कार्यालय प्रधान मुख्य वन संरक्षक (वन्यप्राणी), मध्य प्रदेश

प्रगति भवन, भोपाल विकास प्राधिकरण, तृतीय तल, एम.पी.नगर, भोपाल
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क्रमांक / व.प्रा. / माचि. / 2022 / MINE-140 / 8522 भोपाल, दिनांक 24/11/2022

प्रति,

M/s Stratatech Minerals Resources Pvt. Ltd.
Adani Corpotate House, Shantigram,
Near Vaisho Devi Circle, S.G. Highway,
Khodiyar Ahmedabad-3824421Gujarat

विषय :– **Submission of 'Site Specific Wildlife Conservation Plan along with location plan and list of flora fauna' for authentication w.r.t. for proposed Dhirauli Coal Block with an area of 267.2 Ha. in Singruli Coalfields at village Aamdand, Amraikhoh, basi Berdah, Phatpani, Belwar, Dhirauli, Jhalari and Sirswah Tehsil Sarai, Singruli District of Madhya Pradesh. (FP/MP/MIN/142344/2021)**

संदर्भ :– प्रधान मुख्य वन संरक्षक (भू–प्रबंध), मध्यप्रदेश की टीप क्रमांक 448 दिनांक 02.11.2022

उपरोक्त विषयांतर्गत स्ट्राटाटेक मिनरल्स रिर्सोस प्रायवेट लिमिटेड, गुजरात द्वारा सिंगरौली जिले के तहसील सरई में रकबा 1436.19 हेक्टेयर में धिरौली कोल ब्लॉक का वन (संरक्षण) अधनियम, 1980 के अंतर्गत वनभूमि व्यपवर्तन के प्रस्ताव संबंधी प्रकरण में प्रस्तावित खदान से 10 कि.मी. की परिधि में पाये जाने वाले फ्लोरा–फौना के संरक्षण के लिये रूपये 1065.00 लाख की 10 वर्षीय वन्यप्राणी संरक्षण योजना वरधान इनवायरोनेट गुरगांव से तैयार कराकर संबंधित वनमण्डलाधिकारी, सिंगरौली को मुख्य वन्यप्राणी अभिरक्षक के अनुमोदन हेतु प्रस्तुत की गई थी। उक्त वन्यप्राणी संरक्षण योजना मुख्य वन संरक्षक, रीवा द्वारा पत्र क्रमांक 7633 दिनांक 14.09.2022 से अनुशंसा सहित प्रधान मुख्य वन संरक्षक (भू–प्रबंध) मध्यप्रदेश को प्रेषित की गई। उनके द्वारा संदर्भित टीप से वन्यप्राणी संरक्षण योजना अनुमोदन हेतु इस कार्यालय को प्रेषित की गई है।

प्रकरण में मुख्य वन संरक्षक, रीवा वृत्त द्वारा प्रेषित प्रतिवेदन के अनुसार फ्लोरा–फौना की जानकारी / सूची एवं वन्यप्राणियों के संरक्षण एवं संवर्धन हेतु राशि रूपये 1065.00 लाख की 10 वर्षों की वन्यप्राणी संरक्षण योजना प्रेषित की गई है, जिसके मुख्य घटक एवं प्रावधानित राशि निम्नानुसार है:–

Sl. No	Management interventions	Year wise financial projection (in Lac.)										
		I	II	III	IV	V	VI	VII	VIII	IX	X	Total
WILDLIFE HABITAT IMPROVEMENT WORKS												
1	Development of water bodies	40.00	00.00	25.00	00.00	20.00	00.00	10.00	00.00	05.00	00.00	**100.00**
2	Meadow development in the areas having canopy density less than 0.4	30.00	20.00	15.00	05.00	05.00	00.00	00.00	00.00	00.00	00.00	**75.00**
3	Eradication of weed hindering the growth of palatable grasses	00.00	30.00	00.00	20.00	00.00	15.00	00.00	05.00	00.00	05.00	**75.00**
4	Salt lick near water bodies/ suitable areas	05.00	00.00	05.00	00.00	05.00	00.00	05.00	00.00	05.00	00.00	**25.00**
5	Planting of species suitable to wildlife	00.00	05.00	00.00	05.00	00.00	05.00	00.00	05.00	00.00	05.00	**25.00**
FIRE PROTECTION WORK												
6	Engaging fire watchers, cleaning and burning of fire lines, hiring vehicles, etc.	05.00	05.00	05.00	05.00	05.00	05.00	05.00	05.00	05.00	05.00	**50.00**
SPECIAL PROVISION FOR HUMAN ELEPHANT CONFLICT												
7	Physical barriers like elephant proof trench,	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	**100.00**

Sl. No	Management interventions	Year wise financial projection (in Lac.)										
		I	II	III	IV	V	VI	VII	VIII	IX	X	Total
	removable barriers, etc. Solar / tentacle/ biological fencing											
8	Various acoustic and farm based deterrence's, Mobile app based technology, Elephant depredation squad, Awareness campaign, monitoring tower and miscellaneous	40.00	35.00	35.00	30.00	25.00	20.00	20.00	15.00	15.00	10.00	**245.00**
ORGANIZATIONAL STRENGTHENING												
9	Purchase of vehicles for monitoring purpose, Wages related to monitoring/ maintenance work, fuel lubricant, etc.	25.00	00.00	15.00	00.00	20.00	00.00	05.00	00.00	05.00	00.00	**70.00**
STRENGTHENING FOREST MANAGEMENT COMMITTEE FOR BETTER COOPERATION AND PROTECTION												
10	Developmental activities in JFM areas for socio-economic development	40.00	00.00	00.00	00.00	00.00	35.00	00.00	00.00	00.00	00.00	**75.00**
11	various eco-tourism promotion activities	00.00	00.00	40.00	00.00	00.00	00.00	00.00	00.00	35.00	00.00	**75.00**
12	Construction of grainery, godown for safety from elephants.	00.00	25.00	00.00	00.00	00.00	00.00	25.00	00.00	00.00	00.00	**50.00**
13	Distribution of seedlings of fruit bearing and other species in village areas.	05.00	00.00	05.00	00.00	05.00	00.00	05.00	00.00	05.00	00.00	**25.00**
MISCELLANEOUS EXPENDITURES												
14	Safety precautions, signage, boards, displays	15.00	00.00	00.00	00.00	00.00	10.00	00.00	00.00	00.00	00.00	**25.00**
15	Study tours for gaining experiences and knowledge about efforts being done, within or outside country in human elephant mitigation.	25.00	00.00	00.00	00.00	00.00	25.00	00.00	00.00	00.00	00.00	**50.00**
	Total	**240.00**	**130.00**	**155.00**	**75.00**	**95.00**	**125.00**	**85.00**	**40.00**	**85.00**	**35.00**	**1065.00**

मुख्य वन संरक्षक, रीवा वृत्त के द्वारा अनुशंसित वन्यप्राणी योजना के पृष्ठ क्रमांक 21 से 49 में उल्लेखित फ्लोरा–फौना के संरक्षण एवं संवर्धन के लिये वन्यप्राणी प्रबंधन हेतु पृष्ठ क्रमांक 98 से 101 पर दर्शाये गये कार्यों के अनुसार रूपये 1065.00 लाख की 10 वर्षों की वन्यप्राणी संरक्षण योजना का अनुमोदन किया जाता है। अनुमोदित वन्यप्राणी संरक्षण योजना की एक प्रति मुख्य वन संरक्षक, रीवा वृत्त एवं एक प्रति वनमण्डलाधिकारी, सामान्य वनमण्डल सिंगरौली को उपलब्ध करायें।

प्रकरण में भारत सरकार/राज्य शासन की अंतिम स्वीकृति उपरांत, माइन प्रारंभ होने के पूर्व समय–सीमा में संशोधित वन्यप्राणी संरक्षण योजना में वन्यप्राणी प्रबंधन हेतु प्रावधानित राशि रूपये 1065.00 लाख एक मुश्त मध्यप्रदेश टाइगर फाउंडेशन सोसायटी के भारतीय स्टेट बैंक, मुख्य शाखा टी.टी. नगर, भोपाल के बचत खाता क्रमांक 10571048460 आई.एफ.एस.सी. कोड SBIN0001308 में जमा करायी जाकर वनमण्डलाधिकारी, सामान्य वनमण्डल सिंगरौली एवं इस कार्यालय को अवगत कराना सुनिश्चित करेंगे।

संलग्न :–उपरोक्तानुसार।

24.11.2022

(जसबीर सिंह चौहान)
मुख्य वन्यप्राणी अभिरक्षक एवं
प्रधान मुख्य वन संरक्षक (व.प्रा.), म.प्र.

क्रमांक / व.प्रा. / मा.चि. / MINE-140 / 8523 भोपाल, दिनांक 24/11/2022

प्रतिलिपि :–

1. संचालक, भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय (इम्पैक्ट असेस्मेंट डिविजन) इंदिरा पर्यावरण भवन, अलीगंज जोर बाग रोड नई दिल्ली–110003 की ओर उनके के पत्र क्रमांक J-11015/49/2021-IA-II(M) दिनांक 03.08.2021 से जारी स्वीकृति के क्रम में सूचनार्थ एव आवश्यक कार्यवाही हेतु प्रेषित।
2. प्रधान मुख्य वन संरक्षक (भू–प्रबंध) सतपुड़ा भवन, भोपाल की ओर सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित। उपरोक्त प्रकरण में वन संरक्षण अधिनियम, 1980 के अंतर्गत आपके स्तर से जारी अंतिम अनुमति मे अनुमोदित वन्यप्राणी संरक्षण योजना में प्रावधानित राशि रूपये 1065.00 लाख आवेदक संस्था द्वारा वनमण्डलाधिकारी, सामान्य वनमण्डल सिंगरौली को एक मुश्त उपलब्ध कराने की शर्त अधिरोपित करने का कष्टकरें।
3. मुख्य वन संरक्षक, रीवा वृत्त रीवा की ओर अनुमोदित वन्यप्राणी संरक्षण योजना की एक प्रति सहित सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।
4. वनमण्डलाधिकारी, सामान्य वनमण्डल सिंगरौली की ओर उक्त अनुमोदित वन्यप्राणी संरक्षण योजना की एक प्रति सहित सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित है। प्रकरण में भारत सरकार/राज्य शासन की अंतिम स्वीकृति उपरांत माइन प्रारंभ होने के पूर्व वन्यप्राणी संरक्षण योजना में प्रावधानित राशि एक मुश्त आवेदक संस्था से प्राप्त कर प्रावधानित कार्यों का समय सीमा मे क्रियान्वयन किया जाना सुनिश्चित करें।

24/11/2022

मुख्य वन्यप्राणी अभिरक्षक एवं
प्रधान मुख्य वन संरक्षक (व.प्रा.), म.प्र.

DHIRAULI COAL MINE

Capacity: 5.0 MTPA (Opencast) & 1.5 MTPA (Underground)

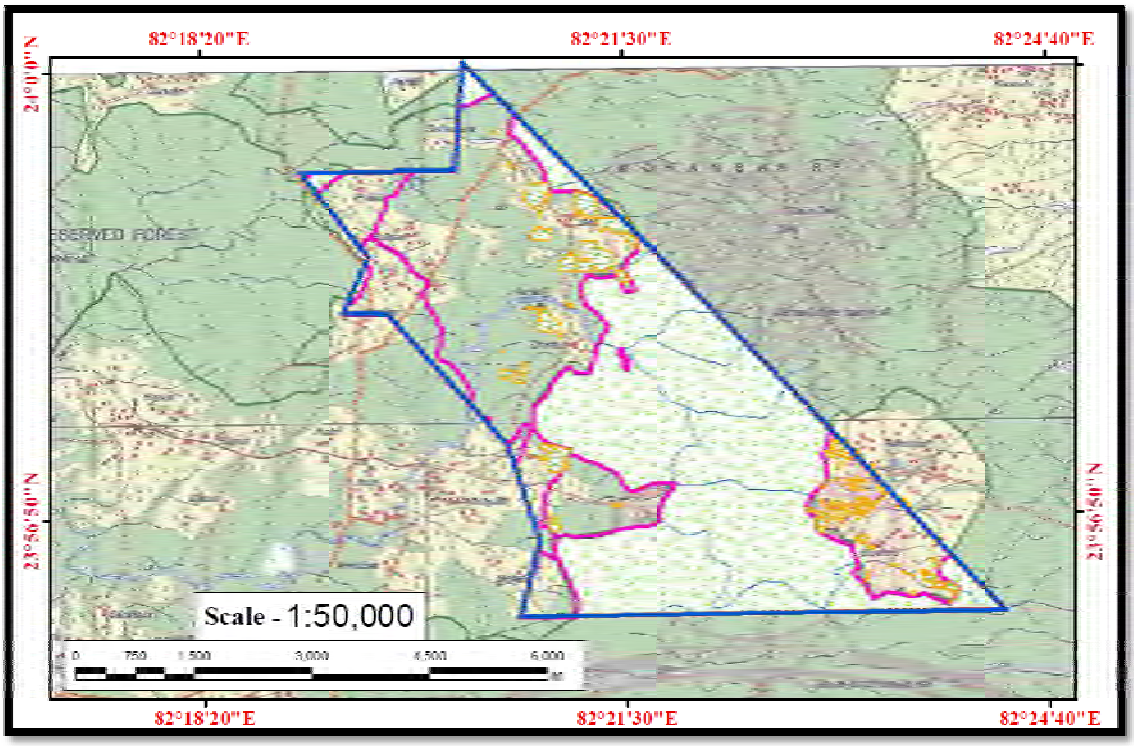
Area: 2672 Ha

in Singrauli Coalfields (Main Basin)

Singrauli Forest Division,

Singrauli district, M.P.

SITE SPECIFIC WILDLIFE CONSERVATION PLAN



September, 2021

Project Proponent

M/s Stratatech Mineral Resource Private Limited (SMRPL)

Adani Corporate House, Shantigram,
Near Vaishno Devi Circle, S. G. Highway, Khodiyar,
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Consultant

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SITE SPECIFIC WILDLIFE CONSERVATION PLAN

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

I Dhirauli Coal Block is located in Singrauli Coalfield (Main Basin), village(s) Aamdand, Belwar, Dhirauli, Jhalari, Phatpani, Amraikhoh, Bansibridha and Sirswah, Tehsil: Sarai, Singrauli district of Madhya Pradesh. The Dhirauli coal block boundary coordinates in WGS84 datum as per CMDPA (Coal Mine Development & Production Agreement) is as follows: List of Cardinal Points P1: Latitude $23^0$56'07" Longitude $82^0$19'04"; P2: Latitude $23^0$56'07" Longitude $82^0$24'21"; P3: Latitude $23^0$03'04" Longitude $82^0$24'21" P4: Latitude $23^0$03'04" Longitude $82^0$19'04" and is covered by Survey of India Toposheet no. 64 I/5.

II The total area involved in this project is 2672 ha, out of which 1436.19 ha is forest land. The block is located at about 70 km south-west of Singrauli township, whereas, it is around 50 km south-west of Waidhan township, the District Headquarter of Singrauli District. Block is traversed by number of fair weathered and forest roads.

III The important villages in and around the block are Suliyari & Dhirauli villages located within the block, while village Jhalri & Majhalipath are located outside, west of the block.

IV In the core zone and buffer zone (10 km radius of the project area) there is only one Reserve Forest detailed below:-

Sr. No.	RF/PF	Direction	Distance (KM)
1.	Mohanban RF	All Directions	Within Mine lease also

V In the buffer zone (10 km radius of the project area) there are following water bodies are present as detailed below:-

Hurdul Nala -Within ML area	Sukar Nala-6.7 km, NNW
Jhana nala within ML area,	Mahan Nala- 1.7 km, N
Sulkhia Nala-5.3 km, W	Hariya Nala- 9.9 km, NNW

Dhirauli Coal Block is located in Singrauli Coalfield (Main Basin), Village Aamdand, Belwar, Dhirauli, Jhalari, Phatpani, Amraikhoh, Bansibridha and Seerswah, Tehsil: Sarai, Singrauli district of Madhya Pradesh. Waidhan-Sidhi State Highway via Bargawan

traverses 20 km north of the block. A metalled road from Parsona to Mara is located further east of the block. An un-metaled road branching out of this at Rajmelan culminates at Sarai. From this road to the west of River Mahan, a north-south running road leads to Langadda via Bhalyatola, Suliyari & Jhalri. The block is also accessible by an all weather metalled road from Singrauli as well as from Waidhan. The distance of Sarai-Gram, the nearest major railway station on Chopan-Singrauli-Katni line of central railway is about 18 km from the block. Renukoot, an important industrial township & railway station is located at a distance of 70 km from Waidhan on Chopan-Garhwa section of eastern railway. Renukoot township is well connected with Hawrah, Tatanagar, Delhi etc. by direct train. Nearest airport Varanasi is located at a distance of 250 km from the Waidhan.

VI Block is traversed by number of fair weathered and forest roads. The important villages in and around the block are Suliyari & Dhirauli villages located within the block, while village Jhalri & Majhalipath are located outside, west of the block.

VII The block area has highly undulating and rugged topography. Western part of Dhirauli block is characterized by almost plain topography, while, north-eastern and south-central part are highly undulating and have rugged topography as evident from the topographical plan. The north-eastern and south central part of the block have forest cover and is occupied by hillocks of elevation up to a maximum of 638 m above MSL. In general elevation of ground varies from 459.23m as observed near borehole MSD-102 to 603.45 m near borehole MDP-19 located in the south-western and south-eastern corner of the block respectively.

VIII As **per Socio-economic** status of this coal block, there are 8 villages (***Aamdand, Belwar, Dhirauli, Jhalari, Phatpani, Amraikhoh, Bansibridha and Seerswah***) within the core zone and total 38 villages in the study area. Summary of demographic pattern of the study area is given below:

Demographic profile of the study area

Sr. No.	Parameter	Study Area
		RURAL
1.	No. of Villages	38
2.	Household	10724
3.	Household Ratio	4.6
4.	Total Population	49383

5.	Male Population %	25143(50.91%)
6.	Female Population %	24240(49.08%)
7.	Population (0-6 Years)%	9688(19.61%)
8.	Sex Ratio	964
9.	Child Sex Ratio	906
10.	Scheduled Caste %	6954(14.08%)
11.	Scheduled Tribes %	24401(49.41%)
12.	Literates %	21449(43.43%)
13.	Main Workers %	14424(29.20%)
14.	Marginal Workers %	8455(17.12%)
15.	Non-Workers %	26504(53.67%)

Source: * PCA Census 2011, Madhya Pradesh State

IX According to the **'India State of Forest Report -2019'** (latest) the total forest area of the Singrauli district is 2,180.13 Km^2 which is 38.42% of the geographical area. The forest area included, 394.41 Km^2 (39441 Ha) of very dense forest, 1002.52 Km^2 (100252 Ha) of medium dense forest and 783.20 Km^2 (78320 Ha) of open forest.

The present Working Plan of Singrauli forest division is valid from 2009-10 to 2018-19. According to revised Forest Types (Champian and Seth 1968) the study area has been classified as Dry Peninsular Sal Forest (5B/C1c), Northern Dry Mixed Deciduous Forest (5B/C2), and Dry Bamboo Brakes (5/E9). In this Working Circle Sal occurs either pure or in mixture with (***Shorea robusta***), Saja (***Terminalia tomentosa***), Dhaora (***Anogesissus latifolia***), Bija (***Pterocarpus marsupium)***, Sena (***Lagerstroemia parviflora***), Salia (***Boswellia serrata***), Tinsa (***Ougeinia oojeinensis***), Sagaun (***Tectona grandis***) , Kari (***Saccopetalum tomentosum***) etc.

X The **flora** existing in the core and buffer zone are Sal (***Shorea robusta***), Teak (***Tectona grandis***), Haldu (***Adina cordifolia***), Dhaora (***Anogeissus latifolia***), Kardhai (***Anogeissus pendula***), Saliha (***Boswellis serrata***) ,Char (***Buchnania lanzan***), Dhobin (***Dalbergia paniculata***), Tendu (***Dyospyros melanoxylon***), Amla (***Emblica officinalis***), Lendia (***Lagerstoremia parviflora***), Gunja (***Lannea coromandelica***), Mahua (***Madhuca indica***), Bija (***Pterocarpus marsupium***), Kusum (***Schleichera oleosa***), Bhelwa (***Semecarpus anacardium***), Jamun (***Syzygium cumini***), Harra (***Terminalia chebula***), Bahara (***Terminalia belerica***), Saja (***Terminalia tomentosa***) etc. **Grasses** noticed are ***Aristida (Aristida funiculate), Chloris (Chloris barbata), Digitaria (Digitaria radicosa), Dimeria, Dactyloctenium (Dactyloctenium aegyptium), Setaria (Setaria glauca), Cenchrus***

(Cenchrus biflorus), Cyperus etc. **Weeds** noticed are ***Ageratum conyzoides, Alysicarous and Euphorbia sps***.

Sal (***Shorea robusta***) is another important timber species in Madhya Pradesh. It is a large evergreen tree belonging to the family Dipterocarpaceae. Sal forests of Madhya Pradesh are ecologically very important as they mark the termination of the great Sal zone of the Central Indian peninsula. Sal forests are located in the eastern part of the state while teak forests are localized in the western part. In between, there is a transition belt of mixed miscellaneous forests.

Fauna noticed are –

mammals- Hare (***Lepus nigricollis***), Palm Squirrel (***Funambulus pennati***), Spotted deer (***Axix axix***), Bat (***Pteropus giganteus***), Mangoose (***Herpestes edwardi***), Red faced Monkey (***Macaca mulata***), Sloth Bear (***Melursus ursinus***), Barking Deer(***Muntiacus muntjak***), Wolf (***Canis lupus pallipes***), Black faced Langur (***Semnopithecus entellus***), Hyena (***Hyaenea hyaena***), Fox (Vulpes bengalensis), Porcupine (***Histrix indica***), Jackal (Canis aureus), Wild Boar (***Sus scrofa cristetus***).

Birds- Brown fish Owl (***Bubo zeylonensis)***, Blue Rock Pigeon (***Columba livia)***, Asian Koel (***Eudynamys scolopacea)***, Rufous Wood Pecker (***Micropternus brachyurus)***, Pied Kingfisher (***Ceryle rudis)***, Painted Partridge (***Galloperdix lunulata)***, Bengal Vulture (***Galloperdix lunulata)***, Indian Great horned Owl (***Bubo bengalensis)***, Common Parakeet (***Psittacula eupatria)***, Grey Jungle Fowl (***Gallus sonneratti)***, Jungle Myna (***Acridotheres tristis)***, Indian Cuckoo (***Cuculus micropterus)***, Indian Roller (***Coracias behghalensis)***, Spotted Dove (***Streptopelia chinensis)***, Bush Quail (***Perdicula asiatica)***, Chestnut bellied Sand Grouse (***Pterocies exustus)***, Peacock (***Pavo cristatus)***, Cattle Egret (***Bubulus ibis)***, Green Imperial Pigeon (***Ducula aenea)***.

Reptiles- Indian Rock Python (***Python molurus),*** Indian Chameleon (***Chameleon zeylanicus)***, Garden Lizard (***Calotes versicolor)***, Rat Snake (***Elephe radiata)***, Indian Cobra (***Naja naja)*** **Fishes**- ***Catla catla*** (Katla), ***Cirrhinus mrigala*** (Mrigal), ***Tor tor*** (Mahaseer), ***Mastooembelus armatus*** (Bam), ***Labeo rohita*** (Rohu), ***Labeo bata.***

XI The anticipated degradation due to this project are Air pollution, Noise pollution, Accidental death of wildlife (Rarely), Litter generation, Habitat degradation, forest fire, and Fragmentation of habitat etc. In view of these, mitigation measures like Improvement and Protection to Habitat, fire protection, awareness promotion, cattle immunization and

incentive to villagers are provided in the core area of this project. Where as in the buffer area mitigation measures like Wildlife Habitat Improvement, Fire protection Measures, anti-depredation squad, Compassionate grant and creation of water hole have been proposed. The total cost of this plan is **Rs.10.65 Crores** for a period of **10 years**.

XII A monitoring committee will be formed with the Chairmanship of Conservator of forest Waidhan circle where DFO, Waidhan Division will be the Member Secretary and other members will be Range Officer, Forester and Forest Guard. Apart from this the village head of surrounding villages will participate in the half yearly meeting where progress and impact of the prescriptions of this plan will be discussed in detail. Any addition or modification to the prescriptions approved by Chief Wildlife Warden will be undertaken.

M/s Vardan EnviroNet wishes to place on record its deep appreciation for the trust reposed in Vardan EnviroNet by Stratatech Mineral Resources Private Limited (SMRPL) and for the active interest and help extended by concerned SMRPL officials. Cooperation extended to M/ s Vardan EnviroNet by the officials of State Forest department is also acknowledged.

CHAPTER-1

INTRODUCTION AND METHODOLOGY

1.0 INTRODUCTION AND METHODOLOGY

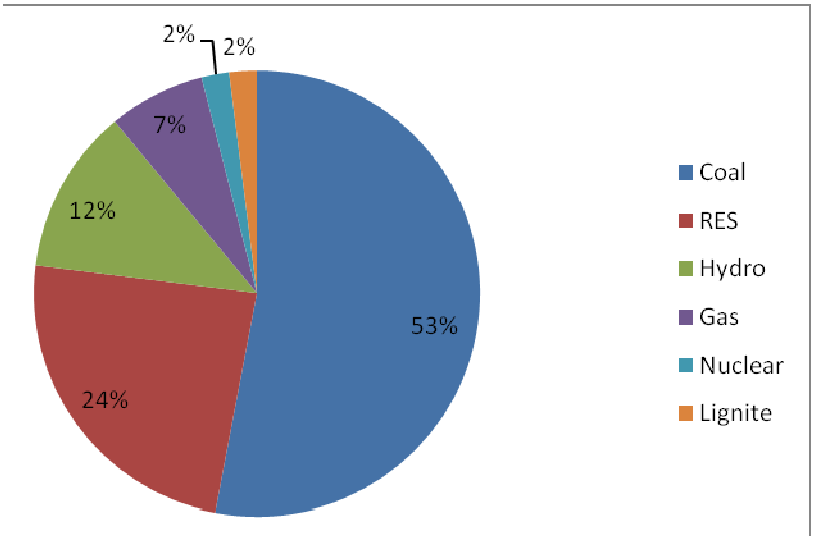
1.1 Introduction:

The mineral wealth of a nation is an important feature in its economic progress, and mining in India has a vital role in the development. Madhya Pradesh has a glorious heritage in the field of natural resources, mines and minerals. The state is geologically so endowed that it has become a veritable repository of minerals.

Electricity is the key factor for development of a nation. All sectors viz. industrial, agriculture and social require electric power for their growth and availability of electricity in the nation. Coal based power plants are probably the most economically viable and time tested solution towards the solution of this problem. These thermal power plants obviously need constant supply of coal. In fact, about 67% of the power plants in India are coal based.

Coal Mining

Coal Coal plays a crucial role in the production of electricity in India. As per the CEA data with regard to installed capacity in India (as of Oct'20), coal based installed capacity is about 53%, followed by Renewable Energy Sources (RES) at 24%, while hydro power (12%), gas (7%), nuclear (2%) and lignite (2%) round up the rest. The graph representing the fuel wise contribution to the country's installed power generation capacity is shown in the figure 1.1 below.



Source: https://powermin.nic.in/en/content/power-sector-glance-all-india

Figure 1.1: Fuel-wise contribution in India installed power generation capacity

Mining is one of the major contributors towards the growth and sustenance of human civilization. In this context, coal mining has played a special role since ancient times, as coal is a major source of energy for the development of a society. However, coal mining has its own downside i.e. coal mines lead to degradation of land and especially for an opencast mine, where large tracts of land are used. During production of coal from mines and subsequent transportation of coal, significant pollution is generated. The pollution includes land degradation, air pollution, and water pollution, noise pollution, besides having impact on socio-economic status of the area and flora & fauna.

Coal deposits in Madhya Pradesh

Coal has been one of the key sources of primary energy for the world, contributing to roughly half of the total primary energy consumption. However, the significance of coal varies across the world with Asia leading the consumption, both in absolute terms and as a proportion of total primary energy consumption. The total coal production in India in 2019-20 surpassed 730 MT and is likely to increase to about 1000 MT by 2022-23. Power generation remains the key consumer of coal in India.

Important deposits of coal occur in Shahdol, Umaria, Singrauli, Betul, Chindwara and Narsingpur districts. Coal is the primary source of energy supply in India. About 55% of the current commercial energy use is met by coal. Rising demand for energy and coal as the primary energy source make it a significant resource in the country. Opening of Dhirauli coal mine will have the following benefits:

- Increase supply of coal for India's power programme.
- Reduces power shortages hindering growth, foreign investment and productivity.
- Generate additional employment, both direct and indirect which will lead to economic growth of the industrial sector as well as country.
- Quality of life of local populace in villages shall improve due to company's community development programmes.

1.2 Lease Area:

The Singrauli Coalfield which forms the northern most part of Son- Mahanadi Master basin occupies a prominent position on power map of India due to its vast Quarriable coal resources. Singrauli Coalfield covering an area of about 2200 sq km is located mainly in

Singrauli district of Madhya Pradesh with a small portion falling in Sonbhadra District of Uttar Pradesh. Singrauli coalfield is structurally composed of two techno-sedimentary domain viz. the Moher sub basin in north east and the Main Basin in the west. The large part of the coalfield known as Main Basin covering nearly 1900 sq km has been partly explored while the Moher sub basin having an area of around 300 sq km has been extensively explored in detail. These two basins of Singrauli Coalfield are separated by a concealed basement high. The Dhirauli Coal block spread over a total 26.72 sq.km area is located at about 70 km south-west of Singrauli township, whereas, it is around 50 km south-west of Waidhan township, the District Headquarter of Singrauli District. This area is a part of Survey of India Topo sheet No.64 I/05 (on R.F.1:50000).

There are twenty eight coal blocks identified by Ministry of Coal, Government of India, New Delhi. They are Amelia (North), Amelia, Chatarsal, Mahan, Mara Mahan, Suliyari, Patpahari, **Dhirauli,** Bandha, Bandha North, Gondbahera Ujheni, Gondbahera Ujheni East, Pachaur, Makri Barka East, Makri Barka, Makri Barka West Phase-I, Gurbara South, Gurbara Central, Gurbara North, Purail, Saratola, Borka, Bari Mahuli, Hattadudhmania, Sarai East, Sarai West, Dongri Tal-I and Dongri Tal-II.

Dhirauli Coal Block is located in Singrauli Coalfield (Main Basin), Village Dhirauli, Phatpani, Sirswah, Amdand, Jhalari, Amraikhoh, Bansibridha, and Belwar, Tehsil: Sarai, Singrauli district of Madhya Pradesh. The Dhirauli Coal Block in Singrauli Coalfield, in the State of Madhya Pradesh has been allocated to M/s Stratatech Mineral Resource Private Limited (SMRPL) vide Letter No. NA-104/7/2020-NA dated 03.03.2021 by MoC, GoI. The Dhirauli coal block boundary coordinates in WGS84 datum as per CMDPA is as follows: List of Cardinal Points P1: Latitude $23^0$56’07” Longitude $82^0$19’04”; P2: Latitude $23^0$56’07” Longitude $82^0$24’21”; P3: Latitude $23^0$03’04” Longitude $82^0$24’21” P4: Latitude $23^0$03’04” Longitude $82^0$19’04” and is covered by Survey of India Toposheet no. 64 I/5.

1.3 Location:

Total area of the block is 2672 ha. The block is located at about 70 km south-west the district headquarter, Singrauli; whereas it is located at a distance of 50 km south-west of the tehsil headquarter, Waidhan town. Waidhan-Sidhi State Highway via Bargawan traverses 20 km north of the block. A metalled road from Parsona to Mara is located

further east of the block. An un-metaled road branching out of this at Rajmelan culminates at Sarai. From this road to the west of River Mahan, a north-south running road leads to Langadda via Bhalyatola, Suliyari & Jhalri. The block is also accessible by an all weather metalled road from Singrauli as well as from Waidhan. The distance of Sarai-Gram, the nearest major railway station on Chopan-Singrauli-Katni line of central railway is about 18 km from the block.

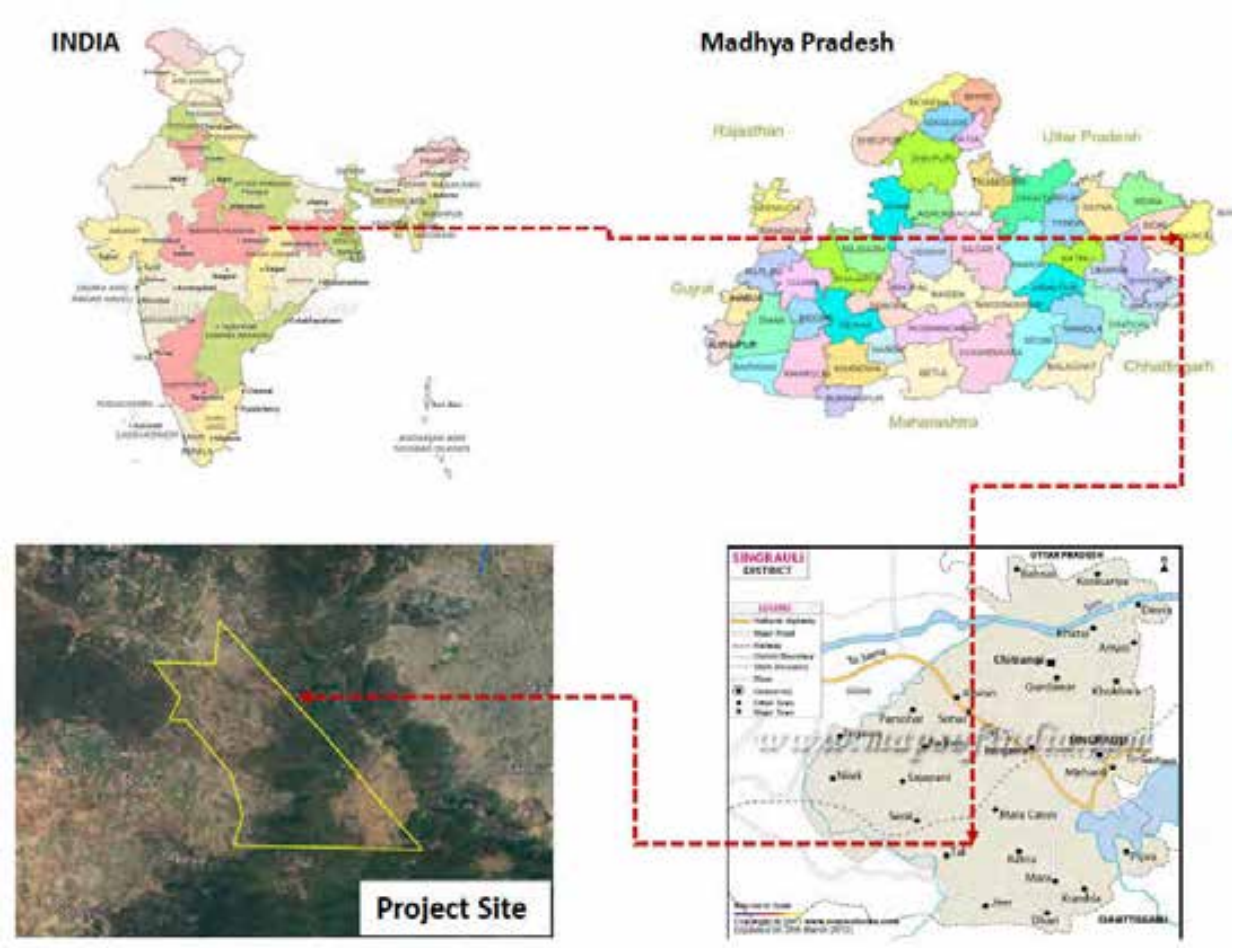


Figure-1.2: Location Map of Dhirauli Coal Block

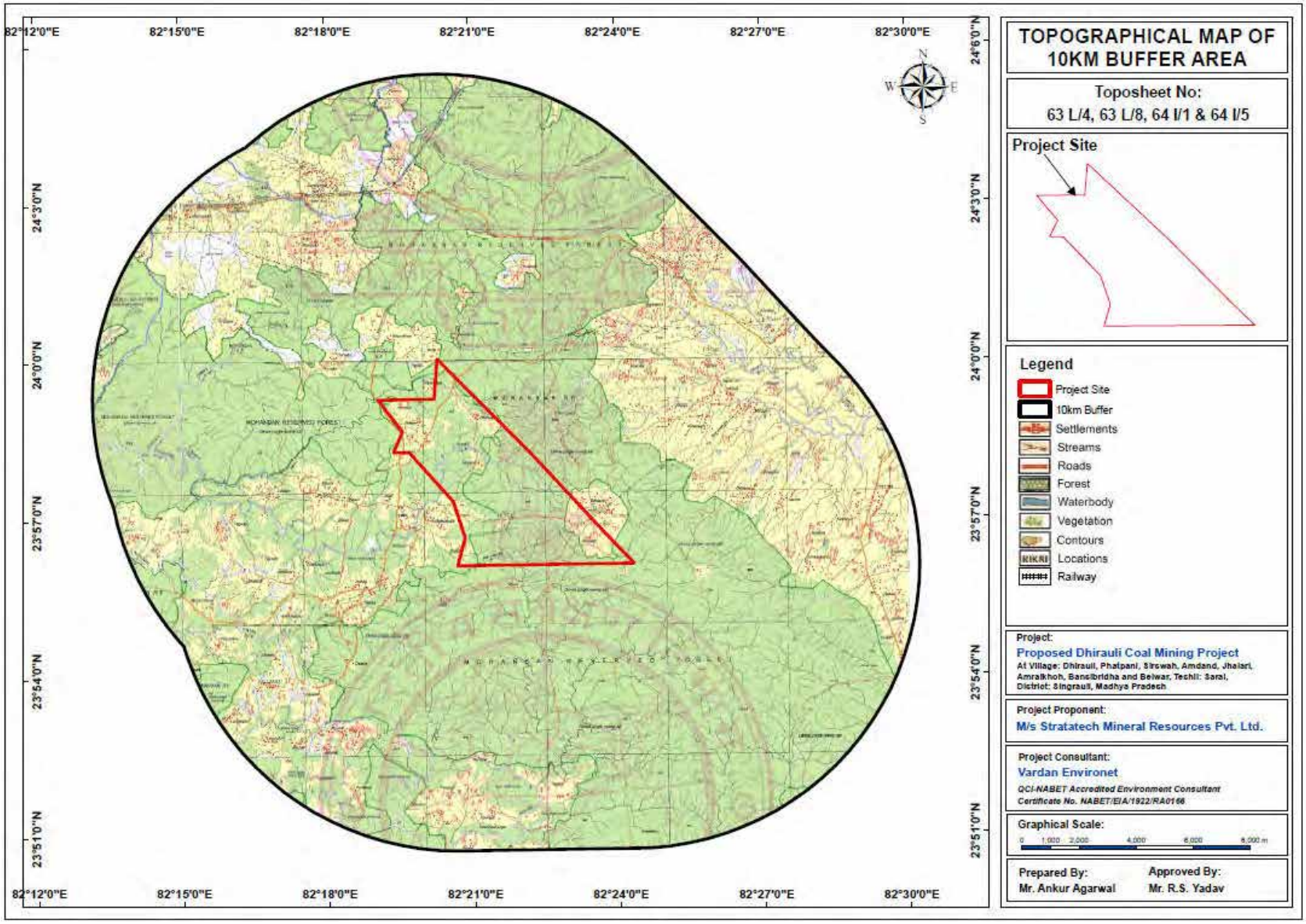


Figure-1.3: 10 km Study area around Dhirauli Coal Block

1.4 Forest Jurisdiction:

The administrative jurisdiction of proposed Dhirauli coal mine comes under Singrauli Forest Division. Out of the lease hold area of 2672 ha only 1436.19 ha is forest land.

Table-1.1: Lease Hold Area

Type of Land	**Area (ha)**
Forest Land	1436.19
Non-Forest Land	1235.81
Total	**2672.001**

1.5 Land Use Pattern:

The project area comprises of total 2672 ha, out of which, 1436.19 ha land is forest land, 554.01 ha tenant land and 681.80 ha area is Govt. Non Forest land. The existing land utilization in the project area is given in **Table 1.2** and Mine development plan represented in **Figure 1.4**.

Table-1.2: Land Use Pattern of Dhirauli Coal Block

Ownership	**Type of Land Use**	**Area (Ha)**
Tenancy Land	Agricultural	554.01
	Township	
	Grazing	
	Barren	
	Water Bodies	
	Road	
	Community	
Sub Total		**554.01**
Govt. Non Forest Land	Agricultural	681.80
	Township	
	Grazing	
	Barren (Road)	
	Other	
Sub Total		**681.80**
Forest Land	Reserve Forest Land	1335.35
	Revenue Forest	100.84
Sub Total		**1436.19**
Grand Total		**2672.00**

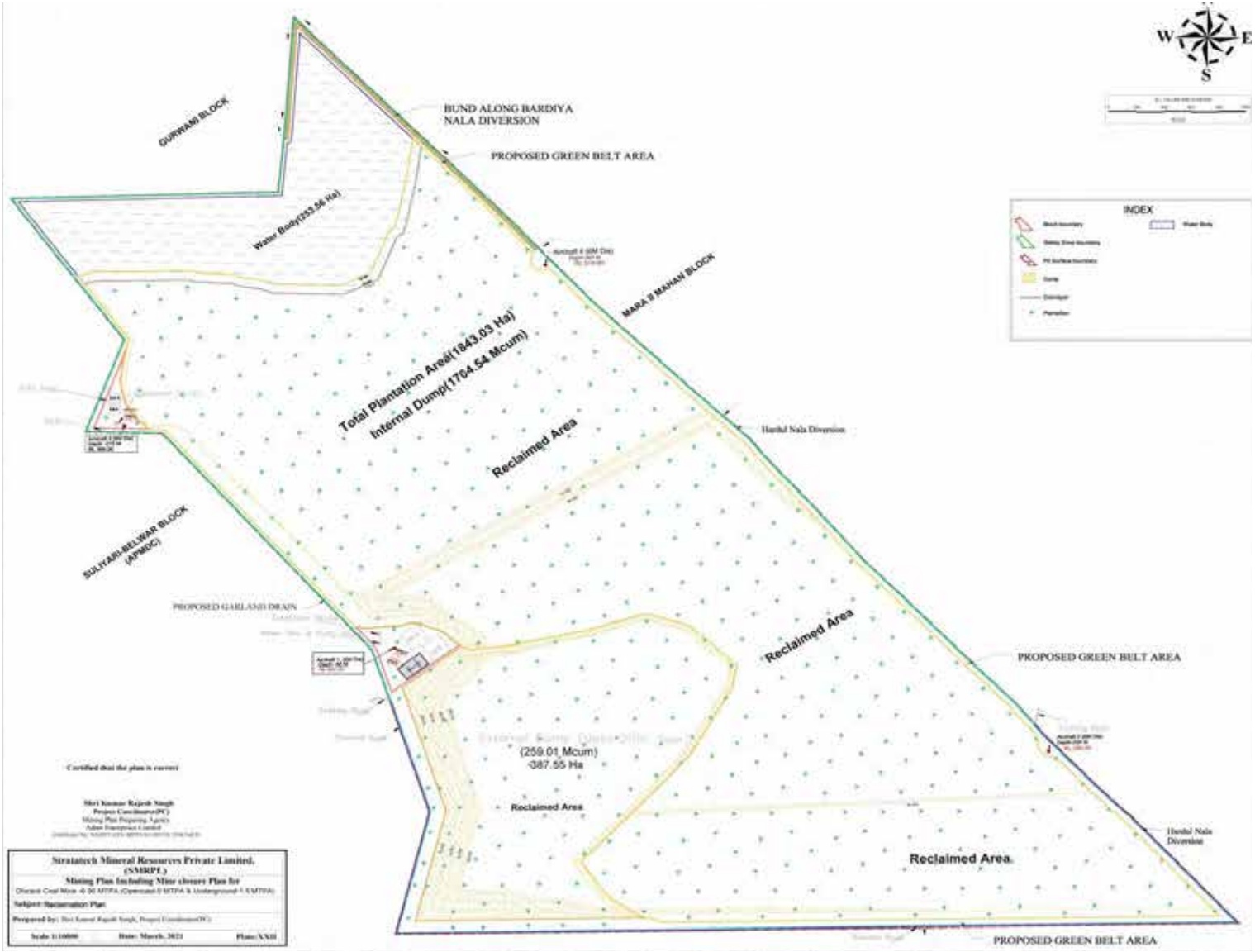


Figure-1.4 Mine Development Plan of the Dhirauli Coal Mine

The existing land use plan for Dhirauli Coal block is presented in **Table: 1.3**:

Table-1.3: Land Use Plan during and Post Mining

Mining Activity	Proposed Land Use Area (Ha)	Land Use (End of Life) Area	Agriculture Land	Plantation	Water Body	Public Use	Forest land (Returned)	Undisturbed	Total
Excavation Area	2,096.59	2,096.59	-	1,843.03		-	1943.03	-	1843.03
Backfilled Area (in Excavation Area	1,796.23	1,796.23	-	1,843.03	-	-	18743.03	-	1843.03
Excavated Void(in Excavation Area)	300.36	300.36	-	-	253.56	-	-	-	253.56
Top Soil Dump	35.34 (Upto 5th Year)	35.34 (Upto 5th Year)	-	-	-	-	-	-	0.00
External Dump	387.55	387.55	-	387.55	-	-	387	-	387.55
Safety Zone	19.73	19.73	-	19.73	-	-	19.73	-	19.73
Haul Road between quarries	-	-	-	-	-	-	-	-	0.00
Road diversion	4.13	4.13	-	-	-	4.13	-	-	40.13
Settling pond	2.20	2.20	-	-	2.20	-	-	-	2.20
Road & Infrastructure area	20.80	20.80	-	20.80	-	-	20.80	-	20.80
CHP &Washery	8.10	8.10	-	8.10	-	-	8.10	-	8.10
Coal Evacuation Route & Approach Road	1.15	1.15	-	1.15	-	-	1.15	-	1.15
Garland drains	5.34	5.34	-	5.34	-	-	5.34	-	5.34
Embankment	7.50	7.50	-	7.50	-	-	7.50	-	7.50
Green Belt	46.80	46.80	-	46.80	-	-	46.80	-	46.80
Water Reservoir	-	-	-	-	-	-	-	-	0.00-
Rationalization area	72.11	72.11	-	72.11	-	-	72.11	-	72.11
Total (exclude back filled void &Topsoil area)	**2672.00**	**2672.00**	**-**	**2412.11**	**255.76**	**4.13**	**2412.11**	**-**	**2672.00**

1.6 Status of Forest Diversion Proposal and Environmental Clearance:

DGPS Survey of forest area has been completed and M/s SMRPL has submitted an online application for forest diversion of 1436.19 ha of forest land for Non-Forest uses vide proposal no. FP/MP/MIN/142344/2021 dated 08/06/2021 in Ministry of Environment Forest & Climate Change (MoEF&CC).

As a part of the procedure, application to MOEF&CC for obtaining Terms of References (TOR) for conducting the EIA study was submitted online vide proposal No. IA/MP/CMIN/214743/2021 on dated 25.06.2021. The proposal was considered in the 15th EAC (Coal Mining) meeting held on 06.07.2021, wherein the ToR for the project was recommended.

The Terms of Reference for the EIA/EMP study for this project as approved by Ministry of Environment, Forest & Climate Change (MoEF&CC), Government of India vide (J-11015/49/2021-IA-II(M) dated 3.08.2021.) is enclosed as **Annexure-I**.

The present report includes a study on habitat utilization by endangered fauna in the study area (comprising of 10 km zone around the mine lease from the lease periphery) and measures for conservation and management of wildlife.

1.7 Demographic Pattern:

There are 38 villages in the study area including 8 villages (*Aamdand, Belwar, Dhirauli, Jhalari, Phatpani, Amraikhoh, Bansibridha* and *Sirswah*) within the core zone. Summary of demographic profile of the study area is given in **Table 1.4**. Demographic and Occupational Structure of the study is given in **Table 1.5 and 1.6 respectively**.

Table-1.4: Demographic profile of the study area

Sr. No.	Parameter	Study Area
		RURAL
1.	No. of Villages	38
2.	Household	10724
3.	Household Ratio	4.6
4.	Total Population	49383
5.	Male Population %	25143(50.91%)
6.	Female Population %	24240(49.08%)
7.	Population (0-6 Years)%	9688(19.61%)
8.	Sex Ratio	964
9.	Child Sex Ratio	906
10.	Scheduled Caste %	6954(14.08%)
11.	Scheduled Tribes %	24401(49.41%)
12.	Literates %	21449(43.43%)
13.	Main Workers %	14424(29.20%)
14.	Marginal Workers %	8455(17.12%)
15.	Non-Workers %	26504(53.67%)

Table-1.5: Details of village-wise demographic pattern

Sr.No.	Villages	Households	Total Population	Male Population	Female Population	Population (0-6 Years)	Scheduled Caste	Scheduled Tribes	Literates
Madhya Pradesh State									
Singrauli District									
Singrauli Tehsil									
1.	Gorwani	148	623	336	287	155	23	540	212
2.	Dhirauli	236	1186	609	577	250	24	801	333
3.	AmraiKhoh	25	111	63	48	23	0	30	48
4.	Amdand	35	163	91	72	28	0	0	76
5.	Majhauli Path	128	673	349	324	108	21	214	321
6.	BasiBerdaha	218	1049	518	531	233	0	936	333
7.	Belwar	86	385	192	193	74	1	60	180
8.	Dogari	541	2752	1389	1363	583	334	1436	1171
9.	Siraswah	15	82	41	41	13	6	39	50
10.	Chalari	422	1852	940	912	369	244	751	877
11.	Phatpani	141	741	358	383	171	300	208	306
12.	Bajaudi	322	1645	856	789	339	173	636	834
13.	Ladbai	72	419	207	212	75	4	387	169
14.	Tal	323	1607	810	797	339	108	1182	632
15.	Digwah	217	1051	544	507	181	122	918	471
16.	Bhaisa Buda	298	1452	710	742	296	231	908	532
17.	KhanuaNawa	629	2687	1340	1347	502	117	2028	1135
18.	Khanua Khas	173	849	433	416	166	129	465	353
19.	Jamgadi	343	1607	816	791	319	93	1001	716
20.	Bhalyatola	214	1098	583	515	210	0	382	553
21.	Budher (Bugher)	40	165	82	83	32	0	93	71
22.	Langhadol	417	1922	952	970	429	314	1436	667
23.	Sajawar	196	896	445	451	199	80	598	286
24.	Rauhal	266	1363	674	689	297	25	460	573
25.	Kamai	147	653	309	344	136	0	493	200
26.	Jeer	344	1548	761	787	298	200	809	633
27.	Pondi Path	338	1688	860	828	381	127	1363	635

28.	Padari Khairwari Tola	87	376	186	190	43	35	274	199
29.	Nadau	247	1155	602	553	227	179	430	496
30.	Amiliya	657	3171	1592	1579	605	431	821	1397
31.	Semua	110	463	231	232	97	14	147	191
32.	Bandhaura	347	1642	833	809	342	737	369	775
33.	Khairahi	402	1840	948	892	403	350	1148	770
34.	Nagwa	1126	4501	2370	2131	783	1227	1869	2164
35.	Dhuni	198	950	500	450	172	313	224	422
36.	Karsua Raja	715	2886	1525	1361	472	849	426	1506
37.	Churwahi	124	602	293	309	98	77	82	312
38.	Malga	377	1530	795	735	240	66	437	850
Total		**10724**	**49383**	**25143**	**24240**	**9688**	**6954**	**24401**	**21449**

Table-1.6: Occupational Structure of the Study Area (RURAL)

Sr.No.	Villages	Total Main Workers	Main Workers				Marginal Workers	Non-Workers
			Cultivators	Agricultural Laborers	Household Laborers	Other Workers		
Madhya Pradesh State								
Singrauli District								
Singrauli Tehsil								
1.	Gorwani	210	11	196	0	3	21	392
2.	Dhirauli	437	146	254	2	35	164	585
3.	AmraiKhoh	45	40	4	0	1	0	66
4.	Amdand	78	64	12	0	2	1	84
5.	Majhauli Path	291	284	3	0	4	28	354
6.	BasiBerdaha	28	19	0	4	5	525	496
7.	Belwar	164	115	33	3	13	1	220
8.	Dogari	1290	220	1038	1	31	82	1380
9.	Siraswah	34	31	3	0	0	0	48
10.	Chalari	565	389	130	0	46	227	1060
11.	Phatpani	255	125	129	0	1	106	380
12.	Bajaudi	565	423	124	0	18	284	796
13.	Ladbai	105	98	3	0	4	106	208
14.	Tal	747	154	574	1	18	6	854

15.	Digwah	245	235	0	0	10	279	527
16.	Bhaisa Buda	728	522	203	0	3	15	709
17.	KhanuaNawa	1268	427	801	2	38	105	1314
18.	Khanua Khas	452	238	201	0	13	1	396
19.	Jamgadi	796	230	527	0	39	6	805
20.	Bhalyatola	166	153	8	1	4	407	525
21.	Budher (Bugher)	72	64	7	0	1	0	93
22.	Langhadol	671	501	157	0	13	330	921
23.	Sajawar	362	104	253	0	5	18	516
24.	Rauhal	409	12	384	6	7	333	621
25.	Kamai	211	183	20	0	8	121	321
26.	Jeer	393	252	111	0	30	332	823
27.	Pondi Path	499	442	32	5	20	515	674
28.	Padari Khairwari Tola	158	129	25	0	4	67	151
29.	Nadau	341	262	10	0	69	172	642
30.	Amiliya	715	356	236	0	123	784	1672
31.	Semua	14	3	0	0	11	49	400
32.	Bandhaura	337	105	45	7	180	236	1069
33.	Khairahi	31	1	2	0	28	767	1042
34.	Nagwa	234	60	40	2	132	1544	2723
35.	Dhuni	233	117	107	2	7	49	668
36.	Karsua Raja	759	341	226	13	179	405	1722
37.	Churwahi	19	3	3	0	13	310	273
38.	Malga	497	350	100	4	43	59	974
Total		**14424**	**7209**	**6001**	**53**	**1161**	**8455**	**26504**

1.8 Cropping Pattern Adopted by Villagers:

Two seasonal crops mainly Kharif (summer crop) and Rabi (winter crop) are well developed in this region. The crops grown are Paddy, Jawar, Maize and Kodo. Mustard and Til are also grown along with the pulses like Arhar, Mung etc. The main Kharif crop is also paddy which is cultivated with a short rotation and this type of crop is grown only where irrigation facilities are available during winter. In addition Alsi, Mustard, etc. are also grown during Rabi. A very significant matter is use of fertilizers and pesticides in this region are very much limited as most of the agricultural practitioners are traditional and support use of green manure.

1.9 Extent of Biotic Pressure of the villagers on the study area:

At present agriculture is not imposing any biotic pressure on the natural ecosystem particularly of this region. The population growth is a common phenomenon all over which is not restricted to only the study area. The population growth has its impact on the natural ecosystem, common to everywhere. The energy consumption by the villagers for cooking food items entirely depends on adjoining forest areas i.e. collection of fuel wood.

1.10 Number of Families depending upon the NTFP Collection:

A majority of families in the impact area belong to SC and ST, who are involved in collection of NTFP. The main NTFP (non-timber forest produce) product is ***mouha*** (***Madhuca indica***) flower. *A*apart from mouha they also collect Amla (***Emblica officinalis***), Baheda (***Terminalia bellirica***), Harra (***Terminalia chebula***) and Aam (***Mangifera indica***) fruits. Honey and ***Jhuna (raal)*** (resin from Sal tree) collection is infrequent in the study area. Tendu leaf collection is also practised here. However, during our survey we did not found any family entirely dependent on NTFP collection. The left over family members of the main work force (old age people, women and children) are mostly engaged in NTFP collection. All family members' joins for collection of NTFP during the lean period when no other engagement for earning their lively hood is available. Apart from NTFP, fire wood (locally called ***Jhati)*** collection from forest is a traditional and common practice in the study area. Villagers cut the tree for small timber and firewood for their own consumption. They collect their fencing materials and materials required for agricultural tools from the surrounding forests. On an average per standard family (Father+ mother+ one child) consumes 10 kg of firewood per day.

1.11 Method of NTFP Collection:

Handpicking from the ground is the main system of collection of mohua. For collecting from the ground villagers clean the forest floor by igniting fire, which destroy the ground vegetation, as well as restrict the regeneration of tree species. Repeated use of this method adversely impact herbivore population. Due to the impact of this cleaning process of underground forest growth, the ground becomes completely barren at places to check the rainwater flow, resulting in to soil erosion.

1.12 Topography:

The Western part of Dhirauli block is characterized by almost plain topography, while, north-eastern and south-central part are highly undulating and have rugged topography as evident from the topographical plan. The north-eastern and south central part of the block have forest cover and is occupied by hillocks of elevation up to a maximum of 638 m above MSL. In general elevation of ground varies from 459.23m as observed near borehole MSD-102 to 603.45 m near borehole MDP-19 located in the south-western and south-eastern corner of the block respectively.

1.13 Natural Drainage Lines:

The Singrauli Coalfield is located in the drainage area of Son & Rihand Rivers. Drainage of the block is mainly controlled by westerly flowing Hardul Nala which traverses the block and passes almost through central part of the block. Many small seasonal nallas originating from elevated topography of north eastern and south central part of the block drain its water into Hardul Nala. The minor nallas and tributaries present in the block shows dendritic to sub-dendritic drainage pattern.

1.14 Climate:

Climate of the area is characterized by hot dry summer as well distributed rainfall in the monsoon season. The summer season begins from March and extends up to May with maximum temperature rising up to 48°C during the peak period. The monsoon period extends from June to September with an average rainfall of 1132.7 mm. The winter season commences in early November up to February with the mean daily temperature of 8.1°C.

1.15 Details of the Linear Infrastructures:

The Waidhan-Sidhi State Highway via Bargawan traverses 20 km north of the block. A metalled road from Parsona to Mara is located further east of the block. An un-metaled

road branching out of this at Rajmelan culminates at Sarai. From this road to the west of River Mahan, a north-south running road leads to Langadda via Bhalyatola, Suliyari & Jhalri. The block is also accessible by an all weather metalled road from Singrauli as well as from Waidhan. The distance of Sarai-Gram, the nearest major railway station on Chopan-Singrauli-Katni line of central railway is about 18 km from the block. Renukoot, an important industrial township & railway station is located at a distance of 70 km from Waidhan on Chopan-Garhwa section of eastern railway. Renukoot township is well connected with Hawrah, Tatanagar, Delhi etc. by direct train. Nearest airport Varanasi is located at a distance of 250 km from the Waidhan.

1.16 Nearest Water Bodies:

Nearest Water bodies in the 10 km radius of the proposed coal mine are given in **Table-1.7**

Table-1.7: Water bodies in 10 km radius of Proposed mine

Hurdul Nala -Within ML area	Sukar Nala-6.7 km, NNW
Jhananala within ML area,	Mahan Nala- 1.7 km, N
Sulkhia Nala-5.3 km, W	Hariya Nala- 9.9 km, NNW

1.17 Description of Flora and Fauna:

A change in the composition of biotic communities is reflected by a change in the distribution pattern of natural species of flora and fauna existing in the ecosystem. The sensitivity of animal and plant species to the changes occurring in their existing ecosystem can, therefore, be used for monitoring of Impact Assessment studies of any project.

Biological communities are the indicator environmental condition and resource of its distribution and survival. Biotic component comprises of both plants (Flora) and animal (Fauna) communities, which interact not only within and between them but also with the Abiotic components, viz. physical and chemical components of the environment. The changes in biotic community are studied in the pattern of distribution, abundance and diversity.

1.17.1. Methodology for Biodiversity Assessment:

I. Floral Diversity:

The present study on the floral assessment for the project activity is based on field survey of the area. Inventory Methodology was adapted to the baseline data of floral diversity in a

corridor of 10km radius from the project site of the proposed project using the relevant toposheets of scale 1:50000.

A forest inventory is **"an attempt to describe the quantity and quality of forest trees and many of the characteristics of the land area upon which the trees are grown."** The objective this floral inventory of the study area, is to provide complete checklist of floristic structure along the entire stretch of the proposed project for formulating effective management and conservation measures. The tree species, shrubs, herbs and climbers observed in the study area (Core zone, Buffer Zone and Protected Areas NP/WLS/PF/RF) are represented in the **Table 1.8.**

II. Faunal Diversity:

A linear transect of 1.0 km each was chosen for sampling at each site. Each transect was trekked for 1.5 hr for the sampling of faunal diversity through following methods for different categories. For the sampling of butterflies, the standard 'Pollard Walk' method was employed and all the species recorded daily. Voucher specimens of the species that could not be identified in the field were collected using a butterfly net besides photographing them.

For bird's sampling, 'Point Sampling' along the fixed transect (Foot trails) was carried out. All the species of birds were observed through a binocular and identified with the help of field guide book and photographs.

For the sampling of mammals, direct count on open width (20m) transect was used. In addition, information on recent sightings/records of mammals by the villagers/locals was also collected. For carnivores, indirect sampling was carried out and the mammals were identified by foot marks, faeces and other marks/sign created by them. In case of reptiles mainly lizards were sampled by direct count on open width transects.

The study of fauna takes substantial amount of time to understand the specific faunal characteristic of area. The assessment of fauna has been done by extensive field survey of the area. During survey, the presence of wildlife was also inhabitants depending on animal sightings and the frequency of their visits in the project area which was later confirmed from forest department, Wildlife Department etc.

III. Aquatic Diversity:

a) Zooplankton:

For zooplankton analysis, 20L of subsurface water was strained through 53µ Nytex plankton net and the concentrate was transferred to labeled plankton bottle after rinsing the net with distilled water. The planktons were immediately preserved in 4% neutral formaldehyde solution for subsequent examination and quantification.

Zooplankton samples were observed in a sedimentation chamber under an inverted plankton microscope. Planktons were identified with the help of standard keys and references.

b) Phytoplankton:

Similarly, for phytoplankton analysis, water sample were taken directly from the sites in 100 ml sampling bottles and preserved with Lugol's solution immediately. Then the samples were centrifuged in the laboratory followed by removal of desired amount of supernatant from the centrifuge tube to make the required concentration.

c) Fishes:

Fisheries data has been collected through consultation with local fishermen and throwing nets.

1.17.2. Forest Types of Study Area:

Madhya Pradesh is a forest rich State and is ranked first among the States in terms of the RFA. The State has a sizeable tribal and rural population which is dependent on the forests for their livelihood and basic needs. As per the Champion & Seth Classification of Forest Types (1968), the forests in Madhya Pradesh belong to five Forest Type Groups, which are further divided into 21 Forest Types. Madhya Pradesh is a pioneering State in the implementation of the Joint Forest Management (JFM) movement in the country. The State has a strong JFM network through 15,228 JFMC/VSS/EDCs covering an area of 66,874 sq km.

Recorded Forest Area (RFA) in the State is 94,689 sq km of which 61,886 sq km is Reserved Forests, 31,098 sq km is Protected Forests and 1,705 sq km is Unclassed Forests. In Madhya Pradesh, during the period 1st January 2015 to 5th February 2019, a total of 12,785.98 hectares of forest land was diverted for nonforestry purposes under the Forest Conservation Act, 1980 (MoEF & CC, 2019).

Ten National Parks and 25 Wildlife Sanctuaries constitute the Protected Area network of the State covering 3.51% of its geographical area. There are 6 Tiger Reserves in the State covering an area of 6117.26 sq km. Eco-sensitive zones have been declared for 19 protected areas. The State with a population of 526 Tigers, is recognized as Tiger State of India, as per the 'All India Tiger Estimation 2018' released recently.

Based on the interpretation of IRS Resourcesat-2 LISS III satellite data of the period Oct 2017 to January 2018, the Forest Cover in the State is 77,482.49 sq km which is 25.14 % of the State's geographical area. In terms of forest canopy density classes, the State has 6,676.02 sq km under Very Dense Forest (VDF), 34,341.40 sq km under Moderately Dense Forest (MDF) and 36,465.07 sq km under Open Forest (OF). Forest Cover in the State has increased by 68.49 sq km as compared to the previous assessment reported in ISFR 2017 (ISFR, 2019).

According to revised Forest Types (Champion & Seth, 1968) the forest type of the lease area along with the 10 km Radius buffer area, confirms to following forest types:-

i. Dry Peninsular Sal Forest (5B/C1c)
ii. Northern Dry Mixed Deciduous Forest (5B/C2)
iii. Dry Deciduous Scrub (5/DS1)
iv. Dry Bamboo Brakes (5/E9)

i. Dry Peninsular Sal Forest (5B/C1c): Sal occurs either pure or in mixture with *Terminalia tomentosa, Terminalia bellerica, Pterocarpus marsupium, Anogeissus latifolia, Lagerstroemia parviflora, Madhuca latifolia, Diospyros melanoxylon, Buchanania lanzan, Ougeinia dalbergiodes* etc. Under storey consists of *Combretum decandrum, Flacourtia cataphracta, Randia dumetorum, Zizyphus mauritiana, Gardenia gummifera, Holarrhena* Spp., *Lantana Camara, Eupatorium odoratum* etc.

ii. Northern Dry Mixed Deciduous Forest (5B/C2): The upper canopy in this forest type is usually light, open and irregular, the trees having relatively short bole and poor form and a height rarely over 10 m. The canopy is formed entirely of deciduous trees. The main species found are *Cassia fistula, Diospyros tomentosa, Acacia catechu, Anogeissus latifolia, Bombax ceiba, Albizzia lebbeck, Albizzia procera, Melia azadirachta, Acacia nilotica, Acacia modesta, Bauhinia variegate, Bauhinia purpurea, Bauhinia racemosa,*

Cassaria eliptica, Syzygium cumini, Mangifera indica, Ehrilia laevis, Phoenix sylvestris, Morus alba, Morus Australia, Terminalia tomentosa, Boswellia serrata, Aegle marmelos, Erythrina suberosa, Ficus glomerata, Grewia elastica, Mallotus philippensis and *Shorea robusta* (Rarely).

The under growth is mainly *Zizyphus mauritiana, Carissa apaca, Holarrhena antidysenterica, Diospyros cordifolia, Capparis deciduas, Adhatoda vasica, Murraya koenigii, Agave Americana, Capparis sepiaria, Cordia dichotoma, Cassia tora, Zizyphus nummularia, Zizyphus oenopolia, Woodfordia fruticosa, Vitex negundo, Dodonea viscosa*.

Climbers found are *Bauhinia vahlii, Militia extensa, Mucuna* Spp., *Tinospora cordifolia, Pueraria tuberose, Vallaris solanacea*. Grasses are *Panicum antidotate, Aristida depressa, Bothrichloa intermedia, Cynodon dactylon, Bothrichloa pertusa, Cymbopogon marini, Dendrophtoe falcate* and Eriophorim comosum.

iii. **Dry Deciduous Scrub (5/DS1):** This forest type represents a degradation stage of the Dry Deciduous Forest and has been brought into existence by adverse biotic factors like excessive grazing, lopping, felling and fires. In spite of sufficient rains, moisture retention is poor and the type has now become a stable edaphic climax. The crop is open with less tree cover. The main tree species found are Diospyros tomentosa, Acacia leucopholea, Butea monosperma, Premna barbata, Cassia fistula, Anogeissus latifolia and Lannea grandis. The undergrowth is mainly Carissa apaca, Woodfordia fruticosa, Nyctanthes arbor-tristis and Flacourtia indica.

iv. **Dry Bamboo Breaks (5/E9):** In this forest type, only one species Dendrocalamus strictus ocuurs and forms low but often dense bamboo breaks. This forest type occurs mainly on dry hillsides of the study area.

Bamboosetum in Buffer Zone

1.17.3. Biodiversity within the Core Zone:

1.17.3.1. Flora:

The core zone, i.e. Dhirauli Coal Block, in Singrauli Coalfield, in the State of Madhya Pradesh has been allocated to M/s Stratatech Mineral Resource Private Limited (SMRPL) vide Letter No. NA-104/7/2020-NA dated 03.03.2021 by MoC, GoI.

The lease is located in Singrauli Coalfields (Main Basin), Village: Dhirauli, Phatpani, Sirswah, Amdand, Jhalari, Amraikhoh, Bansibridha, and Belwar, Tehsil: Sarai, Singrauli district of Madhya Pradesh. The details of floral diversity of Dhirauli coal block (core zone) is given in **Table-1.8**.

Table-1.8: Floral Diversity within Core Zone

SN.	Scientific Name	Local Name	Family	Habit
		TREES		
1.	*Acacia catechu*	Khair	Fabaceae	Tree
2.	*Acacia leucophloea*	Reunjha	Fabaceae	Tree
3.	*Acacia nilotica*	Babul	Fabaceae	Tree
4.	*Aegle marmelos*	Bel	Rutaceae	Tree
5.	*Ailanthus excels*	Maharukh	Simaroubaceae	Tree
6.	*Alangium salvifolium*	Ankol	Cornaceae	Tree
7.	*Albizia lebbeck*	Kala Siris	Fabaceae	Tree
8.	*Artocarpus heterophyllus*	Kathal	Moraceae	Tree
9.	*Azadirachta indica*	Neem	Rutaceae	Tree
10.	*Bauhinia malabarica*	Aasta	Caesalpiniaceae	Tree
11.	*Bauhinia purpurea*	Kachnar	Caesalpiniaceae	Tree
12.	*Bauhinia racemosa*	Kathmahula	Caesalpiniaceae	Tree
13.	*Bombax ceiba*	Semal	Malvaceae	Tree
14.	*Boswellia serrata*	Salai	Burseraceae	Tree
15.	*Buchanania lanzan*	Chironji	Anacardiaceae	Tree
16.	*Butea monosperma*	Palash	Fabaceae	Tree
17.	*Careya arborea*	kumbhi	Lecythidaceae	Tree
18.	*Cassia fistula*	Amaltas	Caesalpiniaceae	Tree
19.	*Cassine glauca*	Jamrashi	Celastraceae	Tree
20.	*Catunaregam nilotica*	Kharhar	Rubiaceae	Tree
21.	*Cordia dichotoma*	Lasora	Boraginaceae	Tree
22.	*Corymbia citriodora*	Safeda	Myrtaceae	Tree
23.	*Dalbergia latifolia*	Shisham	Fabaceae	Tree
24.	*Dillenia indica*	Bhavya	Dilleniaceae	Tree
25.	*Diospyros melanoxylon*	Tendu	Ebenaceae	Tree
26.	*Diospyros montana*	Patvan	Ebenaceae	Tree
27.	*Dodonaea angustifolia*	Khareta	Sapindaceae	Tree

SN.	Scientific Name	Local Name	Family	Habit
28.	*Erythrina suberosa*	Haduwa	Fabaceae	Tree
29.	*Ficus benghalensis*	Bargad	Moraceae	Tree
30.	*Ficus hispida*	Kathmur	Maoraceae	Tree
31.	*Ficus racemosa*	Gular	Moraceae	Tree
32.	*Ficus religiosa*	Papal	Moraceae	Tree
33.	*Ficus virens*	Pakar	Moraceae	Tree
34.	*Flacourtia indica*	Kaakai	Salicaceae	Tree
35.	*Gardenia gummifera*	Kaapar	Rubiaceae	Tree
36.	*Gardenia latifolia*	Papra	Rubiaceae	Tree
37.	*Garuga pinnata*	Kharpat	Burseraceae	Tree
38.	*Gmelina arborea*	Khamer	Verbenaceae	Tree
39.	*Grewia tiliifolia*	Dhankat	Tiliaceae	Tree
40.	*Haldina cordifolia*	Haldu	Rubiaceae	Tree
41.	*Holarrhena pubescens*	Kutki	Apocynaceae	Tree
42.	*Holoptelea integrifolia*	Chilbil	Ulmaceae	Tree
43.	*Kydia calycina*	Barunga	Malvaceae	Tree
44.	*Lagerstroemia parviflora*	Sendha	Lythraceae	Tree
45.	*Lannea coromandelica*	Gunja	Anacardiaceae	Tree
46.	*Madhuca longifolia*	Mahua	Sapotaceae	Tree
47.	*Mallotus philippensis*	Sindoor	Euphorbiaceae	Tree
48.	*Mangifera indica*	Aam	Anacardiaceae	Tree
49.	*Manilkara hexandra*	Khirni	Sapotaceae	Tree
50.	*Melia azedarach*	Bakain	Meliaceae	Tree
51.	*Mitragyna parvifolia*	Kaima	Rubiaceae	Tree
52.	*Moringa oleifera*	Sainjna	Moringaceae	Tree
53.	*Morus alba*	Sehtut	Moraceae	Tree
54.	*Phoenix sylvestris*	Khajur	Arecaceae	Tree
55.	*Phyllanthus emblica*	Aaonla	Euphorbiaceae	Tree
56.	*Polyalthia longifolia*	Ashok	Annonaceae	Small Tree
57.	*Pongamia pinnata*	Karanj	Fabaceae	Tree
58.	*Pterocarpus marsupium*	Bijasal	Fabaceae	Tree
59.	*Salix tetrasperma*	Bansa	Salicaceae	Tree
60.	*Schleichera oleosa*	Kusum	Sapindaceae	Tree
61.	*Semecarpus anacardium*	Bhilma	Anacardiaceae	Tree
62.	*Shorea robusta*	Sal	Dipterocarpaceae	Tree
63.	*Sterculia urens*	Kullu	Sterculiaceae	Tree
64.	*Sterculia villosa*	Udaal	Sterculiaceae	Tree
65.	*Strychnos nux-vomica*	Kochila	Loganiaceae	Tree
66.	*Syzygium cumini*	Jamun	Myrtaceae	Tree
67.	*Tamarindus indica*	Imli	Caesalpiniaceae	Tree
68.	*Tectona grandis*	Sagaun	Verbenaceae	Tree
69.	*Terminalia alata*	Sanja	Combretaceae	Tree
70.	*Terminalia arjuna*	Arjun	Combretaceae	Tree

SN.	Scientific Name	Local Name	Family	Habit
71.	*Terminalia bellirica*	Bahera	Combretaceae	Tree
72.	*Terminalia catappa*	Badam	Combretaceae	
73.	*Terminalia chebula*	Harra	Combretaceae	Tree
74.	*Wrightia tinctoria*	Dudhi	Apocynaceae	Tree
		SHRUBS		
1.	*Abelmoschus manihot*	Jangali Bhindi	Malvaceae	Shrub
2.	*Abutilon indicum*	Kanghi	Malvaceae	Shrub
3.	*Adhatoda zeylanica*	Adusa	Acanthaceae	Shrub
4.	*Alangium salvifolium*	Ankola	Cornaceae	Shrub
5.	*Annona squamosa*	Sitaphal	Annonaceae	Shrub
6.	*Calotropis gigantea*	Safed Aak	Asclepiadaceae	Shrub
7.	*Calotropis procera*	Gulabi Aak	Asclepiadaceae	Shrub
8.	*Carica papaya*	Papita	Caricaceae	Shrub
9.	*Carissa opaca*	Karaunda	Apocynaceae	Shrub
10.	*Carissa spinarum*	Jangali Karaunda	Apocynaceae	Shrub
11.	*Cassia occidentalis*	Kasaundhi	Caesalpiniaceae	Shrub
12.	*Catunaregam nilotica*	Kharhar	Rubiaceae	Shrub
13.	*Citrus limon*	Neebu	Rutaceae	Shrub
14.	*Clerodendrum multiflorum*	Bharangi	Verbenaceae	Shrub
15.	*Combretum nanum*	Bilaura, Medila	Combretaceae	Shrub
16.	*Euphorbia nivulia*	Sehund	Euphorbiaceae	Shrub
17.	*Flemingia chappar*	Galphula	Fabaceae	Shrub
18.	*Flemingia nana*	Gursankari	Tiliaceae	Shrub
19.	*Flemingia paniculata*	Ramdant	Fabaceae	Shrub
20.	*Helicteres isora*	Marodfali	Sterculiaceae	Shrub
21.	*Hibiscus rosa-sinensis*	Gudhal	Malvaceae	Shrub
22.	*Holarrhena pubescens*	Kurriya	Apocynaceae	Shrub
23.	*Indigofera tinctoria*	Neel	Fabaceae	Shrub
24.	*Ixora pavetta*	Khujja	Rubiaceae	Shrub
25.	*Jatropha curcas*	Ratanjyot	Euphorbiaceae	Shrub
26.	*Lawsonia inermis*	Mehndi	Lythraceae	Shrub
27.	*Murraya paniculata*	Aathil	Rutaceae	Shrub
28.	*Nyctanthes arbor-tristis*	Harsingar	Oleaceae	Shrub
29.	*Phoenix acaulis*	Bhui Khajur	Arecaceae	Shrub
30.	*Phyllanthus reticulatus*	Panjoli	Euphorbiaceae	Shrub
31.	*Ricinus communis*	Rendi	Euphorbiaceae	Shrub
32.	*Thespesia lampas*	Chaumukhia,	Malvaceae	Shrub
33.	*Vitex negundo*	Nirgundi	Verbenaceae	Shrub
34.	*Woodfordia fruticosa*	Dhavai	Lythraceae	Shrub
35.	*Ziziphus mauritiana*	Ber	Rhamnaceae	Shrub
36.	*Ziziphus oenoplia*	Barari	Rhamnaceae	Shrub
		HERBS		
1.	*Achyranthes aspera*	Apamarg	Amaranthaceae	Herb
2.	*Acorus calamus*	Buch	Araceae	Herb

SN.	Scientific Name	Local Name	Family	Habit
3.	*Aerva lanata*	Gorakhganja	Amaranthaceae	Herb
4.	*Ageratum conyzoides*.	Agreatum	Asteraceae	Herb
5.	*Allium leptophyllum*	Van Lehsun	Liliaceae	Herb
6.	*Alternanthera sessilis*	Gudari sag	Amaranthaceae	Herb
7.	*Alysicarpus monilifer*	Alisicarpus	Fabaceae	Herb
8.	*Andrographis paniculata*	Kalmegh	Acanthaceae	Herb
9.	*Anisomeles indica*	Jangali Tulsi	Lamiaceae	Herb
10.	*Argemone Mexicana*	Swarnchhiri (Peeli)	Papaveraceae	Herb
11.	*Bacopa monnieri*	Brahmi	Scrophulariaceae	Herb
12.	*Bacopa procumbens*	Jal-Neem	Scrophulariaceae	Herb
13.	*Boerhavia diffusa*.	Raktpunarwa	Nyctaginaceae	Herb
14.	*Bulbostylis barbata*		Cyperaceae	Sedges
15.	*Cassia tora*	Chakramard	Caesalpiniaceae	Herb
16.	*Catharanthus roseus*	Sadabahar	Apocynaceae	Herb
17.	*Centella asiatica*	Mandukparni	Apiaceae	Herb
18.	*Chlorophytum tuberosum*	Safed Musli	Liliaceae	Herb
19.	*Cleome gynandra*	Hurhur	Capparaceae	Herb
20.	*Commelina benghalensis*	Kanchara	Commelinaceae	Herb
21.	*Commelina diffusa* Burm	Kanshura	Commelinaceae	Herb
22.	*Convolvulus prostratus*	Shankhpushpi	Convolvulaceae	Herb
23.	*Crotalaria prostrate*	Kartik Jhumka	Fabaceae	Herb
24.	*Curcuma angustifolia*	Tikhur	Zingiberaceae	Herb
25.	*Curculigo orchioides*	Kali Musli	Hypoxidaceae	Herb
26.	*Curcuma aromatica*	Van Haldi	Zingiberaceae	Herb
27.	*Cyperus rotundus*	Motha	Cyperaceae	Sedges
28.	*Dentella repens*	Parpat	Rubiaceae	herb
29.	*Desmodium triflorum*	Desmodium	Fabaceae	Herb
30.	*Eclipta prostrata*	Bhringraj	Asteraceae	Herb
31.	*Elytraria acaulis*	Sahasramuniya	Acanthaceae	herb
32.	*Euphorbia hirta*	Doodhi	Euphorbiaceae	Herb
33.	*Evolvulus alsinoides*	Sakhpushpi	Convolvulaceae	Herb
34.	*Fimbristylis dipsacea*	NA	Cyperaceae	Sedges
35.	*Fimbristylis falcata*	Hathi Paw	Cyperaceae	Sedges
36.	*Fumaria indica*	Pitpapra	Papaveraceae	Herb
37.	*Heliotropium indicum*	Hastimundi	Boraginaceae	Herb
38.	*Ipomoea eriocarpa*	Besharam	Convonvulaceae	Herb
39.	*Justicia quinqueangularis*	Justicia	Acanthaceae	Herb
40.	*Leucas aspera*	Bhondaki	Lamiaceae	Herb
41.	*Melilotus indica*	Van Maithi	Fabaceae	herb
42.	*Ocimum basilicum*	Ban Tulsi	Lamiaceae	Herb
43.	*Oxalis corniculata*	Teenpati	Oxalidaceae	Herb
44.	*Oxalis corniculata*	Teen Patti	Oxalidaceae	Herb
45.	*Oxalis richardiana*	Teenpatti	Oxalidaceae	Herb

SN.	Scientific Name	Local Name	Family	Habit
46.	*Phyllanthus amarus*	Bhuin Anwla	Euphorbiaceae	Herb
47.	*Physalis minima*	Chirponta	Solanaceae	Herb
48.	*Polygonum barbatum*	Polygonum	Polygonaceae	Herb
49.	*Polygonum glabrum*	Polygonum		Herb
50.	*Rauvolfia serpentina*	Sarpandha	Apocynaceae	Herb
51.	*Rungia pectinata*	Rungia	Acanthaceae	Herb
52.	*Sida acuta* Burm.	Mahabala	Malvaceae	Herb
53.	*Sida cordifolia*	Kharenti	Malvaceae	Herb
54.	*Sida rhombifolia*	Atibala	Malvaceae	Herb
55.	*Solanum nigrum*	makoya	Solanaceae	Herb
56.	*Solanum virginianum*	Katai	Solanaceae	Herb
57.	*Tridax procumbens*	Khal Muriya	Asteraceae	Herb
58.	*Triumfetta pentandra*	Chipki	Tiliaceae	Herb
59.	*Triumfetta rhomboidea*	Chipki	Tiliaceae	Herb
60.	*Xanthium strumarium*	Gokharu	Asteraceae	Herb
	GRASSES			
1.	*Aristida adscensionis.*	Aristida	Poaceae	Grasses
2.	*Bambusa bambos*	Bamboo	Poaceae	Grasses
3.	*Bothriochloa pertusa*	Bothricloa	Poaceae	Grasses
4.	*Cenchrus ciliaris*	Cenchurus	Poaceae	Grasses
5.	*Chrysopogon serrulatus*	Chrysopogan	Poaceae	Grasses
6.	*Cynodon dactylon*	Doob	Poaceae	Grasses
7.	*Dichanthium annulatum*	Dichanthium	Poaceae	Grasses
8.	*Digitaria stricta*	Digitaria	Poaceae	Grasses
9.	*Eragrostis amabilis*	Erogrostis	Poaceae	Grasses
10.	*Heteropogon contortus*	hetropogan	Poaceae	Grasses
11.	*Imperata cylindrica*	Imperata	Poaceae	Grasses
12.	*Oryza minuta* J.Presl	Jangali Dhan	Poaceae	Grasses
13.	*Saccharum spontaneum*	Kans	Poaceae	Grasses
14.	*Dendrocalamus strictus*	Bans	Poaceae	Grasses
	CLIMBERS			
1.	*Abrus precatorius*	Kali Ghughchi	Fabaceae	Climber
2.	*Asparagus racemosus*	Shatawar	Liliaceae	Climber
3.	*Butea superba*	Palas Bel	Fabaceae	Climber
4.	*Cissus quadrangularis*	Hadjood	Vitaceae	Climber
5.	*Coccinia grandis*	Kunduru	Cucurbitaceae	Climber
6.	*Combretum roxburghii*	Bilora, Medila	Combretaceae	Climber
7.	*Cryptolepis buchanani*	Nagbel	Asclepiadaceae	Climber
8.	*Gymnema sylvestre*	Gudmar	Asclepiadaceae	Climber
9.	*Tinospora cordifolia*	Giloya	Menispermaceae	Climber
	EPIPHYTES			
1.	*Cuscuta reflexa.*	Amarbel	Convolvulaceae	Epiphyte
2.	*Vanda tessellata*	Vanda	Orchidaceae	Epiphyte

(Source: Primary Survey Data)

1.17.3.2. Fauna:

The Fauna of a particular region indicates environmental conditions and the well being of the population residing in the region. Faunal studies help to understand the well being of the natural systems and indicate functioning of ecosystem. It helps to monitor pollution levels, biological richness or heritage quality, habitat change quantifying threatened species. The faunal components such as Arthropods, Molluscs, Pisces, Birds and Mammals are very sensitive to any change in the ecosystem, therefore are very good indicators of the health of an ecosystem. The details of faunal diversity of Dhirauli coal block (Core Zone) is given in Table-1.9.

Table-1.9: Faunal Diversity within Core Zone

Sl. No.	Common Name	Scientific Name	Schedule as per WPA, 1972	Conservation Status as per IUCN
		Mammals		
1	Spotted Deer	*Axis axis*	III	LC #
2	Bandicoot Rat	*Bandicota bengalensis*	V	LC #
3	Jackal	*Canis aureus*	II	LC #
4	Indian Wolf	*Canis lupus callipes*	I	LC #
5	Short Nosed Fruit Bat	*Cynopterus sphinx*	V	LC #
6	Wild Cat	*Felis chaus*	II	LC #
7	Five striped Palm squirrel	*Funambulus pennanti*	IV	LC #
8	Mongoose	*Herpestres edwardsii*	IV	LC #
9	Striped Hyena	*Hyaena hyaena*	III	NT #
10	Indian Porcupine	*Hystrix indica*	IV	LC #
11	Hare	*Lepas nigricollis*	IV	LC #
12	Rhesus Macaque (Monkey)	*Macaca mulatta*	II	LC #
13	Indian Pangolin	*Manis crassicaudata*	I	EN #
14	Honey Badger	*Mellivora capensis*	I	LC #
15	Sloth Bear	*Melursus ursinus*	I	Vu #
16	Barking Deer	*Muntiacus muntjak*	III	LC #
17	Indian Field Mouse	*Mus booduga*	V	LC #
18	Hedgehog	*Paraechinus micropus*	IV	LC #
19	Indian Pipistrelle	*Pipistrellus mimus*	IV	LC #
20	Barking Deer	*Muntiacus muntjak*	III	LC #
21	Flying Fox	*Pteropus giganteus*	V	LC #
22	Common house Rat	*Rattus rattus*	V	LC #
23	Hanuman Langur	*Semnopithecus entellus*	II	LC #
24	Musk Shrew	*Suncus murinus*	-	LC #
25	Wild Pig	*Sus scrofa*	III	LC #

Sl. No.	Common Name	Scientific Name	Schedule as per WPA, 1972	Conservation Status as per IUCN
26	Common Fox	*Vulpes bengalensis*	II	LC #
27	Indian Civet	*Viverricula indica*	II	LC#
		Birds		
1	Shikra	*Accipter badius*	IV	LC #
2	Jungle Mynah	*Acridotheres fuscus*	IV	LC #
3	Common Mynah	*Acridotheres tristis*	IV	LC #
4	Common Iora	*Aegithina tiphia*	IV	LC #
5	Common Kingfisher	*Alcedo atthis*	IV	LC #
6	Quaker Babbler	*Alcippe poioicephala*	IV	LC #
7	Rufous-tailed Finch-lark	*Ammomanes phoenicurus*	IV	LC #
8	Open Billed Stork	*Anastomus oscitans*	IV	LC #
9	House swift	*Apus affinis*	IV	LC #
10	Tawny Eagle	*Aquila rapax*	I	VU #
11	Pond Heron	*Ardeola grayii*	IV	LC #
12	Ashy Swallow Shrike	*Artamus fuscus*	-	LC #
13	Eagle Owl	*Bubo bubo*	IV	LC #
14	Cattle Egret	*Bubulcus ibis*	IV	LC #
15	Common Indian Nightjar	*Caprimulgus asiaticus*	IV	LC #
16	Crow Pheasant	*Centropus sinensis*	IV	LC #
17	Crow Pheasant	*Centropus sinensis*	IV	LC #
18	Golden-fronted Leaf-bird	*Chloropsis aurifrons*	IV	LC #
19	Gold-mantled Leafbird	*Chloropsis chochinchinensis*	IV	LC #
20	Pied Crested Cuckoo	*Clamator jacobiuns*	IV	LC #
21	Blue Rock Pegion	*Columba livia*	IV	LC #
22	White Rumped Shama	*Copsychus malabaricus*	IV	LC #
23	Magpie Robin	*Copsychus saularis*	IV	LC #
24	Indian Roller	*Coracias benghalensis*	IV	LC #
25	Large Cuckoo-shrike	*Coracina novaehollandiae*	-	LC #
26	Jungle Crow	*Corvus marorhynchos*	IV	LC #
27	Common Crow	*Corvus splendens*	V	LC #
28	Common Quail	*Coturnix coturnix*	IV	LC #
29	Brain-fever bird	*Cuculus varius*	IV	LC #
30	Indian Tree Pie	*Dendrocitta vagabunda*	IV	LC #
31	Tickell's Flower Pecker	*Dicaeum erythrarthynchos*	IV	LC #
32	Fire-breasted Flower Pecker	*Dicaeum ignipectus*	IV	LC #
33	Drongo	*Dicrurus adsimilis*	IV	LC #
34	White-bellied Drongo	*Dicrurus caerulescens*	IV	LC #
35	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	IV	LC #
36	Lesser Golden Backed	*Dinopium benghalense*	IV	LC #

Sl. No.	Common Name	Scientific Name	Schedule as per WPA, 1972	Conservation Status as per IUCN
	Woodpecker			
37	Black Winged Kite	*Elanus caeruleus*	IV	LC #
38	Ashy-crowned Finch-lark	*Eremopterix grisea*	IV	LC #
39	Red Munia	*Estrilda amandava*	IV	LC #
40	Koel	*Eudynamis scolopacea*	IV	LC #
41	Lesser Kestrel	*Falco naumanni*	IV	LC #
42	Common Kestrel	*Falco tinnunculus*	IV	LC #
43	Black Partridge	*Francolinus francolinus*	IV	LC #
44	Painted Partridge	*Francolinus pictus*	IV	LC #
45	Grey Partridge	*Francolinus pondicerianus*	IV	LC #
46	Red Spurfowl	*Galloperdix spadicea*	IV	LC #
47	Red Jungle Fowl	*Gallus gallus*	IV	LC #
48	Jungle Owlet	*Glaucidium radiatum*	IV	LC #
49	White Rumped Vulture	*Gyps bengalensis*	I	CR #
50	White Breasted Kingfisher	*Halcyon smyrnensis*	IV	LC #
51	Heartspotted Woodpecker	*Hemicircus canente*	IV	LC #
52	Indian Cliff Swallow	*Hirundo fluvicola*	-	LC #
53	Wire-tailed Swallow	*Hirundo smithii*	-	LC #
54	Rufous Backed Shrike	*Lanius schach*	-	LC #
55	Black-headed Munia	*Lonchura malacca*	IV	LC #
56	Coppersmith Barbet	*Megalaima haemacephala*	IV	LC #
57	Crested Bunting	*Melophus lathami*	IV	LC #
58	Small Green Bee-eater	*Merops orientalis*	IV	LC #
59	Blue tailed Bee-eater	*Merops philippinus*	IV	LC #
60	Blue cheeked Bee-eater	*Merops superciliosus*	IV	LC #
61	Pariah Kite	*Milvus migrans*	IV	LC #
62	Blacknaped Flycatcher	*Monarcha azurea*	IV	LC #
63	Blue headed Rock Thrush	*Monticola cinclorhynchus*	IV	LC #
64	Pied Wagtail	*Motacilla alba*	-	LC #
65	Grey Wagtail	*Motacilla cinerea*	-	LC #
66	Yellow Wagtail	*Motacilla flava*	-	LC #
67	Large Pied Wagtail	*Motacilla maderaspatensis*	-	LC #
68	Tickell's Blue Flycatcher	*Muscicapa tickelliae*	IV	LC #
69	Purple Sunbird	*Nectarinia asiatica*	IV	LC #
70	Crested Hawk Eagle	*Nisaetus cirrhatus*	I	LC #
71	Golden Oriole	*Oriolus oriolus*	IV	LC #
72	Black Headed Oriole	*Oriolus xanthornus*	IV	LC #
73	Tailor Bird	*Orthotomus sutorius*	IV	LC #
74	Grey Tit	*Parus major*	IV	LC #
75	Yellow-cheeked Tit	*Parus xanthogenys*	IV	LC #

Sl. No.	Common Name	Scientific Name	Schedule as per WPA, 1972	Conservation Status as per IUCN
76	House Sparrow	*Passer domesticus*	IV	LC #
77	Pea-fowl	*Pavo cristatus*	I	LC #
78	Jungle Bush Quail	*Perdicula asiatica*	IV	LC #
79	Small Minivet	*Pericrocotus cinnamomeus*	IV	LC #
80	Scarlet Minivet	*Pericrocotus flammmeus*	IV	LC #
81	Black Redstart	*Phoenicurus ochruros*	IV	LC #
82	Yellow-fronted Pied Woodpecker	*Picoides mahrattensis*	IV	LC #
83	Indian Pitta	*Pitta brachyura*	IV	LC #
84	Weaver Bird	*Ploceus philippinus*	IV	LC #
85	Slaty-headed Scimitar Babbler	*Pomatorhinus horsfieldi schisticeps*	IV	LC #
86	Ashy Wren-warbler	*Prinia socialis*	IV	LC #
87	Blossom headed Parakeet	*Psittacula cyanocephala*	IV	LC #
88	Large Indian Parakeet	*Psittacula eupatria*	IV	NT #
89	Rose Ringed Parakeet	*Psittacula krameri*	IV	LC #
90	Red Vent Bulbul	*Pycnonotus cafer*	IV	LC #
91	Red Whiskered Bulbul	*Pycnonotus jocosus*	IV	LC #
92	White-throated Fantail Flycatcher	*Rhipidura albicolis*	IV	LC #
93	White-browed Fantail Flycatcher	*Rhipidura aureola*	IV	LC #
94	Pied Bush-chat	*Saxicola caprata*	IV	LC #
95	Collared Bush-chat	*Saxicola torquata*	IV	LC #
96	Indian Robin	*Saxicoloides fulicata*	IV	LC #
97	Chestnut-bellied Nuthatch	*Sitta castanea*	-	LC #
98	Velvet-fronted Nuthatch	*Sitta frontalis*	-	LC #
99	Crested Serpent Eagle	*Spilornis cheela*	-	LC #
100	Spotted Dove	*Streptopelia chinensis*	IV	LC #
101	Indian Ring Dove	*Streptopelia decaocto*	IV	LC #
102	Red Turtle Dove	*Streptopelia tranquebarica*	IV	LC #
103	Pied Mynah	*Sturnus contra*	IV	LC #
104	Grey-Headed Mynah	*Sturnus malabaricus*	IV	LC #
105	Black-headed Mynah	*Sturnus pagodarum*	IV	LC #
106	Rosy Pastor	*Sturnus roseus*	IV	LC #
107	Paradise Flycatcher	*Terpsiphone paradisi*	IV	LC #
108	Black Headed Ibis	Threskiornis *melanocephalus*	IV	NT#
109	Indian Grey Hornbill	*Tokus birostris*	-	LC #
110	Yellow-footed Green Pigeon	*Treron phoenicoptera*	IV	LC #
111	Jungle Babbler	*Turdoides striatus*	IV	LC #

Sl. No.	Common Name	Scientific Name	Schedule as per WPA, 1972	Conservation Status as per IUCN
112	Hoopoe	*Upupa epops*	IV	LC #
113	Red Wattled Lapwing	*Vannelus indicus*	IV	LC #
114	Red Wattled Lapwing	*Vannelus indicus*	IV	LC #
		Reptiles		
1	Green Vine Snake	*Ahaetulla nasuta*	IV	LC #
2	Garden Lizard	*Calotes versicolor*	-	-
3	Russel's Viper	*Daboia russelii*	IV	LC #
4	Geckos	*Hemidactylus sps.*	IV	-
5	Common Skink	*Mabuya carinata*	-	LC #
6	Indian Cobra	*Naja naja*	IV	LC #
7	Yellow Rat Snake	*Ptyas mucosa*	II	-
8	Indian Python	*Python morulus*	I	Vu #
9	Bengal Monitor Lizard	*Varanus bengalensis*	I	LC #
		Fishes		
1	Chela	*Chela sp.*	NA	NA
2	Magur	*Clarias batrachus*	NA	NA
3	Punti	*Barbus sp.*	NA	NA
4	Snakehead	*Ophiocephalus punctatus*	NA	NA
		Butterflies		
1.	Common Emigrant	*Catopsilia pomona*	NA	NA
2.	Stripped Tiger	*Danaus genutia*	NA	NA
3.	Common crow	*Euploea core*	NA	NA
4.	Common Grass Yellow	*Eurema hecabe*	NA	NA
5.	White orange tip	*Ixias marianne*	NA	NA

LC – Least Concern; NT – Near Threatened; Vu – Vulnerable; EN – Endangered; CR – Critically Endangered

1.17.4. Biodiversity within the Buffer Zone:

1.17.4.1. Flora:

The block area has highly undulating and rugged topography. Western part of Dhirauli block is characterized by almost plain topography, while, north-eastern and south-central part are highly undulating and have rugged topography as evident from the topographical plan. The north-eastern and south central part of the block have forest cover and is occupied by hillocks of elevation up to a maximum of 638 m above MSL. The study area best represents as moist region. The vegetation is fairly dense and occurs on crystalline rocks and yellow loam soils. Soil and topography vary together. It can be helpful to

differentiate three subtypes of topography; hilltops and plateaus, lower hill slopes and valley bottom. There is light shrub and weed growth under the forest canopy. The vegetation mainly consists of tall tress of *Shorea robusta, Tectona grandis, Terminalia tomentosa, Madhuca indica.* The vegetation can be described as moist peninsular Sal forest.

The total species of plants are indicating the floristic richness of the area. However, these species are not uniform in their distribution. The most dominant genera were *Shorea, Tectona, Bahuinia, Cassia, Ficus, Euphorbia* followed by *Acacia, Anogessus, Lagerstromia, Bamboo, Jatropha* and *Madhuca.* The most dominant family was Fabaceae, followed by Poaceae (22 species), Euphorbiaceae (17 species), Mimosaceae (11 species), Caesalpinaceae (13 species), Asteraceae (15 species) and Amaranthaceae (10 species).

There is predominance of herbs and trees followed by shrubs, climbers, epiphytes, grasses and sedges. The common climbers are *Butea superba, Combretum decandrum,* and *Bauhinia vahli.* Only two Gymnosperms were noticed which are cultivated in gardens. The Pteridophytes represented reasonably good number (7) along with 6 Bryophytes. They are very much sensitive to humidity and moisture. List of plant species as reported according to the Working Plans of **Singrauli Forest Division** has been studied out of which the main associates of Sal as observed in the field are furnished below in **Table No. 1.10.**

Table-1.10: Floral Diversity within buffer zone of Proposed coal mine

SN.	Scientific Name	Local Name	Family	Habit
		TREES		
1.	*Acacia catechu*	Khair	Fabaceae	Tree
2.	*Acacia leucophloea*	Reunjha	Fabaceae	Tree
3.	*Acacia nilotica*	Babul	Fabaceae	Tree
4.	*Aegle marmelos*	Bel	Rutaceae	Tree
5.	*Ailanthus excelsa*	Maharukh	Simaroubaceae	Tree
6.	*Alangium salvifolium*	Ankol	Cornaceae	Tree
7.	*Albizia lebbeck*	Kala Siris	Fabaceae	Tree
8.	*Albizia odoratissima*	Chichwa	Fabaceae	Tree
9.	*Albizia procera*	Safed Siris	Fabaceae	Tree
10.	*Anogeissus latifolia*	Dhawda	Combretaceae	Tree
11.	*Artocarpus heterophyllus*	Kathal	Moraceae	Tree
12.	*Azadirachta indica*	Neem	Rutaceae	Tree
13.	*Bauhinia malabarica*	Aasta	Caesalpiniaceae	Tree
14.	*Bauhinia purpurea*	Kachnar	Caesalpiniaceae	Tree
15.	*Bauhinia racemosa*	Kathmahula	Caesalpiniaceae	Tree

SN.	Scientific Name	Local Name	Family	Habit
16.	*Bombax ceiba*	Semal	Malvaceae	Tree
17.	*Boswellia serrata*	Salai	Burseraceae	Tree
18.	*Bridelia retusa*	Kasai	Euphorbiaceae	Tree
19.	*Buchanania lanzan*	Chironji	Anacardiaceae	Tree
20.	*Butea monosperma*	Palash	Fabaceae	Tree
21.	*Careya arborea*	kumbhi	Lecythidaceae	Tree
22.	*Cassia fistula*	Amaltas	Caesalpiniaceae	Tree
23.	*Cassine glauca*	Jamrashi	Celastraceae	Tree
24.	*Catunaregam nilotica*	Kharhar	Rubiaceae	Tree
25.	*Chloroxylon swietenia*	Bhirra	Rutaceae	Tree
26.	*Cordia dichotoma*	Lasora	Boraginaceae	Tree
27.	*Cordia obliqua*	Lasora	Boraginaceae	Tree
28.	*Corymbia citriodora*	Safeda	Myrtaceae	Tree
29.	*Dalbergia latifolia*	Shisham	Fabaceae	Tree
30.	*Dillenia indica*	Bhavya	Dilleniaceae	Tree
31.	*Dillenia pentagyna*	Karkat	Dilleniaceae	Tree
32.	*Diospyros melanoxylon*	Tendu	Ebenaceae	Tree
33.	*Diospyros montana*	Patvan	Ebenaceae	Tree
34.	*Dodonaea angustifolia*	Khareta	Sapindaceae	Tree
35.	*Ehretia laevis*	Charmor	Boraginaceae	Tree
36.	*Erythrina suberosa*	Haduwa	Fabaceae	Tree
37.	*Ficus benghalensis*	Bargad	Moraceae	Tree
38.	*Ficus hispida*	Kathmur	Maoraceae	Tree
39.	*Ficus mollis*	Baril	Moraceae	Tree
40.	*Ficus racemosa*	Gular	Moraceae	Tree
41.	*Ficus religiosa*	Papal	Moraceae	Tree
42.	*Ficus tinctoria*	Paakar	Moraceae	Tree
43.	*Ficus virens*	Pakar	Moraceae	Tree
44.	*Flacourtia indica*	Kaakai	Salicaceae	Tree
45.	*Gardenia gummifera*	Kaapar	Rubiaceae	Tree
46.	*Gardenia latifolia*	Papra	Rubiaceae	Tree
47.	*Garuga pinnata*	Kharpat	Burseraceae	Tree
48.	*Gmelina arborea*	Khamer	Verbenaceae	Tree
49.	*Grewia tiliifolia*	Dhankat	Tiliaceae	Tree
50.	*Haldina cordifolia*	Haldu	Rubiaceae	Tree
51.	*Holarrhena pubescens*	Kutki	Apocynaceae	Tree
52.	*Holoptelea integrifolia*	Chilbil	Ulmaceae	Tree
53.	*Kydia calycina*	Barunga	Malvaceae	Tree
54.	*Lagerstroemia parviflora*	Sendha	Lythraceae	Tree
55.	*Lannea coromandelica*	Gunja	Anacardiaceae	Tree
56.	*Litsea glutinosa*	Maida	Lauraceae	Tree
57.	*Madhuca longifolia*	Mahua	Sapotaceae	Tree
58.	*Mallotus philippensis*	Sindoor	Euphorbiaceae	Tree
59.	*Mangifera indica*	Aam	Anacardiaceae	Tree

SN.	Scientific Name	Local Name	Family	Habit
60.	*Manilkara hexandra*	Khirni	Sapotaceae	Tree
61.	*Melia azedarach*	Bakain	Meliaceae	Tree
62.	*Miliusa tomentosa*	Kaari	Annonaceae	Tree
63.	*Mitragyna parvifolia*	Kaima	Rubiaceae	Tree
64.	*Moringa oleifera*	Sainjna	Moringaceae	Tree
65.	*Morus alba*	Sehtut	Moraceae	Tree
66.	*Oroxylum indicum*	Sonpatha	Bignoniaceae	Tree
67.	*Ougeinia oojeinensis.*	Tinsa	Fabaceae	Tree
68.	*Phoenix sylvestris*	Khajur	Arecaceae	Tree
69.	*Phyllanthus emblica*	Aaonla	Euphorbiaceae	Tree
70.	*Polyalthia longifolia*	Ashok	Annonaceae	Tree
71.	*Pongamia pinnata*	Karanj	Fabaceae	Tree
72.	*Pterocarpus marsupium*	Bijasal	Fabaceae	Tree
73.	*Salix tetrasperma*	Bansa	Salicaceae	Tree
74.	*Schleichera oleosa*	Kusum	Sapindaceae	Tree
75.	*Schrebera swietenioides*	Ghainta	Oleaceae	Tree
76.	*Semecarpus anacardium*	Bhilma	Anacardiaceae	Tree
77.	*Shorea robusta*	Sal	Dipterocarpaceae	Tree
78.	*Sterculia urens*	Kullu	Sterculiaceae	Tree
79.	*Sterculia villosa*	Udaal	Sterculiaceae	Tree
80.	*Stereospermum colais*	Chota Padar	Binoniaceae	Tree
81.	*Strychnos nux-vomica*	Kochila	Loganiaceae	Tree
82.	*Symplocos racemosa*	Lodra	Symplocaceae	Tree
83.	*Syzygium cumini*	Jamun	Myrtaceae	Tree
84.	*Tamarindus indica*	Imli	Caesalpiniaceae	Tree
85.	*Tectona grandis*	Sagaun	Verbenaceae	Tree
86.	*Terminalia alata*	Sanja	Combretaceae	Tree
87.	*Terminalia arjuna*	Arjun	Combretaceae	Tree
88.	*Terminalia bellirica*	Bahera	Combretaceae	Tree
89.	*Terminalia catappa*	Badam	Combretaceae	
90.	*Terminalia chebula*	Harra	Combretaceae	Tree
91.	*Trema orientalis*	Jibhi	Ulmaceae	Tree
92.	*Trema politoria*	Trema	Ulmaceae	Tree
93.	*Trewia polycarpa*	Surahi	Euphorbiaceae	Tree
94.	*Wrightia tinctoria*	Dudhi	Apocynaceae	Tree
95.	*Ziziphus mauritiana*	Ber	Rhamnaceae	Small Tree
		SHRUBS		
1.	*Abelmoschus manihot*	Jangali Bhindi	Malvaceae	Shrub
2.	*Abutilon indicum*	Kanghi	Malvaceae	Shrub
3.	*Adhatoda zeylanica*	Adusa	Acanthaceae	Shrub
4.	*Alangium salvifolium*	Ankola	Cornaceae	Shrub
5.	*Annona squamosa*	Sitaphal	Annonaceae	Shrub
6.	*Barleria prionitis*	Katsaraiya	Acanthaceae	Shrub

SN.	Scientific Name	Local Name	Family	Habit
7.	*Boehmeria macrophylla*	Sohkhara	Urticaceae	Shrub
8.	*Calotropis gigantea*	Safed Aak	Asclepiadaceae	Shrub
9.	*Calotropis procera*	Gulabi Aak	Asclepiadaceae	Shrub
10.	*Carica papaya*	Papita	Caricaceae	Shrub
11.	*Carissa opaca*	Karaunda	Apocynaceae	Shrub
12.	*Carissa spinarum*	Jangali Karaunda	Apocynaceae	Shrub
13.	*Cassia occidentalis*	Kasaundhi	Caesalpiniaceae	Shrub
14.	*Catunaregam nilotica*	Kharhar	Rubiaceae	Shrub
15.	*Citrus limon*	Neebu	Rutaceae	Shrub
16.	*Clerodendrum multiflorum*	Bharangi	Verbenaceae	Shrub
17.	*Colebrookea oppositifolia*	Ameda	Lamiaceae	Shrub
18.	*Combretum nanum*	Bilaura, Medila	Combretaceae	Shrub
19.	*Euphorbia neriifolia*	Sehud	Euphorbiaceae	Shrub
20.	*Euphorbia nivulia*	katthuar	Euphorbiaceae	Shrub
21.	*Flemingia chappar*	Galphula	Fabaceae	Shrub
22.	*Flemingia nana*	Gursankari	Tiliaceae	Shrub
23.	*Flemingia paniculata*	Ramdant	Fabaceae	Shrub
24.	*Grewia helicterifolia*	Vansuli	Tiliaceae	Shrub
25.	*Grewia hirsuta*	Gursankari	Tiliaceae	Shrub
26.	*Helicteres isora*	Marodfali	Sterculiaceae	Shrub
27.	*Hibiscus rosa-sinensis*	Gudhal	Malvaceae	Shrub
28.	*Holarrhena pubescens*	Kutki, Kurriya	Apocynaceae	Shrub
29.	*Indigofera tinctoria*	Neel	Fabaceae	Shrub
30.	*Ixora pavetta*	Khujja	Rubiaceae	Shrub
31.	*Jasminum humile*	Pili Chameli	Oleaceae	Shrub
32.	*Jatropha curcas*	Ratanjyot	Euphorbiaceae	Shrub
33.	*Lawsonia inermis*	Mehndi	Lythraceae	Shrub
34.	*Leea macrophylla*	Hatfun	Leeaceae	Shrub
35.	*Murraya paniculata*	Aathil	Rutaceae	Shrub
36.	*Nyctanthes arbor-tristis*	Harsingar	Oleaceae	Shrub
37.	*Ochna obtusata*	Kanak Champa	Ochnaceae	Shrub
38.	*Phoenix acaulis*	Bhui Khajur	Arecaceae	Shrub
39.	*Phyllanthus reticulates*	Panjoli	Euphorbiaceae	Shrub
40.	*Plumbago zeylanica*	Chitrak	Plumbaginaceae	Shrub
41.	*Premna barbata*	Aradi	Verbenaceae	Shrub
42.	*Ricinus communis*	Rendi	Euphorbiaceae	Shrub
43.	*Tamarix ericoides*	Jhau	Tamaricaceae	Shrub
44.	*Thespesia lampas*	Chaumukhia,	Malvaceae	Shrub
45.	*Vitex negundo*	Nirgundi	Verbenaceae	Shrub
46.	*Woodfordia fruticosa*	Dhavai	Lythraceae	Shrub
47.	*Ziziphus mauritiana*	Ber	Rhamnaceae	Shrub

SN.	Scientific Name	Local Name	Family	Habit
48.	*Ziziphus oenoplia*	Barari	Rhamnaceae	Shrub
		HERBS		
1.	*Acalypha ciliata*	Chipki	Asteraceae	Herb
2.	*Achyranthes aspera*	Apamarg	Amaranthaceae	Herb
3.	*Acorus calamus*	Buch	Araceae	Herb
4.	*Aerva lanata*	Gorakhganja	Amaranthaceae	Herb
5.	*Aerva sanguinolenta*	Gorakh Ganja	Amaranthaceae	Herb
6.	*Ageratum conyzoides*	Agreatum	Asteraceae	Herb
7.	*Allium leptophyllum*	Van Lehsun	Liliaceae	Herb
8.	*Alternanthera sessilis*	Gudari sag	Amaranthaceae	Herb
9.	*Alysicarpus monilifer*	Alisicarpus	Fabaceae	Herb
10.	*Ammannia baccifera*	Dadmari	Lythraceae	Herb
11.	*Andrographis paniculata*	Kalmegh	Acanthaceae	Herb
12.	*Anisomeles indica*	Jangali Tulsi	Lamiaceae	Herb
13.	*Aponogeton crispum*	*Aponogeton*	Aponogetonaceae	Herb
14.	*Argemone mexicana*	Swarnchhiri	Papaveraceae	Herb
15.	*Asphodelus tenuifolius*	Bokat	Linaceae	Herb
16.	*Atylosia scarabaeoides*	Lotar	Fabaceae	Herb
17.	*Bacopa monnieri*	Brahmi	Scrophulariaceae	Herb
18.	*Bacopa procumbens.*	Jal-Neem	Scrophulariaceae	Herb
19.	*Barleria cristata*	Katsaraiya	Acanthaceae	Herb
20.	*Boerhavia diffusa*	Raktpunarwa	Nyctaginaceae	Herb
21.	*Bulbostylis barbata*		Cyperaceae	Sedges
22.	*Cassia tora*	Chakramard	Caesalpiniaceae	Herb
23.	*Catharanthus roseus*	Sadabahar	Apocynaceae	Herb
24.	*Centella asiatica*	Mandukparni	Apiaceae	Herb
25.	*Chlorophytum tuberosum*	Safed Musli	Liliaceae	Herb
26.	*Cleome gynandra*	Hurhur	Capparaceae	Herb
27.	*Cleome viscose*	Hurhur	Capparaceae	Herb
28.	*Commelina benghalensis*	Kanchara	Commelinaceae	Herb
29.	*Commelina diffusa*	Kanshura	Commelinaceae	Herb
30.	*Convolvulus prostratus*	Shankhpushpi	Convolvulaceae	Herb
31.	*Crotalaria prostrata*	Kartik Jhumka	Fabaceae	Herb
32.	*Curcuma angustifolia*	Tikhur	Zingiberaceae	Herb
33.	*Curculigo orchioides*	Kali Musli	Hypoxidaceae	Herb
34.	*Curcuma aromatica*	Van Haldi	Zingiberaceae	Herb
35.	*Cyperus rotundus*	Motha	Cyperaceae	Sedges
36.	*Dentella repens*	Parpat	Rubiaceae	herb
37.	*Desmodium heterocarpon*	Salparni	Fabaceae	Herb
38.	*Desmodium triflorum*	Desmodium	Fabaceae	Herb
39.	*Dipteracanthus suffruticosus*	Chowlai	Acanthaceae	Herb
40.	*Echinops echinatus*	Utkatara	Asteraceae	Herb
41.	*Eclipta prostrata*	Bhringraj	Asteraceae	Herb
42.	*Elytraria acaulis*	Sahasramuniya	Acanthaceae	herb

SN.	Scientific Name	Local Name	Family	Habit
43.	*Euphorbia hirta*	Doodhi	Euphorbiaceae	Herb
44.	*Evolvulus alsinoides*	Sakhpushpi	Convolvulaceae	Herb
45.	*Fimbristylis dipsacea*	NA	Cyperaceae	Sedges
46.	*Fimbristylis falcata*	Hathi Paw	Cyperaceae	Sedges
47.	*Fumaria indica*	Pitpapra	Papaveraceae	Herb
48.	*Heliotropium indicum*	Hastimundi	Boraginaceae	Herb
49.	*Hygrophila salicifolia*	Talamkhana	Acanthaceae	Herb
50.	*Ipomoea eriocarpa*	Besharam	Convonvulaceae	Herb
51.	*Justicia quinqueangularis*	Justicia	Acanthaceae	Herb
52.	*Leucas aspera*	Bhondaki	Lamiaceae	Herb
53.	*Melilotus indica*	Van Maithi	Fabaceae	herb
54.	*Ocimum basilicum*	Ban Tulsi	Lamiaceae	Herb
55.	*Oxalis corniculata*	Teenpati	Oxalidaceae	Herb
56.	*Oxalis corniculata*	Teen Patti	Oxalidaceae	Herb
57.	*Oxalis richardiana*	Teenpatti	Oxalidaceae	Herb
58.	*Phyllanthus amarus*	Bhuin Anwla	Euphorbiaceae	Herb
59.	*Physalis minima*	Chirponta	Solanaceae	Herb
60.	*Polygonum barbatum*	Polygonum	Polygonaceae	Herb
61.	*Polygonum glabrum*	Polygonum	Polygonaceae	Herb
62.	*Rauvolfia serpentina*	Sarpandha	Apocynaceae	Herb
63.	*Rungia pectinata*	Rungia	Acanthaceae	Herb
64.	*Scleria levis* Retz.	Scleria	Cyperaceae	Sedges
65.	*Sesbania bispinosa*	Sirmili	Fabaceae	Herb
66.	*Sida acuta*	Mahabala	Malvaceae	Herb
67.	*Sida cordifolia*	Kharenti	Malvaceae	Herb
68.	*Sida rhombifolia*	Atibala	Malvaceae	Herb
69.	*Solanum nigrum*	makoya	Solanaceae	Herb
70.	*Solanum virginianum*	Bhatkataiya	Solanaceae	Herb
71.	*Tridax procumbens*	Khal Muriya	Asteraceae	Herb
72.	*Triumfetta pentandra*	Chipki	Tiliaceae	Herb
73.	*Triumfetta rhomboidea*	Chipki	Tiliaceae	Herb
74.	*Xanthium strumarium*	Gokharu	Asteraceae	Herb
		GRASSES		
1.	*Apluda mutica*	Apluda	Poaceae	Grasses
2.	*Apocopis vaginata*	Apocopis	Poaceae	Grasses
3.	*Aristida adscensionis*	Aristida	Poaceae	Grasses
4.	*Bambusa bambos*	Bamboo	Poaceae	Grasses
5.	*Bothriochloa glabra*	Bothriochloa	Poaceae	Grasses
6.	*Bothriochloa intermedia*	Bothriochloa	Poaceae	Grasses
7.	*Bothriochloa pertusa*	Bothricloa	Poaceae	Grasses
8.	*Brachiaria eruciformis*	Brachiaria	Poaceae	Grasses
9.	*Brachiaria ramosa*	Brachiaria	Poaceae	Grasses
10.	*Brachiaria reptans*	Brachiaria	Poaceae	Grasses
11.	*Cenchrus ciliaris*	Cenchurus	Poaceae	Grasses

SN.	Scientific Name	Local Name	Family	Habit
12.	*Chloris dolichostachya*	Chloris	Poaceae	Grasses
13.	*Chloris virgata*	Chloris	Poaceae	Grasses
14.	*Chrysopogon fulvus*	Chrysopogan	Poaceae	Grasses
15.	*Chrysopogon serrulatus*	Chrysopogan	Poaceae	Grasses
16.	*Cymbopogon martinii*	Musail	Poaceae	Grasses
17.	*Cynodon dactylon*	Doob	Poaceae	Grasses
18.	*Dichanthium annulatum*	Dichanthium	Poaceae	Grasses
19.	*Digitaria stricta*	Digitaria	Poaceae	Grasses
20.	*Eragrostis amabilis*	Erogrostis	Poaceae	Grasses
21.	*Eragrostis atrovirens*	Erogrostis	Poaceae	Grasses
22.	*Eragrostis cilianensis*	Erogrostis	Poaceae	Grasses
23.	*Eragrostis ciliaris*	Erogrostis	Poaceae	Grasses
24.	*Heteropogon contortus*	hetropogan	Poaceae	Grasses
25.	*Imperata cylindrica*	Imperata	Poaceae	Grasses
26.	*Oplismenus compositus*	Oplismenus	Poaceae	Grasses
27.	*Oropetium thomaeum*	Oplismenus	Poaceae	Grasses
28.	*Oryza minuta*	Jangali Dhan	Poaceae	Grasses
29.	*Panicum psilopodium*	Panicum	Poaceae	Grasses
30.	*Panicum sumatrense*	Panicum	Poaceae	Grasses
31.	*Paspalidium flavidum*	Paspalum	Poaceae	Grasses
32.	*Paspalidium punctatum*	Paspalum	Poaceae	Grasses
33.	*Pennisetum pedicellatum*	Pennisetum	Poaceae	Grasses
34.	*Pennisetum polystachyon*	Pennisetum	Poaceae	Grasses
35.	*Perotis indica*	Perotis	Poaceae	Grasses
36.	*Saccharum spontaneum*	Kans	Poaceae	Grasses
37.	*Dendrocalamus strictus*	Bans	Poaceae	Grasses
CLIMBERS				
1.	*Abrus precatorius*	Kali Ghughchi	Fabaceae	Climber
2.	*Asparagus racemosus*	Shatawar	Liliaceae	Climber
3.	*Butea superba*	Palas Bel	Fabaceae	Climber
4.	*Cissus quadrangularis*	Hadjood	Vitaceae	Climber
5.	*Coccinia grandis*	Kunduru	Cucurbitaceae	Climber
6.	*Combretum roxburghii*	Bilora, Medila	Combretaceae	Climber
7.	*Cryptolepis buchanani*	Nagbel	Asclepiadaceae	Climber
8.	*Gymnema sylvestre*	Gudmar	Asclepiadaceae	Climber
9.	*Tinospora cordifolia*	Giloya	Menispermaceae	Climber
EPIPHYTES				
1.	*Cuscuta reflexa*	Amarbel	Convolvulaceae	Epiphyte
2.	*Vanda tessellata*	Vanda	Orchidaceae	Epiphyte

Qualitative Analisis at Mohanban R.F.

1.17.4.2. Fauna:

The study of fauna takes substantial amount of time to understand the specific faunal characteristic of area. The assessments of fauna were done by extensive field survey of the area. During survey, the presence of wildlife has been confirmed by direct field survey and by the oral information by local inhabitants and data procured from the concerned forest department has been made and given in below (**Table-1.11**).

Table-1.11: Faunal Diversity from Study Area (Buffer Zone)

Sl. No.	Common Name	Scientific Name	Schedule of WPA, 1972	Conservation Status as per IUCN
		Mammals		
1	Spotted Deer	*Axis axis*	III	LC #
2	Bandicoot Rat	*Bandicota bengalensis*	V	LC #
3	Nilgai	*Boselaphus tragocamelus*	III	LC #
4	Jackal	*Canis aureus*	II	LC #
5	Indian Wolf	*Canis lupus callipes*	I	LC #
6	Sambhar	*Cervus unicolor*	III	LC #
7	Dhole	*Cuon alpinus*	II	EN #
8	Short Nosed Fruit Bat	*Cynopterus sphinx*	V	LC #
9	Indian Elephant	*Elephas maximus*	I	EN #
11	Wild Cat	*Felis chaus*	II	LC #
12	Five striped Palm squirrel	*Funambulus pennanti*	IV	LC #
13	Chinkara	*Gazella bennettii*	I	LC #
14	Mongoose	*Herpestres edwardsii*	IV	LC #
15	Striped Hyena	*Hyaena hyaena*	III	NT #
16	Indian Porcupine	*Hystrix indica*	IV	LC #
17	Hare	*Lepas nigricollis*	IV	LC #
18	Otter / Odha	*Luthra luthra*	II	NT#
19	Rhesus Macaque	*Macaca mulatta*	II	LC #
20	Indian Pangolin	*Manis crassicaudata*	I	EN #
21	Honey Badger	*Mellivora capensis*	I	LC #
22	Sloth Bear	*Melursus ursinus*	I	Vu #
23	Barking Deer	*Muntiacus muntjak*	III	LC #
24	Indian Field Mouse	*Mus booduga*	V	LC #
25	Leopard	*Panthera pardus*	I	Vu #
27	Hedgehog	*Paraechinus micropus*	IV	LC #
28	Indian Pipistrelle	*Pipistrellus mimus*	IV	LC #
29	Flying Fox	*Pteropus giganteus*	V	LC #
30	Common house Rat	*Rattus rattus*	V	LC #
31	Hanuman Langur	*Semnopithecus entellus*	II	LC #
32	Musk Shrew	*Suncus murinus*	-	LC #
33	Wild Pig	*Sus scrofa*	III	LC #
34	Four-horned antelope	*Tetracerus quadricornis*	I	Vu #
35	Mouse Deer	*Tragulus meminna*	I	LC #
36	Indian Civet	*Viverricula indica*	II	LC#
37	Indian Fox	*Vulpes bengalensis*	II	LC #
		Birds		
1	Shikra	*Accipter badius*	IV	LC #

2	Jungle Mynah	*Acridotheres fuscus*	IV	LC #
3	Common Mynah	*Acridotheres tristis*	IV	LC #
4	Common Iora	*Aegithina tiphia*	IV	LC #
5	Common Kingfisher	*Alcedo atthis*	IV	LC #
6	Quaker Babbler	*Alcippe poioicephala*	IV	LC #
7	Rufous-tailed Finch-lark	*Ammomanes phoenicurus*	IV	LC #
8	Common Teal	*Anas crecca*	IV	LC #
9	Open Billed Stork	*Anastomus oscitans*	IV	LC #
10	Pied Hornbill	*Anthracoceres coronatus*	I	NT #
11	House swift	*Apus affinis*	IV	LC #
12	Tawny Eagle	*Aquila rapax*	I	VU #
13	Grey Heron	*Ardea cineara*	IV	LC #
14	Pond Heron	*Ardeola grayii*	IV	LC #
15	Ashy Swallow Shrike	*Artamus fuscus*	-	LC #
16	Eagle Owl	*Bubo bubo*	IV	LC #
17	Cattle Egret	*Bubulcus ibis*	IV	LC #
18	Common Indian Nightjar	*Caprimulgus asiaticus*	IV	LC #
19	Crow Pheasant	*Centropus sinensis*	IV	LC #
20	Crow Pheasant	*Centropus sinensis*	IV	LC #
21	Whiskered Tern	*Chlidonias hybrida*	-	LC #
22	Golden-fronted Leaf-bird	*Chloropsis aurifrons*	IV	LC #
23	Gold-mantled Leafbird	*Chloropsis chochinchinensis*	IV	LC #
24	White Necked Stork	*Ciconia episcopus*	IV	VU #
25	White stork	*Ciconia episcopus*	I	LC #
26	Pied Crested Cuckoo	*Clamator jacobiuns*	IV	LC #
27	Blue Rock Pegion	*Columba livia*	IV	LC #
28	White Rumped Shama	*Copsychus malabaricus*	IV	LC #
29	Magpie Robin	*Copsychus saularis*	IV	LC #
30	Magpie Robin	*Copsychus saularis*	IV	LC #
31	Indian Roller	*Coracias benghalensis*	IV	LC #
32	Large Cuckoo-shrike	*Coracina novaehollandiae*	-	LC #
33	Jungle Crow	*Corvus marorhynchos*	IV	LC #
34	Common Crow	*Corvus splendens*	V	LC #
35	Common Quail	*Coturnix coturnix*	IV	LC #
36	Brain-fever bird	*Cuculus varius*	IV	LC #
37	Indian Tree Pie	*Dendrocitta vagabunda*	IV	LC #
38	Lesser Whistling Teal	*Dendrocygna javanica*	IV	LC #
39	Tickell's Flower Pecker	*Dicaeum erythrarthynchos*	IV	LC #
40	Fire-breasted Flower Pecker	*Dicaeum ignipectus*	IV	LC #
41	Drongo	*Dicrurus adsimilis*	IV	LC #
42	White-bellied Drongo	*Dicrurus caerulescens*	IV	LC #

43	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	IV	LC #
44	Lesser Golden Backed Woodpecker	*Dinopium benghalense*	IV	LC #
45	Little Egret	*Egretta garzetta*	IV	LC #
46	Black Winged Kite	*Elanus caeruleus*	IV	LC #
47	Ashy-crowned Finch-lark	*Eremopterix grisea*	IV	LC #
48	Red Munia	*Estrilda amandava*	IV	LC #
49	Koel	*Eudynamis scolopacea*	IV	LC #
50	Lesser Kestrel	*Falco naumanni*	IV	LC #
51	Common Kestrel	*Falco tinnunculus*	IV	LC #
52	Black Partridge	*Francolinus francolinus*	IV	LC #
53	Painted Partridge	*Francolinus pictus*	IV	LC #
54	Grey Partridge	*Francolinus pondicerianus*	IV	LC #
55	Fantail Snipe	*Gallinago gallinago*	IV	LC #
56	Moorhen	*Gallinula chloropus*	IV	LC #
57	Red Spurfowl	*Galloperdix spadicea*	IV	LC #
58	Red Jungle Fowl	*Gallus gallus*	IV	LC #
59	Jungle Owlet	*Glaucidium radiatum*	IV	LC #
60	White Rumped Vulture	*Gyps bengalensis*	I	CR #
61	White Breasted Kingfisher	*Halcyon smyrnensis*	IV	LC #
62	Heartspotted Woodpecker	*Hemicircus canente*	IV	LC #
63	Black-winged Stilt	*Himantopus himantopus*	IV	LC #
64	Indian Cliff Swallow	*Hirundo fluvicola*	-	LC #
65	Wire-tailed Swallow	*Hirundo smithii*	-	LC #
66	Pheasant Tailed Jacana	*Hydrophasianus chirurgus*	IV	LC #
67	Rufous Backed Shrike	*Lanius schach*	-	LC #
68	Black-headed Munia	*Lonchura malacca*	IV	LC #
69	Coppersmith Barbet	*Megalaima haemacephala*	IV	LC #
70	Crested Bunting	*Melophus lathami*	IV	LC #
71	Small Green Bee-eater	*Merops orientalis*	IV	LC #
72	Blue tailed Bee-eater	*Merops philippinus*	IV	LC #
73	Blue cheeked Bee-eater	*Merops superciliosus*	IV	LC #
74	Bronze Winged Jacana	*Metopidius indicus*	IV	LC #
75	Pariah Kite	*Milvus migrans*	IV	LC #
76	Blacknaped Flycatcher	*Monarcha azurea*	IV	LC #
77	Blue headed Rock Thrush	*Monticola cinclorhynchus*	IV	LC #
78	Pied Wagtail	*Motacilla alba*	-	LC #
79	Grey Wagtail	*Motacilla cinerea*	-	LC #

80	Yellow Wagtail	*Motacilla flava*	-	LC #
81	Large Pied Wagtail	*Motacilla maderaspatensis*	-	LC #
82	Tickell's Blue Flycatcher	*Muscicapa tickelliae*	IV	LC #
83	Purple Sunbird	*Nectarinia asiatica*	IV	LC #
84	Golden Oriole	*Oriolus oriolus*	IV	LC #
85	Black Headed Oriole	*Oriolus xanthornus*	IV	LC #
86	Tailor Bird	*Orthotomus sutorius*	IV	LC #
87	Grey Tit	*Parus major*	IV	LC #
88	Yellow-cheeked Tit	*Parus xanthogenys*	IV	LC #
89	House Sparrow	*Passer domesticus*	IV	LC #
90	Pea-fowl	*Pavo cristatus*	I	LC #
91	Jungle Bush Quail	*Perdicula asiatica*	IV	LC #
92	Small Minivet	*Pericrocotus cinnamomeus*	IV	LC #
93	Scarlet Minivet	*Pericrocotus flammmeus*	IV	LC #
94	Small Indian Cormorant	*Phalacrocorax niger*	IV	LC #
95	Black Redstart	*Phoenicurus ochruros*	IV	LC #
96	Yellow-fronted Pied Woodpecker	*Picoides mahrattensis*	IV	LC #
97	Indian Pitta	*Pitta brachyura*	IV	LC #
98	Weaver Bird	*Ploceus philippinus*	IV	LC #
99	Eastern Golden Plover	*Pluvialia dominica*	IV	LC #
100	Slaty-headed Scimitar Babbler	*Pomatorhinus horsfieldi schisticeps*	IV	LC #
101	Purple Moorhen	*Porphyrio porphyrio*	IV	LC #
102	Ashy Wren-warbler	*Prinia socialis*	IV	LC #
103	Blossom headed Parakeet	*Psittacula cyanocephala*	IV	LC #
104	Large Indian Parakeet	*Psittacula eupatria*	IV	NT #
105	Rose Ringed Parakeet	*Psittacula krameri*	IV	LC #
106	Red Vent Bulbul	*Pycnonotus cafer*	IV	LC #
107	Red Whiskered Bulbul	*Pycnonotus jocosus*	IV	LC #
108	White-throated Fantail Flycatcher	*Rhipidura albicolis*	IV	LC #
109	White-browed Fantail Flycatcher	*Rhipidura aureola*	IV	LC #
110	Painted Snipe	*Rostratula benghalensis*	IV	LC #
111	Pied Bush-chat	*Saxicola caprata*	IV	LC #
112	Collared Bush-chat	*Saxicola torquata*	IV	LC #
113	Indian Robin	*Saxicoloides fulicata*	IV	LC #
114	Chestnut-bellied Nuthatch	*Sitta castanea*	-	LC #
115	Velvet-fronted Nuthatch	*Sitta frontalis*	-	LC #
116	Crested Serpent Eagle	*Spilornis cheela*	-	LC #

117	Crested Hawk Eagle	*Nisaetus cirrhatus*	I	LC #
118	Spotted Dove	*Streptopelia chinensis*	IV	LC #
119	Indian Ring Dove	*Streptopelia decaocto*	IV	LC #
120	Red Turtle Dove	*Streptopelia tranquebarica*	IV	LC #
121	Pied Mynah	*Sturnus contra*	IV	LC #
122	Grey-Headed Mynah	*Sturnus malabaricus*	IV	LC #
123	Black-headed Mynah	*Sturnus pagodarum*	IV	LC #
124	Rosy Pastor	*Sturnus roseus*	IV	LC #
125	Paradise Flycatcher	*Terpsiphone paradisi*	IV	LC #
126	Black Headed Ibis	Threskiornis *melanocephalus*	IV	NT#
127	Indian Grey Hornbill	*Tokus birostris*	-	LC #
128	King Vulture	*Sarcogyps calvus*	I	CR #
129	Yellow-footed Green Pigeon	*Treron phoenicoptera*	IV	LC #
130	Redshank	*Tringa totanus*	IV	LC #
131	Jungle Babbler	*Turdoides striatus*	IV	LC #
132	Hoopoe	*Upupa epops*	IV	LC #
133	Red Wattled Lapwing	*Vannelus indicus*	IV	LC #
134	Red Wattled Lapwing	*Vannelus indicus*	IV	LC #
		Reptiles		
1	Garden Lizard	*Calotes versicolor*	-	-
2	Russel's Viper	*Daboia russelii*	IV	LC #
3	Common Skink	*Mabuya carinata*	-	LC #
4	Indian Cobra	*Naja naja*	IV	LC #
5	Yellow Rat Snake	*Ptyas mucosa*	II	-
6	Indian Python	*Python morulus*	I	Vu #
7	Bengal Monitor Lizard	*Varanus bengalensis*	I	LC #
8	Russel's Viper	*Vipera russelii*	II	NA
9	Checkered Keelback	*Xenochrophis piscator*	IV	-
		Fishes		
1.	Chelluah	*Aspidoparia morar*	NA	NA
2.	Barna Baril	*Barilius barna*	NA	NA
3.	Katla	*Catla catla*	NA	NA
4.	Chaguni	*Chagunius chagunio*	NA	NA
5.	Great Snakehead	*Channa maruliuss*	NA	NA
6.	Reba Carp	*Cirrhinus reba*	NA	NA
7.	Singi	*Clarias batrachus*	NA	NA
8.	Common Carp	*Cyprinus carpio*	NA	NA
9.	Calbasu	*Labeo calbasu*	NA	NA
10.	Kali, Boalla	*Labeo dyocheilus*	NA	NA
11.	Rohu	*Labeo rohita*	NA	NA
12.	Cat fish	*Mystus cavasius*	NA	NA
13.	Bronze Feather Back	*Notopterus notopterus*	NA	NA

14.	Swamp Barb	*Puntius chola*	NA	NA
15.	Hilsa	*Tenualosa ilisha*	NA	NA
		Butterflies		
1.	Common Emigrant	*Catopsilia pomona*	NA	NA
2.	Common map	*Cyrestis thyodamas*	NA	NA
3.	Stripped Tiger	*Danaus genutia*	NA	NA
4.	Plain Tiger	*Danaus chrysippus*	NA	NA
5.	Stripped Tiger	*Danaus genutia*	NA	NA
6.	Common crow	*Euploea core*	NA	NA
7.	Common Grass Yellow	*Eurema hecabe*	NA	NA
8.	western blue sapphir	*Heliophorus sp.*	NA	NA
9.	Danaid Egg Fly	*Hypolimanas misippus*	NA	NA
10.	White orange tip	*Ixias marianne*	NA	NA
11.	Blue pancy	*Junonia orithya*	NA	NA
12.	Common evening Brown	*Melanitis leda*	NA	NA
13.	Common Bush Brown	*Mycalesis perseus*	NA	NA
14.	Lime butterfly	*Papilio demoleus*	NA	NA
	# LC – Least Concern; NT – Near Threatened; Vu – Vulnerable; EN – Endangered; CR – Critically Endangered			

(Source: Primary Survey Data) *Note:- NA= Not assessed yet,*

1.17.5. Aquatic Ecology:

The biological species are the best indicators of environmental quality. This includes different species, such as, phytoplankton, zooplankton, benthos, fishes etc. Studies on biological aspects of certain ecosystems are an important part of any environmental impact assessment in view of the need for conservation of environmental quality and safety of aquatic life.

From the baseline survey on existing aquatic environmental conditions in and around the proposed Project on the Hurdul Nala and Jhana Nala within the mine lease area and Mahan Nala, Chhiraha Nala, Sulkhia Nala, Biniao Nala, Sukhra Nala, Nimji Nala, Hariya Nala Ramnpa & Gopad River and other drainages/ponds the following data's were generated:

- Biological characteristics of river water
- Inventorization of phytoplankton and Zooplankton
- Present status of riverine fish fauna: Identification of fish species
- Migratory pattern, feeding and breeding grounds of the fish fauna
- Assessment of local catches during the field trips to assess the fish fauna

1.17.5.1. Assessment of Aquatic diversity:

The samples for qualitative and quantitative analysis of planktons were collected from the sub surface layer at knee depth. Water samples were filtered through plankton net of 20µ mesh size (APHA, 1971). The filtered samples were concentrated by using the centrifuge. By using Lackey's drops method and light microscope (Lackey, 1938), the qualitative analysis was carried out for phytoplankton and zooplankton (**Table 1.12**). The standard flora and other literature were followed for the qualitative evaluation of Plankton.

Table 1.12: Phytoplankton and Zooplanktons Recorded in the Study Area

	Phytoplankton Species	**Zooplankton Species**
1.	Navicula sp. (Diatom)	Daphnia sp.
2.	Cyclotella sp. (Diatom)	Moina sp.
3.	Synedra sp. (Diatom)	Paramecium sp.
4.	Pinnularia sp. (Diatom)	Euglena sp.
5.	Oscillatoria sp.	Ranatra sp.
6.	Nostoc sp.	Larvae of culex sp.
7.	Anabaena sp. (Diatom)	Larvae of Dytiscus sp.
8.	Spirogyra sp.	Cyclops sp.
9.	Pediastrum.sp.	Diaptomus sp.
10.	Microspora sp.	

1.17.5.2. Fish:

Fish occurrences were determined by collecting samples using different fishing gears like cast net, scoop net, hand net, hook-line, pot and open local devices methods. Also visual observations in different habitats were made. Fishes were identified up to the species level with the help of keys of Jayaram (1981), Menon (1987) and Talwar and Jhingran (1997). IUCN red data list (2006) was compared to assess threatened, endangered and vulnerable species in the study area.

List of Fishes in the Study Area:

Fishes are the integral component of stream and rivers which are not only the best sources of food and animal protein for the human population but provides a source of income for the local inhabitants. People capture fishes for their consumption and in some cases to sell

in local markets as an alternative means for procurement of foods and other requirement of daily needs.

Table: 1.13 Common fish species recorded in Buffer Zone

No.	Common name	Scientific name
1.	Catla	*Catla catla*
2.	Rohu	*Labeo rohita*
3.	Maral	*Channa punctata*
4.	Dokh	*Channa gachua*
5.	Mangur	*Clarias batrachus*
6.	Dandvan	*Garra mulllya*
7.	Malya	*Oreochromis mosambicus*
8.	Darai	*Puntius sarana*
9.	Khavli	Puntius sophore
10.	Dara	*Rasbora daniconius*
11.	Chikli	*Indoreonectes evezardi*
12.	Chikani	*Lepidocephalichthys thermalis*

1.17.5.3. Aquatic Floral Diversity:

Wetlands are very useful to us. By producing resources, enabling recreational activities and controlling flood and pollution, they contribute to the national and local economies and environmental consequences. Wetlands provide important and incredible services to society, these services can neither be sold nor do they have the market value and tried to give wetlands an economic value.

Table 1.14: Wetland/Marshland Diversity of Study area

Family	Botanical Name	Local Name
Salviniaceae	*Azolla pinnata*	Mosquito Fern
Commelinaceae	*Commelina benghalensis*	Kana
Cyperaceae	*Cyperus alternifolius*	Umbrella Sedge
Poaceae	*Echinochloa colona*	Shama
Pontederiaceae	*Eichhornia crassipes*	Jal Kumbhi
Lemnaceae	*Lemna minor*	Duck Weed
Onagraceae	*Ludwigia adscendens*	Water Primrose
Marsileaceae	*Marsilea quadrifolia*	Four Leaf Clover
Oxalidaceae	*Oxalis corniculata*	Amrul
Ranunculaceae	*Ranunculus sceleratus*	Aglaon
Typhaceae	*Typha angustifolia*	Patera

***Typhya angustifolia* near Sukhra Nala**

***Eichhornia crassipes* near local pons in Suliyari Village**

1.17.6. Details of Endemic, Threatened and Scheduled Species:

As per list of **The Indian Wildlife (Protection) Act, 1972,** Fauna coming under the **schedule - I** is treated as endangered species. The **schedule - I** fauna as per reconnaissance survey are listed in **Table-1.15**. Although these are very common species and found in every locality, even in villages, certain steps should be taken to conserve the critical wild life:

I. Programs for the conservation of wildlife will be formulated and implemented outside the protected areas by educating the local communities with help of local public agencies, and other stakeholders including the environment division officers of our company, in order to reduce the scope of man-animal conflict.

II. It will be ensured that human activities on the fringe of the protected areas do not degrade the habitat.

Over all, the status of wildlife in a region is an accurate index of the state of ecological resources, and thus, of the natural resources base of human well-being. This indicates the interdependent nature of ecological entities (the web of life), in which wild life is a vital link and a base of eco-tourism. Thus, the importance of conserving and protecting wildlife will be spread among the local people.

Table-1.15 List of Scheduled species from study area

Sr. No.	Scientific name	Common Name	Schedule
Mammals			
1.	*Melursus ursinus*	Sloth bear	Schedule-I
2.	*Elephas maximus indicus*	Elephant	Schedule-I
3.	*Manis crassicaudata*	Pangolin	Schedule-I
4.	*Canis lupus callipes*	Indian Wolf	Schedule-I
5.	*Mellivora capensis*	Honey Badger	Schedule-I
6.	*Panthera pardus*	Leopard	Schedule-I
7.	*Tetracerus quadricornis*	Four-horned antelope	Schedule-I
8.	*Gazella bennettii*	Chinkara	Schedule-I
9.	*Tragulus meminna*	Mouse Deer	Schedule-I
Reptiles			
10.	*Varanus bengalensis*	Bengal Monitor Lizard	Schedule-I
11.	*Python molurus*	Python	Schedule-I
Birds			
12.	*Pavo cristatus*	Indian Peafowl	Schedule-I

13.	*Aquila rapax*	Tawny Eagle	Schedule-I
14.	*Gyps bengalensis*	White Rumped Vulture	Schedule-I
15.	*Nisaetus cirrhatus*	Crested Hawk Eagle	Schedule-I
16.	*Anthracoceres coronatus*	Pied Hornbill	Schedule-I
17.	*Ciconia episcopus*	White stork	Schedule-I
18.	*Sarcogyps calvus*	King Vulture	Schedule-I

So far, according to our study and from the available literature, there is no endemic plant or animal species present in this area. A brief note on facts on these animals is as follows:

1.18 Status of Schedule-I Fauna present in the study area:

1.18.1. Sloth Bear (*Melursus urnsinus*):

The allotted coal block area has both degraded forest, & Reserved forest as well as cultivated area. Bear is a nocturnal animal. Generally it remains within the forest area, but ocassionally it intrudes within the village area. This is mainly due to the Mahua flower, because Mahua trees are most common around the village areas. Therefore approach of the bear near to the village area is more during the months of Mahua flowering: the Months of March and April. Approach of the animal near the village areas in other months is extremely rare. Their density is also very low. A good study on bear has been made in the central India by Bargali *et. al*., (2004).

Habitat: Sloth bears, in the area, occupy a wide range of habitats including forests, scrublands, and grasslands where boulders and scattered shrubs and trees provide shelter. The most common shelter is a den, a cavern like structure generally in rocks.

Home Range: To date, there is no definitive research detailing the exact nature of the home range of the sloth bear. The size of the home range of an individual sloth bear will vary with the concentration of high energy food sources. Thus, the more concentrated the food sources, the smaller the range necessary to maintain an animal.

Habit: The sloth bear is more inclined to attack man unprovoked than almost any other animal. Sloth bears avoid areas where human disturbance is high, however, the bear raid peanut, maize, and fruit crops. Sloth bears like to escape from the heat of the day and forage for food at night. They will start to become active as the sun starts to set. This is also the time when many insects such as termites are more active.

They are generally nocturnal, occasionally approaching near to the village area even during the day time. Locally they prefer isolated shelters below rocks and caverns to spend their

day time hours. Occasionally, near to the village area, after consuming large amount of mahua (*Madhuca latifolia*) flower they remain sleeping below the tree late after sun rise.

Food: Sloth bears subsist primarily on termites, ants, and fruits. This is the only species of bear adapted specifically for myrmecophagy (ant and termite-eating). The ratio of insects to fruits in the diet varies seasonally and geographically. Most bears are opportunistic omnivores. As such, their activities are governed by the availability of food items and dietary components within their habitat. When trees are in fruit, usually during the monsoon season, sloth bears dine on mango, fig, ebony, and other fruits, and also on some flowers. However, ground dwelling ants and termites, dug out of their cement-hard nest mounds, are a year-round staple. They have special liking for the honey for which the animal can climb trees and knock down honeycombs, later collecting the sweet bounty on the forest floor. Beetles, grubs, ants, and other insects round out their diet. During food shortages, sloth bears will eat carrion. In March and April, they will eat the fallen petals of mahua trees and are partial to mangoes, sugar cane, and the pods of the Amaltas and the fruit of the jacktree. Sloth bears are extremely fond of honey. Sloth bears will also climb and shake fruit trees to obtain food. They will also eat leafy plants, sugar- rich fruits, nuts, root, tubers, berries, vegetables, honey, eggs and small vertebrates like rodents, will also eat virtually any carrion which they may discover. Seasonal availability and geographic location are the biggest factors determining the primary food sources of sloth bears.

Food items of bear are documented with the help of scat analysis and direct observation. However, percent occurrence of a particular food in scats may differ from actual consumption. It is possible that most easily digestible food may be observed less in the scat while less digested food may be more.

A study on the scat of bear, in the central India has revealed following to be present in the scat and hence forming the food item of the bear. Months of their local availability has been added with each of the food item.

i. Black ant and their egg: Available all round the year but more during winter and summer season.
ii. Red ant and their eggs: Available all round the year but more during winter and summer season.
iii. Termite and their egg: Available all round the year.

iv. Honey Bees: Available all round the year but more during late winter and summer season
v. *Ficus benghalensis* (Bargad), *Ficus religiosa* (Pipal): Summer season
vi. *Ficus virens*: Winter, Summer
vii. *Ficus racemosa*: Winter summer
viii. *Ficus glomerata* (Gular): Summer
ix. *Ziziphus mauritiana* (Ber), *Ziziphus oenoplia* (beri) and *Ziziphus nummularia* (Jharberi): Winter
x. *Aegle marmelos* (Bel): summer
xi. *Briedelia squamosa* (Kasihi): Late winter to early summer
xii. *Diospyros melanoxylon* (tendu): Summer
xiii. *Buchanania lanzan* (Achar): Summer
xiv. *Schleichera oleosa* (Kusum): Summer
xv. *Syzygium cumini* (Jamun): Summer
xvi. *Cassia fistula*(Amaltas) fruit: Rainy
xvii. *Madhuca indica* (Mahua) (flower): March-April, *Madhuca indica* (fruit): June-July
xviii. *Arachis hypogeal* (Groundnut): Late rainy season
xix. *Zea mays* (Corn): rainy
xx. Amarood (*Psidium guajava*): Winter
xxi. Aam (*Mangifera indica*): Summer
xxii. Kathal (*Artocarpus heterophyllus*): Summer
xxiii. Bones, hair and animal tissue

Many of the non-timber forest produce, forming the food of the bear are collected like flowers and fruits of mahuwa (*Madhuca indica*) and fruits of bel (*Aegle marmelos*), char (*Buchanania lanzan*), jamun (*Syzygium cumini*), and tendu (*Diospyros melanoxylon*). Such collection may limit their availability for bears. *Ficus* spp are not used by local people, so are readily available to the bears. Thus Ficus spp play important roles by providing supply of food for most of the part of the year. This is particularly important during summer when there are no crops in fields to raid and fewer fruiting species, and bears find it difficult to dig for termite and ants.

Threats: Major threats to this species are habitat loss, poaching and conflict killings. Habitat loss is mainly due to overharvest of forest products, monoculture plantations (e.g., teak, eucalyptus), expansion of agricultural areas, human settlements, and roads. Poaching is mainly for the commercial trade in bear parts. Encounters resulting in conflicts between people and sloth bears occur mainly where the habitat has become severely degraded but still being used by both. The only natural threats to sloth bears are tigers (*Panthera tigris*) and possibly leopards (*P. pardus*). Dhole packs may also attack sloth bears. Asian elephants are reported not to tolerate sloth bears in their vicinity. The reason for this is unknown. Bear parts are valuable commodities in the trade for Asian medicines. Incentives for killing bears are therefore high. Although, bear is protected to varying degrees by national laws, however, they can be killed to protect life or property.

Conflicts: The sloth bear is more inclined to attack man unprovoked than almost any other animal. Major man-bear conflicts result during the mawha flowering season. Persons going early to collect the flower encounter the animal, frequently, sometimes the bear remain sleeping below the tree after consuming large amount of mahua flower and is one of the mjor causes of man-bear conflicts. Persons going to the forest for the collection of wood or other forest produce encounter the bear, inadvertently resulting in conflicts.

Conservation Status: *CITES APPENDIX*: I: *Indian Wildlife (Protection) Act (1972) (As amended up to 2002)*: Scheduled I; Part I; *Indian Red Data Book (IUCN 1994)*: Not Listed; *IUCN (1998)* (Proposed; Vulnerable (National) and Data Deficient (Global); *IUCN (2002)* (Proposed): Vulnerable (Global) based on Version 2.3 1994 (IUCN, 2003). According to Alfred et al considering the nature and degree of threats and treads reported, it is strongly recommended to include sloth bear in one of the endangered categories of IUCN. They are particularly vulnerable to loss of habitat because of their reliance on lowland areas, which tend to be the places most readily used by people. Poaching and trade in sloth bears or their parts is also common in many parts of their range.

Conservation Measures:

i. Education will help to reduce bear-human conflicts and enhance a conservation ethic among locals.
ii. Habitat improvements (government or community-based reforestation) would be helpful in alleviating conflicts.

iii. Planting of fruit trees more particularly the spp. of Ficus, because Ficus spp are not collected by man but form an important diet to the animal.

iv. Promoting honey bee in the area will not only serve as food to the bear but will help also in warding off the elephant.

v. Red ant (*Oecophylla smaragdina*) can be promoted easily to form colonies in the trees. This will serve as important source of insect diet and may compensate for the termite.

vi. Artificial method to promote termite colonies should be developed.

vii. Den like structures should be developed in the area if such structures are lacking or less in number in the area.

viii. It is unfortunate that the conservation of Elephant and Bear go contradictory to each other.

ix. Villagers should avoid growing crops of liking to bear like ground nut and corn etc. particularly near their den sites.

x. Translocation of bears from isolated habitat patches to more suitable areas should be carried out.

1.18.2. Elephant (*Elephas Maximus indicus*):

Elephants have not been reported from the mining lease area as well as from the impact area. However, there are reports of the movement of elephants, far beyond the lease area in the district of Korba and Sarguja of Chhattisgarh State. The According to the ministry of Environment, Forest & Climate Change, there are 2,865 elephants in Odisha, Jharkhand and Chattisgarh, of which Odisha has close to 70% (1,930 elephants) followed by Jharkhand (688 elephants), Chattisgarh (247 elephants) as of 2012. Jharkhand state is more famous for the residence as well as movement of elephants, but the boundary of the state is much farther away from the lease area. The movement of elephants also reported in the eastern part of the Renukoot Dam. But the dam is a huge barrier for the elephants to reach anywhere near to the presently Dhirauli coal mine lease area. The movement of elephants and other mega wildlife in Singrauli Forest Division is shown in **Figure-1.5 i.e.** a map showing "*Diverted wildlife corridor due to coal mines*" obtained from forest department, Singrauli Forest Division.

Habitat: Elephants are generalists, but use mainly scrub forest. They can be found in the jungle, but generally on the edge where open, grassy areas are accessible. They prefer areas that combine grass, low woody plants, and forest. Elephants rarely forage in one area for more than a few days in a row. In general, food, water and shade are the three basic resources that can be expected to influence the movement of the elephant (Sukumar ***et al***, 2003). Their Home range ranges from 30-600 km^2.

Food: Elephants eat a wide variety of species of vegetation. They are herbivore, folivore and lignivore. More than 100-130 different species of plants may be eaten They prefer grasses, but they also consume bark, roots, leaves, wood, stems and leaves of trees, vines, shrubs, tubers, bamboo and barn, An average day's intake is 150-200kg of wet vegetation. The proportions of the different plant types in their diet vary depending upon the habitat and season. Annual diet has been found to be dominated by grass. Maximum straying distance covered by the raiding elephant has been recorded up to 5.5km.

Time activity budget of elephants: Generally they are active almost throughout the day during rainy and winter months, but during summer months they are active only in the morning and evening hours. They become active well before dawn and start their morning activities in the vicinity of the area where they spent night. Evening hour is the time for drinking and bathing especially during summers. In summer season percentage of movement is more due to lack of fodder species and shrinkage of natural water sources.

Food Plants: Following is a list of plants reported as food by different workers. However, only the names of plants, local to the area, have been taken and the local names have been changed. Part of the plant eaten may be different for the different species.

Threats: The pre-eminent threats to the Asian elephant today are habitat loss, degradation, agriculture and farming, grazing, mining, human interference, trade, pollution, hunting for ivory, insurgency, corridor loss, anthropogenic pressures on the habitat, man-elephant conflict, forest fires, illegal captures of live animals etc. Poisoning and disease are some other threats to the animal.

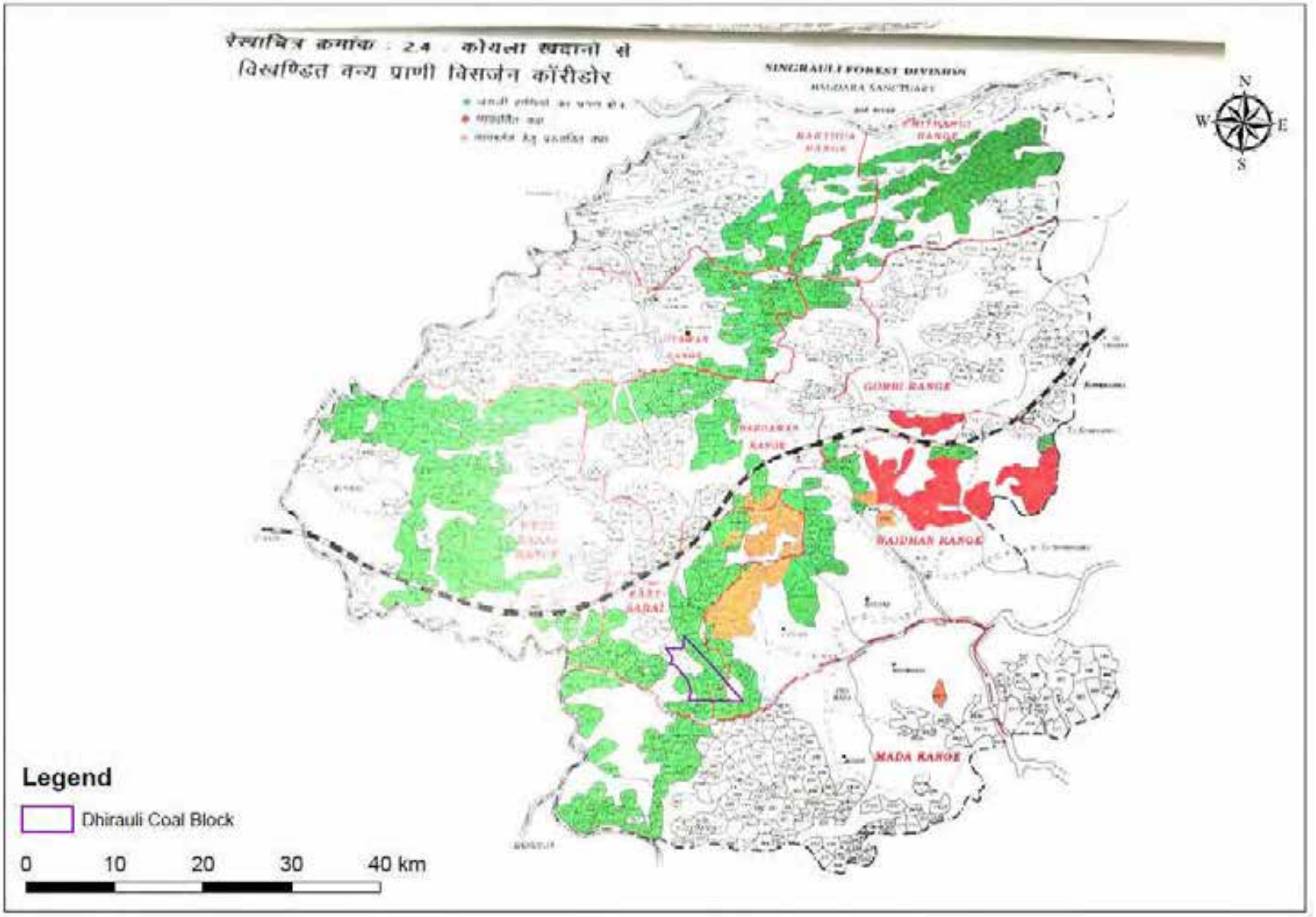


Figure-1.5: Diverted wildlife corridor due to coal mines

Table-1.16: List of Food Plants for Elephant

Sr. No.	Botanical Name	*Local Name*
1	*Acacia catechu*	Khair
2	*Acacia nilotica*	Babool
3	*Aegle marmelos*	Bel
4	*Albizzia lebbek*	Kala siris
5	*Bambusa arundinacea*	Bans
6	*Albizzia procera*	Safed siris
7	*Bauhinia variegata*	Kachnar
8	*Bauhinia vahlii*	Mahul
9	*Bauhinia malabarica*	Khatua
10	*Bombax* ceiba	Semal
11	*Brachiaria sp.*	Ghas
12	*Bridelia retusa*	Kasai
13	*Careya arborea*	Kumhi
14	*Cordia myxa*	Lassora
15	*Cymbopogon flexuosus*	Ghas
16	*Cynodon dactylon*	Doob Grass
17	*Dalbergia sissoo*	Shisham
18	*Dendrocalamus strictus*	Bans / Bamboo
19	*Desmostachya bipinnata*	Urai/Khus
20	*Eleusine sp.*	Ghas
21	*Emblica officinalis*	Amla
22	*Eucalyptus* spp	Nilgiri
23	*Eulaliopsis binata*	Bagai Ghas
24	*Feronia elephantum*	Kaith
25	*Ficus bengalensis*	Bargad/Bar
26	*Ficus glomerata*	Dumar/Gular
27	*Ficus religiosa*	Pipal
28	*Ficus rumphii*	Duranga-hesa
29	*Ficus infectoria*	Pakar
30	*Flacourtia indica*	Kandai
31	*Garuga pinnata*	Kekad
32	*Grewia elastica*	Dhaman
33	*Helicteres isora*	Ainthi
34	*Holarrhena antidysenterica*	Korea
35	*Ipomoea* spp.	Karmata
36	*Imperata arundinacea*	Ulu
37	*Kydia calycina*	Baranga/Pula
38	*Lagerstroemia parviflora*	Senha/Sidha
39	*Limonia acidissima*	Kaith
40	*Mallotus philippinensis*	Sinduri/Rohini
41	*Mimosa pudica*	Lajwanti
42	*Mitragyna parvifolia*	Mudhi

Sr. No.	Botanical Name	*Local Name*
43	*Musa paradisiaca*	Banana
44	*Neyraudia arundinacea*	Bichhloo
45	*Oryza sativa*	Dhan
46	*Ougeinia oojeinensis*	Tinsa
47	*Phoenix humilis*	Buta Chhind
48	*Pithecellobium dulce*	Jangal Jalebi
49	*Randia dumetorium*	Mainphal
50	*Saccharum munja*	Kandi-khar
51	*Saccharum officinarum*	Ganna
52	*Saccharum spontaneum*	Kans
53	*Sansevieria sp.*	Sisal
54	*Schleichera oleosa*	Kosam/Kusum
55	*Shorea robusta*	Sarai/Sal
56	*Syzygium cumini*	Jamun
57	*Tamarindus indica*	Amli / Imli
58	*Terminalia tomentosa*	Saja
59	*Tectona grandis*	Sagaun / Teak
60	*Tinospora cordifolia*	Giloe / Gurch
61	*Thysanolaena agrostis*	Hathi ghas / Pirlu
62	*Zizyphus mauritiana*	Bhander
63	*Zizyphus xylopyra*	Ghont

Elephant Corridor: There is no notified elephant corridor within the 15 km radius of project site. However, as reported by the Forest Divisions, elephants move from one important forest block to another within their habitat. Revenue forestlands, Demarcated Protected Forests (DPF), and village forest areas interlink these isolated forest blocks. They form the movement track for the elephants between the Reserve Forest blocks.

The central Indian elephant habitats are one of the most fragmented and degraded because of encroachment, shifting cultivation and mining activities.

1.18.3. Indian Pangolin (*Manis crassicaudata*):

Manis Crassicaudata are insectivorous mammals understood to occur in various types of tropical forests as well as open land, grasslands and degraded habitats, including in close proximity to villages. It is a medium-sized mammal, with a streamline elongated body and tail covered with large overlapping scales rather than fur. Indian Pangolin is widely distributed in India, except the arid region, high Himalayas and the North-East. It can be found at elevation up to 2500m. The species also occurs in Bangladesh, Pakistan, Nepal and Sri Lanka.

Habitat: *Manis crassicaudata* occupy a variety of habitats. They have been found in tropical rainforests, subtropical thorn forests, plains and the lower slopes of mountains. The Indian pangolin is solitary, mostly nocturnal, and terrestrial.

Ecology and Behavior: These pangolins dig their own burrows in the ground, at depths of 1.5-6 m; these are frequently under large rocks and the entrance is often hidden with soil. When in danger, they roll up into balls, with their large tails pressed tightly against face and belly to help protect them. Longevity of this animal in captivity can exceed 19 years.

These pangolins are not often observed in the wild due to their solitary, secretive, and nocturnal nature. A loud emission of a hissing sound has been reported when they are frightened or angry.

Food: The Indian pangolin is almost entirely insectivorous and more specifically a myrmecophage (ant/termite specialist). Its diet includes beetles, cockroaches, termites, and possibly worms, but mainly ants and termites. It feeds on the eggs, larvae, and adults of its prey, but eggs are the preferred choice. The Indian pangolin is nocturnal and uses its well-developed sense of smell to locate ant nests or termite mounds and other food sources. Pangolins tear apart and dig into mounds by using the three centre claws on their forefeet, throwing loose soil backwards with their hind feet. When feeding, the rostral part of the pangolin's tongue is quickly inserted and withdrawn to capture prey. This movement is also used for drinking.

Conservation Status: The species is therefore listed as endangered in the IUCN Red List of Threatened Species; under the Schedule I of the Wildlife (Protection) Act 1972 of India and included in Appendix II of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

1.18.4. Leopard (*Panthera pardus*):

Habitat: Indian leopard has high capability to adopt any type of habitat where it can get sufficient food and covers. Leopards avoid overlapping their territory or the home range with the tigers. Therefore they try to occupy the fringe areas of the forests, as well as dare more to enter the human inhabited areas.

Behavior: leopards are highly territorial. Leopards are not only the widest ranging of all Big Cats but are actually one of the most adaptable and are found in a variety of different habitats. The Leopard can be found inhabiting numerous different areas providing that

there is a good source of cover and an ample supply of food including tropical rainforests, tree-lined savannah, barren deserts and mountain highlands.

Food Habits: The diet of these big cats is surprisingly varied which includes: wildebeest, impalas, reed-bucks, Thomson's gazelles, jackals, monkeys, fish and storks. However, at times they seem to show a preference for canines, even attempting to snatch dogs right from the feet of their masters. They can also eat fish and domestic stock such as goats and cows. They will even eat carrion.

Status: The species has been assigned almost all the categories of IUCN Red List Categories including: Near threatened, Threatened, Endangered, Critically endangered to Vulnerable, by different workers and agencies. However these categories have been assigned mostly on regional basis. On global basis the species has been assigned Lower Risk Status. The species has been included in Shedule I in The Wildlife (Protection) Act, 1972 of our country.

Conservation Status: *CITES APPENDIX*: I; *Indian wildlife* (*Protection*) *Act* (*1972*) (*As amended up to 2002*); Sheduled-1; Part-1; *Indian Red Data Book* (*IUCN, 1994*); Vulnerable; (*IUCN 1998*) (Proposed); Vulnerable (National) and Data Deficient (Global).

Man-leopard Conflicts: Major conflicts arise when leopards start preying on livestock. These conflicts have increased in recent years due to population growth among humans. The conflict becomes more severe when some leopards become man-eaters. They can prey on children and even enter homes at night to attack humans.

Threats: The Indian leopard (*Panthera pardus fusca*) is facing the crisis of adaptation. The species could soon qualify for Vulnerable under criterion A4 (30% decline over a period of 30 years = three generations, including both past and future). Despite being the most widespread cat, the Indian leopard faces several types of threat. The animal shares its habitat with other animals, which include tigers, bears, wolves, Asian elephants, hyenas, and wild dogs. These animals may kill leopard cubs if given a chance. Apart from its natural enemies, the leopard's main threat is people. For years, it has been threatened, due to loss of habitat and poaching. A rapidly increasing threat to Leopards is the poisoning of carcasses targeting carnivores as a form of retaliation as well as a means of predator control. An estimated 50% of the population lives outside Protected Areas and so it is vulnerable to habitat destruction.

Conservation: Capture and translocation to protected areas has been practiced more as a means of conservation. However, investigations have shown that the animal is highly territorial. Shifting causes inter and intra specific fighting to establish a territory in the translocated area. They are so much particular about their territory that they may make all the efforts to reach back to their original territory. However, Leopards are somewhat tolerant of habitat conversion, and may persist close to large human populations provided they have suitable cover and prey. The MoEF&CC has issued guidelines:

Guidelines for Dealing with Man-leopard Conflict, Press Note, Ministry of Environment and Forests, Govt. of India, moef.nic.in/downloads/public-informat. Accessed on, 01-08-2011.

The guidelines suggest a three pronged strategy to deal with man-leopard conflict as a means to their conservation:

i. Awareness generation among local communities, media and officials of various departments.
ii. Establish trained teams at two levels; the primary response team and the emergency response team, and
iii. Use of latest technology and scientific know-how to improve efficacy of capture, handling, care and translocation of the animal.

1.18.5. Indian wolf (*Canis lupas callipes*):

The Indian wolf (*Canis lupus pallipes*) is a subspecies of grey wolf that ranges from Israel to the Indian Subcontinent. It is intermediate in size between the Tibetan and Arabian wolf, and lacks the former's luxuriant winter coat. The Indian wolf is similar in structure to the European wolf, but is smaller, more slightly built, and has shorter fur with little to no under fur.

Habitat: Its habits are similar to those of other grey wolf subspecies, though the Indian wolf generally lives in smaller packs rarely exceeding 6-8 individuals, and are relatively less vocal, having rarely been known to howl. It tends to breed from mid-October to late December, and whelp in holes or ravines. It typically preys on antelopes, rodents, and hares.

Ecology and Behavior: The Indian wolf, although somewhat gregarious, is not known to associate in large packs. It is also rather a silent animal, but sometimes, it barks like a

pariah dog. It is rarely, if ever, heard to howl. Indian wolves prey on all mammals or birds they can kill, but especially on sheep, goats, and antelopes. They course and run down hares and foxes, and occasionally attack cattle. They not infrequently kill dogs.

Food: Wolves are carnivores (meat eaters) but they will eat other foods as well. Their diet ranges from big game, such as elk and moose, to earthworms, berries and grasshoppers. To avoid using too much energy catching their food, wolves prey on weaker members of a herd, such as old, young or sick animals. In summer, when the herds migrate, wolves eat mice, birds and even fish. Wolves eat their food very quickly, probably to protect it from being stolen, and to decrease the chance of attack from other predators. They eat the best parts first, and come back later for the remainder, as they can't afford to be wasteful. They will hide food in the snow, or icy soil, which helps to preserve it, and protect it from scavengers. Wolves can eat every 5-6 hours when there is plenty of food available, or they can fast and live on scraps for 2 weeks when there is less food around.

Threats: Despite the highest level of protection accorded to the wolves in India, hunting remains rampant and is a major cause of concern. Killing of adult wolves and pups by local sheepherders is common throughout the range of the wolf. Conflict with humans for livestock depredation, depletion of prey species (like blackbuck, hare) due to livestock, exaggerated public fear regarding their danger, and fragmented habitats that are too small for populations with long-term viability are threatening their survival today.

Conservation Status: The Indian Wolf (*Canis lupus*), is an endangered species in Schedule I of Indian wildlife according to the Wild Life (Protection) Act, 1972. IUCN Red List, Least Concern species (IUCN 3.1). It is also in appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

1.18.6. Honey Badger (*Mellivora capensis*):

The honeys badger (Mellivora capensis), also called ratel, and are an interesting animal as there are many myths surrounding its nature and behaviour. It is well known as a fearless creature that can be quite aggressive when threatened.

Species Identification: Honey badgers stand around 250mm tall at their shoulders and weigh approximately 12kg. Their fur is course, with a strip of gray or brown hair running laterally down their dorsal side running from the base of the skull to the base of the tail.

They have a stocky build, with short legs and long claws. Honey badgers are primarily terrestrial, but possess the ability to climb. They can run quick and for extended periods of time when chasing prey.

Breeding: Reproduction is considered asynchronous with an estimated gestation period of 50-70 days. Most commonly only one cub was produced, rarely two. Cubs stay in the den until three months of age, and then they begin foraging with their mother. Cubs are almost completely hairless until 3-5 weeks. They do not become independent until 12-16 months old. Parental care is provided by the female while the male completes his involvement after copulation.

Habitat: Honey badger habitat is described as open woodlands, desert, high mountains and coastal shrubs. In Assam, India badgers have been observed to inhabit scrub jungle and tall elephant grass. Honey badgers are burrowing mustelids; because of this they need specific habitat to create their burrows. In India, honey badger burrows are found on the banks of streams, rock cavities, and thick brush and in the spaces naturally formed by tree roots.

Diet: Their diet consists of scorpions, Hottentotta rugiscutis, Heterometrus swammerdami, Hottentotta tamulus, and Lychas tricarinatus; small rodents: lesser bandicoot rat (Bandicota bengalensis), Indian bush rat (Golunda ellioti), soft-furred rat (Millardia meltada), little Indian field mouse (Mus booduga), house mouse (Mus musculus), Sahyadris forest rat (Rattus satarae), Nilgiri long-tailed tree mouse (Vandeleuria nilagirica), jungle palm squirrel (Funambulus tristriatus), Malabar spiny dormouse (Platacanthomys lasiurus), Etruscan shrew (Suncus etruscus), and the Asian house shrew (Suncus murinus); and herpetofauna, Brook's gecko (Hemidactylus brookii), bark gecko (Hemidactylus leschenaultia), brahminy skink (Mabuya carinata), Indian rat snake (Ptyas mucosa), and the banded racer (Argyrogena fasciolatus).

Conservation Status: The Indian Wildlife (Protection) Act of 1972 (No. 53 of 1972), gives the honey badger an extremely high level of protection in India as a Schedule 1 organism.

1.18.7. Four Horned Antelope (*Tetracerus quadricornis*):

The four horned antelope (Tetracerus quadricornis) also known as "Chausingha or Chauka" is endemic to the Indian subcontinent. According to IUCN redlist this is

vulnerable species with decreasing population trend. The Four-horned Antelope has a wide distribution, occurring in scattered populations from the Himalayan foothills to peninsular India.

Four horned antelope is non-migratory, probably a sedentary and territorial species occupying restricted home ranges. It is generally a solitary but sometimes can be seen in a small group of three to five animals. It is elusive and difficult to observe in wild. It has peculiar anti-predatory behaviour where it prefers to hide than run, making it obscure. It is herbivorous with a ruminal digestive system.

Habitat: The four-horned antelope inhabits areas with significant cover from grasses or heavy undergrowth, and close to water bodies. It generally keeps away from human-inhabited areas. Though they are habitat generalists, four-horned antelopes mostly occur in open, dry, deciduous forests in hilly terrain.

Conservation Status: The four-horned antelope is threatened by the loss of its natural habitat due to agricultural expansion and mining activities in forest areas. Moreover, the unusual four-horned skull and the horns have been a popular target for trophy hunters. In India, the species is protected under Schedule I the Wildlife Protection Act of 1972 and the Nepalese population is listed in CITES Appendix III. The four-horned antelope is classified as Vulnerable by the International Union for the Conservation of Nature and Natural Resources (IUCN).

1.18.8. Chinkara (*Gazella bennettii*):

Indian gazelle or Chinkara (*Gazella bennettii*), a globally threatened ungulate, once widely distributed antelope in India, now facing threat due to increasing human population, mechanised agriculture, mining activities and hunting by locals.

Habitat: Chinkara live in arid plains and hills, deserts, dry scrub and light forests. They inhabit more than 80 protected areas in India. Indian gazelles can thrive in a variety of habitats. They have been observed in dry deciduous forests, open woodlands, and dry areas such as sand dunes, semi-arid deserts, and arid valleys that have an annual rainfall of 150 to 750 mm. Indian gazelles are facultative drinkers and can withstand relatively long intervals between visits to water points by conserving metabolic water and taking advantage of water found in vegetation.

FOOD HABITS: Indian gazelles are better adapted to browsing than grazing, but they can consume legumes and grasses in large quantities. Their diet typically consists of grasses, various leaves, crops and fruits such as pumpkins and melons. A majority of their metabolic water intake comes from the vegetation they consume. The brush and trees that make up their diet are found in mountain ranges and deciduous forests, while grasses and other herbaceous plants are found in valleys and agricultural fields.

CONSERVATION STATUS: *Gazella bennettii* is considered a species of least concern by the International Union for Conservation of Nature (IUCN). Indian gazelles were considered threatened in the 1950's due to habitat loss and anthropogenic activities such as hunting and poaching. Agricultural practices along with the general increase in human population has led to extirpation in certain areas.

In 1994 the species was considered vulnerable, and in 1996 *Gazella bennettii* was considered a species of lower risk. The species has since recovered and is now considered a species of least concern by the IUCN.

Gazella bennettii was considered a Schedule 1 species under the Wildlife (Protection) Act of India in 1972. Indian law fully protects Indian gazelles, reserving 80% of India as protected land, 5% of Pakistan and 9% of Iran.

1.18.9. Mouse Deer (*Tragulus meminna*):

The Indian spotted chevrotain (*Tragulus meminna*) is a species of even-toed ungulate in the family Tragulidae found in India and possibly Nepal. It has a body length of 23 in (57.5 cm), with a tail length of 1 in (2.5 cm); it weighs around 7 lb (3 kg). It lives in rainforests and is nocturnal.

Habitat: Mouse-deer (tragulids) in general occupy a range of habitats from evergreen forests to plantations. They are an ancient group of frugivorous ungulates, small-bodied and active both day and night. Moschiola meminna are only active at night, and are often found in evergreen, semi-evergreen and deciduous forests, as well as in grassland and commercial plantations.

Food Habits: *T. meminna* are primarily frugivores, consuming easily digestible items which provide relatively high protein and less fibrous materials. Indian chevrotains usually

browse the understory vegetation and eat mainly fallen fruits. Other food items include young leaves, shrubs, shoots, and sometimes animal materials found on the forest floor.

T. meminna are ruminants with a three-chambered simple stomach. The selection of a very digestible diet allows rapid fermentation and swift passage through the gut, which in turn aids in rapid and efficient digestion.

Conservation Status: *Tragulus meminna* populations are listed as 'Least Concern' by IUCN. The main threat for the species is from hunting by local communities, Industrial/Mining Activities and forest fire as they are sensitive to habitat loss, alteration and degradation.

1.18.10. Bengal Monitor Lizard (*Varanus bengalensis*):

Habit: They are often found in agricultural areas. Bengal monitors shelter in burrows that they dig or crevices in rocks and abandoned termite mounds. It is mostly diurnal in habit.

Habitat: It is found in a wide range of habitats, *viz.* forest, river banks, by the side of nullah, and agricultural land. It occupies burrows, dense vegetation, hollows of trees, rock cracks and crevices.

Behavior: Mainly ground dweller, but is a very good climber as well. Bengal Monitors are usually solitary and usually found on the ground although the young are often seen on trees. They shelter and spend nights in burrows or crevices in rocks, make use also of abandoned termite mounds. In the night their body temperature drops below ambient. In the morning they raise their body temperatures by basking before commencing activity and for this reason they are rarely active early in the morning and most active in the afternoons when temperatures are highest.

Food: Their normal prey consists of beetles, grubs, orthopterans, scorpions, crabs, snails, ants and other invertebrates. Vertebrate prey is comparatively rare and includes frogs, fish, other lizards, snakes birds and their eggs and rodents. They sometimes capture roosting bats.

Threat: Monitor lizards are hunted for skin and their body fat. Its eggs are considered a delicacy and the entire animal is also eaten. Unani, the Greco-Arabian system of medicine, recommends the use of various body parts of monitors to cure numerous ailments. The population of the Common Indian Monitor, ***Varanus bengalensis*** has alarmingly dwindled throughout the Indian sub-continent mainly due to excessive exploitation of the adults for

their commercially valuable skins, as food and in traditional medicines. Habitat loss due to large-scale deforestation, urbanization, dams and hydroelecture projects and other biotic factors are also responsible for the population decline of the species.

Conservation Status: Status: Not Listed (IUCN 2000); Endangered (ESA). Schedule I Indian Wildlife (Conservation) Act, 1972.

1.18.11. Indian Python (*Python molursus*):

Habitat: It is a non-poisonous, lethargic and slow moving snake, exhibiting little if any timidity and rarely rousing itself seriously to escape, even when attacked. Diurnal and/or nocturnal habit depends upon the degree of disturbance from man in their environment. The snake hibernates in cold season, in any convenient retreat. There are very few records of attack on human beings are also there in the area.

Food: Feeds on mammals, birds and reptiles, but prefers mammals. Stomach content has shown frogs, toads, monitor lizard, wild duck, peafowl, poultry, rat, hare, porcupine, langur, jackal, mousedeer, and hogdeer, chital, smabar fawn, barking deer, chinkara and leopard. Thus has a very wide range of food items.

Threats: It is killed for flesh and skin. However, in the presently applied lease area it is not eaten. Killing for skin is also not reported in the area. However, it is killed only because it is a snake.

Conservation: The snake, although occurs in the area but is rare. Reports of its conflicts with human being are extremely rare. Public awareness is the most important method for its conservation.

Conservation Status: This species is classified as Lower Risk/Near Threatened (LR/NT) on the IUCN Red List of Threatened Species (v2.3, 1994). This means that it has been evaluated, but does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. However, it is considered Near Threatened (NT), meaning that it does not qualify for Conservation Dependent, but is close to qualifying for Vulnerable. Year assessed: 1996.

1.18.12. Conservation plan for Schedule-I Bird Species:

Birds, occupying higher trophic levels in the ecosystems, respond quickly to the changes in the habitats and therefore serve as one of the best indicators for evaluating the ecological status and functioning of ecosystems of the area. Therefore, we created baseline data on

birds by systematically collected data on occurrence in the core and buffer areas separately. For creating baseline data on birds, we carried out bird surveys in different habitats as differential habitat preferences are seen in birds. Based on our extensive field visits, literature survey, and consultation local people, we found 8 bird species of high conservation significance as they belong to Schedule-I of Indian Wildlife Protection Act 1972 **(Table-1.17)**.

Table-1.17 List of Scheduled Bird species from study area

Birds			
1.	*Pavo cristatus*	Indian Peafowl	Schedule-I
2.	*Aquila rapax*	Tawny Eagle	Schedule-I
3.	*Gyps bengalensis*	White Rumped Vulture	Schedule-I
4.	*Nisaetus cirrhatus*	Crested Hawk Eagle	Schedule-I
5.	*Anthracoceres coronatus*	Pied Hornbill	Schedule-I
6.	*Ciconia episcopus*	White stork	Schedule-I
7.	*Sarcogyps calvus*	King Vulture	Schedule-I

Occurrences of birds in the study area are mainly due to the overall ecological condition which provides them suitable habitats where they obtain their food and safety for their breeding or wintering in the region. Therefore, any changes or degradation of air, soil and water quality would lead to degradation of vegetation and habitats of birds. Increased noise levels and disturbance levels would result in their displacement form the core area and its immediate surroundings. Direct disturbance by presence of people, vehicle, their noise, vibrations, lights etc. can potentially displace most of the birds‟ species from core area.

Therefore, it is recommended that project proponent shall take utmost care in controlling dust, fugitive emissions and put in place all pollution control measures during construction phase which would not result in degradation of air, soil, water qualities that affect the surrounding forest areas and vegetation. It is also recommended that workers shall be strictly instructed so that they don't engage in poaching of birds. It is further recommended that project proponent shall monitor the ecological status of the study area including species of birds and their habitats as part of their periodic comprehensive biodiversity monitoring programme.

1.19 Movement of Mega Wildlife:

Elephant is the flagship species of this area and the only mega herbivore (wildlife) with long ranging movement behaviour, present in the Singrauli Forest Division. Elephants have not been reported from the mining lease area as well as from the impact area. However, there are reports of the movement of elephants, far beyond the lease area in the district of Korba and Sarguja of Chhattisgarh State. Elephants follow streams and move in valleys and unless hard pressed try to avoid hilly terrain to conserve energy. This behaviour exposes them close to human habitation. The movement of elephants also reported in the eastern part of the Renukoot Dam. But the dam is a huge barrier for the elephants to reach anywhere near to the presently Dhirauli coal mine lease area. The movement of elephants in Singrauli Forest Division is shown in **Annexure-III**.

1.20 Man-Animal Conflict:

Man animal conflict refers to negative interaction between wild animals and human beings such as crop raiding, human death and injury caused by wildlife and in retaliation (or otherwise) human beings killing the animals. Wildlife conservation efforts raise conflict issues not only through crop raiding , cattle lifting , property and life damage but also, generally when conservation comes into conflict with development. Both wildlife and people are in conflict and the goal is to enable coexistence and sharing of resources on sustainable scale. This is best achieved by addressing both sides of the equation.

The bear population is quite high in this area and the surrounding forests. A peculiar phenomenon is prevalent in this area. The sloth bear usually remains inside the forest during the winter months but comes out of its cover in search of Mahua flowers which is a delicacy for it. Normally in the winter mornings the environment remains full of fog and the bear has long fur on its eyebrows, which obstruct its vision. On the other hand the villagers are also engaged in Mahua collection during the early hours and are usually also not able to see the approaching Bear early enough due to fog. As a result, the Bear and the Mahua collectors invariably find themselves face to face and then the Bear usually attacks the Mahua collectors on instinct.

Of late, another phenomenon has also troubled the local populace. Elephant herds have been reported to have occasionally crossed the area while moving from the Odisha Forests to the Elephant habitats down south. The local populaces have had their houses brought

down and suffered a lot on account of these elephant movements. The Madhya Pradesh Government has however taken a commendable stand on this account. While the aggrieved villagers have been provided adequate compensation, the Elephant movement has not been discouraged and the wildlife wing of the Madhya Pradesh forest department is actually working on a very elaborate plan in this direction.

1.21 Poaching / Killing of animals:

While forest fires are usually unintentional and are inadvertently due to carelessness, poaching is intentional and a crime of a very serious nature. Poaching is usually organized crime and there are tiers of different level of criminals involved in the racket. At the lowest level are usually the local people. There are certain tribes that are known to have been poachers for generations. They are usually the least benefited in terms of money that a serious poaching can accrue but without them usually poaching is not possible. The reason is simple, it's they who know the jungles well and its they who can walk long distances inside the forest and its they who use ingenious and usually difficult to trace methods like electrocution (by using a connection from overhead H.T. electrical transmission lines), poisoning (sometimes even large poisoning of water sources which shrink during the pinch period and a large number of animals can come to drink water from one water hole and get poisoned) and traps. The traps are sometimes very ingenious and entirely home made using small iron pieces and iron springs. These are usually so smartly hidden that they can be completely overlooked even by the people. The forest staff may have a real tough time in weeding out such traps.

Apart from the local people there is a whole chain that goes upright to the International level. This well-oiled system makes wildlife crimes very lucrative and International data suggest that wildlife related crimes are only third after arms drugs related crimes in terms of money exchanged (WPSI-Wildlife Protection Society of Indian publication).

Nevertheless, poaching can be thwarted and the poachers brought to book but there is no short cut. It requires 24 hr monitoring of forest areas, particularly those that have relatively high biodiversity and where the number of animals is high.

1.22 Working Plan Prescriptions:

The present Working Plan of Singrauli Forest Division, valid from 2009-10 to 2018-19 consists of nine Working Circles as detailed below:-

- Selection cum Improvement Management Working Circle
- Improvement Working Circle
- Protection Management Working Circle
- Soil and Water Conservation Working Circle
- Rehabilitation Working Circle
- Plantation Working Circle
- Plantation Maintenance overlapping Working Circle
- Rehabilitation of degraded Bamboo Forest Working Circle
- Wildlife Working Circle

The demand of the day is to manage the forest by active participation of local people (Joint Forest Management) on sharing basis. In the end for any felling takes place the stake holders will have a 50% share. Only in Protection Management Working Circle this procedure has not been adopted as no felling is permitted. Therefore thrust has been more on eco-development through strategies aimed at uplifting the local economy and also at increasing the general awareness of the local community about the importance of biodiversity and wildlife. When we plan for conservation of Wildlife in a forest area (and its neighbouring Impact Area) that has to be diverted for a non-forest activity like coal mining, the task becomes rather peculiar because the question of usufruct sharing in case of Participatory Forest Management can only be addressed by the forest department and can certainly not go beyond the provisions of the Working Plans in force. What can be done though is a whole-hearted effort towards eco-development through uplifting of the local economy and also through enhancing the awareness level of the local community about the need of biodiversity and wildlife conservation. The Conservation Plan would then focus towards awareness building of local people and also uplifting of local economy through capacity building and monetary support. While previously the whole emphasis used to be on exploitation of forests produce for economic gain, now a day the emphasis is more on protection, improvement and rehabilitation of the forests by treating the forests more as an ecosystem rather than as a timber factory. For our case we would discuss the Bio-diversity and Wildlife Conservation Management Circle in some detail in the paragraphs below.

1.23 Bio-diversity Conservation Management Circle:

The main objectives of this Biodiversity Conservation Management Circle as listed in the two Working Plans are outlined briefly below:

- Conservation and propagation of Biodiversity
- Increase density of Forest Crop
- Soil & water conservation
- Improve habitat for wildlife
- Conservation and propagation of endangered species
- Provide special protection to plants of medicinal value
- Involve fringe villagers for active cooperation in eco-development

To meet these objectives the following treatments are proposed in general:

- Wildlife Habitat Improvement by Enrichment Plantation which will include species suitable for wildlife in general and Elephant in particular.
- Priority would be given to engineering structures (Soil Moisture Conservation measures) for preventing soil erosion.
- Special Fire protection measures including fire lines and use of fire blowers.
- Provisions for salt licks and water holes.
- Creation of Grass lands and meadows especially for herbivores.
- Studies on elephant habitat utilisation by engaging Research Scholars.
- Bio-diversity assessment and monitoring by engaging Scientist and Research assistant.
- To create a Bio-diversity Park for nature lovers and student having Biology as a subject in their reading to identify the species, their phenology and area of distribution.

1.24 Wildlife Conservation:

Objectives of Wildlife Management:

- To improve the habitat of wildlife by reducing biotic interference caused in the form of illicit felling, poaching, grazing, shifting cultivation, encroachment, over exploitation of timber and bamboos and forest fire etc.
- Food, water, cover and space are the most important components of wildlife habitats

- To conserve and preserve the diversity and integrity of flora and fauna within natural ecosystem.
- To carry out extensive as well as intensive research concerning to the improvement and development of wild habitat and wildlife.
- To educate the local inhabitants about the importance of wild fauna in the forest ecosystem.
- To conserve the existing prime wildlife habitats like the areas which are frequently visited by wild animals and birds for shelter, food, water, cover, etc. By providing adequate protection and by taking various developmental measures.
- Food is an essential prerequisite for wildlife habitat. Food availability in a habitat changes with the season. Herbivores depend on plant materials for their sustenance and normally selective feeders as their food preference are related to palatability.

Herbivores prefer the leaves, barks, twigs, flowers, fruits and seeds of their selective species. Wild elephants feed on barks and leaves of especially of Moraceae family. Deer, monkey, langur, hares feed on wild fruits. Among the plant materials, grass constitutes a major portion of the herbivores' foods.

Dead trees (snags) and stag headed trees are to be preserved for avi-fauna (wood picker) and reptiles like snakes and lizards to live and breed. Similarly rookeries are to be preserved for mongoos to live and breed. Earthen mounts inside the forests are to be retained for bear and ratel that mainly depend on white ants.

Wildlife are basically divided into two broad groups i.e. Carnivores and herbivores. Carnivores prey on herbivores. The population growth of herbivores will increase the population of carnivores. Therefore, protection to forest is primefacily required. Besides, anti-depredation squad has to be deployed at vulnerable places in order to depredate elephant intervening to human habitats and herbivores soling near the villages to quench their thirst during summer.

1.24.1. Methodology:

This conservation plan will follow the methods regularly used by foresters (starting from forest guard to DFO, Waidhan Division). The objectives of this plan are necessarily,

prescriptions of approved Working Plan need to be followed by the foresters for management of both forest and wildlife of the ZoI of this coal block area. The prescriptions are applicable to the Core area (mining project) and Buffer area i.e. **10 km from the periphery of mining lease boundary.**

Biogeographically, the state falls in Deccan bio-region comprising representative fauna of central India like Leopard (*Panthera pardus*), Gaur (*Bos gaurus*), Sambhar (*Cervus unicolor*), Chital (*Axix axis*), Nilgai (*Boselaphus tragocamelus*) and Wild Boar (*Sus scrofa*). The wild buffalo (*Bubalus bubalis*) and Hill myna (*Gracula religiosa*) are also present which have been declared as rare and endangered (IUCN Red Data Book).

1.24.2. Data Referred:

The following Data has been referred;

- Project Details including impact of mining.
- Locality factors including Climate, Geology, Hydrology and Ecology.
- Demography
- Forest and Wildlife related Chapters of Working Plan.
- Bio-diversity scenario.
- Survey of India Toposheets, Maps indicating mining area, surface map, forest maps of Singrauli district.
- Information about Plant species of medicinal and economic importance.
- Information about rare and endangered plants and animals.
- Information about Wildlife census and Poaching.
- Information about Compensation paid to victims due to Wildlife- Human interface.
- Present forest management practices and Working Plan prescriptions.
- Present Wildlife management in the area as depicted in the Working Plan (Wildlife overlapping Working Circle).

1.24.3. Data Source:

- Working Plans of Singrauli Forest Division were the primary source of Data for preparation of this Plan.

- Range Officer, Dhirauli, Tehsil-Sarai, furnished data about poaching, compensation to Wildlife Victims apart from data on wildlife census, presence and movement of wild animals and indirect evidence about them in the impact area of this Coal mine.
- On our approach to Chief Conservator of Wildlife regarding census figure of Wildlife in the State, he replied that no such detailed census has been carried out nor recorded.
- Topo Sheets, Mining Plan with maps were provided by the User Agency.
- Forest Maps of Singrauli district particularly coridor area was collected from Divisional Forest Office, Singrauli and studied.
- The local Forest Staff and villagers were also interviewed by displaying a pictorial Book on Wildlife according to Schedule as depicted in the Wildlife Protection Act, 1972 to collect data about wildlife available in the area.

The Project area and Impact area was visited by the author to conceptualize the flora and fauna available in the area from 10.08.2021 to 15.08.2021.

The following informations were collected from Mining Plan:

- Although the life of this mine is considering underground 87 years, life of Opencast mine is 40 years (excluding 2 years of construction period).
- The geological reserve from open cast mining is 260.263 (million tonnes) and 297.748 MT from Underground mining, whereas the extractable reserve is only 186.06 MT from opencast mining and 112.07 MT from Underground mining. A total of around 1963.55 MBCM overburden & Inter-burden waste will be generated from the mines upto the conceptual stage.
- Green belt development, progressive afforestation since inception of the project and concurrent backfilling from 10^{th} year of mining will facilitate at least ground nesting birds and reptile and small herbivores to take shelter in and under the reclaimed land/ green cover.

CHAPTER-2

THE PERCEIVED IMPACTS OF THE PROJECT ON THE ENVIRONMENT

2.0. THE PERCEIVED IMPACTS OF THE PROJECT ON THE ENVIRONMENT

2.1. Impact on the Environment in General:

Any mining project has its impacts on the biotic, physical and socio-economic environment. Some are beneficial to the society some are not. Evaluating these impacts, all projects are implemented. The Dhirauli Coal Block is not left untouched in these aspects. When certain impacts are disasters, it necessitates mitigating such problem with established technology and scientific study. Such negative impacts are discussed here to help in implementing mitigative measures. This mining lease when in operation will certainly displace wild animals and flora and restrict the use of habitat within the lease. All the species from the area of mine will be displaced to the adjoining Protected Forest. Mining have long term adverse impacts on wildlife, including impairment of its habitat or native environment. Many animal species cannot adjust to the changes brought on by the land disturbances due to mining. Important habitats such as primary breeding ground may lead to elimination of species. The unique habitat of old forest growths may be impossible to restore even after proper reclamation of the mined out areas. The exodus of animals from the lease area will force them to move into safer habitats, putting extra pressure there on existing resources and also they may move into human habitation, leading to more conflict with human.

The block area has highly undulating and rugged topography. Western part of Dhirauli block is characterized by almost plain topography, while, north-eastern and south-central part are highly undulating and have rugged topography as evident from the topographical plan. The north-eastern and south central part of the block have forest cover and is occupied by hillocks of elevation up to a maximum of 638 m above MSL. In general elevation of ground varies from 459.23m as observed near borehole MSD-102 to 603.45 m near borehole MDP-19 located in the south-western and south-eastern corner of the block respectively.

The Singrauli Coalfield is located in the drainage area of Son & Rihand Rivers. Dhirauli Coal Mine has dendritic to sub-dendritic drainage pattern. The drainage of the mine is mainly controlled by westerly flowing Hurdul nala which traverses the mine in the north-

eastern part and passes through the mine. Many small seasonal nallas drain into Hardul Nala.

The mine is envisaged to be worked with by combination of opencast and underground mining method. Opencast mining is proposed by Surface miners (SM) -FEL-Truck for coal and drill blast for OB. Underground mining is proposed by Continuous miner (CM).

Considering the geo-mining characteristics of the block and for conservation of resource, it is proposed to extract the coal reserves within the block using combination of open cast mining (upto seam VII) and underground mining (below Seam VII to Seam II) method.

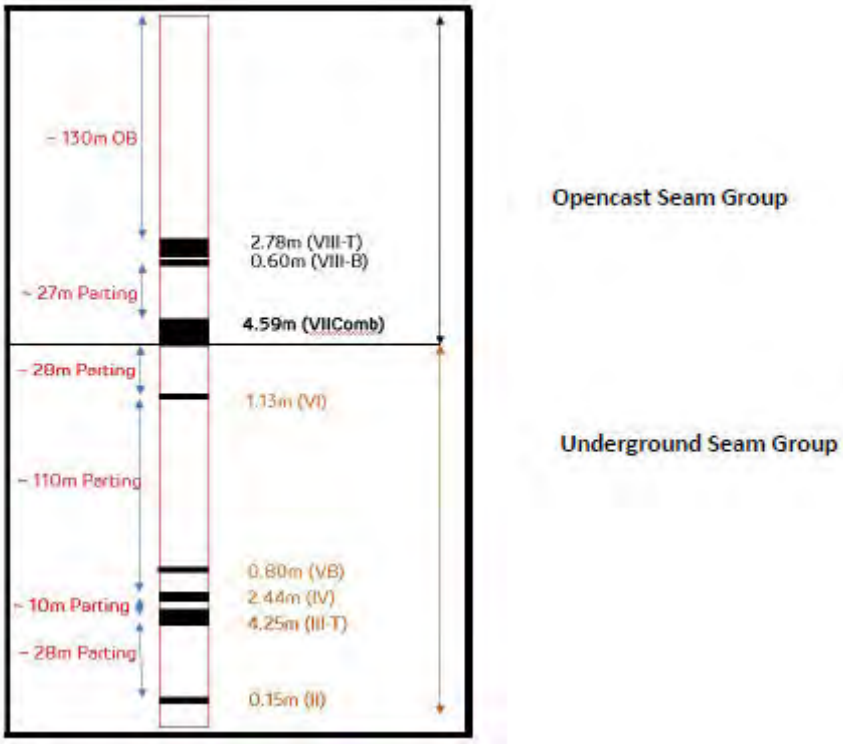


Figure 2.1: Generalized Coal and Parting Thickness

Selective mining is required to control coal quality. It is, therefore, suggested to use surface miner methods of coal extraction for this mine. Surface Miner, 5-6 M³ pay loaders & 35T Rear Dumpers have been proposed for coal extraction. The list of HEMM and other equipment along with their population at peak production stage is provided below in Table:

Table-2.1: Configuration of HEMM

Sl no	Particulars	Capacity	No. of equipment
HEMM			
Overburden:			
1.	Hydraulic shovel	3-4.5 cu.m.	20
2.	Rear Dumper	35 T	98
3.	Dozer	410 HP	2
4.	Ripper Attachment		2
5.	Hydraulic shovel	10-12 cu.m.	7
6.	Rear Dumper	100 T	49
7.	Dozer	410 HP	8
8.	Blast Hole Drill	160 mm	15
Coal (OCP)			
1.	Surface Miner	2200/3800	2
2.	Hyd. Shovel	5-6 m3	2
3.	Front End Loader	5-6 m3	3
4.	Rear Dumper	35	22
5.	Wheel Dozer	410 HP	6
6.	Ripper attachment		2
7.	Blast Hole Drill	160 mm	2
Coal (UG)			
1.	Continuous Miner (CM)		3
2.	Shuttle Cars		6
3.	Twin Roof Bolting Machines		6
4.	Feeder Breaker with suitable power pack		3
5.	Belt Conveyors		
6.	LHD		3
7.	Material Haulage		
8.	Main & Auxiliary Fan		4
Common			
1.	Hyd. Exc.(Backhoe)	1.2-2.5m3	2
2.	Motor Grader	280 HP	2
3.	Vibratory Compactor	30 T	1
4.	Explosive Van	10T	2

Sl no	Particulars	Capacity	No. of equipment
HEMM			
Overburden:			
5.	Wheel Dozer	410HP	1
6.	Mobile R.T. Crane	75T	1
7.	R.T. Crane	30T	1
8.	R.T. Crane	8T	2
9.	Front End Loader	5-6M3	1
10.	Water Sprinkler	28 Kl	4
11.	Wagon Drill	100-120mm	2
12.	Diesel Bowser	10KL	2
13.	Tyre Handler		2
14.	Fire Tender		1
15.	Tipping Trucks	10T 2	2
16.	Maintenance Van		2
17.	Ambulance		1

Before any attempt is made to reduce various stressors and to avoid / minimize or mitigate their adverse impacts, it is necessary to identify various factors that have negative influence on the bio-diversity (flora and fauna). These are specified below considering the terms of reference for the preparation of Site Specific Wildlife Conservation Plan:

2.1.1. Impact on Soil:

Land degradation is the main impact of the mining. As mentioned above, the existing topography of the core zone (Dhirauli Coal Block) shall be altered due to the mining project. The mining has been proposed to be done by horizontal slicing and as per field position commonly it has been noticed that the top soil is very thin. The Overburden generated may impact the productivity of the adjacent land, if not properly reclaimed. The soil is ferruginous sandy soil, typical of the area. The thickness of the top soil varies from nil to maximum of 10.50 cm.

2.1.2. Geomorphic Changes:

This is a long term impact in which the original surface is disturbed, removed and redistributed. Origin of nalas or nala heads is obliterated. Top of the hill is sliced and altitude will be altered. The soil of underground layers is piled up on the surface. These changes are so severe, quick and systematically drastic that it usually leads to destruction

or extinction of species in areas of excavation and soil piling. Large ungulates and those having large home ranges leave the area. Reptiles, burrowing rodents and small mammals like porcupine and hare may be totally destroyed.

2.1.3. Loss of Forest Cover (Habitat):

Out of the total forest area of 1436.19 Ha, except, the safety zone of 8.23 Ha, all forest growth will be cleared within the lease period i.e. 42 years in phases according to approved by Mining Plan by MoC. All such activities will seriously affect the wildlife habitat. Besides, anthropogenic pressure from the migrant work force will also contribute to habitat degradation. All wild animals, arboreal, terrestrial & underground will be affected. Effect on wildlife will be direct or indirect, both short term and long term. The impact on wildlife is due to disturbing, removing and redistributing the land surface. A species may either be destroyed or more commonly displaced in areas of excavation and spoil piling. Geo-morphological changes reduce or eliminate living space. Where a critical habitat like primary breeding area is lost, a species may be dislocated.

2.1.4. Soil Erosion:

Although provision has been made in the proposed land use Plan for storage of top soil over 35.34 Ha, part of it will get washed away unless assiduously protected by biological method. The general slope being south east, during rains, there is danger of soil erosion from the surface of the overburden dumps. Soil disturbance and compaction, movement of heavy earth moving machineries (HEMM) & tippers on haul roads, scouring of banks of garland drains also lead to soil erosion. Unless erosion is firmly arrested, regeneration of reclaimed areas will be slow and ineffective. Productivity of an eroded area will be poor due to loss of soil structure and aggregate break down. Loss of productivity will delay or exclude the possibility of colonization by displaced animals. Sediment load will clog the nala and affect the feeding and breeding of amphibians and fish fauna.

2.1.5. Moisture Loss:

Mine area bereft of forest cover will mean less of percolation and more run off of rain water. This will affect the hydrology of Gopad River. The sediment load will render it unfit for use by animals.

2.1.6. Forest Fire:

The importance to address forest fire is felt on a priority basis owing to its effects on most eco-systems' flora and fauna. Forest Fires can be Characterized in terms of the cause of ignition, their physical properties, the combustible material present and the effect of the weather on fire. They can cause damage to property and human life, except in those areas where it may induce growth and development of grass and meadow for wider benefit for wildlife. Forest fires mostly occur during the dry summer months (February to June) when most of the state's deciduous forest shed their leaves. It is the mandatory task of a Forester to address this vital issue by checking fire occurrence through preventive measures like creating awareness programme, involvement of VSS and EDCS, fire line creation etc. and protective measures like extinguishing forest fire. Recent technological interventions on location of forest, fire occurrences received through satellite data from Forest Survey of India and hence to plan and address mitigation programmes within a time frame. One of the easiest and effective ways of glowing leaf litter and creating fire lines to control further spread of forest fire – is the use of air blowers.

Intensive use of the area by labour force and machines is a potential hazard as a source of fire. Accidental fire in coal stock piles in summer may spread to forest and create large scale damage to ground flora, shrub layer and trees. Ground nesting birds, slow moving reptiles or mammals and young ones will perish in such an eventuality. Accidental fires that sweep over forest degrade the habitat and recovery is a slow process either through root stock or seed fall. Plantation may be damaged outright.

2.1.7. Accidental fall:

By the end of 5th year and 10th year of mining, it may lead to accidental fall of large animals like sloth bear, deer or even elephant inside the pit, which will either be fatal or result in permanent disability/ casualty.

2.1.8. Air pollution and Rise in Ambient local temperature:

Combustion of coal occurs due to exothermic reaction between coal and air in extreme hot and arid scenario. Coal seam fires may also happen occasionally. Burning of coal results in production of CO_2, SO_2, N_2O and many other toxic substances. Coal bed methane (CBM), though not substantial in the ML area, it is generally lost to atmosphere through exposed

seams or from piles or through boreholes or fissures or cracks in the ground surface. Methane is 24 times more potent as green house gas than CO_2. Nitrous oxide ranks at the top of green house gas. As the coal of Hasdeo-Arand coalfields is having dual characters of both low and high rank also the ambient temperature in the locality goes up to 45^{o}C in summer. Therefore, combustion of coal has to be guarded against.

2.1.9. Noise Pollution:

Drilling, blasting, movement of HEMMs, surface miner etc. will create substantial noise. Similar noise will be produced in adjacent coal blocks, which will be felt in this area also. Such noise may result in emigration of animals. Other adverse effects of noise pollution are:

- Hearing loss, resulting from noise levels of 85 db or more
- Marking, which is the inability to hear important environmental cues and animal signals like mating call, alarm call etc essential for survival
- Physiological effects due to stress, i.e. increased heart rate or respiration, weakened immune response etc.
- Behavioral effects depending on noise levels may result in loss in reproductive fitness, neglect in parental care.
- Constant rumble of tippers and excavators, pay loaders may mask the sound of down chorus of birds, particularly males to attract females. Upsetting this vital part of breeding process and this could decline the bird population.
- Drowning noise made by approaching predators and blockade of alarm calls.

2.1.10. Dust Pollution:

Barring rainy days and those during which ground remains wet, dust pollution is considerable in summer. Huge clouds of dust disrupt normal living conditions. It may cause inflammation of lungs and breathing problems leading to overly aggressive responses in animals. Dust is a stressor, as it alters heart rate. Dust contains bacteria, fungi and virus and can cause disease in stressed animals. In plants, dust may bring down photosynthesis due to reduced light penetration. In the long run, due to reduced seeding, regeneration is affected. Dust deposits increases the incidences of plant pests and diseases

by acting as a medium for the growth of fungi and reducing natural predators of insect pests of plants.

2.1.11. Light Pollution:

The coal yard, office, garage space, workshop, staff quarters, coal-washery, all of these will remain lighted from dusk to dawn. Horizontal dispersion of chronically increased illumination is disadvantageous to all wild animals. They are disoriented, their normal movement and behavior patterns namely, light sensitive cycles are altered.

2.1.12. Invasive weeds:

Weeds like *Xanthium strummarium*, (Cocklebur), *Parthenium hysterophorus* (Carrot grass), *Chromolaena odorata* (Poksunga), *Ocimum gratissimum* (Bantulasi) etc may strike a strong hold invading the area. Weeds are invasive in nature because their seeding potential is higher and seeds are produced round the year. Such weeds are able to disseminate their seeds through air currents or through water. They thrive and multiply well, where the vigour of natural vegetation is weakened through clearings; weeds have low water and nutritional requirement and multiply well in altered landscape, where the soil is new. However, weeds are strong light demanders. Weeds like *Lantana camara* (Naga Airi) is propagated by birds of field and scrub level vegetation. Uprooting of weeds is expensive, difficult to accomplish, it robs nutrients and makes establishment of plantation difficult. Weeds serve no purpose as food for animals.

2.1.13. Disturbance due to vehicular traffic:

Coal extraction has been proposed to be carried out by deploying surface miners. Surface miners will cut the coal and leave the cut coal behind it as windrows. Cut coal having -100 mm size will be loaded into 35 t capacity dumpers using pay loaders having 4.5 cu. m bucket capacity and will be transported to the unloading station of the proposed Coal Handling Plant (CHP).

2.1.14. Garbage:

Much garbage is likely to be generated by labor force carrying their eatables, in canteen, staff quarters, office etc. The garbage is not only offending to the environment; it attracts stray dogs, jackals, Hyena, crows and kites. Ingestion of polythene wrappers may spell disaster for mammalian species by blocking their alimentary canal leading to death.

2.2. Impact in the zone of Influence (10 km radius):

2.2.1. Depletion of Forest Growth:

Of the total study area of 2672 Ha, 1436.19 Ha is forest area present in mining lease area. The forests are more or less well conserved. However, influx of migratory population in search of work in coal mine will require small poles for hutments and other bonfire use. Several service providers like grocery shops, eateries, Kiosks etc will come up in the area which will also need construction material. Several mine blocks in series, adjacent to one another, when operate in full swing, it is likely that forest habitat will get depleted and degraded further. Degradation of forest shall result in loss of food and shelter availability for several species of animals. Consequently, a sub-optimal habitat will no longer be able to hold and support wild animals for long, which will force emigration to less disturbed and better habitats.

2.2.2. Fragmentation of Habitat:

This is emergence of discontinuity in animal habitat. Habitat fragmentation occurs due forest degradation and change in land use pattern. Habitats once become divided into separate fragments, the animals will suffer for food, water etc. Due to fragmentation of habitat, smaller forest areas tend to be smaller islands isolated from each other and loose habitat qualities of a unified massive landscape. The process involves 6 discrete phenomena, viz.

I. Reduction in total area of habitat
II. Increase in the amount of edge
III. Decrease in the amount of interior habitat
IV. Isolation of one habitat fragment from other areas of habitats.
V. Breaking up of one patch of habitat into several smaller patches.
VI. Decrease in average size of each patch of habitat.

Habitat fragments are rarely representative samples of the initial landscape. By direct reduction of space for both plants & animals, biodiversity is affected. Species like elephants, which have long home range, move from one habitat fragment to the other. Those that do not have this faculty, e.g. porcupine, hare, python etc are constrained to remain in a smaller fragment. Smaller fragments mean smaller number of species and

lesser population of a species. Smaller populations are vulnerable to extinction with reduced viability due to inbreeding and/or climatic catastrophe or diseases. Habitat fragmentation leads to **'edge effects'**. Micro climates differ significantly between the interior habitat and the edge habitat. Smaller fragments are likely to be more vulnerable by fire damage. Species adapted to interior habitats are less likely to survive in an edge habitat of smaller fragments are less likely to survive in an edge habitat of smaller fragments. Invasive weeds take a faster stronghold in an edge habitat to the gradual exclusion and elimination of native species. In nutshell, habitat fragmentation lowers the viability of the habitat, critical to the survival of several species.

2.2.3. Forest Fire:

Fire is lit in the forest for several purposes viz. for ease of collection of Sal seeds, Mahua flower, Tendu leaves, grazing, and facilitating shikar, to get nutrient wash from forest floor to fields and so on. However, coal mining will introduce yet another threat from accidental coal fires from stacks and its spread to forests far and wide. Large work force is a threat as a causative agent. True, fire leads to short term increases in animal food and temporary increase in breeding potential but subsequently, these increases are upset by animals' inability to thrive in an altered, simplified plant structure, which has a reduced shelter value. Fire severity, frequency size etc change the species composition of plant community and the dependent animal species. Responses of fauna to fire may include injury to larger mammalian species and death of python, ground nesting birds like partridges, jungle fowl and pea fowl etc. Although fire creates snags, they can also destroy snags, down wood and important nurseries of animals under bushes. Fires increase dead wood; there is an eruption of wood borers and consequently insect eating birds. Raptors increase due to increased visibility. Fire alters chemical, physical and biological properties of the soil, annihilates soil microbes, reduce soil fertility and makes reforestation problematic due to lack of nutrients in soil. Fires also alter infiltration rates of rain water by clogging fine pores in soil by splash effect of rain drops. Over all, fire is deleterious to wild animals in the long run.

2.2.4. Soil Erosion:

When ground cover is destroyed and mineral soil is exposed due to mining, soil loss is accelerated during peak flow. Run off increases in steep inclines devoid of vegetation and

carries silt loads with it. Soil erodability is enhanced due to unstable soil and rapid change in geo morphology. As a consequence, natural regeneration is hampered and afforestation becomes problematic due to slow growth. As soil type is reflected in the nature of vegetation and the nature of vegetation is prime determinant of wild animal species, eroded soil means poor animal community.

2.2.5. Loss of Biodiversity:

Biodiversity is variability within life entities such as species, individuals (genes), populations, communities and ecosystems. This allows adaptation of life forms to change and thus the generation of new biodiversity. Protecting the process of evolution is of central interest. Maintenance of biodiversity sustains the adaptive capacity of life, its loss is non adaptive. The latter threatens the very existence of the life support system and shelters inter and intra specific relationships and dependence. The loss of biodiversity means loss of resilience in ecosystem. Direct drivers of biodiversity loss are land cover change, fragmentation, habitat loss, pollution and increase in ambient temperature of a locality. The crux of the problem is once lost, biodiversity and the resultant ecosystem functions cannot be recreated. Decrease in genetic variation in a small and isolated population, not open to migration results in genetic drift and disadvantageous genes get fixed in a population. Decreased variation or heterozygosity leads to increase in inbreeding resulting in inbreeding depression in a population.

2.2.6. Loss of Natural Water Resources:

There are 6 nala and one River is located in the study area of Dhirauli Coal Block. Hurdul nala and Jhana nala is located within the lease area. These nalas have more or less perennial water in summer months, getting dry with isolated water pools in drought years. But with increased mining activities and diversion of nala, increased silt load in water courses, it is feared that periodicity of stream flow will get seasonal and pools of water less. This may pose really serious problem to mega herbivore like elephant. Consequently, elephant habitats of today may not be supportive of any elephant population, although smaller animals may cling on to the habitat.

2.2.7. Animal Depredation:

The habitations and cultivation are all in low lying nala banks on foot hills. Forest boundaries being very zigzag, elephant groups, while moving from one forest to other due to fragmentation, essentially have to pass through intervening cultivation. Even otherwise, during migration, elephants keep to water courses and level grounds for conserving their energy. The intensive mining activities in the region are feared to affect the normal movement pattern and consequently, the quantum of depredation will not only increase but may surface in hitherto unknown areas.

Aggression in elephants in this area is not known but may manifest due to stress syndrome thrust due to loss of habitats and accustomed travel routes. Stress alters the delicate balance of body metabolism, which the animal tries to avoid through either escape or determined approach to obliterate the stressor. Such deliberate movement is conditioned by secretion of hormones. Past favorable and/or unfavorable experience determine the course of action and approach to human beings.

2.2.8. Poaching:

Poaching is not a problem in the locality now. Given the good access of interstate road, rail link close by, interstate border, cases of poaching may surface anytime, when large number of mine laborers and transporters will congregate in the mine area. Interstate poacher gangs may enter the villages in guise of persons connected with mine survey and working. Lure of cash and gifts may motivate simple tribals not only to host the poacher but to cooperate and lead him as well. Poacher will always exploit the depredation scenario and vulnerability of the people to his advantage. Poaching for elephant tusks, bear bile, mongoose hair, and pangolin scales, trapping of live birds and even capture of snakes may occur. Such activities will make a dent on biodiversity status & plant and animal communities.

2.2.9. Displacement Dilemma:

Animals displaced from mine areas or natural home ranges may be forced to use adjacent areas in buffer zone, which may be stocked to its carrying capacity. Overcrowding of displaced animals in remaining habitats of buffer zone results in their degradation and hence lower is the carrying capacity. This gives rise to reduced reproductive success,

increased inter species and intra species competition and theoretically greater losses to animal numbers.

2.2.10. Grazing by Livestock:

Domestic cattle and buffaloes are usually taken to nearby forests for grazing. As mining will reduce the area available to livestock, the incidences of grazing in some patches will increase, as rotational facilities may not exist. This will have an impact on vegetation, the common food resources of wild animals. Competition for food may be intense and health of domestic/wild animals may be negatively affected. Coupled with inbreeding depression in a fragmented scenario, wild animals may be more vulnerable to cattle borne diseases.

2.2.11. Heavy Vehicular Traffic:

Mining activities will mean enhanced vehicular traffic in the buffer zone. The traffic will not only be on the main road alone but on the interior approach roads as well. Shortcut roads may develop to railway siding, coal washery and main road. Network of road and traffic will add to fragmentation, pollution levels and surface as a barrier to movement of animals across roads.

2.2.12. Disturbance due to Noise and Light:

The combined effect of noise of machineries and lights will be stressors enough to affect the physiology, behaviour and movement patterns. Faced with the option of limited habitat use, depredation intensity and frequency may be on the rise. The sky glow is known to alter activity pattern of birds by disturbing their innate behaviour.

2.2.13. Conflict over Resources:

Mining involves appropriation and loss of resources, which people rely on for their livelihood e.g. agricultural land, forests, drinking water resources (streams), grazing grounds, NTFP producing areas and even loss of homes. Unless the lost livelihood is adequately addressed and if the people do not benefit from the mine, a conflict will ensue.

2.2.14. Artifacts within the Landscape:

a) Road Link:

The project site is connected by road network. Waidhan-Sidhi State Highway via Bargawan traverses 20 km north of the block. A metalled road from Parsona to Mara is located further east of the block. An un-metaled road branching out of this at Rajmelan

culminates at Sarai. From this road to the west of River Mahan, a north-south running road leads to Langadda via Bhalyatola, Suliyari & Jhalri. The block is also accessible by an all weather metalled road from Singrauli as well as from Waidhan.

b) Rail Link:

The distance of Sarai-Gram, the nearest major railway station on Chopan-Singrauli-Katni line of central railway is about 18 km from the block. Renukoot, an important industrial township & railway station is located at a distance of 70 km from Waidhan on Chopan-Garhwa section of eastern railway. Renukoot Township is well connected with Hawrah, Tatanagar, Delhi etc. by direct train. Nearest airport Varanasi is located at a distance of 50 km from the Waidhan.

c) Electric Transmission Lines:

Total 5 transmission lines (132kv- one line and 765kv – 4 lines) are passing from the block which is proposed to divert from outside of Dhirauli coal block.

d) Boundary wall and other civil Constructions:

Boundary wall of residential complex and other civil constructions like, houses, culverts and bridges are a deterrent for free movement of animals next to mining pits and O.B. dumps. This is worrisome for free movement and continuance of animal populations in this belt.

CHAPTER-3

OBJECTIVES OF MANAGEMENT AND MITIGATION STRATEGIES

3.0. OBJECTIVES OF MANAGEMENT AND MITIGATION STRATEGIES

3.1. Objective of Management:

The main objective of the plan is to reduce various stress begin due to the working of the mine in this particular locality touching wildlife. The Site Specific Wildlife Conservation Plan will suggest measures to minimise or mitigate such stress, if possible how to avoid certain activities which could reduce the negative influence of the mining activity. Wildlife management consists of promoting welfare factors, arresting or reducing the impacts of decimating factors and neutralizing harmful effects of limiting factors that keep the animal population lower than the carrying capacity of the area. It also aims at management of human dimensions relating to regulation of habitat use, sufferance from animal damages, livelihood issues and taking people as partners in conservation management. Such concerns are reflected in the prescriptions. The management of the ML area will aim for maintenance of habitat for smaller animals that used to live and share habitat with mining activity. At the same time, the virgin area will nurture as a part of the larger habitat for wild animals that may come over. The management of Buffer Zone will target optimization and maintenance of wildlife habitat and biodiversity, involving local people as far as practicable and aim to avoid / minimise or mitigate the adverse impacts of the mining activity. The ML area has full of forest growth. Tall trees stand in virgin area. Besides small animals larger ones like deer and elephants make use of the area regularly, as the area is undisturbed. Large animals will be displaced form the area once the mining commences with full vigour. The displaced animals should not be left as refugee. Their rehabilitation would be the major objective of the plan. To fulfil all these requirements, the plan focused on improving forage and browse volume by increasing food plant diversity with vertical and horizontal cover. These will arrest habitat destruction and fragmentations also prevent soil erosion and loss of bio-diversity. Keeping natural water resource free from negative impact of the mining activity will also be targeted.

Objective of management to mitigate the threats to the wildlife is covering the following aspects.

i. Undertake appropriate attentive measures in mine working so as to avoid/minimise or mitigate the adverse impacts on wildlife in and around the mine.
ii. Maintain/enhance food and cover values in buffer habitats while counterbalancing decimating factors.
iii. Initiate studies on habitat utilization pattern of the Umbrella Species 'elephant' and other wildlife with a view to strengthen and secure the critical habitat.
iv. Control depredation by wild animals to generate public support in conservation management and build up synergy in conjunction with regular protection set up.

3.2. Strategies to Mitigate and Minimize adverse Impacts:

Keeping the above objectives in view, following strategies are suggested to mitigate and minimize the adverse impacts.

3.3. Strategies for mining lease area:

3.3.1. Protection of Virgin Forest:

Total ***10 Nos. of Van Sahayaks*** will be engaged for protection of 1436.19 ha of virgin forests. They will be selected from local villages on the recommendation of Forest Range Officer, and Gram Head. The youth shall have working knowledge to read and write but the prime requirement will be knowledge of the forest area and movement path of animals. They will take orders from the Manager of the mine and report to him on day to day happenings and animals seen. Each one will maintain a log book of area visited and events/activities seen. They will have a bag with pencil, note book, a sharp knife, measuring tape and water bottle. Uniform will be supplied to them. Rigid protection will facilitate colonisation of plants in blank areas through wild air borne seeds and through birds (Birds are litmus of nature). These forest patches will also provide shelter small to animals.

3.3.2. Reclamation of Mine Pits & Plantation:

This is a virgin mine. As the mine is to be top sliced, reclamation of mine pits is not possible instantaneously. However, after 10 years onwards, reclamation followed by biological afforestation can be done. For this, the mining has to be systematic and directional. Indigenous species preferred for elephant food and associate cover values will

be planted. Besides, plantings over safety zone of 19.73 ha of ML area and other suitable vacant area will be planted. The plantation schedule will be as under:

Plantation will be taken up from 2035-36 planting season and hence, preparatory activities will be started from 2034-35. Plantation in reclaimed area is very technical due to loss of topsoil and low nutrient status. This will wait till the ore is totally exhausted. Only Safety Zone plantings will therefore be taken up. Pitting of 45cm cube will be done at 2.5x2.5m spacing after alignment and stacking so as to accommodate 2500 seedlings/sapling per ha. This work has to be taken up a year following reclamation, after consolidation of soil. Pitting is best done during February-March, when the ground is moist enough for easy workability. Soil is allowed to wither for about 4 to 5 months soon after pitting. A basketful of farm yard manure/leaf mould /compost as is convenient is added to each pit. Simultaneously seedlings are grown in nursery in 22x12cm Poly-pots. Planting is done on the onset of monsoon. A basal dose of 50gm Ralli meal, 10gm Neem shield and a pinch of bio-fertiliser are added to the pit before planting. Half-moon trench is done on uphill side to tap rainwater. Plantation is tended for 10 years. One weeding and soil working together will be done respectively during first, second & third years. Plantation will be fire protected. Pruning may be done in 4^{th} or 5^{th} year. Stone/clod mulching will be done to keep the weed growth under check. **The cost of biological reclamation need to be included in the conceptual Mining Plan.** Trees to be used in plantation are as under:

Table-3.1: Selected Species for Plantation

Browse plants		
1	Dhaman	*Grewia tiliafolia*
2	Bana Kapasia	*Kydia calycina*
3	Bija	*Pterocarpus marsupium*
4	Sisoo	*Dalbergia latifolia*
5	Safed siris	*Albizzia procera*
6	Kala Siris	*Albizzia adoratissima*
7	Ber	*Ficus bengalensis*
8	Hill Bamboo	*Dendrocalamus strictus*

Cover plants		
1	Mango	*Mangifera indica*
2	Jamun	*Syzygium cumini*
3	Chhatian	*Alstonia scholaris*
4	Karanj	*Pongamia pinnata*
5	Kusum	*Scheichera oleosa*
6	Tamarind	*Tamarindus indica*
7	Mundi	*Mitragyna parviflora*
8	Kasai	*Bridelia restusa*
9	Neem	*Azadirachta indica*
10	Jari	*Ficus retusa*

3.3.3. Soil Erosion Control:

The opencast mine is planned upto 280 m depth on the floor of seam-VII with overall average stripping ratio of 10.55 m3/te. The total volume of OB has been estimated as 1963.55 Mcum. The OB removed during initial years will be placed beyond the incrop of the seam VII as external dump.

During 1st year, height of external dump will be kept at only 60 m above the ground level. During 3rd year, height of eastern external dump and eastern in-pit dump will be merged by maintaining 90m height above the ground level (RL of 600). At the end of 5th year height of internal dump will be 90m above ground level. At the end of mine life, internal dump will be at 60 above the ground level for some part.

Topsoil is proposed to be removed separately and dumped outside the quarry in a manner so as not to lose its fertility. The top soil would be spread over the reclaimed land, afterward. Topsoil will be removed and dumped on the area shown on surface plan.

Topsoil will be stored for initial four years and during subsequent years it will be directly spread over the reclaimed area.

Topsoil details:

1) Height of Topsoil dump : 3 meters
2) Year of reclamation : after 5th year of mine operation.

Over burden dumps will be stabilized by engineering methods as under:

a. A 1.2m dry stone wall will be made in a trapezoidal section all along the foot hill of the Dump to stabilize the soil.
b. A garland drain will be made on the toe of the O.B. dumps, which will be 0.6m deep lined with boulders and 1m wide.
c. The overburden dump will be made in such a way so as to make terraces of 2m width and 10 m height.
d. Check dams of boulder will be made on nalla beds and gullies to check velocity of water.

3.3.4. Grass Seeding:

The OB dumps, will be further stabilized by seeding of grass pellets all over. Such pellets can be made by mixing powdered clay with organic manure in 6:1 ratio, needed to make dough in which grass seeds are thoroughly mixed. Such dough is then rolled into balls of 1cm. dia and sun dried. Per hectare requirement of seeds will be 3 kg. Pellets will be put at spacing of 1.5x1m and 7000 such pellets will be needed per ha. Species of grass to be used are *Imperata cylindrica*, *Chrysopogon zizanioides* and *Themeda triandra.*

3.3.5. Water Pollution Control:

The system of garland drains will be connected to settling tanks where turbid water is allowed to move slowly. Alum is also added to the water facilitate sedimentation of silt and colloid. The clean water will be allowed to be discharged in the natural streams. Here also series of check dams will be made to facilitate deposition of silt. Grass cover over blanks will also reduce silt load in water.

3.3.6. Dust, Noise and Light Control:

Dust will be controlled by spraying water on haul roads and covering of minerals during transit. Drills will be provided with dust bags to collect dust particles. Noise will be controlled by proper stemming of charge to required depth and keeping machineries in perfect condition. Blasting will be done during afternoon well ahead of movement of elephants, which starts 3pm onwards. Lights will be provided with proper reflector and shaded to prevent sky glow and only allow directional light. Milky light will be used in preference to dazzling light/yellow ones.

3.3.7. Fire Line:

A fire line along with the boundary of the adjoin P.F./R.F. forest area and mine area will be maintained. Workers engaged for fire tracing in the beginning of February in the morning hours, when the wind is not high and ground wet, there after every fortnight till the end of fire season. Every 100 m in the line, brush wood piles will be made in 2m height and 1.5m dia to provide artificial shelter to small animals and gallinaceous birds. Surrounds of such piles, however, will have to be periodically control burned of leaf litter and brushwood. Trees above 30cm in girth will not be felled. Fire line will be maintained in 4 to 5 m width. This line will be maintained for the rest period of the Mine.

3.3.8. Promotion of Awareness:

Strong awareness will be built up among mine workers about working ethics in a forest area. They will be told to keep the noise levels to the barest minimum, take all precaution against fire, damage to trees etc. Drivers carrying Coal from the mine will be appraised to control speed of vehicle so as not to run over slow moving reptiles. Behavioural change will be expected from each worker on the above points and use of garbage bins. Any sick and injured animal will have to be rescued and given first-aid and water. Such animal is to be subsequently handed over to the nearest forest official. No worker shall get involved in crime against animals & forests. Such ethics can be installed through popular lectures, through film shows and announcement/award of prizes to best eco friendly worker.

3.4. Conservation Plan for Zone of Influence:

3.4.1. Studies on Elephant Habitat Utilization:

Habitat utilization by animals change over time depending on habitat factors. New areas may be used and favoured sites may be relinquished. As precise data is not available, it is of utmost importance to initiate studies on elephant habitat use.

3.4.2. Wildlife Census:

Annual game census will be organized, that involves taking stock of existing populations of Leopard, Elephant, and other herbivores, Aves & reptiles. Combination of methods will be used to obtain reasonable estimates of species populations. The methods include 24-hour Camera Trap method or PPP (Pug Impression Pad) method for leopards and other mega wildlife near waterholes, spoor counts, walking strip counts, daily forest

guard observations and hunting reports. An analysis of the census data will provide essential information on the present status of the mega wildlife species populations and facilitate prediction of trends in composition and structure of these populations.

Studies of the characteristics of various species including mating habits, sex/age ratios, breeding age, number of young at birth, feeding and roosting ranges, mobility, migration, saturation point, carrying capacity, habitat requirements, food preferences, water requirements and diseases.

This census will give an indication of increase or decrease in wildlife population growth and basing on that, remedial measures for vegetative growth has to be adjudged.

3.4.3. Meadow Development:

This can be taken up in adjoining PF/RF in the Zone of Inflence where permanent gaps are available and weeds have overgrown over **20 ha**. First, the weeds will be uprooted and grass seeds mixed with leguminoceae seeds will be sown broadcast before monsoons. When such areas are not available, canopy pepper pot openings will be created and undergrowth thinned to encourage grass growth. This will not be overdone to attract weeds. Needless to say, cattle will have to be kept out of this area or regulated grazing will be enforced. From Wildlife point of view these meadows serve the purpose of grazing ground for herbivores.

3.4.4. Water Body:

With a view to neutralise effect of the limiting factor i.e. water, one water body will be created in each P.F. at the periphery of mine lease area (As per Singrauli Forest Department).This is a hilly tract and water shortage is felt during summer. All animals, especially small ones will be benefitted immensely, since they have limited mobility. Water bodies will be made in valleys, depressions or nalla banks where there is reasonable prospect of water storage during summer. Each water body will be 40’ x 30’. Excavation will go up to about 5m depth.

3.4.5. Salt Licks:

Mineral salt is needed by all animals, starting from elephant, deer to porcupine, pangolin etc. to have good health. To compensate the natural salt licks affected by habitat degradation, 10 more salt licks will be provided. Salt licks are made by mixing 6 parts

clay with 1 part mineral mixture. Mineral mixture is compounded with 90 parts of common salt, 8 parts of rock salt and 2 parts of mineral mixture. The latter consists of essential elements like Calcium (Ca), Magnesium (Mg), Zinc (Zn), Selenium (Se), Molybdenum (Mo), Iron (Fe), Phosphorus (P), Sulphur (S), Boron (B) etc.

3.4.6. Corpus Fund:

A corpus fund at the Project cost will be operated by DFO, Singrauli division to outreach victims of house damage or accidental death due to trampling by elephant in particular and other mega wildlife in general. Ex-gratia will be sanctioned in part forthwith from this fund by concerned DFO after preliminary enquiry report received from Range Officer and Revenue Inspector and local Police Officer.

3.4.7. Inoculation of Livestock:

In Waidhan Taluka as per information gathered from VAS approximately 10,000 cattle are living. Regularly they visit the nearby forest area where ungulates like deer, sambar, wild boar and Nil gai are also living. These village cattle are often affected by FMD (Foot and Mouth disease) when visit forest area for grazing such disease will transmit to wild ungulates. In order to overcome this short-comings, the cattle will be regularly inoculated against F.M.D (Foot and Mouth Disease), to prevent spread of cattle borne diseases in the forest and affect wild animals (Hoofed animals like Deer, Sambar, Wild Boar etc.).

3.4.8. Conveyance facility for DFO, Singrauli and ancillary expenditure:

One Vehicle will be provided to DFO, Singrauli to monitor anti-depredation squad, Fire-fighting squad and movement of elephants. A driver on daily wage cost of fuel and life time wear and tear in kind from time to time will be facilitated by the User Agency.

3.4.9. Monitoring Committee:

A monitoring committee under the Chairmanship of Conservator of Forests will be formed where D.F.O., Singrauli will be the member. Besides, the Range Officers, Foresters, Forest Guards will also be members together with VSS (Van Surakhya Samiti) presidents of V.S.S.s involved in the Project area. Also the Honorary Wildlife Warden of Singrauli Division will be special invitees. A representative of User Agency shall also be invited to such meeting.

3.4.10. Safeguard along Roadside:

Waidhan-Sidhi State Highway via Bargawan traverses 20 km north of the block. A metalled road from Parsona to Mara is located further east of the block. An un-metaled road branching out of this at Rajmelan culminates at Sarai. From this road to the west of River Mahan, a north-south running road leads to Langadda via Bhalyatola, Suliyari & Jhalri. The block is also accessible by an all weather metalled road from Singrauli as well as from Waidhan.

There is movement of elephants and other herbivore/carnivore species from dusk to dawn and possibility of accident is inevitable. Therefore State Highway Authorities will be appraised to provide road underpass near the Rivers and Local Nalas within the transportation route of coal in Singrauli coal field area.

Fluorescent Sign Boards (both metal boards as well as masonry boards) with good write ups about movement of wild animals will be provided on sensible points of the National Highway and State Highway adjacent to this Coal Block in order to make aware the passers-by about occurrence of accident if they are confronted with wildlife.

CHAPTER-4

MANAGEMENT STRATEGIES WITHIN THE PROJECT AREA WITH FINANCIAL FORECAST

4.0 MANAGEMENT STRATEGIES WITHIN THE PROJECT AREA WITH FINANCIAL FORECAST

A. Interventions to be implemented by the project authority inside the project area with justification. All measures are discussed in Chapter-3**.** The financial requirement of various interventions suggested in the plan as per current costs is given in flowing table for the plan period of 10 years and annual cash flow for the core area of the project. All activities within the core area will be implemented by the project proponent.

B. Relevant provision of Environmental plan for the project and the intervention overlapping in nature are to be specified.

Table-4.1: Financial Forecast

S. No.	Management Interventions	Budget (Lakh)
1.	Study project on wild elephant habitat use and mitigation measures to minimize man-elephant conflict through WII or other technical Institute	50.00
2.	Wildlife estimation: Trap camera and other suitable instruments will be procured and used for wildlife estimation and presence in sensitive areas	50.00
3.	Meadow development in relocated villages	50.00
4.	Water harvesting structures/saucers creation and maintenance	100.00
5.	Uprooting of invasive species	10.00
6.	Procurement of truck mounted tankers (2)- their operational and maintenance cost for transporting water for filling saucers in peak summer and fire fighting	40.00
7.	Fire fighting equipments and squads including construction of five watch towers	50.00
8.	Strengthening of patrolling camps-providing basic facilities in camps like drinking water, solar light, toilets, fencing etc and field gear like uniform, boots, caps, raincoat, cycles, first aid kit, water bottles, gamcha, winter jackets, mosquito nets, camp cots, sleeping bags, cooking facilities, buckets, torches, cane, camp furniture, storage tanks etc.	50.00
9.	Corpus fund for payment of property damage by wild animals, medical aid to injured humans/cattle and other exigencies to be kept at DFO Singrauli	100.00
10.	Inoculation of livestock – purchase of medicines, ice boxes, honorarium to go-sevak and cold chain	20.00
11.	Conveyance facility to DFO singrauli for monitoring including cost of POL/Maintenance and a driver on daily wages basis	20.00
12.	Signages along roadside and in prominent and sensitive areas	10.00

13.	Appropriate fencing along village-forest interface to prevent wild animals from damaging the crop	75.00
14.	Development and maintenance of patrolling camps/watch towers/entry points/barriers etc.	50.00
15.	Up gradation/maintenance of roads, culverts, causeways	70.00
16.	Procurement of rescue equipments for rescue of problematic/straying animals including customized rescue vehicle with cage, its POL, maintenance and operating charges	75.00
17.	Human resource development-training/study tour of staff, villagers, anti depredation squads including training equipments and development of training centre	50.00
18.	Construction of building: for field functionaries manials, drivers including solar electrification	40.00
19.	Strengthening of offices: maintenance of building, procurement of office furniture, generator, inverters, water coolers, computers and peripherals, photocopier, fax machine etc	30.00
20.	Strengthening of communication network, procurement of wireless sets, mobiles, batteries, inverters, internet facilities	20.00
21.	Construction of animal enclosures and maintenance of existing enclosures for safe release of wild animals	75.00
22.	Development of nature interpretation centre and awareness programme	30.00
	Total	**1065.00**

(Rs. Ten Crore Crore Sixty Five Lakhs Only)

ANNEXURES

रेखाचित्र क्रमांक : 2.4 : कोयला खदानों से विखण्डित वन्य प्राणी विसर्जन कॉरीडोर
जंगली हाथियों का भ्रमण क्षेत्र
व्यपवर्तित कक्ष
व्यपवर्तन हेतु प्रस्तावित कक्ष
SINGRAULI FOREST DIVISION
BAGDARA SANCTUARY
KARTHUA RANGE
CHITRANGI RANGE
JIYAWAN RANGE
GORBI RANGE
BARGAWAN RANGE
WEST SARAI RANGE
WAIDHAN RANGE
EAST SARAI
MADA RANGE
GOPAD RIVER
SON RIVER
TO SIDHI
TO KATNI
TO CHOPAN
SONBHADRA
To Sonbhadra
To Sonbhadra
NIWAS
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KHUTAR
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KHAMARIA
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SARGUJA
N
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W
Legend
Dhirauli Coal Block
0
10
20
30
40 km

F. No. J-11015/49/2021-IA-II(M)]
Government of India
Ministry of Environment, Forest and Climate Change
(Impact Assessment Division)
*****

Indira Paryavaran Bhawan,
Jorbagh Road, N Delhi – 3
Email: lk.bokolia@nic.in Tel: 01124695363

Dated: 3rd August , 2021

To,

The Head Singrauli Cluster
M/s Stratatech Mineral Resources Pvt. Ltd. (SMRPL)
Adani Corporate House, Shantigram,
S.G. Highway, Ahmedabad- 382421
Email: dhirauli@adani.com

Sub: Dhirauli Coal Mining Project of Open cast cum Underground of 6.5 MTPA (5 MTPA Open Cast & 1.5 MTPA Underground) in Mine Lease Area of 2672 ha by M/s Stratatech Mineral Resources Private Limited (SMRPL) located at villages Dhirauli, Phatpani, Sirswah, Amdand, Jhalari, Amraikhoh, Bansibridha, and Belwar, Teshil Sarai, District Singrauli, (Madhya Pradesh) – For Terms of References – reg.

Sir,

This has reference to your Online Proposal No. IA/MP/CMIN/214743/2021 on 25th June, 2021, on the above-mentioned subject.

2. The Ministry of Environment, Forest and Climate Change has considered the proposal for grant of Terms of Reference to Dhirauli Coal Mining Project of Open cast cum Underground of 6.5 MTPA (5 MTPA Open Cast & 1.5 MTPA Underground) in Mine Lease Area of 2672 ha by M/s Stratatech Mineral Resources Private Limited (SMRPL) located at villages Dhirauli, Phatpani, Sirswah, Amdand, Jhalari, Amraikhoh, Bansibridha, and Belwar, Teshil Sarai, District Singrauli (Madhya Pradesh).

3. The proposal was considered by the sectoral Expert Appraisal Committee (EAC) in the Ministry in its 15th EAC meeting held on 6th July, 2021 through Video Conferencing. The details of the project, as per the documents submitted by the project proponent, and also as informed during the meeting, are reported to be as under: -

(i) The Dhirauli coal block boundary coordinates in WGS84 datum as per CMDPA is as follows: List of Cardinal Points P1: Latitude 23056'07" Longitude 82019'04"; P2: Latitude 23056'07" Longitude 82024'21"; P3: Latitude 23003'04" Longitude 82024'21" P4: Latitude 23003'04" Longitude 82019'04".

(ii) Coal linkage of the project: Alloted under the commercial coal mining auction process. There shall be no restriction to carryon mining operations for own consumption, sale or for any other purpose

(iii) No Joint venture cartel has been formed.

(iv) Project does not fall in the Critically Polluted Area (CPA), where the MoEF&CC's vide its OM dated 13th January, 2010 has imposed moratorium on grant of environment clearance

(v) The total requirement of land is estimated as 2672 Ha, which includes 1436.19 ha of forest land and 1235.81 of non-forest land. Dhirauli Coal Block has a gross geological reserve of 620.013 MT and net geological reserve of 558.011 MT (OCP-260.263 MTPA; UG-297.748 MTPA).

(vi) The mining plan envisages for mining of 313.79 MTPA (OCP-195.74 MTPA, UG-118.05 MTPA) of mineable coal reserves within the area where the reserves are proved at an average stripping ratio of 10.55.

(vii) The method of mining will be opencast mining of coal. The life of mine is about 40 years for opencast & 87 years for underground mining based on Mining Plan.

(viii) The land usage pattern of the project is as follows:

Ownership	Type of Land	Area(Ha)
Tenancy Land	Agricultural	530.841
	Township	
	Grazing	
	Barren	
	Water bodies	6.000
	Road	12.000
	Community	
Sub Total		**548.841**
Govt Non Forest Land	Agricultural	684.431
	Township	
	Grazing	
	Barren (Road)	
	Other	
Sub Total		**684.431**
Forest Land	Protected Forest land	1337.144
	Rev Forest (CJBJ)	101.585
Free hold		
Sub Total		**1438.729**
Grand Total		**2672.00**

Mining Activity	Proposed Land Use Area (Ha)	Land Use (End of Life) Area	Post Mining Land Use (Ha)						
			Agriculture Land	Plantation	Water Body	Public Use	Forest land (Returned)	Undisturbed	Total
Excavation Area	2,096.59	2,096.59	-	1,843.03		-	1,843.03	-	1,843.03
	1,796.23	1,796.23	-	1,843.03	-	-	1,843.03	-	1,843.03

Backfilled Area (in Excavation Area)									
Excavated Void (in Excavation Area)	300.36	300.36	-	-	253.56	-	-	-	253.56
Top Soil Dump *	35.34 (Upto 5th Year)	35.34 (Upto 5th Year)	-	-	-	-	-	-	0.00
External Dump	387.55	387.55	-	387.55	-	-	387.55	-	387.55
Safety Zone	19.73	19.73	-	19.73	-	-	19.73		19.73
Haul Road between quarries	-	-	-	-	-	-	-	-	0.00
Road diversion	4.13	4.13	-	-	-	4.13	-	-	4.13
Settling pond	2.20	2.20	-	-	2.20	-	-	-	2.20
Road & Infrastructure area	20.80	20.80	-	20.80	-	-	20.80	-	20.80
CHP & Washery	8.10	8.10	-	8.10	-	-	8.10	-	8.10
Coal Evacuation Route & Approach Road	1.15	1.15	-	1.15	-	-	1.15	-	1.15
Garland drains	5.34	5.34	-	5.34	-	-	5.34	-	5.34
Embankment	7.50	7.50	-	7.50	-	-	7.50	-	7.50
Green Belt	46.80	46.80	-	46.80			46.80		46.80
Water Reservoir	-	-	-	-	-	-	-	-	0.00
Rationalization area	72.11	72.11	-	72.11	-	-	72.11	-	72.11
Total (exclude back filled void & topsoil area)	**2,672.00**	**2,672.00**	-	**2,412.11**	**255.76**	**4.13**	**2,412.11**	-	**2,672.00**

(ix) Total geological reserve reported in the mine lease area is 558.331 MT. Out of total mineable reserve of 313.79 Mte. is available for extraction. Percentage of extraction is 53.43%.

(x) Considering the geo-mining characteristics of the block and for conservation of resource, it is proposed to extract the coal reserves within the block using combination of open cast mining (upto seam VII) and underground mining (below Seam VII to Seam II) method.

(xi) Grade of coal is power grade (G8). stripping ratio 10.55 mm^3/t, while gradient is 2° to 4°. The project has external OB dumps in an area of 387.55 ha with 90 m height and 259.01 Mm^3 of OB. Internal OB in an area of 1796.23 ha with 1704.53 Mm^3 of OB is envisaged in the project.

(xii) Total quarry area is 2096.59 ha out of which backfilling will be done in 1843.03 ha while final mine void will be created in an area of 253.56 ha with a depth of 30 m. Backfilled quarry area of 1843.03 ha shall be reclaimed with plantation. Final mine void will be converted into water body.

(xiii) Transportation of coal has been proposed by truck/conveyor in mine pit head, from surface to siding by truck and at sidings by truck/railway as per requirement of the consumers for sale of coal.

(xiv) Reclamation Plan in an area of 2320.27 ha, comprising of 387.55 ha of external dump, 1843.03 ha of internal dump & void and 46.80 ha of green belt and 42.89 ha of infrastructure area. In addition to this, an area of 91.84 ha, included in the safety zone/rationalization area, has also been proposed for green belt development.

(xv) The forest land of 1335.35 ha and Revenue Forest land 100.84 ha is involved and for which Forest clearance has been applied vide proposal no. FP/MP/MIN/142344/2021 dated 8th June 2021 and pending at DFO.

(xvi) No National Parks, Wildlife Sanctuaries and Eco-Sensitive Zones have been reported with 10 km boundary of the project.

(xvii) The demand of water for the project has been estimated as per industrial norms. An amount of 1540 KLD of industrial water, which includes 50 KLD of potable water will be required for the proposed coal mine. It is envisaged that to meet the requirement of water for construction, drinking and sanitation as well as mine operation, at the initial stage of 2- 3 years, will be met from ground water. After that mine quarry will collect sufficient water which will meet the industrial demand. However, the potable water demand at mine, mine facilities will be met through ground water by bore wells

(xviii) About 970 people will get (direct/indirect) employment during the entire life of the project.

(xix) No, waste water will be generated as a result of mining activities. The machinery will be maintained and washed in workshop so no generation of waste water is envisaged from the ML area. Mine seepage water will be used for dust suppression, plantation and other industrial purpose, and water extracted for drinking water requirement will be met from borewell.

(xx) The total capital cost for the proposed coal mining project is about Rs. 2800 Crores.

4. The Expert Appraisal Committee in its 15th EAC meeting held on 6th July, 2021, through Video Conferencing has recommended the proposal for grant of Terms of References (ToR). Based on the recommendations of the EAC, the Ministry of Environment, Forest and Climate Change hereby grants approval to the Terms of References for **Dhirauli Coal Mining Project of Open cast cum Underground of 6.5 MTPA (5 MTPA Open Cast & 1.5 MTPA Underground) in Mine Lease Area of 2672 ha by M/s Stratatech Mineral Resources Private Limited (SMRPL) located at villages Dhirauli, Phatpani, Sirswah, Amdand, Jhalari, Amraikhoh, Bansibridha, and Belwar, Teshil Sarai, District Singrauli (Madhya Pradesh),** for preparation of EIA/EMP reports

with public consultations, under the provisions of the Environment Impact Assessment Notification, 2006 and subsequent amendments/circulars thereto, subject to the compliance of the following terms and conditions as specified/notified in the standard ToR applicable for opencast coal mines, along with the additional conditions as under:-

(i) Public Consultation, including public hearing, shall be conducted through concerned SPCB in the concerned districts as per the provisions/procedure contained in the EIA Notification, 2006 for information of the stakeholders about the present coal mining operations inviting comments and their redressal.

(ii) As suggested by EAC, no diversion of Hurdul source stream shall be allowed and the same shall be proposed in EIA Study with appropriate mining methods to recover the coal in river catchment so that biodiversity in the area by source stream could be maintained.

(iii) Stage-I Forest Clearance for diversion for non-forestry activity shall be submitted.

(iv) In addition to existing data already collected (if any), the Cumulative Impact Assessment Study, carrying capacity and ecosystem services study of the area shall be carried over by project proponent considering the project being in Singrauli, having ~1400 ha of forest land and presence of other coal mining activity and industries. PP shall collect one season baseline data of all environmental parameters and shall compare with the data of earlier data collected for cumulative assessment of area. Air pollution impact prediction shall be conducted by considering the maximum values.

(v) PP shall explore the possibilities of utilization of OB material for different purposes (in construction of roads, manufacture of artificial sand, aggregates, use for farmers etc.) and accordingly Plan shall be included in EIA/EMP Report.

(vi) Inpit conveyor belt with silo loading should be proposed and installed for transportation of coal till railway siding. No transportation of coal by trucks/dumpers shall be proposed in EIA/EMP.

(vii) Wind rose pattern in the area should be reviewed and accordingly location of AAQMS shall be planned by the collection of air quality data. Monitoring location for collecting baseline data should cover overall the 10 km buffer zone i.e. dispersed in 10 km buffer area.

(viii) Project proponent to prepare Environmental Cost Benefit Analysis for the project in EIA/EMP Report.

(ix) PP shall provide the details of mining technology/methodology proposed to be adopted for coal mining operations and its associated environmental benefits of using from Climate Change perspective.

(x) Detailed Social Impact Assessment shall be prepared in villages for Rehabilitation and Re-settlement. R &R Activity shall be proposed with timeline and allotted fund.

(xi) Permission for ground water withdrawal shall be obtained from Central Ground Water Authority (CGWA) only for mining activity.

(xii) Heavy metals including other parameters in surface water quality shall be analyzed and provided in EIA Report. Further, detailed mineralogical and chemical composition of the mineral and percentage of free silica from a NABL/MoEF&CC accredited laboratory

(xiii) PP shall be submitting R &R in respect of SCs /STs and other weaker sections of the society in the study area, a need based sample survey, family-wise, should be undertaken to assess their requirements, and action programs prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government.

(xiv) Inpit conveyor belt with silo loading should be proposed and installed for transportation of coal till railway siding. No transportation of coal by trucks/dumpers shall be proposed in EIA/EMP.

(xv) No mining activity shall be proposed on grazing land till the alternate land is provided of same area to the community.

(xvi) PP should clearly bring out that what is the specific diesel consumption ~ (Liters/Tonne of total excavation & mineral) and steps to be taken for reduction of the same. Year-wise target for reduction in the specific diesel consumption needs to be submitted.

(xvii) PP shall provide provision of integrated mine plan and mine reclamation cum land form / land scape plan for both underground and open cast coal mining projects. The plan must show the predicted post mining reclaimed and reformed surface by regarding and reshaping to reduce its height as close to the original surface level and proper sloping benching and terracing of external dup should be clearly brought out in the post mine closure plan. This would also include water management strategies such as surface water catchment and drainage paths etc. of post mining land surface.

(xviii) PP shall propose to use LNG/CNG based mining machineries and trucks for mining operation and transportation of coal.

(xix) PP shall submit letter from Principal Chief Conservator of Forest, State Government that the area does not falls under any Eco-sensitive zone and areas and further is no corridor of Elephants & Tigers.

4.1. This grant of Terms of References(ToR) for the said project is further subject to the general conditions as under

(i) All documents should be properly indexed, page numbered.

(ii) Period/date of data collection should be clearly indicated.

(iii) Authenticated English translation of all material provided in Regional languages.

(iv) After the preparation of the draft EIA-EMP Report as per the aforesaid TOR, the proponent shall get the Public Hearing conducted as prescribed in the EIA Notification 2006 and take necessary action for obtaining environmental clearance under the provisions of the EIA Notification 2006.

(v) The letter/application for EC should quote the Ministry's file No. and also attach a copy of the letter prescribing the ToR.

(vi) The copy of the letter received from the Ministry on the ToR prescribed for the project should be attached as an annexure to the final EIA-EMP Report.

(vii) General Instructions for the preparation and presentation before the EAC of ToR/EC projects of Coal Sector should be incorporated/followed.

(viii) The aforesaid ToR has a validity of **Four** years only.

(ix) Grant of ToR does not necessarily mean grant of EC.

(x) Grant of ToR to the present project does not necessarily mean grant of TOR/EC to the captive/linked project.

(xi) Grant of ToR to the present project does not necessarily mean grant of approvals under the Forest (Conservation) Act, 1980 or the Wildlife (Protection) Act, 1972.

(xii) Grant of EC is also subject to circulars issued under the EIA Notification 2006, which are available on the Ministry's website: www.envfor.nic.in

5. Standard ToR: The EIA/EMP report should contain the information in accordance with provisions & stipulations as given in the standard ToR for Underground coal mine projects (please visit the following link to download the Standard ToR:
http://environmentclearance.nic.in/writereaddata/standardtorreference.pdf

6. You are required to submit the final EIA/EMP prepared as per TORs to the Ministry within 4 years as per this Ministry's Notification vide S.O 751 (E) dated 17th February, 2020 for considering the proposal for environmental clearance.

7. The consultants involved in the preparation of EIA/EMP report after accreditation with Quality Council of India/National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other organization(s)/laboratories including their status of approvals etc. vide Notification of the MoEF dated 19th July, 2013.

(Lalit Bokolia)
Director

Copy to:

1. The Secretary, Ministry of Coal, Shastri Bhawan, New Delhi
2. The Secretary, Department of Environment & Forests, Government of Madhya Pradesh, Secretariat, Bhopal.
3. Principal Chief Conservator of Forests, Head of Forest Force, Madhya Pradesh Forest Department, Sapura Bhawan, 1st Floor, Bhopal.
4. The Member Secretary, Madhya Pradesh State Pollution Control Board, Paryavaran Parisar, E-5, Arera Colony, Bhopal -462 016
5. The Chairman, Central Pollution Control Board, CBD-cum-Office Complex, East Arjun Nagar, Delhi - 32
6. The District Collector, Singrauli. Government of Madhya Pradesh,
7. Monitoring File/Guard File/Record File. 9. PARIVESH Portal

(Lalit Bokolia)
Director

A. Generic TOR for an opencast / UG coalmine project

(i) An EIA-EMP Report should be prepared for a peak capacity of …… **MTPA** over an area of …… ha addressing the impacts of the underground coalmine project including the aspects of mineral transportation and issues of impacts on hydrogeology, plan for conservation of flora/fauna and afforestation/plantation programme based on the generic structure specified in Appendix III of the EIA Notification 2006.. Baseline data collection can be for any season except monsoon.

(ii) The EIA-EMP report should also cover the impacts and management plan for the project specific activities on the environment of the region, and the environmental quality – air, water, land, biotic community, etc. through collection of baseline data and information, generation of baseline data on impacts for ……. MTPA of coal production based on approval of project/Mining Plan.

(iii) A Study area map of the core zone and 10km area of the buffer zone (15 km of the buffer zone in case of ecologically sensitive areas) delineating the major topographical features such as the land use, drainage, locations of habitats, major construction including railways, roads, pipelines, major industries/mines and other polluting sources, which shall also indicate the migratory corridors of fauna, if any and the areas where endangered fauna and plants of medicinal and economic importance are found in the area.

(iv) Map showing the core zone along with 3-5 km of the buffer zone) delineating the agricultural land (irrigated and unirrigated, uncultivable land (as defined in the revenue records), forest areas (as per records) and grazing land and wasteland and water bodies.

(v) Contour map at 3m interval along with Site plan of the mine (lease/project area with about 3-5 km of the buffer zone) showing the various surface structures such as buildings, infrastructure, CHP, ETP, Stockyard, township/colony (within/adjacent to the ML), green belt and undisturbed area and if any existing roads, drains/natural water bodies are to be left undisturbed along with details of natural drainage adjoining the lease/project and modification of thereof in terms of construction of embankments/bunds, proposed diversion/rechannelling of the water courses, etc., highways, passing through the lease/project area.

(vi) Original land use (agricultural land/forestland/grazing land/wasteland/water bodies) of the area. Impacts of project, if any on the landuse, in particular, agricultural land/forestland/grazing land/water bodies falling within the lease/project and acquired for mining operations. Extent of area under surface rights and under mining rights.

S.N.	ML/Project Land use	Area under Surface Rights (ha)	Area Under Mining Rights (ha)	Area under Both (ha)
1.	Agricultural land			
2.	Forest Land			
3.	Grazing Land			
4.	Settlements			
5.	Others (specify)			

Area Under Surface Rights

S.N.	Details	Area (ha)	Forest Land	Agr. land	Wasteland	Settle ments	Other s
1.	Buildings						
2.	Infrastructure						
3.	Roads						
4.	Others (specify)						
	TOTAL						

(vii) Study on the existing flora and fauna in the study area carried out by an institution of relevant discipline and the list of flora and fauna duly authenticated separately for the core and buffer zone and a statement clearly specifying whether the study area forms a part of the migratory corridor of any endangered fauna. The flora and fauna details should be furnished separately for the core zone and buffer zone. The report and the list should be authenticated by the concerned institution carrying out the study and the names of the species scientific and common names) along with the classification under the Wild Life Protection Act, 1972 should be furnished.

(viii) Details of mineral reserves, geological status of the study area and the seams to be worked, ultimate working depth and progressive stage-wise working plan/scheme until end of mine life should be reflected on the basis of the approved rated capacity and calendar plans of production from the approved Mining Plan. Geological maps should also be included.

(ix) Impact of mining on hydrology, modification of natural drainage, diversion and channelling of the existing rivers/water courses flowing though the ML and adjoining the lease/project and the impact on the existing users and impacts of mining operations thereon.

(x) Collection of one-season (non-monsoon) primary baseline data on environmental quality – air (PM_{10}, $PM_{2.5}$, SO_x, NO_x and heavy metals such as Hg, Pb, Cr, AS, etc), noise, water (surface and groundwater), soil along with one-season met data.

(xi) Map of the study area (core and buffer zone) clearly delineating the location of various monitoring stations (air/water/soil and noise – each shown separately) superimposed with location of habitats, wind roses, other industries/mines, polluting sources. The number and location of the stations should be selected on the basis of the proposed impacts in the downwind/downstream/groundwater regime. One station should be in the upwind/upstream/non-impact non-polluting area as a control station. Wind roses to determine air pollutant dispersion and impacts thereof shall be determined. Monitoring should be as per CPCB guidelines and standards for air, water, noise notified under Environment Protection Rules. Parameters for water testing for both ground and surface water should be as per ISI standards and CPCB classification of surface water wherever applicable.

(xii) Impact of mining and water abstraction and mine water discharge in mine on the hydrogeology and groundwater regime within the core zone and 10km buffer zone including long–term modelling studies on the impact of mining on the groundwater regime. Details of rainwater harvesting and measures for recharge of groundwater should be reflected wherever the areas are declared dark/grey from groundwater development.

(xiii) Study on subsidence, measures for mitigation/prevention of subsidence, modelling subsidence prediction and its use during mine operation, safety issues.

(xiv) Detailed water balance should be provided. The breakup of water requirement as per different activities in the mining operations, including use of water for sand stowing should be given separately. Source of water for use in mine, sanction of the competent authority in the State Govt. and impacts vis-à-vis the competing users should be provided.

(xv) Impact of choice of mining method, technology, selected use of machinery - and impact on air quality, mineral transportation, coal handling & storage/stockyard, etc, Impact of blasting, noise and vibrations.

(xvi) Impacts of mineral transportation – within and outside the lease/project. The entire sequence of mineral production, transportation, handling, transfer and storage of mineral and waste, and their impacts on air quality should be shown in a flow chart with the specific points where fugitive emissions can arise and the specific pollution control/mitigative measures proposed to be put in place. Examine the adequacy of roads existing in the area and if new roads are proposed, the impact of their construction and use particularly if forestland is used.

(xvii) Details of various facilities to be provided in terms of parking, rest areas, canteen, and effluents/pollution load from these activities. Examine whether existing roads are adequate to take care of the additional load of mineral and their impacts.

(xviii) Examine the number and efficiency of mobile/static water sprinkling system along the main mineral transportation road within the mine, approach roads to the mine/stockyard/siding, and also the frequency of their use in impacting air quality.

(xix) Impacts of CHP, if any on air and water quality. A flow chart of water use and whether the unit can be made a zero-discharge unit.

(xx) Conceptual Final Mine Closure Plan along with the fund requirement for the detailed activities proposed there under. Impacts of change in land use for mining operations and whether the land can be restored for agricultural use post mining.

Table 1 Stage-wise Cumulative Plantation

S.N	YEAR*	Green Belt		External Dump		Backfilled Area		Others (Undisturbed Area / etc)		TOTAL	
		Area (ha)	No. of trees	Area (ha)	No. of Trees	Area (ha)	No. of Trees	Area (ha)	No. of Trees	Area (ha)	No. of Trees
1.	1st year										
2.	3rd year										
3.	5th year										
4.	10th yr										
5.	15th yr										
6.	20th yr										
7.	25th yr										
8.	30th yr										
9.	34th year (end of mine life)										
10	34-37th Year										

	(Post-mining)										

*As a representative example

(xxi) Occupational health issues. Baseline data on the health of the population in the impact zone and measures for occupational health and safety of the personnel and manpower for the mine should be furnished.

(xxii) Details of cost of EMP (capital and recurring) in the project cost and for final mine closure plan. The specific costs (capital and recurring) of each pollution control/mitigative measures proposed in the project until end of mine life and a statement that this is included in the project cost.

(xxiii) Integrating in the Env. Management Plan with measures for minimising use of natural resources – water, land, energy, raw materials/mineral, etc.

(xxiv) R&R: Detailed project specific R&R Plan with data on the existing socio-economic status (including tribals, SC/ST) of the population in the study area and broad plan for resettlement of the displaced population, site for the resettlement colony, alternate livelihood concerns/employment for the displaced people, civic and housing amenities being offered, etc and costs along with the schedule of the implementation of the R&R Plan.

(xxv) CSR Plan along with details of villages and specific budgetary provisions (capital and recurring) for specific activities over the life of the project.

(xxvi) **Public Hearing should cover the details as specified in the EIA Notification 2006**, and include notices issued in the newspaper, proceedings/minutes of public hearing, the points raised by the general public and commitments by the proponent made should be presented in a tabular form. If the Public Hearing is in the regional language, an authenticated English Translation of the same should be provided.

(xxvii) Status of any litigations/ court cases filed/pending in any Court/Tribunal on the project should be furnished.

(xxxvi) Submission of sample test analysis of: Characteristics of coal - this includes grade of coal and other characteristics – ash, S and heavy metals including levels of Hg, As, Pb, Cr etc.

(xxxviii) Copy of clearances/approvals – such as Forestry clearances, Mining Plan Approval, NOC from Flood and Irrigation Dept. (if req.), etc.

(A) Forestry Clearance

Total ML / /Project Area (ha)	Total Forest Land (ha)	Date of FC	Extent of forest land	Balance area for which FC is yet to be obtained	Status of appl. for diversion of forestland
		If more than one, provide details of each FC			

(B)

Mining Plan / Project Approval: Date of Approval of Mining Plan/Project Approval: Copy of Letter of Approval of Mining Plan/Project Approval

(xxxviii) Corporate Environment Responsibility:

a) The Company must have a well laid down Environment Policy approved by the Board of Directors.

b) The Environment Policy must prescribe for standard operating process/procedures to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions.

c) The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions must be furnished.

d) To have proper checks and balances, the company should have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large.