i>Solanum torvum</i>
	<i>Thysanolaena maxima</i>
<b>Climbers /Epiphyte</b>	
<i>Asplenium nidus</i>	
<i>Dendrobium</i> sp.	
<i>Dioscorea</i> sp.	
<i>Gnetum scandens</i>	

<i>Hedyotis scandens</i>	
<i>Luisea</i> sp.	
<i>Lygodium flexuosum</i>	
<i>Melocalamus compectiflorus</i>	
<i>Mikania macrantha</i>	
<i>Neohouzia helperii</i>	
<i>Paederia scandens</i>	
<i>Raphidophora decursiva</i>	
<i>Thunbergia grandiflora</i>	
<b>List of plants found in Tongseng – Sonapur sector</b>	
<b>Trees</b>	<b>Herbs/Shrubs</b>
<i>Albizia</i> sp.	<i>Ageratum conyzoides</i>
<i>Anthocephalus chinense</i>	<i>Alpinia</i> sp.
<i>Bauhinia purpurea</i>	<i>Amaranthus</i> sp.
<i>Callicarpa arborea</i>	<i>Aroides</i> sp.
<i>Cyathea</i> sp.	<i>Begonia</i> sp.
<i>Dalbergia</i> sp.	<i>Blachnum</i> sp.
<i>Dendrocalamus hamiltonii</i>	<i>Boehmeria</i> sp.
<i>Duabanga grandiflora</i>	<i>Chenopodium</i> sp.
<i>Elaeocarpus</i> sp.	<i>Clerodendron viscosum</i>
<i>Englegardtia spicata</i>	<i>Coffea</i> sp.
<i>Ficus</i> sp.	<i>Coleus</i> sp.
<i>Gmelina arborea</i>	<i>Elatostema</i> sp.
<i>Grewia</i> sp.	<i>Erigeron Canadensis</i>
<i>Hibiscus macrophyllus</i>	<i>Eupatorium odoratum</i>
<i>Hydnocarpus kurzii</i>	<i>Fagopteris auriculata</i>
<i>Mallotus tetracoccus</i>	<i>Ferns</i> sp.
<i>Oroxylum indicum</i>	<i>Leea</i> sp.
<i>Pandanus</i> sp.	<i>Licuala peltata</i>
<i>Prunus acuminate</i>	<i>Ludwigia octovalis</i>
<i>Pterospermum acerifolium</i>	<i>Musa</i> sp.

<i>Sapium baccatum</i>	<i>Osbekia</i> sp.
<i>Saurauia</i> sp.	<i>Oxyspora</i> sp.
<i>Streospermum chelenoides</i>	<i>Phrynium pubenervae</i>
<i>Terminalia bellerica</i>	<i>Polygonum chinense</i>
<i>Terminalia myriocarpa</i>	<i>Pteris</i> sp.
<i>Tetrameles nudiflora</i>	<i>Saccharum spontaneum</i>
<i>Toona ciliate</i>	<i>Salamona</i> sp.
<i>Villebrunea frutescens</i>	<i>Saurauia</i> sp.
<i>Xerospermum</i> sp.	<i>Sellaginella</i> sp.
	<i>Solanum torvum</i>
	<i>Thysanolaena maxima</i>

<b>Climbers /Epiphyte</b>	
<i>Asplenium nidus</i>	
<i>Dendrobium</i> sp.	
<i>Dioscorea</i> sp.	
<i>Lygodium flexuosum</i>	
<i>Melocalamus compectiflorus</i>	
<i>Mikania macrantha</i>	
<i>Raphidophora decursiva</i>	
<i>Thunbergia grandiflora</i>	
<b>List of plants found in Lumshnong – Umlunar sector</b>	
<b>Trees</b>	<b>Herbs/Shrubs</b>
<i>Ailanthes grandis</i>	<i>Ageratum conyzoides</i>
<i>Albizia</i> sp.	<i>Alpinia</i> sp.
<i>Anthocephalus chinense</i>	<i>Aroides</i> sp.
<i>Bauhinia purpurea</i>	<i>Begonia</i> sp.
<i>Cinnamomum bezolghota</i>	<i>Boehmeria</i> sp.
<i>Cyathea</i> sp.	<i>Carax cruciata</i>
<i>Dalbergia</i> sp.	<i>Chenopodium</i> sp.
<i>Dendrocalamus hamiltonii</i>	<i>Clerodendron colebrookianum</i>
<i>Duabanga grandiflora</i>	<i>Coffea</i> sp.
<i>Elaeocarpus aristatus</i>	<i>Elatostema</i> sp.
<i>Englegardtia spicata</i>	<i>Erigeron Canadensis</i>
<i>Ficus</i> sp.	<i>Eupatorium odoratum</i>
<i>Grewia</i> sp.	<i>Fagopteris auriculata</i>
<i>Hydnocarpus kurzii</i>	<i>Ferns</i> sp.
<i>Mallotus tetracoccus</i>	<i>Leea indica</i>
<i>Pandanus</i> sp.	<i>Ludwigia octovalis</i>
<i>Sapium baccatum</i>	<i>Mimosa himalayana</i>
<i>Saurauia</i> sp.	<i>Musa</i> sp.
<i>Spondius pinnata</i>	<i>Osbeckia</i> sp.
<i>Tetrameles nudiflora</i>	<i>Phrynium capitata</i>
<i>Toona ciliate</i>	<i>Phrynium pubenervae</i>

<i>Villebrunea frutescens</i>	<i>Polygonum chinense</i>
<b>Climbers /Epiphyte</b>	<i>Pteris</i> sp.
<i>Asplenium nidus</i>	<i>Saccharum spontaneum</i>
<i>Dendrobium</i> sp.	<i>Salamona</i> sp.
<i>Melocalamus compectiflorus</i>	<i>Sellaginella</i> sp.
<i>Mikania macrantha</i>	<i>Solanum torvum</i>
<i>Nepenthes khasiana</i>	<i>Thysanolaena maxima</i>
<i>Raphidophora decursiva</i>	

### **Agricultural Crops**

The principal crop of the area is paddy. At some areas maize, rabi and other pulses are cultivated. Some of the agricultural crops are as follows: *Brassica nigra*, *Capsicum frutescens*, *Cucumis sativus*, *Oryza sativa*, *Phaseolus vulgaris*, *Raphanus sativus*, *Zea mays*

### **Commercial Crops**

The commercial crops in the area are: *Citrus aurantium*, *Hevea brasiliensis*, *Thysanolaena maxima*.

### **Plantation**

Some of the species normally planted here are: *Litsea citrata*, *Populus glambelei*, *Terminalia myriocarpa*

### **Grasslands**

*Mimosa himalayana*, *Osbekia* sp., *Oxyspora* sp., *Saccharum spontaneum*, *Salamona* sp., *Selaginella* sp., *Solanum torvum*

### **NTFP Species including Ornamentals**

*Aroides* sp., *Begonia* sp., *Calamus*, *Phrynium capitatum*, *Phrynium pubinerve*, *Rhaphidophora decursiva*

### **Endangered Species**

*Arundina graminifolia*, *Cyathea spinulosa*, *Dendrobium* sp, *Gnetum scandens*, *Nepenthes khasiana*



## Endemic Species

*Nepenthes khasiana*

## FAUNA

Buffer Zone: The following species of fauna found in the buffer zone

### List of Fauna

#### Mammals

Zoological Name	Common Name	Schedule Status
<i>Arctonyx collaris</i>	Hog Badger	Schedule I Part I
<i>Cannomys badius badius</i>	Bamboo Rat	Schedule V
<i>Callosciurus erythraeus erythraeus</i>	Squirrel	US
<i>Crocidura attenuata rubricosa</i>	Grey Shrew	US
<i>Felis bengalensis</i>	Leopard Cat	Schedule I Part I
<i>Herpestes edwardsii</i>	Indian Grey Mongoose	Schedule II
<i>Lutra lutra monticola</i>	Otter	US
<i>Mus booduga</i>	Field Rat	Schedule V
<i>Mus musculus</i>	House Mouse	Schedule V
<i>Niviventer fulvescens fulvescens</i>	White bellied Rat	Schedule V
<i>Rattus nitidus nitidus</i>	Himalayan Rat	Schedule V
<i>Rattus rattus</i>	House Rat	Schedule V
<i>Rattus rattus brunneusculus</i>	Black Rat	Schedule V
<i>Rhinolophus affinis himalayanus</i>	Intermediate Horse Shoe Bat	US
<i>Rhinolophus pearsoni</i>	Pearson's Horse Shoe Bat	US
<i>Scotomanes ornatus ornatus</i>	Harlequin Horse Shoe Bat	US

<i>Suncus murinus Griffith</i>	House Shrew	US
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### Birds

Zoological Name	Common Name	Schedule Status
<i>Acridotheres tristis tristis</i>	Indian Myna	IV
<i>Bambusicola fytchii hokinsoni</i>	Assam Bamboo Partridge	Schedule I Part III
<i>Bubo flavipes</i>	Tawny Fish Owl	US
<i>Milvus migrans lineatus</i>	Large Indian Kite	US
<i>Motacilla indica</i>	Forest Wagtail	US
<i>Scolopax rusticola rusticola</i>	Wood Cock	US
<i>Alcedinidae</i>	Kingfisher	Schedule IV

### Reptiles

Zoological Name	Common Name	Schedule Status
<i>Calotes versicolor</i>	Garden Lizard	US
<i>Colliophis maclellandi</i>	Coral Snake	IV
<i>Chrysopelea ornate</i>	Flying Snake	US
<i>Natrix piscicolor</i>	Water Snake	US
<i>Chameleon sp.</i>	Chameleon	Schedule II Part I

### Amphibians

Zoological Name	Common Name	Schedule Status
<i>Amolops afghanus</i>		US
<i>Bufoides meghalayana</i>		US

<i>Microphyla ornate</i>		US
<i>Rana danieli</i>	Frog	US
<i>Rana livida</i>	Frog	US
<i>Rhacophorus maximus</i>		US

### Fishes

Zoological Name	Khasi Name	Schedule Status
<i>Brachydanio rerio</i>	Shalynnai	US
<i>Danio aequipinnatus</i>	Shalynnai	US
<i>Danio dangila</i>	Shalynnai	US
<i>Labeo dera</i>	Kha bah	US
<i>Labeo rohita</i>	Kha bah	US
<i>Puntius shalynius</i>	Shalynnai	US

### List of Invertebrate species found in the area

Group/Species of Invertebrates	Common Name	Schedule Status
<b>Acari</b>		
<i>Malaconothrus sp.</i>		US
<i>Scheloribates parvus</i>		US
<i>Paralamellobates bengalensis</i>		US
<b>Annelida: Oligochaeta</b>		
<i>Drawidia sp.</i>	Earthworm	US
<b>Arthropoda: Crustacea</b>		

Macrobrachium assamensis	Shrimp	US
<b>Arthropoda: Lepidoptera</b>		
<i>Arnetta atkinsoni</i>		US
<i>Eurema brigitta rubella</i>		US
<i>Halpe kumara</i>		US
<i>Matapa druna</i>		US
<b>Arthropoda: Insecta</b>		
Plecoptera- Immature		US
Trichoptera- Immature		US
Odonata- Immature		US
Chironomidae larvae		US
<b>Mollusca: Gastropoda</b>		
Bellamyia bendalensis	Snail	US
<b>Zooplankton: Rotifera</b>		
Brachonus quadridentatus		US
Brachonus calciflorus		US
<i>Filinia longiseita</i>		US
<i>Lecane sp.</i>		US
<b>Zooplankton: Cladocera</b>		
Sida crystalline		US
<i>Daphnia carinata</i>		US
<b>Zooplankton: Copepoda</b>		

<i>Arctodiaptomus keifari</i>		US
<i>Heliodiaptomus sp.</i>		US
<i>Mescocyclops leuckrti</i>		US

***Threatened Animal species in the Area***

<b>Zoological Name</b>	<b>Common Name</b>	<b>Schedule Status</b>
<i>Lutra lutra monticola</i>	Otter	US

**List of Aquatic fauna found in river within 15 Km**

<b><i>Fishes</i></b>	<b>Schedule status</b>
<i>Brachydanio rerio</i>	US
<i>Danio aequipinnatus</i>	US
<i>Danio dangila</i>	US
<i>Labeo dera</i>	US
<i>Labeo rohita</i>	US
<i>Puntius shalynius</i>	US
<b>Arthropoda: Insecta</b>	
Plecoptera- Immature	US
Trichoptera- Immature	US
Odonata- Immature	US
Chironomidae larvae	US
<b>Mollusca: Gastropoda</b>	
Bellamya bendalensis	US
<b>Zooplankton: Rotifera</b>	
Brachionus quadridentatus	US

Brachonus calciflorus	US
<i>Filinia longiseita</i>	US
<i>Lecane sp.</i>	US
<b>Zooplankton: Cladocera</b>	
Sida crystalline	US
<i>Daphnia carinata</i>	US
<b>Zooplankton: Copepoda</b>	
<i>Arctodiaptomus keifari</i>	US
<i>Heliodiaptomus sp.</i>	US
<i>Mescocyclops leuckrti</i>	US

#### **US- Un-scheduled animals**

There are three schedule I Species found in buffer zone namely:

- 1) *Arctonyx collaris* (Hog Badger)
- 2) *Felis bengalensis bengalensis* (Leopard Cat) ,
- 3) *Bambusicola fytchii hokinsoni*(Assam Bamboo Partridge)

For that separate conservation plan has been prepared and annexed in report. This is not migratory path of any faunal species.

### **Impact and Mitigation Measures for Flora and Fauna**

#### **Impact on flora**

- Mining can affect vegetation in the core zone. The mining activity will generate dust which may impact the vegetation and crop.

#### **Mitigation Measures:**

- Mining will not affect flora in core and buffer zone because majority of landscape in the core zone is devoid of significant vegetation. Core zone has scanty vegetation with few trees of *Terminalia catappa*, *Toona ciliate*, *Artocarpus heterophyllus* sps.
- In buffer zone there is good vegetation such as *Albizia lucida*, *Albizia* sp. Mining will be limited to the core zone. Therefore the flora and fauna will thrive in the buffer

zone. Raw material will be transported to captive cement plant at 3 km. So vehicular dust will be confined to 3 kms only.

- The mined out area will be closed progressively along with rehabilitation of the land for the gainful use by turning it into a water reservoir. Plantation will be done 160 trees per year as per approved mining plan. Thus it is expected that the natural vegetation in the area will not be affected. No forest area diversion is required in the proposed mining.
- There will be no cutting of trees during mining as the area is devoid of trees will be done.
- A site reclamation plan will be developed that will addresses both interim and final reclamation requirements and that identifies vegetation, soil stabilization, and erosion reduction measures.

### **Impact on Fauna**

- Noise from mining equipments, blasting, transportation, changes in land use may affect the migration of avifauna.
- Effect on eco-sensitive areas like National Park, Wildlife Sanctuary, Biosphere Reserves or Tiger Reserves.
- Mining may drive away the wild life from their habitat, and significantly affect wildlife.

### **Mitigation Measures:**

- In core zone there is no or very rare vegetation, flora since the land is barren. The mining activity will be in no vegetation area. Hence, no impact on flora is envisaged.
- There is Narpuh Wild Life Sanctuary at 4.8 Km SE from the lease boundary. There major faunal diversity is observed. As per baseline study shows Sc-I & II fauna is found in buffer zone namely:

### **There are three schedule I Species found in buffer zone namely:**

- Arctonyx collaris* (Hog Badger)
  - Felis bengalensis bengalensis* (Leopard Cat) ,
  - Bambusicola fytchii hokinsoni* (Assam Bamboo Partridge)
- For the preservation of Sc-I species separate conservation plans have been prepared.
  - To protect the fauna protective measures for reclamation and green belt development will be done to enhance the vegetation and a forestation in core zone. Emphasis will be given to local species & plants of economic importance.

- Measures for protection and conservation of wildlife species will be done by organizing awareness campaigns and vigilance program by involvement of community youth against poaching of animals.
- To check/reduce the impact of dust and noise, thick plantation cover will be developed which will provide acoustic buffer and therefore will dampen blasting sound.

#### **PLANTATION / AFFORESTATION PROGRAMME:**

Plantation will be done in upper mining benches, in the statutory boundary and area left for barrier HT line. Any soil generated during mining shall be stacked & used for progressive plantation in the lease hold area. Total 11.76Ha area will be developed as green belt. In the 0.5Ha area which is initially allocated for plantation, shall be developed into green belt by planting@160 plants per year, further plantation shall be done once the mine is fully developed. Locally thriving flora shall be planted till the end of life of mine.

**Table: Plantation Schedule for the first five years as per approved mining plan**

<b>Year</b>	<b>Area to be planted (Ha)</b>	<b>Spacing</b>	<b>No. of Saplings</b>	<b>Type of Species to be planted</b>	<b>Location</b>
<b>1<sup>st</sup> Year</b>	0.1	2.5	160	Mixed species as champa, maha neem, jackfruit etc.	Afforestation to be carried out in south-western and northern side of the M.L boundary.
<b>2<sup>nd</sup> Year</b>	0.1	2.5	160		
<b>3<sup>rd</sup> Year</b>	0.1	2.5	160		
<b>4<sup>th</sup> Year</b>	0.1	2.5	160		
<b>5<sup>th</sup> Year</b>	0.1	2.5	160		
<b>Total</b>	0.5		800		

- After 5 years the area of left will be planted at the rate of 160 trees per year in the HTL barrier and the upper mining benches.