GONDULPARA COAL MINE

Capacity: 4.0 MTPA (Opencast)

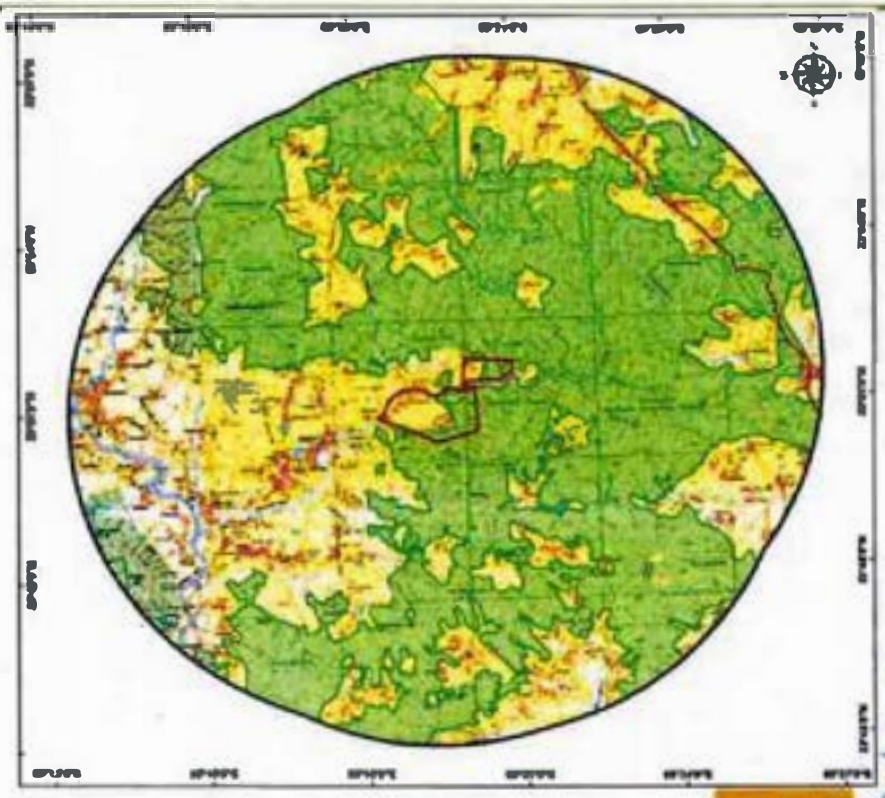
Area: 513.18 Ha

In North Karanpura Coalfields

Hazaribagh (W)Forest Division,

Hazaribagh-district, Jharkhand

SITE SPECIFIC WILDLIFE CONSERVATION PLAN



VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

Project Proponent

M/s Adani Enterprises Limited (AEL)

Adani Corporate House, Shantigram,
Near Vaishno Devi Circle, S. G. Highway, Khodiyar,
Ahmedabad - 382421
Gujarat - India

Vardan Environet Gurugram, HR

Consultant

VARDAN ENVIRONET
Accredited EIA Consultant Organization by
QCI-NABET ACCREDITATION NO.:
NABET/EIA/2023/RA0158
Plot No. 82A, Sector-5, IMT Manesar, Gurgaon
www.vardan.co.in
E-Mail: info@vardanenvironet.com
Contact: 0124-4343750, +91 9953147268, 09810355569

GONDULPARA COAL MINE

Capacity: 4.0 MTPA (Opencast)
Area: 513.18 Ha
in North Karanpura Coalfields
Hazaribagh (W) Forest Division,
Hazaribagh-district, Jharkhand

SITE SPECIFIC WILDLIFE CONSERVATION PLAN

CONTENTS

AFFIXED
VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXURES:

CHAPTER-1

INTRODUCTION

CHAPTER-1
INTRODUCTION

1. INTRODUCTION

India is currently producing about 729 million tons of coal. However, it is a fact that domestic production is not able to meet the demand of coal in the country. India has imported 247 million tons of coal last year and had spent 1.58 lakh crore as foreign exchange. Despite India being world's second largest coal producer and being the 5th largest country in terms of coal deposits, with coal reserves which may last at least 100 years more, the country is unable to produce adequate quantity of coal to meet the requirement of domestic industry and development.

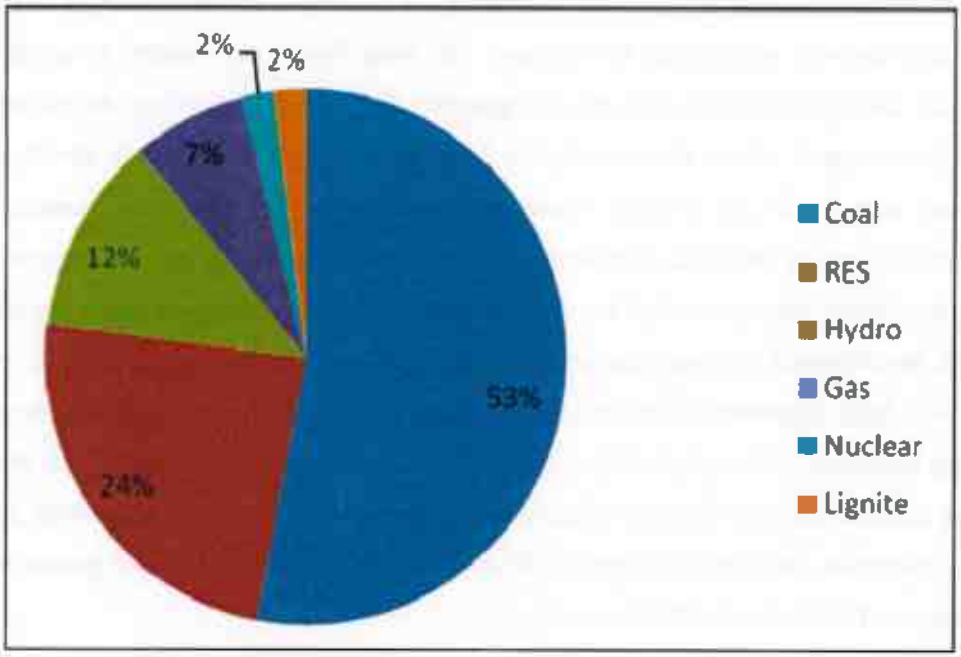
It is the intention of the Government of India to bring faster economic development to the aspiring regions of the country. Since these States are resource rich, harnessing of these resources is critical in the development of these States. Commercial auction of coal mines along with transparent measures taken by the Government of India has come at an opportune time to bridge the mismatch between the demand and supply of coal in the country. This will not only provide a huge opportunity for employment in the backward regions but will also save precious foreign exchange to the extent of almost Rs.20,000 crores to Rs.30,000 crores per year.

These reforms will also have an effect on other sectors dependent on coal. With an increase in coal production the positive impact will also be felt on production and processing in Steel, Aluminum, Fertilizers and Cement sector.

India has a reserve of 289 Billion tons of non-coking coal and about 80% of coal produced is used in thermal power plants. Coal gasification is considered as cleaner option as compared to burning of coal and utilizes the chemical properties of coal. Syn Gas produced from Coal gasification can be utilized in producing Synthetic Natural Gas (SNG), energy fuel (methanol & ethanol), production of urea for fertilizers and production of Chemicals such as Acetic Acid, Methyl Acetate, Acetic Anhydride, DME, Ethylene and Propylene, Oxo chemicals and Poly Olefins. **These products will help in import substitution and help the mission of Government of *Atmanirbhar* Bharat.**

2. COAL MINING IN INDIA

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.

India has rich deposits of coal in the world. Total estimated reserves of coal in 2020 were 344.02 billion tons, an addition of 17.53 billion tons over the 2019 in corresponding period. In terms of percentage, there has been a growth of 5.37% in the total estimated coal reserves during the year 2020 over 2019. The top three states with highest coal reserves in India are Jharkhand, Odisha, Chhattisgarh, which account for approximately 70% of the total coal reserves in the country. Out of the total reserves in the country, proven reserves i.e. those available for extraction in terms of i.e. economically viability, feasibility study and geologically exploration level, account for almost 47% of the total as depicted below in Fig 1.2.

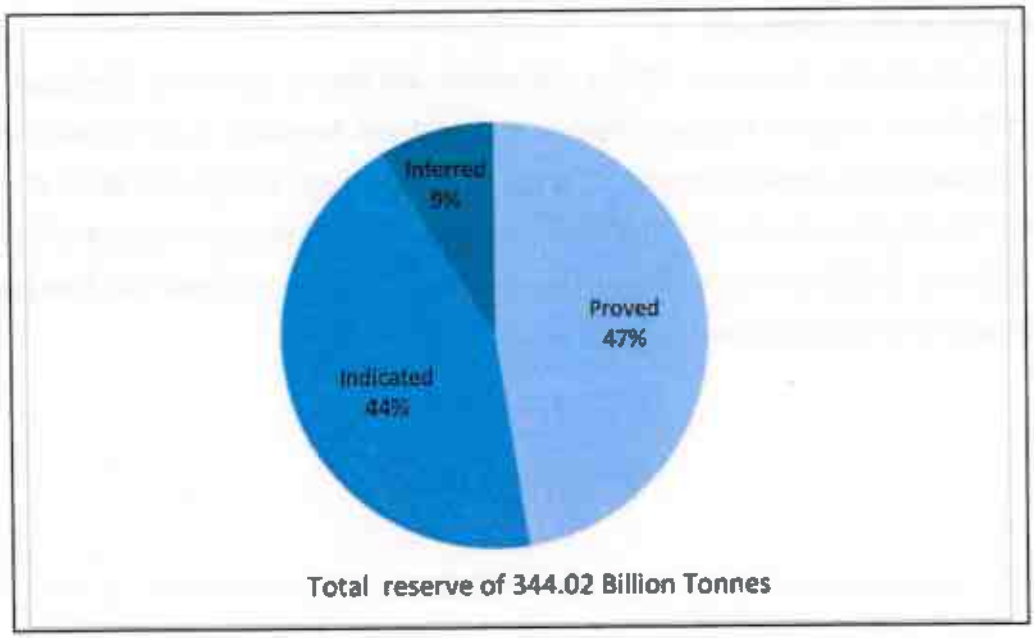


Figure 1.2: Estimated Reserves of Coal as on 01.04.2020

3. NORTH KARANPURA COALFIELDS

Coal mining in India also raises several social and environmental concerns on the regions of its operation. There had been allegations that the coal mining industry has ignored the social impact or rehabilitation of entire communities displaced by these activities. There have also been conflicts while going for acquisition of land for developing coal mines especially while dealing

with the subsistence needs have displaced poor and indigenous families. Studies in Jharkhand observed that during 1950–91 mining was responsible for 27% of the total displacement in that State (coal mining 18% and non-coal mining 9%).

The North Karanpura coalfields embrace the core Karanpura Valley but also extend well beyond it. They are elliptical in shape having axes of 64 km in east-west direction and 32 km in north-south direction. The coalfields are in the upper Damodar River Valley lying between the Ranchi plateau in the south, and the Hazaribagh plateau in the north.

The coalfields of about 1230 km2 and the coal reserves (14 billion tons proved, indicated and inferred, or 9% of India's coal reserves), make them amongst the biggest in India. It has been reported that about 75% of the coal reserves comprise of non-coking coal and the rest comprise of high ash medium coking coal.

The core NKCB falls in Latehar, Chatra, Hazaribagh and Ranchi districts of Jharkhand, under three CD Blocks of district Latehar (Chandwa, Balumath and Bariyatu), one of Chatra (Tandwa), three of Hazaribagh district (Keredari, Barkagaon, and Dari) and Khelari CD Block of Ranchi district. The forests in the proper NKCB area are under the administrative control of Chandwa and Balumath Ranges of Latehar Forest Division, Tandwa of Chatra South FD, Barkagaon of Hazaribagh West FD and Burmu Range of Ranchi Forest Division.

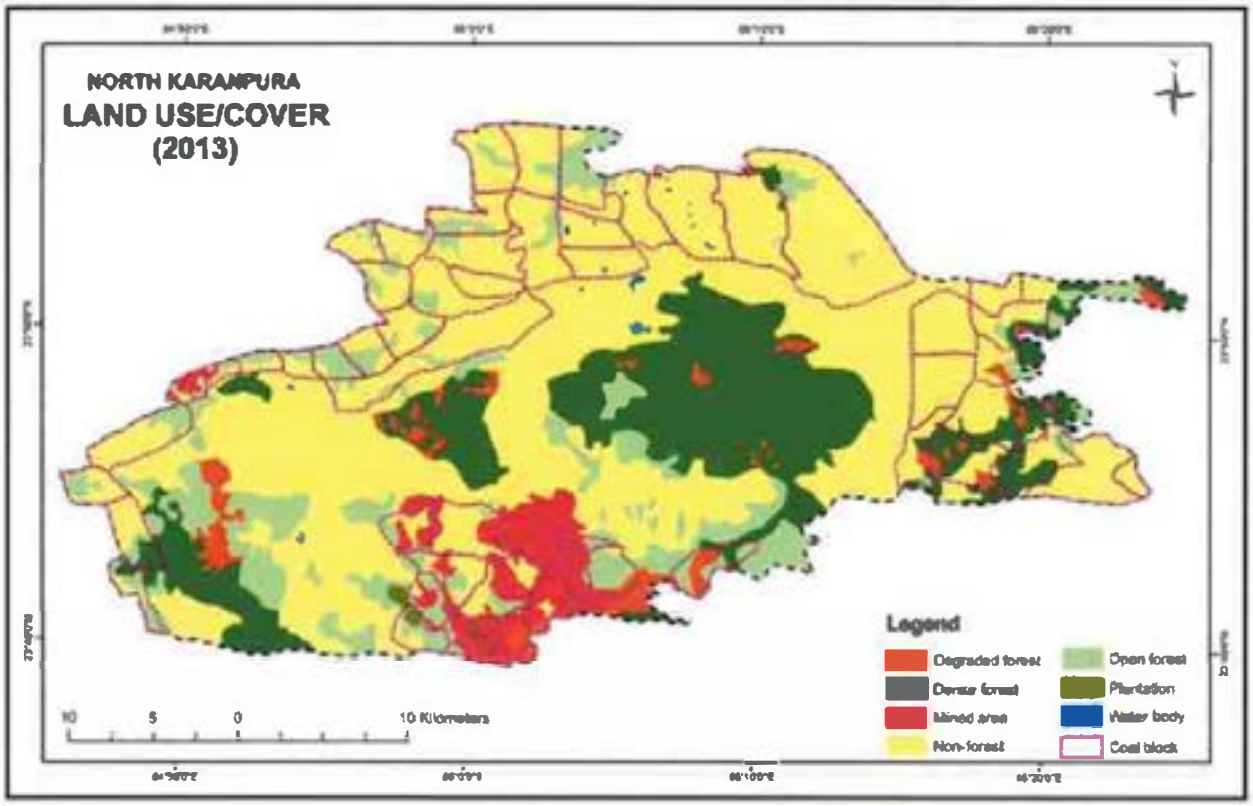


Figure 1.3: Land Use Cover Map of North Karanpura Coalfield

The North Karanpura coalfields embrace the **core** Karanpura Valley but also extend well beyond it. They are elliptical in shape having axes of 64 km in east-west direction and 32 km in north-south direction. The coalfields are in the upper Damodar River Valley lying between the Ranchi plateau in the south, and the Hazaribagh plateau in the north. The core coalfields overlap several districts: Ranchi (41 villages of Burmu Development Block (DB), Hazaribag and Chatra districts (123 villages of Tandwa, Keredari and Barkagaon DBs), Latehar District (39 villages of Balumath and Chandwa DBs). The 10 kms **buffer** comprises additional 1018 villages covering the present districts of Hazaribagh, Chatra, Latehar, Ranchi and Ramgarh. The coalfields of about 1230 km2 and the coal reserves (14 billion tones proved, indicated and inferred, or 9% of India's coal reserves), make them amongst the biggest in India. It has been reported that about 75% of the coal reserves comprise of non-coking coal and the rest comprise of high ash medium coking coal.

AFROZ
VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

4. GONDULPARA COAL BLOCK

The Gondulpara block was explored by CMPDI and GSI, occupies an area of about 4.10 sq km and is situated in the north eastern part of north Karanpura Coalfield. The detailed cardinal points are given in key map.

- Latitude from: 23°50'20" N to 23°51'20" N
- Longitude from: 85°18'20" E to 85°20'15" E

The Gondulpara coal mine is approachable from Badam village through a 3 Km long Kutcha road. The Badam village in turn is connected by a fair weather road to Barkagaon village located on Tandwa-Hazaribagh metalled road at a distance of about 12 Km. The distance from the block to Hazaribagh town is about 35 Km. The nearest major Railway Station is Patratu at a distance of about 35 Km towards south from the block-on Daltonganj-Barkakana-Dehri-on-Sone loop line of the South Eastern Railway. The road leading to the Patratu Railway Station is partly through fair weather and partly through un-metalled road. The nearest Airport is at Ranchi located at a distance of about 120 Km from the block.

The proposed Gondulpara coal mine of 4.0 MTPA capacity is an open cast coal mine to supply for open market, which will fulfill the future power requirement of Jharkhand State and will accelerate the economic development of the State.

For the proposed Gondulpara coal mine, the total requirement of land is estimated as 513.18 Ha, which includes 219.80 ha of forest land, 70.16 ha of Govt non-forest land and 223.22 ha of Tenancy land.

The proposed Gondulpara coal mine of 4.0 MTPA of capacity which is a commercial coal mine of Adani Enterprises Limited (AEL) allotted under the commercial coal mining auction process. There shall be no restriction to carry on mining operations for own consumption, sale or for any other purpose.

As per the vesting order no: NA-104/10/2020-NA dated 8th March 2021, Government of India, Ministry of Coal has allocated the Gondulpara coal mine to Adani Enterprises Limited (AEL).

The ultimate target production capacity is estimated as 4.0 MTPA from Gondulpara Coal Mine. The production build up has been planned in such a way that it will meet the requirement of 4.0 MTPA in the 4th year of mine operation.

AFROZ
VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

As per the geological report prepared by CMPDI, Gondulpara Block has a net geological reserve of 166.185 MT. The mining plan envisages for mining of 120.11 MT of mineable coal reserves within the area. After proving of the balance indicated reserves in the remaining area within the block by additional drilling, mining will be further extended to mine total mineable coal reserves of 114.10 Mt. over a total project life of 32 years at an average overall stripping ratio of 2.45.

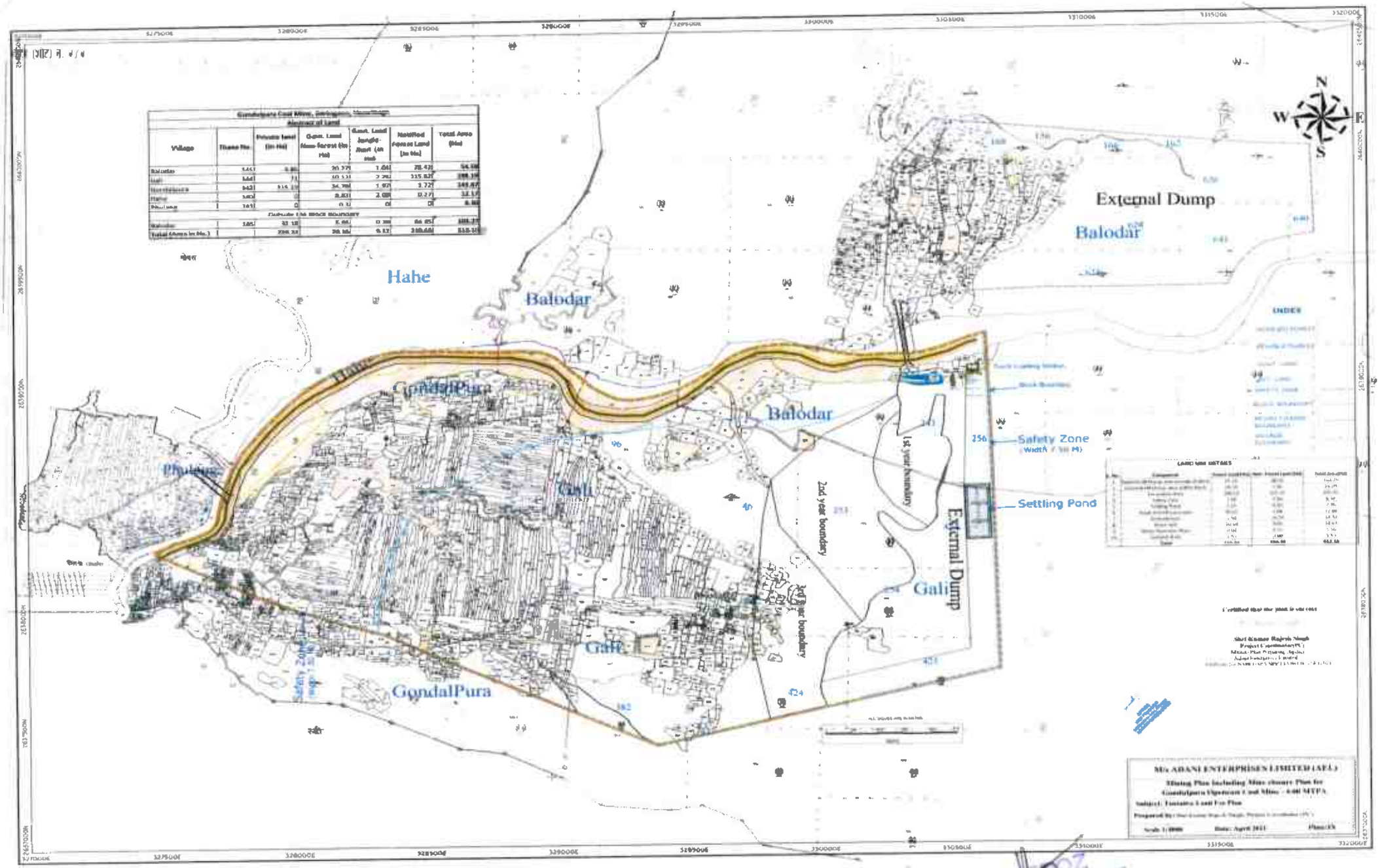


Figure 1.4: Land Use Map of Gondulpara Coal Block

VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

CHAPTER-2

GONDULPARA COAL BLOCK

CHAPTER-2
GONDULPARA COAL BLOCK

1. GONDULPARA COAL BLOCK

The Gondulpara block was explored by CMPDI and GSI, occupies an area of about 4.10 sq km and is situated in the north eastern part of north Karanpura Coalfield. The detailed cardinal points are given in key map.

- Latitude from: 23°50'20" N to 23°51'20" N
- Longitude from: 85°18'20" E to 85°20'15" E

The Gondulpara coal mine is approachable from Badam village through a 3 Km long Kutcha road. The Badam village in turn is connected by a fair weather road to Barkagaon village located on Tandwa-Hazaribagh metalled road at a distance of about 12 Km. The distance from the block to Hazaribagh town is about 35 Km. The nearest major Railway Station is Patratu at a distance of about 35 Km towards south from the block-on Daltonganj-Barkakana-Dehri-on-Sone loop line of the South Eastern Railway. The road leading to the Patratu Railway Station is partly through fair weather and partly through un-metalled road. The nearest Airport is at Ranchi located at a distance of about 120 Km from the block.

The proposed Gondulpara coal mine of 4.0 MTPA capacity is an open cast coal mine to supply for open market, which will fulfill the future power requirement of Jharkhand State and will accelerate the economic development of the State.

For the proposed Gondulpara Coal Mine, the total requirement of land is estimated as 513.18 Ha, which includes 219.80 ha of forest land, 70.16 ha of Govt. non-forest land and 223.22 ha of tenancy land.

The proposed Gondulpara Coal Mine of 4.0 MTPA of capacity which is a commercial coal mine of Adani Enterprises Limited (AEL) allotted under the commercial coal mining auction process. There shall be no restriction to carry on mining operations for own consumption, sale or for any other purpose.

As per the vesting order no: NA-104/10/2020-NA dated 8th March 2021, Government of India; Ministry of Coal has allocated the Gondulpara Coal Mine to Adani Enterprises Limited (AEL).

AFROZ
VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

The ultimate target production capacity is estimated at 4.0 MTPA from Gondulpara Coal Mine. production planned in such way that requirement MTPA in the 4th year of mine operation.

As per the geological report prepared CMPDI, Gondulpara Block has a net geological reserve of 166.185 MT. The mining plan envisages for mining of 120.11 MT of mineable coal reserves within the area. After proving of the balance indicated reserves in the remaining area within the block by additional drilling, mining will be further extended to mine total mineable coal reserves of 114.10 Mt. over a total project life of 32 years at an average overall stripping ratio of 2.45.

L a n nd a

r

The Gondulpara Coal Block covering an area of 409.92 ha, is bounded by latitude 23°50'20" N to 23°51'20" N and longitude 85°18'20" E to 85°20'15" E and is covered by Survey of India Toposheet No. **F45B5** on R.F. 1:50,000. It is located in the north eastern part of the North Karanpura Coalfield and falls within the jurisdiction of Hazaribagh district.

a d a

			r		
	(W)	Barkagaon	Barkagaon	Gondulpara	Gondulpara, Gali, Balodar, Hahe, and Phulang

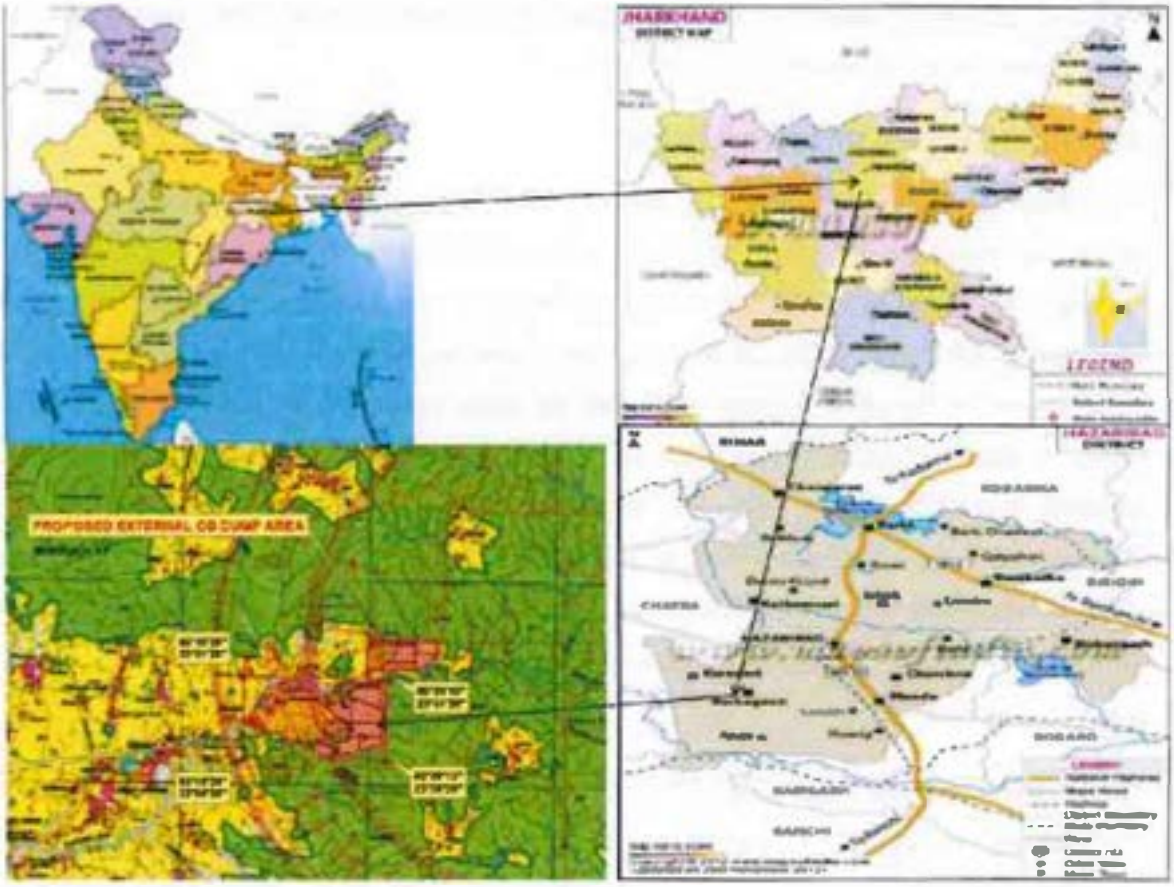
The east-west dimension of Gondulpara block is about 2.7 km and north-south dimension is about 1.6 km. The Gondulpara block is surrounded by Moitra block towards noth, the Badam block towards west, and virgin lower Barakar/Karharbari formation rocks towards east and south.

Additional 103.26 ha non coal bearing land (outside the block boundary), for external dump which will later merged with internal dump, is required to accommodate 50.20 MBCM. To avoid sterilization of coal reserves and for ensuring maximun extraction of coal in order to maximize coal conservation, external OB dumping has been planned outside the Block Boundary.

The proposed area for external OB dump is envisaged north of Badmahi River beyond the Block Boundary towards the east and outside the Block Boundary of Moitra Block.

AFROZ
VICE PRESIDENT
GONDULPARA COAL PROJECT
AMI ENTERPRISES LIMITED

S. No.		Area (Ha)
1.	Gondulpara Coal Block	409.92
2.	External OB dump area	103.26
Total		**513.18**



Buffer

The impact of coal mining will be wide spread due to displacement of people, loss of forest area and displacement of the wildlife present in the area. The forest division which will be impacted is Hazaribagh West.

Perched atop a plateau and surrounded by several mountains and valleys, Hazaribag, popularly known as city of thousand gardens," is the principal town and administrative headquarter of the district. Hazaribag city also serves as Headquarter for the North Chotanagpur Division. The boundary of this district consists of Gaya and Koderma in the north, Giridih and Bokaro in the east, Ramgarh in the South and Palamu and Chatra in the west. The district of Hazaribag is endowed with rich mineral deposits. Coal can be found in abundance here, and there exists sufficient deposits of Limestone, Mica and Quartz. Explorations of these minerals have provided job opportunities to the inhabitants of this district.

Agriculture Profile of Hazaribagh District

Hazaribagh is a largely agricultural district, with many citizens engaging themselves in agriculture and allied activities. Most parts of the district are full of forests and stones. The cultivable land in the district can be divided into two parts namely - Upper land and Lower land. The lands situated on the banks of rivers are fertile and one can get good crop even after using lesser amount of fertilizers in these lands. But the upper land is barren and a huge amount of fertilizers and irrigation is required for cultivation in these lands. Rabi and Kharif crops are generally sown here. Irrigation facility is not adequate in this district due to hilly terrain. However, there are small natural rivulets, which are generally used for irrigation and there is no other natural source of irrigation. Currently, percentage of irrigated area in the district stands at 18.25%, which is considerably below the national average.

Soils

Three types of soils are found in the district.

A. Hill and forest soils of steep slopes and high-dissected region in Barkagaon, Bishungarh and Charhi blocks.
B. Red yellow and light grey soil in Barhi, Ichak, Katkamsandi, keredari and Hazaribagh blocks.
C. Pale yellow, yellow and pinkish deep soil on high micaceous schists.

Drainage

The district is drained by two major rivers, the Damodar and the Barakar River with a few minor tributaries like Naikari, Bhera, Kusum, Bokaro, Mohana and kumari.

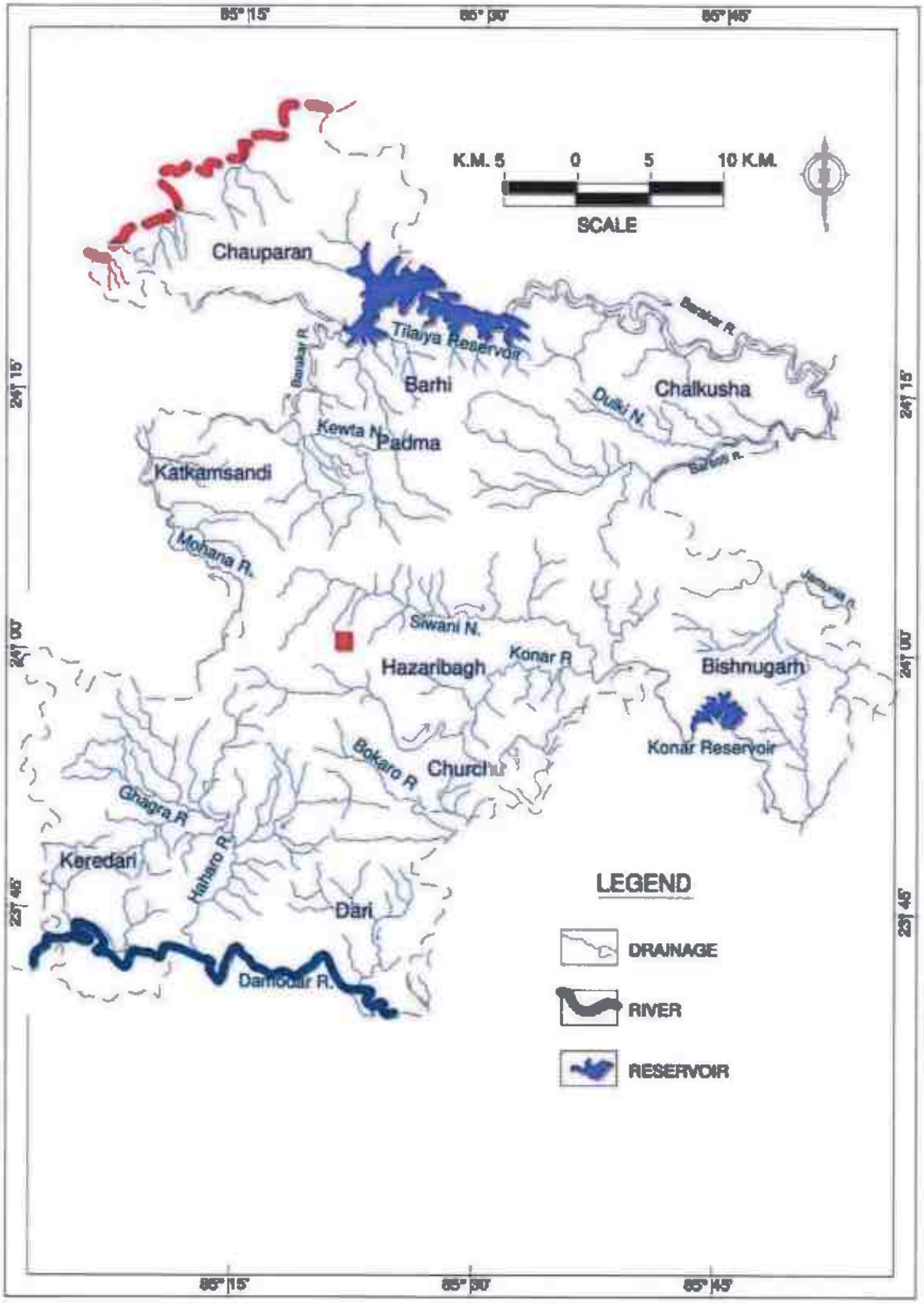


Figure 2.2: Drainage Map of Hazaribagh District

AFROZ
VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

Table 2.3: List of Water Bodies within the Study Area

Haharo nadi 6.6 SW	Badamahi nadi adjacent to mine
Dudhi nadi 2.3 SE	Taria nala
Kunur nadi 8.3 NE	Bokaro nala 3.9 N
Rajhar nala adjacent to mine	Pakwa nala 8.6 WNW
Lathorwa nala 9.8 W	Bingi nala 2.8 SSW
Shermara nala 3.5 SSW	Maramgarha nala 5.9 SE
Kalia nala 1.8 E	Duhu daag Nala 1.8 E

1.2. Forest Jurisdiction and Land Use Pattern

The administrative jurisdiction of proposed Gondulpara coal mine comes under Hazaribagh (W) Forest Division. The Gondulpara Block as per the geological report covers an area of 4.10 km^2 of which 1.54 km^2 (37.6 %) is forest land. The remaining area is tenancy land of 1.90 km^2 Government non forest land of 0.66 km^2.

Out of the total 410 ha of land within the block, 326.01 Ha is proposed to fall within the quarry area while the balance area within the block lies beyond the incrop of the bottom most seam-I.

External dumping sites have been identified. The sites for infrastructure have been envisaged in the eastern part within the block boundary on non-coal bearing area on the up-dip side of the incrop of seam-I.

For the proposed Gondulpara Opencast Project, the total requirement of land is estimated to be 513.18 ha, which includes 219.80ha of forest land and 293.38 ha of non-forest land. The details of 409.92 Ha of land within the Gondulpara Block and 103.26 Ha land for external dumping is given in Table-2.4.

Table-2.4: Land Use Pattern of Gondulpara Coal Block

Ownership	Type of Land Use	Area (Ha)
Tenancy Land	Agricultural	223.22
	Township	
	Grazing	
	Barren	
	Water Bodies	
	Road	
	Community	
Govt. Non Forest Land	Agricultural	70.16
	Township	

Ownership	Type of Land Use	Area (Ha)
	GR z	
	Barren (Road)	
	Other	
Forest Land	Protected Forest Land	
	Revenue Forest (CJBJ)	
Sub Total		219.80
Grand Total		

Table-2.5: Land Use Plan during and Post Mining

Mining Activity	Proposed Land Use Area (Ha)	La Use (E of Life Area	Agricultu Land	Plan tio	Water Body	Public U	Forest land (Returned)	Undis ed bed	Total
Excavation Area	326.01	326.01	--	--	--	--	--	--	--
a. Backfilled Area (in Excavation Area	166.89		--	--	--	--	166.89	--	
b. Excavated Area)	159.12	159.12	--	--	159.12	--	--	--	159.12
Top Soil Dump	22 (upto 6th Year)	22 (upto 6th Year)	--	--	--		--	--	0.00
External Dump	129.35	129.35	--	--	--	--	129.35	--	129.35
	6.50	6.50	--	--	--	--	6.50	--	6.50
Road & Infrastructure area	12.80	12.80	--	--	--	--	12.80	--	12.80
Garland drains	1.53	1.53	--	--	1.53	--	--	--	1.53
Embankment	18.54	18.54	--	--	--	--	18.54	--	18.54
Green Belt	10.69	10.69	--	--		--		--	10.69
Water Reservoir	5.56	5.56	--	--	5.56	--	--	--	5.56
Rationalization area	--		--	--	--	--	--	--	--
Total (exclude &Topsoil area)	**513.18**	**513.18**	--	--	**168.41**	--	**344.77**	--	

**Afforested land shall be returned to forest department, hence, same shall be considered as plantation.*

Source: Mine Plan

APROZ
VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

M/s

th

Sr. No.	RF/PF		
		NW	
		E	
5.			
		S	

1.4. Demographic Pattern

AFROZ
VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

W o o r W o

a a s u i o e

Description	Gondulpara	Gali	Phulang	Hahe	balador
	1245		2		487
Female	1109	156	5		470
Total	**2354**	**317**		**394**	

l l

l e e l l m

t e t t e

e t l n will

CHAPTER-3

BIODIVERSITY OF GONDULPARA COAL BLOCK

CHAPTER-3
BIODIVERSITY OF GONDULPARA COAL BLOCK

1. INTRODUCTION

e r r h r

h

h h

m m a

m e m r

e e

e

t

e m^2 c r

2 t 2

2. a h m^2,

h

r

M o

a t

c

to m

e

c t n e n a

o e a

a l i fol

B D s a

e m h f h

a nt i a i l

Mitragyna parvifolia, Schleichera oleosa, Cochlospermum religiosum, Sterculia villosa, Lannea coromandelica, Buchanania lanzan, Boswellia serrata etc.

Most common shrubs of these forests are *Nyctanthes arborstristis, Cassia opaca, Woodfordia fruticosa, Caesaria tomentosa* etc.

Important climbers are: *Bauhinia vahlii, Millettia auriculata, Butea superb* etc.

C. Northern Dry Mixed Deciduous Forest (5B/C2):

The general appearance of the Northern Dry Deciduous Forest is similar to that of its southern counterpart. This forest type is formed by a mixture of trees particularly all of which are deciduous during the dry season. Some characteristic vegetation species form extensive consociations, notably *Anogeissus latifolia, Adina cordifolia, Mitragyna parvifolia, Cleistanthus collinus* etc. This type of forest occurs extensively on steep slopes and in upper valleys where the soil is scanty.

Jorakath Reserved Forest: Northern Dry Mixed Deciduous Forest (5B/C2)

Comparatively drier lands are covered with this type of forest with low frequency of Sal. Major components of this forest are: *Terminalia tomentosa, Adina cordifolia, Mitragyna parvifolia, Lagerstroemia parviflora, Cleistanthus collinus, Madhuca longifolia, Garuga pinnata, Butea monosperma, Pterocarpus marsupium, Gmelina arborea, Holoptelea integrifolia, Ougeinia oojeinensis, Bombax ceiba, Soymida febrifuga, Buchanania lanzan, Boswellia serrata, Sterculia villosa, Diospyros melanoxylon, Chloroxylon swietenia, Gardenia latifolia, Schleichera oleosa, Limonia acidissima, Alangium lamarckii* and *Dalbergia latifolia* etc.

D. Dry Deciduous Scrub (5/DS1):

The forests described above have been reduced to dry deciduous scrubs near human habitations and mining areas. The only species left in these areas in addition to heavily lopped Sal trees are *Acacia catechu, Flacourtia indica, Carissa opaca, Combretum roxburghii, Zizyphus xylophora* etc.

E. Dry Bamboo Brakes (5/E9):

Mixed deciduous forests at places have been converted into dry bamboo brakes of *Dendrocalmus strictus* forming patches in Hazaribagh range.

Bamboo Brakes

2. DESCRIPTION OF BIODIVERSITY

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.

2.1. 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 3.1.**

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.

2.2. Biodiversity within the Core Zone:

2.2.1. Flora:

The core zone, i.e. Gondulpara Coal Block, in Northern Karanpura Coalfield, in the State of Jharkhand has been allocated to M/s Adani Enterprises Limited (AEL) vide Letter No. NA-104/7/2020-NA dated 8th March 2021 by MoC, GoI.

The Gondulpara Coal Block covering an area of 409.92 ha, is bounded by latitude 23°50'20" N to 23°51'20" N and longitude 85°18'20" E to 85°20'15" E and is covered by Survey of India Toposheet No. F45B5 on R.F. 1:50,000. It is located in the north eastern part of the North Karanpura Coalfield and falls within the jurisdiction of Hazaribagh district. The details of floral diversity of Gondulpara coal block (core zone) is given in **Table-3.1**.

Table-3.1: 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.	*Albizia lebbeck*	Kala Siris	Fabaceae	Tree
7.	*Artocarpus heterophyllus*	Kathal	Moraceae	Tree
8.	*Azadirachta indica*	Neem	Rutaceae	Tree
9.	*Bauhinia purpurea*	Kachnar	Caesalpiniaceae	Tree
10.	*Bauhinia racemosa*	Kathmahula	Caesalpiniaceae	Tree
11.	*Bombax ceiba*	Semal	Malvaceae	Tree
12.	*Boswellia serrata*	Salai	Burseraceae	Tree
13.	*Buchanania lanzan*	Chironji	Anacardiaceae	Tree
14.	*Butea monosperma*	Palash	Fabaceae	Tree
15.	*Cassia fistula*	Amaltas	Caesalpiniaceae	Tree
16.	*Cordia dichotoma*	Lasora	Boraginaceae	Tree
17.	*Corymbia citriodora*	Safeda	Myrtaceae	Tree
18.	*Dalbergia latifolia*	Shisham	Fabaceae	Tree
19.	*Diospyros melanoxylon*	Tendu	Ebenaceae	Tree
20.	*Diospyros montana*	Patvan	Ebenaceae	Tree
21.	*Ficus benghalensis*	Bargad	Moraceae	Tree
22.	*Ficus racemosa*	Gular	Moraceae	Tree
23.	*Ficus religiosa*	Papal	Moraceae	Tree
24.	*Ficus virens*	Pakar	Moraceae	Tree
25.	*Flacourtia indica*	Kaakai	Salicaceae	Tree
26.	*Gardenia gummifera*	Kaapar	Rubiaceae	Tree
27.	*Gardenia latifolia*	Papra	Rubiaceae	Tree
28.	*Garuga pinnata*	Kharpat	Burseraceae	Tree
29.	*Gmelina arborea*	Khamer	Verbenaceae	Tree
30.	*Grewia tiliifolia*	Dhankat	Tiliaceae	Tree
31.	*Haldina cordifolia*	Haldu	Rubiaceae	Tree
32.	*Holarrhena pubescens*	Kutki	Apocynaceae	Tree
33.	*Holoptelea integrifolia*	Chilbil	Ulmaceae	Tree
34.	*Lagerstroemia parviflora*	Sendha	Lythraceae	Tree
35.	*Lannea coromandelica*	Gunja	Anacardiaceae	Tree
36.	*Madhuca longifolia*	Mahua	Sapotaceae	Tree
37.	*Mallotus philippensis*	Sindoor	Euphorbiaceae	Tree
38.	*Mangifera indica*	Aam	Anacardiaceae	Tree
39.	*Melia azedarach*	Bakain	Meliaceae	Tree
40.	*Mitragyna parvifolia*	Kaima	Rubiaceae	Tree

SN.	Scientific Name	Local Name	Family	Habit
41.	*Moringa oleifera*	Sainjna	Moringaceae	Tree
42.	*Morus alba*	Sehtut	Moraceae	Tree
43.	*Phoenix sylvestris*	Khajur	Arecaceae	Tree
44.	*Phyllanthus emblica*	Aaonla	Euphorbiaceae	Tree
45.	*Pongamia pinnata*	Karanj	Fabaceae	Tree
46.	*Pterocarpus marsupium*	Bijasal	Fabaceae	Tree
47.	*Shorea robusta*	Sal	Dipterocarpaceae	Tree
48.	*Sterculia urens*	Kullu	Sterculiaceae	Tree
49.	*Sterculia villosa*	Udaal	Sterculiaceae	Tree
50.	*Syzygium cumini*	Jamun	Myrtaceae	Tree
51.	*Tamarindus indica*	Imli	Caesalpiniaceae	Tree
52.	*Tectona grandis*	Sagaun	Verbenaceae	Tree
53.	*Terminalia alata*	Sanja	Combretaceae	Tree
54.	*Terminalia arjuna*	Arjun	Combretaceae	Tree
55.	*Terminalia bellirica*	Bahera	Combretaceae	Tree
56.	*Terminalia catappa*	Badam	Combretaceae	Tree
57.	*Terminalia chebula*	Harra	Combretaceae	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

SN.	Scientific Name	Local Name	Family	Habit
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
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	Papaveraceae	Herb
11.	*Bacopa monnieri*	Brahmi	Scrophulariaceae	Herb
12.	*Bacopa procumbens*	Jal-Neem	Scrophulariaceae	Herb
13.	*Boerhavia diffusa.*	Raktpunarwa	Nyctaginaceae	Herb
14.	*Cassia tora*	Chakramard	Caesalpiniaceae	Herb
15.	*Catharanthus roseus*	Sadabahar	Apocynaceae	Herb
16.	*Centella asiatica*	Mandukparni	Apiaceae	Herb
17.	*Chlorophytum tuberosum*	Safed Musli	Liliaceae	Herb
18.	*Cleome gynandra*	Hurhur	Capparaceae	Herb
19.	*Commelina benghalensis*	Kanchara	Commelinaceae	Herb
20.	*Commelina diffusa* Burm	Kanshura	Commelinaceae	Herb
21.	*Convolvulus prostratus*	Shankhpushpi	Convolvulaceae	Herb
22.	*Crotalaria prostrate*	Kartik Jhumka	Fabaceae	Herb
23.	*Curcuma angustifolia*	Tikhur	Zingiberaceae	Herb
24.	*Curculigo orchioides*	Kali Musli	Hypoxidaceae	Herb
25.	*Curcuma aromatica*	Van Haldi	Zingiberaceae	Herb
26.	*Cyperus rotundus*	Motha	Cyperaceae	Sedges
27.	*Dentella repens*	Parpat	Rubiaceae	herb
28.	*Desmodium triflorum*	Desmodium	Fabaceae	Herb
29.	*Eclipta prostrata*	Bhringraj	Asteraceae	Herb

SN.	Scientific Name	Local Name	Family	Habit
30.	*Elytraria acaulis*	Sahasramuniya	Acanthaceae	herb
31.	*Euphorbia hirta*	Doodhi	Euphorbiaceae	Herb
32.	*Evolvulus alsinoides*	Sakhpushpi	Convolvulaceae	Herb
33.	*Fimbristylis dipsacea*	NA	Cyperaceae	Sedges
34.	*Fimbristylis falcata*	Hathi Paw	Cyperaceae	Sedges
35.	*Fumaria indica*	Pitpapra	Papaveraceae	Herb
36.	*Heliotropium indicum*	Hastimundi	Boraginaceae	Herb
37.	*Ipomoea eriocarpa*	Besharam	Convonvulaceae	Herb
38.	*Justicia quinqueangularis*	Justicia	Acanthaceae	Herb
39.	*Leucas aspera*	Bhondaki	Lamiaceae	Herb
40.	*Melilotus indica*	Van Maithi	Fabaceae	herb
41.	*Ocimum basilicum*	Ban Tulsi	Lamiaceae	Herb
42.	*Oxalis corniculata*	Teenpati	Oxalidaceae	Herb
43.	*Oxalis corniculata*	Teen Patti	Oxalidaceae	Herb
44.	*Oxalis richardiana*	Teenpatti	Oxalidaceae	Herb
45.	*Phyllanthus amarus*	Bhuin Anwla	Euphorbiaceae	Herb
46.	*Physalis minima*	Chirponta	Solanaceae	Herb
47.	*Polygonum barbatum*	Polygonum	Polygonaceae	Herb
48.	*Polygonum glabrum*	Polygonum		Herb
49.	*Rauvolfia serpentina*	Sarpandha	Apocynaceae	Herb
50.	*Rungia pectinata*	Rungia	Acanthaceae	Herb
51.	*Sida acuta* Burm.	Mahabala	Malvaceae	Herb
52.	*Sida cordifolia*	Kharenti	Malvaceae	Herb
53.	*Sida rhombifolia*	Atibala	Malvaceae	Herb
54.	*Solanum nigrum*	makoya	Solanaceae	Herb
55.	*Solanum virginianum*	Katai	Solanaceae	Herb
56.	*Tridax procumbens*	Khal Muriya	Asteraceae	Herb
57.	*Triumfetta pentandra*	Chipki	Tiliaceae	Herb
58.	*Triumfetta rhomboidea*	Chipki	Tiliaceae	Herb
59.	*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

SN.	Scientific Name	Local Name	Family	Habit
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)

2.2.2. 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 Gondulpara coal block (Core Zone) is given in Table-3.2.

Table-3.2: 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	Indian Wolf	*Canis lupus callipes*	I	LC #
4	Short Nosed Fruit Bat	*Cynopterus sphinx*	V	LC #
5	Wild Cat	*Felis chaus*	II	LC #

Sl. No.	Common Name	Scientific Name	Schedule as per WPA, 1972	Conservation Status as per IUCN
6	Five striped Palm squirrel	*Funambulus pennanti*	IV	LC #
7	Mongoose	*Herpestres edwardsii*	IV	LC #
8	Indian Porcupine	*Hystrix indica*	IV	LC #
9	Hare	*Lepas nigricollis*	IV	LC #
10	Rhesus Macaque (Monkey)	*Macaca mulatta*	II	LC #
11	Indian Pangolin	*Manis crassicaudata*	I	EN #
12	Indian Field Mouse	*Mus booduga*	V	LC #
13	Hedgehog	*Paraechinus micropus*	IV	LC #
14	Flying Fox	*Pteropus giganteus*	V	LC #
15	Common house Rat	*Rattus rattus*	V	LC #
16	Hanuman Langur	*Semnopithecus entellus*	II	LC #
17	Musk Shrew	*Suncus murinus*	-	LC #
18	Wild Pig	*Sus scrofa*	III	LC #
19	Common Fox	*Vulpes bengalensis*	II	LC #
20	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 #

Sl. No.	Common Name	Scientific Name	Schedule as per WPA, 1972	Conservation Status as per IUCN
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	Racket-tailed Drongo	*Dicrurus paradiseus*	IV	LC #
36	Lesser Golden Backed Woodpecker	*Dinopium benghalense*	IV	LC #
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 #

Sl. No.	Common Name	Scientific Name	Schedule as per WPA, 1972	Conservation Status as per IUCN
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	Golden Oriole	*Oriolus oriolus*	IV	LC #
71	Black Headed Oriole	*Oriolus xanthornus*	IV	LC #
72	Tailor Bird	*Orthotomus sutorius*	IV	LC #
73	Grey Tit	*Parus major*	IV	LC #
74	Yellow-cheeked Tit	*Parus xanthogenys*	IV	LC #
75	House Sparrow	*Passer domesticus*	IV	LC #
76	Pea-fowl	*Pavo cristatus*	I	LC #
77	Jungle Bush Quail	*Perdicula asiatica*	IV	LC #
78	Small Minivet	*Pericrocotus cinnamomeus*	IV	LC #
79	Scarlet Minivet	*Pericrocotus flammmeus*	IV	LC #
80	Black Redstart	*Phoenicurus ochruros*	IV	LC #
81	Yellow-fronted Pied Woodpecker	*Picoides mahrattensis*	IV	LC #
82	Indian Pitta	*Pitta brachyura*	IV	LC #
83	Weaver Bird	*Ploceus philippinus*	IV	LC #
84	Slaty-headed Scimitar Babbler	*Pomatorhinus horsfieldi schisticeps*	IV	LC #
85	Ashy Wren-warbler	*Prinia socialis*	IV	LC #
86	Blossom headed Parakeet	*Psittacula cyanocephala*	IV	LC #
87	Large Indian Parakeet	*Psittacula eupatria*	IV	NT #
88	Rose Ringed Parakeet	*Psittacula krameri*	IV	LC #
89	Red Vent Bulbul	*Pycnonotus cafer*	IV	LC #
90	Red Whiskered Bulbul	*Pycnonotus jocosus*	IV	LC #
91	Pied Bush-chat	*Saxicola caprata*	IV	LC #
92	Collared Bush-chat	*Saxicola torquata*	IV	LC #
93	Indian Robin	*Saxicoloides fulicata*	IV	LC #
94	Chestnut-bellied Nuthatch	*Sitta castanea*	-	LC #
95	Velvet-fronted Nuthatch	*Sitta frontalis*	-	LC #
96	Crested Serpent Eagle	*Spilornis cheela*	-	LC #
97	Spotted Dove	*Streptopelia chinensis*	IV	LC #

Sl. No.	Common Name	Scientific Name	Schedule as per WPA, 1972	Conservation Status as per IUCN
98	Indian Ring Dove	*Streptopelia decaocto*	IV	LC #
99	Red Turtle Dove	*Streptopelia tranquebarica*	IV	LC #
100	Pied Mynah	*Sturnus contra*	IV	LC #
101	Grey-Headed Mynah	*Sturnus malabaricus*	IV	LC #
102	Black-headed Mynah	*Sturnus pagodarum*	IV	LC #
103	Rosy Pastor	*Sturnus roseus*	IV	LC #
104	Paradise Flycatcher	*Terpsiphone paradisi*	IV	LC #
105	Black Headed Ibis	Threskiornis *melanocephalus*	IV	NT#
106	Indian Grey Hornbill	*Tokus birostris*	-	LC #
107	Jungle Babbler	*Turdoides striatus*	IV	LC #
108	Hoopoe	*Upupa epops*	IV	LC #
109	Red Wattled Lapwing	*Vannelus indicus*	IV	LC #
110	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

2.3. Biodiversity within the Buffer Zone:

2.3.1. Flora:

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 Northern Dry Mixed Deciduous 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 robusta, Tectona grandis, 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 Final Report of Integrated Wildlife Management Plan for North-Karanpura Coal Block, Jharkhand has been studied out of which the main associates of Sal as observed in the field are furnished below in **Table No. 3.3.**

Table-3.3: 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

SN.	Scientific Name	Local Name	Family	Habit
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
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

SN.	Scientific Name	Local Name	Family	Habit
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
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

SN.	Scientific Name	Local Name	Family	Habit
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
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

SN.	Scientific Name	Local Name	Family	Habit
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
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

SN.	Scientific Name	Local Name	Family	Habit
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
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

SN.	Scientific Name	Local Name	Family	Habit
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
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

SN.	Scientific Name	Local Name	Family	Habit
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

2.3.2. 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-3.4**).

Table-3.4: 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	Mongoose	*Herpestres edwardsii*	IV	LC #
14	Striped Hyena	*Hyaena hyaena*	III	NT #
15	Indian Porcupine	*Hystrix indica*	IV	LC #
16	Hare	*Lepas nigricollis*	IV	LC #
17	Otter / Odha	*Luthra luthra*	II	NT#
18	Rhesus Macaque	*Macaca mulatta*	II	LC #
19	Indian Pangolin	*Manis crassicaudata*	I	EN #
20	Honey Badger	*Mellivora capensis*	I	LC #
21	Sloth Bear	*Melursus ursinus*	I	Vu #
22	Barking Deer	*Muntiacus muntjak*	III	LC #
23	Indian Field Mouse	*Mus booduga*	V	LC #
24	Leopard	*Panthera pardus*	I	Vu #
25	Hedgehog	*Paraechinus micropus*	IV	LC #
27	Indian Pipistrelle	*Pipistrellus mimus*	IV	LC #
28	Flying Fox	*Pteropus giganteus*	V	LC #
29	Common house Rat	*Rattus rattus*	V	LC #
30	Hanuman Langur	*Semnopithecus entellus*	II	LC #
31	Musk Shrew	*Suncus murinus*	-	LC #
32	Wild Pig	*Sus scrofa*	III	LC #
33	Mouse Deer	*Tragulus meminna*	I	LC #
34	Indian Civet	*Viverricula indica*	II	LC#
35	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 #

VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

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

VICE PRESIDENT GONDULPARA COAL PROJECT DAMI ENTERPRISES LIMITED

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,*

2.4. 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 Badamahi River and Rajhar Nala adjacent to the mine lease area and Haharo Nadi, Dudhi Nadi, Taria Nala, Bokaro Nala, Kunur Nadi, Pakwa Nala, Lathorwa nala, Bingi Nala, Shermara nala, Maramgarha Nala, Kalia Nala, Duhu daag Nala 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

2.4.1. 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 3.5**). The standard flora and other literature were followed for the qualitative evaluation of Plankton.

Table 3.5: 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.	

2.4.2. 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: 3.6 Common fish species recorded in study area

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 mullya*
7.	Malya	*Oreochromis mosambicus*
8.	Darai	*Puntius sarana*
9.	Khavli	Puntius sophore
10.	Dara	*Rasbora daniconius*
11.	Chikli	*Indoreonectes evezardi*
12.	Chikani	*Lepidocephalichthys thermalis*

2.4.3. 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 3.7: 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

CHAPTER-4

SCHEDULED BIODIVERSITY AND THEIR MANAGEMENT

CHAPTER-4
SCHEDULED BIODIVERSITY AND THEIR MANAGEMENT

1. INTRODUCTION

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-4.1**. 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-4.1: 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.	*Tragulus meminna*	Mouse Deer	Schedule-I
	Reptiles		
8.	*Varanus bengalensis*	Bengal Monitor Lizard	Schedule-I
9.	*Python molurus*	Python	Schedule-I

		Birds	
10.	*Pavo cristatus*	Indian Peafowl	Schedule-I
11.	*Aquila rapax*	Tawny Eagle	Schedule-I
12.	*Gyps bengalensis*	White Rumped Vulture	Schedule-I
13.	*Nisaetus cirrhatus*	Crested Hawk Eagle	Schedule-I
14.	*Anthracoceres coronatus*	Pied Hornbill	Schedule-I
15.	*Ciconia episcopus*	White stork	Schedule-I
16.	*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:

2. STATUS OF SCHEDULE-I FAUNA PRESENT IN THE STUDY AREA

2.1. Sloth Bear (*Melursus ursinus*):

The allotted coal block area has both Protected 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.

2.2. 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 Hazaribagh and Palamau of Jharkhand 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

AFROZ
VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

Jharkhand (688 elephants), Chattisgarh (247 elephants) as of 2012. Jharkhand state is more famous for the residence as well as movement of elephants. The movement of elephants and other mega wildlife in North Karanpura Coal Field is shown in **Figure-4.1 i.e.** a map showing "*Connectivity plan between palaamau tiger reserve and Hazaribagh wildlife sanctuary, Hazaribagh of north karanpura coal block in Jharkhand*" obtained from forest department, Hazaribagh 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.

Table-4.2: 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

Sr. No.	Botanical Name	*Local Name*
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
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.

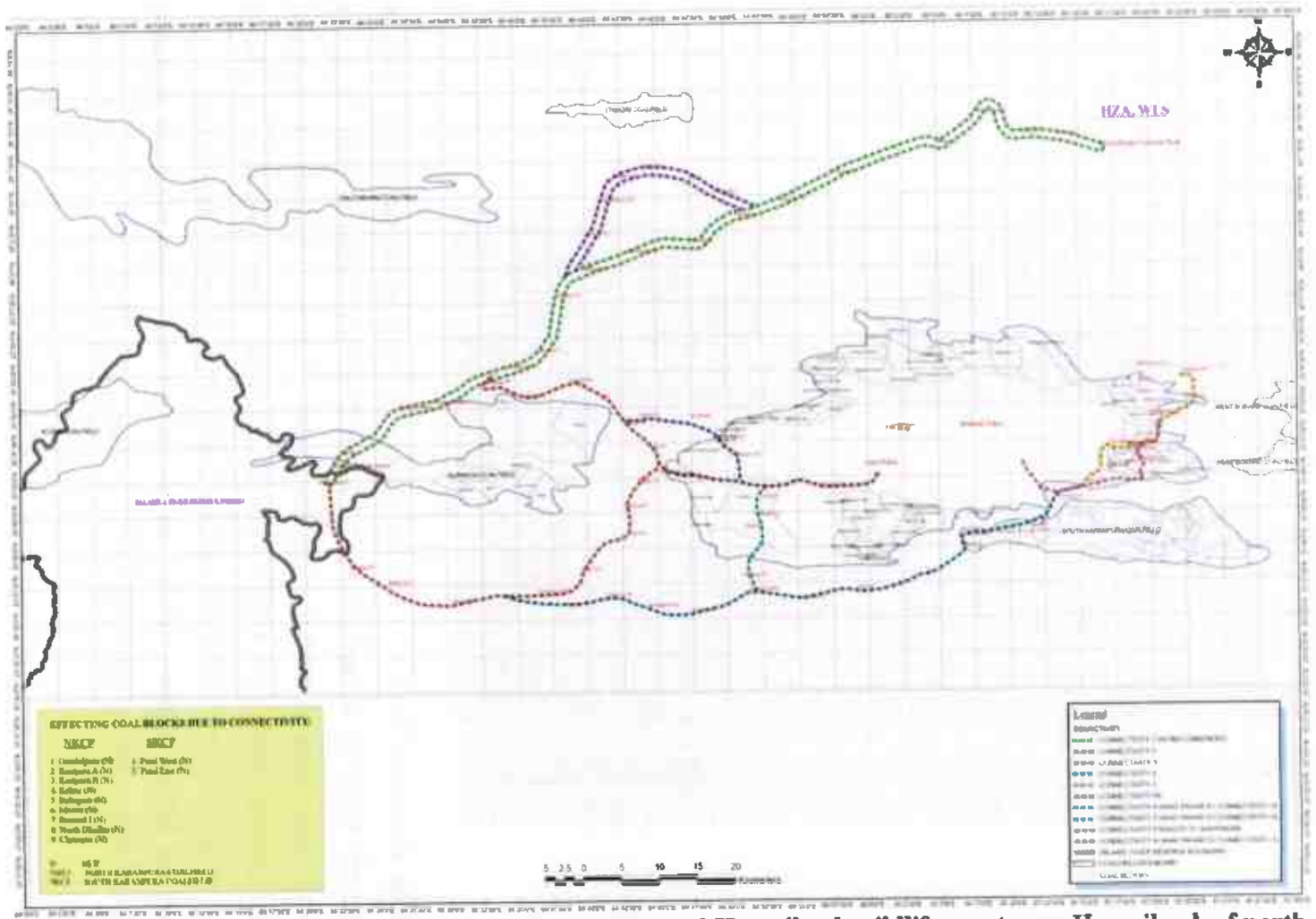


Figure 4.1: Connectivity plan between palaamau tiger reserve and Hazaribagh wildlife sanctuary, Hazaribagh of north karanpura coal block in Jharkhand

2.3. 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).

2.4. 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.

2.5. 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).

2.6. 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.

2.7. 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.

2.8. 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.

2.9. 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.

2.10. 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-4.3**).

Table-4.3: 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.

3. 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 Hazaribagh (W) 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 Gondulpara coal mine lease area. The movement of elephants in Hazaribagh (W) Forest Division is shown in **Figure-4.1**.

4. 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 Jharkhand 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 Jharkhand forest department is actually working on a very elaborate plan in this direction.

5. 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.

6. WORKING PLAN PRESCRIPTIONS

The present report of Integrated Wildlife Management Plan of North-Karanpura Coal Block, Jharkhand is valid for Gondulpara Coal Mine, Hazaribagh (W) 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.

7. 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.

8. 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 prime facility 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.

CHAPTER-5

THE PERCEIVED IMPACTS OF THE PROJECT ON THE ENVIRONMENT

CHAPTER-5
THE PERCEIVED IMPACTS OF THE PROJECT ON THE ENVIRONMENT

1. INTRODUCTION

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 Gondulpara 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 Gondulpara coal mine is approachable from Badam village through a 3 Km long Kutcha road. The Badam village in turn is connected by a fair weather road to Barkagaon village located on Tandwa-Hazaribagh metalled road at a distance of about 12 Km. The distance from the block to Hazaribagh town is about 35 Km. The nearest major Railway Station is Patratu at a distance of about 35 Km towards south from the block-on Daltonganj-Barkakana-Dehri-on-Sone loop line of the South Eastern Railway. The road leading to the Patratu Railway Station is partly through fair weather and partly through un-metalled road. The nearest Airport is at Ranchi located at a distance of about 120 Km from the block.

The proposed Gondulpara coal mine of 4.0 MTPA capacity is an open cast coal mine to supply for open market, which will fulfill the future power requirement of Jharkhand State and will accelerate the economic development of the State.

For the proposed Gondulpara coal mine, the total requirement of land is estimated as 513.18 Ha, which includes 219.80 ha of forest land, 70.16 ha of Govt non-forest land and 223.22 ha of Tenancy land.

Almost the entire block is covered by soil/alluvium. The maximum depth of soil/weather mantle as per borehole records comes to 21.0 m. However, generally it varies 8-12m. It is commonly dirty white to reddish brown in colour. The Gondulpara block represents a rugged topography with hills in the eastern part and river valley toward west and north. Ahill range traverses along the eastern and southeastern parts covering substantial area of the block. Hills are steep with maximum elevation of over 516 m. southeast of borehole CMKB-144. The difference between foot hills and the highest peak is about 60m. The minimum elevation along the Badmahi River is about 417m. The Badmahi River, flowing southerly through the block in the northern and western parts controls the main drainage of the area. Many rivulets originate from the hill range and feed the Badmahi River.

The Badmahi River in turn joins the Damodar River towards south. The Badmahi River is perennial water sources for the region.The climate is tropical with severe summer. The temperature during summer (March to June) goes as high as 45C. Summer days are hot with dusty winds but nights are generally pleasant. The minimum summer temperature is around 20^0C. The winters (November to February) are cold and the minimum temperature recorded is 1^0C. The rainy season is generally June to October. The total rainfall on an average is about 1100mm, of which 69 precipitations is during rainy season only.

Six villages (Balodar, Gali, Gondulpara , Hahe , Phulang and Balodar) are located in / immediate periphery of the block. Diversion of road is not required as there is only one road to connect the Gondulpara village which will be displaced during the mining operation. Few Small ponds and dug wells in the area. These are utilized for irrigation and drinking water purpose. Nala/River Badmahi river flows from east to west, along the northern boundary block. An embankment is planned along the Badmahi river. One nala

flowing from south to north (tributary of Badmahi river) which will be diverted along the eastern boundary of block, bund is also proposed along the diverted route.

Gondulpara Coal Block earier allotted to Tenughat EMTA Coal Mines Limited (JV of Tenughat Vidyut Nigma Limited and Eastern Minerals Trading Agency). The block was than de-allocated by Ministry of coal after Honble Supreme Court verdict dated 24 Sept 2014. The block comes under commercial coal block auction and won by Adani Enterprises Limited. As per CMDPA coal production date is June 2025.

Badmahi River flows from east to west, along the northern boundary block. An embankment is planned along the Badmahi River. One nala flowing from south to north (joins Badmahi river) which will be diverted along the Eastern boundary of block a bund is also proposed along the diverted route.

Table-5.1: Configuration of HEMM/Equipments Proposed

Sl No	Particulars	Capacity	No. of equipment
	HEMM		
1.	Rear Dumper	30	24
2.	Blast Hole Diesel Drill	250	2
3.	Vibratory Compactor	1	1
4.	Tyre Handler	1	1
5.	Water Sprinkler	28	2
6.	Blast Hole Diesel Drill	160	1
7.	Dozer (Ripper Attachment)	320	2
8.	Crane	40	1
9.	Crane	10	2
10.	Diesel Bowser	10	1
11.	Explosive Van	1	1
12.	Fire Tender	1	1
13.	Tipping Truck	10	1
14.	Heavy Duty Toe Truck	1	1
15.	Grader	280	2
16.	Crane	80	1
17.	Surface Miner	690	2
18.	Farm Tractor	1	1
19.	Diesel Hvd. Backhoe	4.5	2
20.	FE Loader	5	2

Sl No	Particulars	Capacity	No. of equipment
	HEMM		
21.	Blast Hole Diesel Drill	160	3
22.	Fork Lift Truck	1	1
23.	Maintenance Van	1	1
24.	Diesel Backhoe	1	1
25.	Dozer	1	1
26.	Diesel Hvd. Shovel	4.5	3
27.	Dozer	525	3
28.	FE Loader	5	1
29.	Dozer	165	1
30.	Grader	145	1
31.	Ambulance	1	1
32.	Grader	1	1
33.	Rear Dumper	100	16
34.	Diesel Hvd. Shovel	11	2
35.	Boom Truck	1	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. IMPACT IN THE CORE ZONE

2.1. Impact on Soil

Land degradation is the main impact of the mining. As mentioned above, the existing topography of the core zone (Gondulpara 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 21.0 cm.

APPROVED
VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

2.2. Geomorphic Changes

This is a long term impact in which the original surface is disturbed, removed and redistributed. 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.

2.3. Loss of Forest Cover (Habitat)

Out of the total forest area of 219.80 Ha, except, the safety zone of 6.5 Ha, all forest growth will be cleared within the lease period 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.

2.4. Soil Erosion

Although provision has been made in the proposed land use Plan for storage of top soil over 22.0 Ha (Internal Dump upto 6th Year) and 129.35 Ha (External Dump), 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.

2.5. 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 Badamahi River. The sediment load will render it unfit for use by animals.

2.6. 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.

2.7. 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.

2.8. 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.

2.9. 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.

2.10. 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.

2.11. 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.

2.12. Invasive Weeds

Weeds like *Xanthium strummarium*, *Parthenium hysterophorus*, *Chromolaena odorata*, *Ocimum gratissimum* 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* 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.

2.13. 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).

2.14. 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.

3. IMPACT IN THE ZONE OF INFLUENCE (10 KM RADIUS)

3.1. Depletion of Forest Growth

Of the total study area of 513.18 Ha, 219.80 Ha is forest area present in mining lease area and external dump 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.

3.2. 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.

3.3. 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.

3.4. 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.

3.5. 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.

3.6. Loss of Natural Water Resources

There are 10 nala and 4 Rivers located in the study area of Gondulpara Coal Block. Rajhar nala and Badamahi Nadi is located adjacent to 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.

3.7. 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.

3.8. 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.

3.9. 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.

3.10. 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.

3.11. 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.

3.12. 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 behavior.

3.13. 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.

3.14. Artifacts within the Landscape

a) Road Link:

The project site is connected by road network. The Gondulpara coal mine is approachable from Badam village through a 3 Km long Kutcha road. The Badam village in turn is connected by a fair weather road to Barkagaon village located on Tandwa-Hazaribagh metalled road at a distance of about 12 Km.

b) Rail Link:

The nearest major Railway Station is Patratu at a distance of about 35 Km towards south from the block-on Daltonganj-Barkakana-Dehri-on-Sone loop line of the South Eastern Railway. The road leading to the Patratu Railway Station is partly through fair weather and partly through un-metalled road.

c) 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-6

OBJECTIVES OF MANAGEMENT AND MITIGATION STRATEGIES

CHAPTER-6
OBJECTIVES OF MANAGEMENT AND MITIGATION STRATEGIES

1. INTRODUCTION

Coal is the most important and abundant fossil fuel in India. India is the third largest coal producer in the world. Coal accounts for about 55% of India's current commercial energy consumption. It is predicted to remain *the king* in the energy mix in India, with the Planning Commission of India stating that it will remain the most viable fuel for driving sustained economic growth over the next 25 years (Lahiri-Dutt, 2007). Power sector is the single biggest consumer of coal in India, using about 75% of the total coal consumed in the country and about 80% of the domestic production. Other industries like steel, cement, fertilizers, chemicals, paper and thousands of medium and small-scale industries are also dependent on coal for their process and energy requirements. Coal accounts for about 80% of India's total mining.

India has a long history of commercial coal mining covering nearly 220 years from 1774 by John Sumner and Suetonius Grant Heatly, East India Company in the Raniganj Coalfield along the Western bank of river Damodar. The Coal Mines (Nationalization) Act of 1973 reinforces the spirit of the MMDRA because by nationalizing the mines, it firmly consigned coal to the purview of the public sector. The Coal Mines (Nationalization) Act 1973 categorically states that 'no person, other than the central government or a government company or a corporation owned, managed or controlled by the central government shall carry on coal mining operation in India, in any form'.

1.1. Objectives 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.

1.2. Strategies to Mitigate and Minimize adverse Impacts

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

1.3. Strategies for Mining Lease Area

1.3.1. Protection of Virgin Forest

Total ***02 Nos. of Van Sahayaks*** (@ one person/Van Sahayak per 110 ha) will be engaged for protection of 219.80 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.

1.3.2. 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 6.5 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.

AFROZ
VICE PRESIDENT
GONDULPARA COAL PROJECT
ADANI ENTERPRISES LIMITED

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 4th or 5th year. Stone/clod mulching will be done to keep the weed growth under check. Trees to be used in plantation are as under:

Table-6.1: 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*

AFROZ
VICE PRESIDENT
GONDULPARA COAL PROJECT

8	Kasai	*Bridelia restusa*
9	Neem	*Azadirachta indica*
10	Jari	*Ficus retusa*

1.3.3. Soil Erosion Control

The floor of Seam-I has been considered as the floor of the opencast mine. The maximum floor depth of these seams from surface is around 300 m in the block. Occurrence of thick Seam-I (11.07m - 20.43m) and Scam-11 (7.39m - 18.10m). Additionally, Other seams namely Seam V, IVD, IV and Scam III & its split seams have thicknesses averaging 4m to 9m. Coal loss in such thick scam conditions can be minimized by opencast mining method.

The depth and average coal thickness offers a low average stripping ratio of 1.69 cum/t (for 'Pit - I') and 2.45 cum/t (with future extension pit) and this makes the opencast mining an obvious choice.

The existence of very low cover for entry to bottom-most seam (Seam-I) from its incrop in the eastern part of the block makes opencast mining an obvious choice. However, the eastern part of the block being under forestland, the mine entry has been envisaged from a surface RL of 435m in the south-central part to reach Seam-II floor an RL of 390m.

Topsoil details:

1) Height of Topsoil dump : 3-6 meters
2) Year of reclamation : after 5th year of mine operation.

1.3.4. 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. diameter 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.*

1.3.5. 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.

1.3.6. 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.

1.3.7. 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 diameter 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.

1.3.8. 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.

1.4. Conservation Strategies for Zone of Influence

1.4.1. Studies on Habitat Utilization of Mega Wildlife

Habitat utilization by animals changes over time to time depending on the 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.

1.4.2. 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.

1.4.3. 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.

1.4.4. 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 Hazaribagh (W) 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.

1.4.5. 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, 5 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.

1.4.6. Corpus Fund

A corpus fund at the Project cost will be operated by DFO, Hazaribagh (W) 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.

1.4.7. Conveyance facility for DFO/Forest Survey Team and ancillary expenditure

One Vehicle will be provided to DFO, Hazaribagh 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.

1.4.8. Monitoring Committee

A monitoring committee under the Chairmanship of Conservator of Forests will be formed where D.F.O., Hazaribagh 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 Hazaribagh Division will be special invitees. A representative of User Agency shall also be invited to such meeting.

1.4.9. Safeguard along Roadside

The project site is connected by road network. The Gondulpara coal mine is approachable from Badam village through a 3 Km long Kutcha road. The Badam village in turn is connected by a fair weather road to Barkagaon village located on Tandwa-Hazaribagh metalled road at a distance of about 12 Km.

There is movement of mega wildlife 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 North Karanpura 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-7

FINANCIAL PROJECTION AND MITIGATION STRATEGIES

CHAPTER-7
FINANCIAL PROJECTION AND MITIGATION STRATEGIES

1. Interventions to be implemented by the project authority inside the project area with justification

All measures are discussed in Chapter-6. 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.

Habitat is the key to any forest/wildlife conservation. This is also the livelihood source of thousands of villagers. The habitat will be under great stress when operation of Gondulpara Coal Mine and other coal mines in NKCB start operation. The issues related to habitat are addressed through fire management and eco-restoration though the other suggested activities also contribute to the habitat conservation. The budget for Habitat and wildlife management will be Rs. 3.786 Lakh/ha of lease area.

Budget for Wildlife conservation plan	=	Mine lease area x Rs. 3.786 Lakh
	=	513.18 x 3.786
	=	1942.90 Lakh

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

Table-7.1: PROPOSED BUDGET FOR INTERVENTION BY HAZARIBAGH WEST FOREST DIVISION

Sr. No.	Name of the activity	Year wise Financial Targets (Rs in Lakh)										Total
		1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	
A	**HABITAT MANAGEMENT**											
I	**Management of Food**											
1	Habitat enrichment with plantation of local species/fruits bearing species (33% of Mine Lease Area i.e. 170Ha)											
	RDF Plantation: 100 Ha (1st Year Advance Work)	185.514	81.399	43.539	32.181	18.930	17.037	--	--	--	--	378.60
	RDF Plantation: 70 Ha (2nd Year Advance Work)	--	107.114	46.999	25.139	18.581	10.930	9.837	--	--	--	218.60
	Silvicultural Operations: 100 Ha (1st Year Advance Work)	185.514	81.399	43.539	32.181	18.930	17.037	--	--	--	--	378.60
	Silvicultural Operations: 70 Ha (2nd Year Advance Work)	--	107.114	46.999	25.139	18.581	10.930	9.837	--	--	--	218.60
2	Provision of Salt lick	1.00	--	1.00	--	1.00	--	1.00	--	1.00	--	5.00
II	**Management of Water**											
3	Desilting, Renovation & Maintenance of water holes	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	--	--	72.00
4	Construction of 5 check dam/water harvesting/year (5 year) in villages of impact area of the project @ 8 lakh	--	40.00	--	40.00	--	40.00	--	40.00	--	40.00	200.00
5	Soil & moisture conservation measures (Gully plugging, Contour trench, silt detention, dam etc.) on degraded forest area	12.00	12.00	12.00	12.00	12.00	12.00	12.00	--	--	--	84.00
III	**Management of Shelter**											
6	Preparation of fire management theme	3.50	--	--	--	--	--	--	--	--	--	3.50

Sr. No.	Name of the activity	Year wise Financial Targets (Rs in Lakh)										Total
		1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	
	plan for fire sensitive zone of Project Area											
7	Fire line cutting & Controlled burning along forest area	3.00	3.00	3.00	3.00	3.00	--	--	--	--	--	15.00
8	Fire fighting Equipments	2.50	--	2.50	--	2.50	--	--	--	--	--	7.50
9	Fire protection through VFPC/Fire Watcher and awareness on role of fire in biodiversity conservation	2.00	--	2.00	--	2.00	--	2.00	--	2.00	--	10.00
10	Weed eradication and its rehabilitation by plantation	--	3.00	--	3.00	--	3.00	--	3.00	--	3.00	15.00
B	**ECO DEVELOPMENT WORK**											
11	Entry point activities with capacity building and livelihood for villagers	20.00	--	20.00	--	20.00	--	20.00	--	20.00	--	100.00
12	Payment towards cost of establishment wild animals rescue team including services of wildlife expert, veterinary doctor, daily wages workers etc.	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	20.00
C	**RESEARCH AND MONITORING**											
13	Comparative analysis of economic valuation of mining and the potential ecosystem services accruing out of the zone of Impact of Gondulpara coal block	10.00	--	--	--	--	--	--	--	--	--	10.00
14	Monitoring and management of man-elephant conflict in the project area	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	--	18.00
15	Monitoring, conservation and Awareness programme of Endangered species like Aves, Reptile, Mammals	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	20.00

Sr. No.	Name of the activity	Year wise Financial Targets (Rs in Lakh)										Total
		1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	
	and other migratory species & Survey for avifauna at IBA site											
D	**AWARENESS AND TRAINING PROGRAMME**											
16	Training and awareness to VFMC, School students, Village level volunteers/members of local self government for biodiversity conservation & protection	1.00	--	1.00	--	1.00	--	1.00	--	1.00	--	5.00
17	Training programme for mitigation of man-animal conflict	--	1.00	--	1.00	--	1.00	--	1.00	--	1.00	5.00
18	Signages/hoardings/pamphlet/brochure in project affected villages	1.50	--	1.50	--	1.50	--	1.50	--	1.50	--	7.50
E	**BIODIVERSITY CONSERVATION**											
19	Creation of rain water harvesting structure and its connectivity to water ponds for sufficient water supply for wildlife	--	2.50	2.50	2.50	2.50	--	--	--	--	--	10.00
F	**MISCELLANEOUS ACTIVITY**											
20	Purchase of 1 vehicle & maintenance for continuous monitoring of work DFO west Division	20.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	38.00
21	Rescue & Rehabilitation vehicle for wildlife	12.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	21.00
22	Purchase of Motor Cycle for Field Staff (5)	5.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	9.50
23	Construction of boundary wall around the RFO, Barkagaon (Hazaribagh West Division)	10.00	--	--	--	--	--	--	--	--	--	10.00

Sr. No.	Name of the activity	Year wise Financial Targets (Rs in Lakh)										Total
		1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	
24	JFMC watcher assistance in patrolling and other protection (2)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	--	--	--	17.50
25	Watch tower for monitoring (1)	--	10.00	--	--	--	--	--	--	--	--	10.00
26	Distribution of smokeless chulla/Solar light/solar laltern and maintenance of old dragon light	--	3.00	--	--	3.00	--	--	3.00	--	--	9.00
27	To promote culture of tree plantation; free distribution of grafted fruit bearing species	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	5.00
28	Purchase of computers, printers, binoculars, GPS, Camera, Internet, Mobile, Cage for rescue of wildlife and other equipments	10.00	--	5.00	--	3.00	--	2.00	--	1.00	--	21.00
Grand Total		**502.528**	**473.026**	**253.076**	**197.640**	**148.022**	**133.434**	**80.674**	**66.00**	**36.50**	**52.00**	**1942.90**

ANNEXURES

OPEN SERIES MAP

No. F45B5

Scale 1:50,000

G45T4	G45T8	G45T12
F45B1	F45B5	F45B9
F45B2	F45B6	F45B10

SURVEY OF INDIA

CONVENTIONAL SYMBOLS

NOTES

1:50,000