

**LIST OF DOCUMENTS ENCLOSED ALONG WITH THE REPLY TO THE 10-POINT QUERY RAISED ON THE COMPLIANCE REPORT OF STAGE-I FOREST CLEARANCE CONDITIONS CHHAL OCP FOR 240.867 HA. (185.017 HA. + 55.850 HA. OF DEEMED FOREST) OF FOREST LAND FOR COAL MINING.**

**PLEASE CLICK THE LINK BELOW TO VIEW THE CONCERNED FILE**

- 1. COMPLIANCE REPORT OF THE 10-POINT QUERY RAISED ON THE COMPLIANCE REPORT OF STAGE-I FOREST CLEARANCE CONDITIONS CHHAL OCP FOR 240.867 HA.**
- 2. ANNEXURE-1A** FOR COMPLAINE OF POINT NO.i OF 10-POINT QUERY- SMC WORK PLAN OF CHHAL OCP
- 3. ANNEXURE-2B** FOR COMPLAINE OF POINT NO.ii OF QUERY-APPROVED WILDLIFE CONSERVATION PLAN OF CHHAL OCP
- 4. ANNEXURE-3A** FOR COMPLAINE OF POINT NO.iii OF QUERY - CHALLAN FOR PAYMENT OF COMENSATORY LEVIES
- 5. ANNEXURE-4A** FOR COMPLAINE OF POINT NO.iv OF QUERY- SCHEME FOR MINIMISING SOIL EROSION WITHIN LEASE AREA OF CHHAL OCP
- 6. ANNEXURE-5A** FOR COMPLAINE OF POINT NO.v OF QUERY -SCHEME FOR PLANTATION AND SMC ACTIVITIES
- 7. ANNEXURE-6A** FOR COMPLAINE OF POINT NO.vi OF QUERY -SCHEME FOR SAFETY ZONE FENCING AND PLANTATION
- 8. ANNEXURE-7A** FOR COMPLAINE OF POINT NO.vii OF QUERY-NOC UNDER FRA 2006 FOR 55.850 HA
- 9. ANNEXURE-8A** FOR COMPLAINE OF POINT NO.viii OF QUERY-DESILTATION PLAN OF CHHAL OCP
- 10. ANNEXURE-9A** FOR COMPLAINE OF POINT NO.ix OF QUERY-UNDERTAKING FOR UPLOADING COMPLETE COMPLIANCE REPORT

**LIST OF DOCUMENTS ENCLOSED ALONG WITH THE COMPLIANCE REPORT OF STAGE-I FOREST CLEARANCE CONDITIONS CHHAL OCP FOR 240.867 HA. OF FOREST LAND FOR COAL MINING.**

**PLEASE CLICK THE LINK BELOW TO VIEW THE CONCERNED FILE**

- 1. COMPLIANCE REPORT OF STAGE-I FOREST CLEARANCE CONDITIONS OF CHHAL OCP**
- 2. ANNEXURE-01 -NPV DEMAND NOTE & PAYMENT OF Rs. 891115814.83 FOR CHHAL OCP**
- 3. ANNEXURE-02- SOIL AND MOISTURE CONSERVATION WORK PLAN OF CHHAL OCP**
- 4. ANNEXURE-03-WILDLIFE MANAGEMENT PLAN OF CHHAL OCP**
- 5. ANNEXURE-4- REHABILITATION AND RESETTLEMENT PLAN OF CHHAL OCP**
- 6. ANNEXURE-05 - MINE CLOSURE PLAN OF CHHAL OCP**
- 7. ANNEXURE-06- UNDERTAKING FOR POINT NO. A.x**
- 8. ANNEXURE-07- UNDERTAKING FOR POINT NO. A.xi**
- 9. ANNEXUR-08 -DESILTATION SCHEME IN RESPECT OF CHHAL OCP**
- 10. ANNEXURE-09- UNDERTAKING FOR POINT NO. A.xiii**
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# कार्यालय वनमण्डलाधिकारी, धरमजयगढ़

रायगढ़ रोड, धरमजयगढ़, जिलारायगढ़ [छ.ग.-496116]

Email - dfo\_dharamjygarh@rediffmail.com Phone & Fax : 07766-266599, 07766-266739

क्रमांक / मा.वि. / प्रति 1062

धरमजयगढ़ दिनांक 11/07/2023

✓ मुख्य वनसंरक्षक,  
विलासपुर वृत्त  
विलासपुर छावनी



**विषय :-** Proposal for non-forestry use of 240.867 ha (185.017 ha Revenue Forest Land + 55.850 ha Deemed Forest) forest land under Forest (Conservation) Act, 1980 for Chhal OC seam III 6 MTY project of SECL in Raigarh District of Chhattisgarh.

- संदर्भ :-**
- भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, नई दिल्ली का पत्र क्र./8-15/2021-FC दिनांक 23.02.2023
  - साउथ इस्टर्न कोल फोल्डर्स लिमिटेड रायगढ़ का पत्र क्र./SECL/GM/RGH/P&P/2023/101 दिनांक 07.07.2023

उपरोक्त विषयान्तर्गत प्रतिवेदन है कि, प्रकरण में भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, नई दिल्ली का पत्र क्र. /File No 8-15/2021-FC दिनांक 06.07.2022 द्वारा अभिरोपित शर्तों के तहत प्रथम चरण स्वीकृति जारी की गई है। प्रथम चरण स्वीकृति के पालन प्रतिवेदन में संदर्भित पत्र क्र. 01 द्वारा अतिरिक्त 10 बिन्दुओं की बिन्दुवार पालन प्रतिवेदन चाही गई है। आवेदक संस्थान द्वारा उक्त अतिरिक्त 10 बिन्दुओं की बिन्दुवार पालन प्रतिवेदन इस कार्यालय में प्रस्तुत किया गया है जो निम्नानुसार है :-

S.No.	Query Raised by MOEF & CC, New Delhi	Status of Compliance
i	User agency has deposited Rs. 3,05,00,000/- in the account of CAMPA towards cost of implementation of Soil and Moisture Conservation. However, approved Soil and Moisture Conservation Plan as per condition A(iv) is not submitted with the compliance report. The same need to be submitted.	CMPDI, Ranchi द्वारा 35684906/- का Soil and Moisture Conservation (SMC) Work Plan तैयार किया गया है। आवेदक द्वारा (SMC) Work हेतु Rs.3,05,00,000/- CAMPA खाते में जमा किया गया है। Wildlife Management Plan approved उपरोक्त एकसाथ अंतर की राशि शीघ्र जमा कराया जावेगा। <b>Annexure-1</b>
ii	With regard to condition no. A(v) the State Government informed that the user agency has submitted an undertaking. However, Elephant/Wildlife Management Plan approved from competent authority and verified from PE Division of this Ministry is not submitted with the compliance report. The same need to be submitted.	SFRTI रायपुर से 1222.91 लाख का Wildlife Management Plan तैयार कराया गया है। उक्त Wildlife Management Plan को PCCF WL से approved की कार्यवाही प्रक्रियाधीन है। आवेदक द्वारा Wildlife Management Plan हेतु Rs.12,20,00,000/- कैम्पा खाते में जमा किया गया है। approved उपरोक्त Wildlife Management Plan एवं अंतर की राशि शीघ्र जमा कराया जावेगा। <b>Annexure-2</b>
iii	State Government informed that the user agency has deposited Rs. 2,07,08,615/- towards NPV in the account of CAMPA. However, on the web portal shown that the user agency has deposited Rs. 29,36,77,168.86/- towards NPV.	उक्त बिन्दु के परिपालन में निम्नानुसार राशि जमा कराया गया है - 1. CA हेतु राशि - 424230030.15 2. NPV हेतु राशि- 293677168.86 3. WLP हेतु राशि- 122000000/-

*(Handwritten mark)*

	in the account of CAMPA. This need to be clarified.	4. SMCP हेतु राशि- 30500000/- 5. Safety Zone हेतु राशि- 20708615.655  कुल राशि- 89,11,15,814.83 Chhattisgarh State CAMPA A/C No.150645816237745 vide UTR No.UTIBR52022090100354111, dtd. 31.08.2022 द्वारा जमा किया गया है। तथा CA अंतर की राशि 42423148/- UTIBR72023070600069648, dtd. 06.07.2023 द्वारा कैम्पा के जमा किया गया है। चालान की प्रति संलग्न है। Annexure-3
iv	Copy of approved Scheme/Plan for Mitigative measure to minimize Soil Erosion, as envisaged in condition no. A(x) of Stage-I approval has not been submitted along with the compliance report. The same needs to be submitted.	संलग्न है। Annexure-4
v	Copy of approved Scheme/Plan for plantation and SMC activities, as envisaged in condition no. A(xi) of Stage-I approval has not been submitted along with the compliance report. The same needs to be submitted.	संलग्न है। Annexure-5
vi	Copy of approved Scheme/Plan for fencing, protection and regeneration, as envisaged in condition no. A(xiii) of Stage-I approval has not been submitted along with the compliance report. The same needs to be submitted	राशि 70727282.50 का Plan छठमो राज्य वन विकास निगम से तैयार कराकर संलग्न है। Annexure-6
vii	State Government has submitted FRA certificate of an area of 185.017 ha of forest land only. FRA certificate for 55.850 ha is not submitted. In this regard State Govt. is requested to submit the complete FRA compliance along with supporting documents to this Ministry.	FRA certificate for the remaining 55.850 ha of forest land of the Project is enclosed herewith as Annexure-7
viii	With respect to condition A(xii) the detailed approved plan for desilting of identified ponds and water bodies uploaded is not verified by the concerned Divisional Forest Officer. In this regard, State is requested to submit a verified copy of same by concerned DFO.	संलग्न है। Annexure-8
ix	User Agency has uploaded compliance report of conditions on e-portal only for 185.017 ha of forest land. Compliance report for entire area need to be uploaded on e-portal.	It is a combined proposal of 240.867 Ha. of forest land (Stage-I FC for 2040.867 Ha. (185.017+55.85) was also granted in the same line). Proposal No. FP/CG/MIN/39334/2019 (55.85 Ha.) is rediverted with FP/CG/MIN/16237/2015 (185.017 Ha.) in PARIVESH portal. Compliance report of Stage-I FC conditions for entire forest land of 240.867 Ha. of the Project has been uploaded on e-portal. Annexure-9
x	The KML files of diverted area, the CA areas, the proposed SMC treatment area and the WLMP area was not uploaded on the e-Green	WLMP approved उपराल Upload किया जावेगा।

watch portal. The same need to be uploaded on e-Green watch portal. And further the state govt. is requested to provide the GPS IDs for the above areas.

अतः आवश्यक कार्यावाही हेतु आपकी ओर प्रतिवेदन संलग्न-सम्प्रेषित है।

संलग्न :- घालत प्रतिवेदन 05 प्रति में।

श्री.  
वनमण्डलाधिकारी  
धरमजयगढ़ वनमण्डल  
/धरमजयगढ़ दिनांक 11/07/23

क्रमांक/मा.वि./2023/ 1083

प्रतिलिपि :-

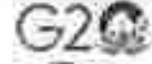
1. अपर प्रधान मुख्य वनसंरक्षक (भू-प्रबंध) अटल नवा रायपुर छोगा की ओर सम्प्रेषित।
2. उप वनमण्डलाधिकारी धरमजयगढ़ उप वनमण्डल की ओर सूचनार्थ एवं आवश्यक कार्यावाही हेतु अग्रेषित।
3. उप महाप्रबंधक साउथ इस्टर्न कोल फोल्डस लिमिटेड छाल उपक्षेत्र SECL नावापारा छाल जिला- रायगढ़ (छ.ग.) की ओर सूचनार्थ एवं आवश्यक कार्यावाही हेतु अग्रेषित।

श्री.  
वनमण्डलाधिकारी  
धरमजयगढ़ वनमण्डल



SOUTH EASTERN COALFIELDS LIMITED  
"A MINI RATNA COMPANY"  
(A SUBSIDIARY OF COAL INDIA LTD.)  
CHHOTE ATARMUDA, RAIGARH-495006  
G.M.OFFICE (FOREST & ENVT)

FAX NO:- 07762-223152  
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E-MAIL - SECLRGH@GMAIL.COM  
CIN-U10102CT1985GO1003161



Ref: - SECL/GM/RGH/S.O. (P&P)/2023/74

Date: - 19/07/2023

To,  
The Divisional Forest Officer  
Dharamajgarh Forest Division, C.G.

**Subject:** - Submission of Wildlife Protection/Management Plan of Chhal OC Seam-III 6.0 MTY Coal Mining Project in compliance with point no.ii of the 10-point query raised by MOEF & CC, New Delhi on 23.02.2023 in respect of Stage-I Forest Clearance for 240.887 Ha. of forest land (185.017 Ha. + 55.850 Ha. of Deemed Forest) granted vide File: No.8-15/2021-FC, dtd.06.07.2022 to Chhal OC Seam-III 6.0 MTY Project of SECL.

Ref:- SECL/GM/RGH/P&P/2023/101, Dated 07/07/2023

Sir,

In continuation with our earlier letter no. SECL/GM/RGH/P&P/2023/101, Dated 07/07/2023, the Wildlife Protection/Management Plan of Chhal OC Seam-III 6.0 MTY Coal Mining Project prepared by SFRTI, Raipur is submitted herewith in compliance with point no.ii of the 10-point query raised by MOEF & CC, New Delhi on 23.02.2023 in respect of Stage-I Forest Clearance for 240.887 Ha. of forest land (185.017 Ha. + 55.850 Ha. of Deemed Forest) for your kind perusal and further needful action for competent approval and subsequent verification by the PE Division of MOEF & CC, New Delhi for the grant of Stage-II FC to the Project at the earliest.

*[Signature]*  
19/07/23  
Staff Officer (P&P),  
Raigarh Area, SECL

Enclosure: - As above.

Advance copy submitted to:-

1. APCCF(LM), Raipur for taking necessary action for competent approval and verification by the PE Division of MOEF & CC, New Delhi.
2. PE Division of MOEF & CC, New Delhi for verification.
3. Office Copy





**SOUTH EASTERN COALFIELDS LIMITED**  
**OFFICE OF THE GENERAL MANAGER, RAIGARH AREA**

P.B. No. 27, P.O. Raigarh, Dist: Raigarh (C.G.) 496001  
Ph No. 07762-222008, 224129, Fax No. 07762-223152

Ref: - SECL/GM/RGH/P&P/2023/ 101

Date: 07/07/2023

To,

The DFO  
Dharamjaigarh (C.G.)

**Sub:-** Submission of compliance report of 10-point query raised by MOEF & CC, New Delhi dt 23.02.2023 in respect of 240.667 h. of forest land (185.017 ha + 55.850 ha. of deemed forest) of Chhal OCP, SECL.

Dear Sir,

Please find enclosed herewith the compliance report of 10-point query raised by MOEF & CC, New Delhi dt 23.02.2023 in respect of 240.667 h. of forest land (185.017 ha + 55.850 ha. of deemed forest) of Chhal OCP, SECL.

This is for your kind information and needful please.

Yours faithfully

*[Handwritten Signature]*  
07-07-23  
S.O.(P&P)  
SECL Raigarh Area

Copy to:

- GM, SECL Raigarh Area
- GM(Forest), SECL Bilaspur
- SAM, Chhal OCP
- N.O.(Forest), SECL Raigarh Area
- Office copy



**COMPLIANCE REPORT OF 10-POINT QUERY RAISED BY MOEF & CC, NEW DELHI IN RESPECT OF 240.667 H. OF FOREST LAND (185.017 HA + 55.850 HA. OF DEEMED FOREST) OF CHHAL OCP, SECL.**

Sl. No.	Query Raised by MOEF & CC, New Delhi	Status of Compliance
i	User agency has deposited Rs. 3,05,00,000/- in the account of CAMPA towards cost of implementation of Soil and Moisture Conservation. However, approved Soil and Moisture Conservation Plan as per condition A(iv) is not submitted with the compliance report. The same need to be submitted.	As per the requirement of MOEF & CC guideline dated 07.06.2022, the User agency has deposited Rs. 3,05,00,000/- in the account of CAMPA towards the cost of implementation of Soil and Moisture Conservation (SMC) Work Plan with a view to avoid any delay in the implementation of SMC Work Plan. The Soil and Moisture Conservation (SMC) Work Plan prepared by CMPDI, Ranchi in consultation with the state forest department is enclosed herewith as <b>Annexure-AA</b>
ii	With regard to condition no. A(v) the State Government informed that the user agency has submitted an undertaking. However, Elephant/Wildlife Management Plan approved from competent authority and verified from PE Division of this Ministry is not submitted with the compliance report. The same need to be submitted.	As per the requirement of MOEF & CC guideline dated 07.06.2022, the User agency has deposited Rs.12,20,00,000/- in the account of CAMPA towards the cost of implementation of Elephant/Wildlife Management Plan with a view to avoid any delay in the implementation of Elephant/Wildlife Management Plan. The Elephant/Wildlife Management Plan prepared by SFRTI, Raipur is under verification by the state forest department for its effectiveness and will be submitted shortly.
iii	State Government informed that the user agency has deposited Rs. 2,07,08,615/- towards NPV in the account of CAMPA. However, on the web portal shown that the user agency has deposited Rs. 29,36,77,168.86/- towards NPV in the account of CAMPA. This need to be clarified.	Requires clarification of state forest department as the User Agency has deposited Rs. 89,11,15,814.83 through online portal into Chhattisgarh State CAMPA A/C No. 150645816237745 vide UTR No UTIBR52022090100354111, dtd. 31.08.2022 as demanded by the concerned state forest department.
iv	Copy of approved Scheme/Plan for Mitigative measure to minimize Soil Erosion, as envisaged in condition no. A(x) of Stage-I approval has not been submitted along with the compliance report. The same needs to be submitted.	Copy of the Scheme/Plan describing (a) Mitigative measures to minimize soil erosion and choking of stream, (b) Planting of adequate drought hardy plant species and sowing of seeds, in the appropriate area within the mining lease to arrest soil erosion, (c) Construction of check dams, retention /toe walls to arrest sliding down of the excavated material along the contour, (d) Stabilize the overburden dumps by appropriate grading/benching so as to ensure



		<p>that angles of repose at any given place is less than 28° and (e) Top soil management in the mining lease area as stipulated in condition no. A(x) of Stage-I approval is enclosed herewith as <b>Annexue-BB</b>.</p> <p>The mitigative measures stated above have been extracted from the Approved Environment Impact Assessment/ Environment Management Plan prepared by RI-V, CMPDI, Bilaspur.</p>
v	Copy of approved Scheme/Plan for plantation and SMC activities, as envisaged in condition no. A(xi) of Stage-I approval has not been submitted along with the compliance report. The same needs to be submitted.	Copy of approved Scheme/Plan prepared by the state forest department for plantation and SMC activities for gap planting and soil & moisture conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.40) located in the area within 100 meters from outer perimeter of the mining lease is enclosed herewith as <b>Annexue-CC</b>
vi	Copy of approved Scheme/Plan for fencing, protection and regeneration, as envisaged in condition no. A(xiii) of Stage-I approval has not been submitted along with the compliance report. The same needs to be submitted	The Scheme/Plan for fencing, protection and regeneration, as envisaged in condition no. A(x) (i.e. regarding safety zone management) prepared by CGRVVN, Chhattisgarh is enclosed herewith as <b>Annexue-DD</b> .
vii	State Government has submitted FRA certificate of an area of 185.017 ha of forest land only. FRA certificate for 55.850 ha is not submitted. In this regard State Govt. is requested to submit the complete FRA compliance along with supporting documents to this Ministry.	FRA certificate for the remaining 55.850 ha of forest land of the Project is enclosed herewith as <b>Annexue-EE</b> .
viii	With respect to condition A(xii) the detailed approved plan for desilting of identified ponds and water bodies uploaded is not verified by the concerned Divisional Forest Officer. In this regard, State is requested to submit a verified copy of same by concerned DFO.	<b>The earlier submitted</b> plan for desilting of identified ponds and water bodies needs to be verified and approved by the state forest department.
ix	User Agency has uploaded compliance report of conditions on e-portal only for 185.017 ha of forest land. Compliance report for entire area need to be uploaded on e-portal.	It is a combined proposal of 240.867 Ha. of forest land (Stage-I FC for 2040.867 Ha. (185.017+55.85) was also granted in the same line). Proposal No. FP/CG/MIN/39334/2019 (55.85 Ha.) is rediverted with FP/CG/MIN/16237/2015 (185.017 Ha.) in PARIVESH portal.

net

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		Compliance report of Stage-I FC conditions for entire forest land of 240.867 Ha. of the Project has been uploaded on e-portal.
x	The KML files of diverted area, the CA areas, the proposed SMC treatment area and the WLMP area was not uploaded on the e-Green watch portal. The same need to be uploaded on e-Green watch portal. And further the state govt. is requested to provide the GPS IDs for the above areas.	To be uploaded by the state forest Department.

  
 NODAL OFFICER (FOREST),  
 RAIGARH AREA, SECL



<b>STRICTLY RESTRICTED</b>
FOR COMPANY USE ONLY
<b>RESTRICTED</b>
The information given in this report is not to be communicated either directly or indirectly to the press or to any person not holding an official position in the CIL/SCCL.

**REPORT  
ON  
SOIL MOISTURE CONSERVATION (SMC)  
WORK PLAN**

**In Compliance to**

Stage-I Forest Clearance Granted Vide File No.8-15/2021-FC Dated 06.07.2022  
Ministry of Environment, Forests & CC of Govt. of India, New Delhi.

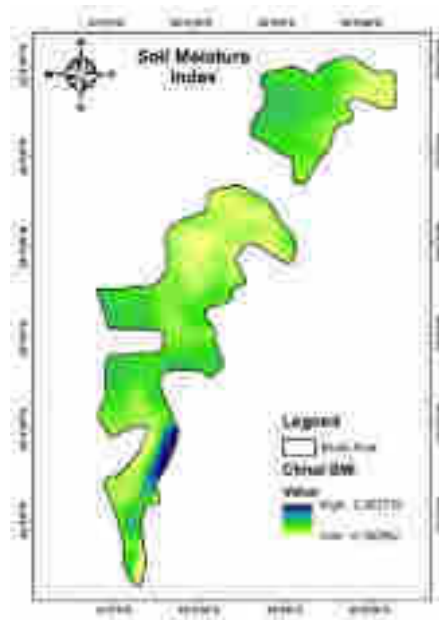
For

Non-forestry use of 240.867 ha, comprising of 185.017 Ha Revenue Forest Land  
and 55.850 ha identified as forest land in terms  
of dictionary meaning under the Forest (Conservation) Act, 1980

Within Total Lease area of 1342.86 Ha.

OF

**Chhal Opencast Coal Mining Project**



**South Eastern Coalfields Limited**

(A Mini Ratna Company)

Seepat Road, Bilaspur, C.G.-495006

(May 2023)



**Central Mine Planning & Design Institute Ltd.**

(A Subsidiary of Coal India Ltd.)

Regional Institute-VII, Bhubaneswar

Regional Institute-V, Bilaspur

&

Environment Division, Kanke Road

Ranchi - 834008 (Jharkhand), India

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**CHAPTER-1**  
**INTRODUCTION**

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## CHAPTER-1

### INTRODUCTION

#### 1. INTRODUCTION

Chhal OC project is an expansion project from 3.5 MTPA (peak) to 6.0 MTPA (Normative) and 7.5 MTPA (Peak). It is coal mining project schedule under Schedule 1(a): Mining of minerals, Category 'A' in EIA notification, 2006. The project is conceived with an additional capital investment of Rs. 610.63 crores (Approved PR 2013). It produces power grade coal.

*Environmental Clearance was granted for Chhal OC Expansion Project (Expansion 3.50 MTPA TO 6.00 MTPA (Normative) and 7.50 MTPA (Peak) Project Area: From 641.013 Ha. to 1342.86 Ha. Tahsil: Dharamjaigarh; District: Raigarh; State: Chhattisgarh vide No.J-11015/1000/2007-IA.II(M) dated 02.08.2023.*

#### **Location**

The project is located in Mand- Raigarh coalfield under the administrative control of Raigarh Area .The project falls in Survey of India Topo Sheet No. 64 N/4.It is situated in the Raigarh district of Chhattisgarh .The project is located south of village Chhal at an approximate distance of 2.5 km on Kharsia - Dharamjaygarh State Highway and 16 km from Kharsia town. The block is bounded by

**Latitude-** 22°4'40" and 22°6'27" N

**Longitude-** 83°6'10" and 83°9'10" E

#### **Project boundary**

The Chhal OC project is bounded by following geological features:

**Table-1.1-Project Boundary**

(Source-PR/SECL)

Direction	Boundary particulars
North	Fault F1-F1 and mining lease boundary of Chhal U/G.
South	Mand river and floor incrop of Seam III
East	Floor incrop of Seam III
West	Mand river

The quarry boundary for the complete mine in the Chhal block have been fixed in the following manner:

**Table-1.2-Quarry Boundary**

(Source-PR/SECL)

Direction	Boundary particulars
North	Fault line – F1 – F1 having throw >400m.
South	Floor incrop of seam III
East	Floor incrop of Seam III
West	60m barrier from Eastern bank of Mand River

**Details of project proponent:**

**Table-1.3: Details of project proponent**

S. No	Particulars	Details
1	Name of Project	Chhal Opencast Project 6 MTPA Normative, 7.5 MTPA Peak
2	Name of the proponent	South Eastern Coalfields Limited (SECL)
3	Registered Address	Office of the Director Technical (Project & Planning), Post office: SECL, Seepat road Dist.: Bilaspur, Pin 495006 E-mail- <a href="mailto:dtp.secl@coalindia.in">dtp.secl@coalindia.in</a> ,

S. No	Particulars	Details
		Telephone-07752 – 241927, 241905, Fax-07752-240250, Website: <a href="http://www.secl-cil.in">http://www.secl-cil.in</a>
4	Legal Status of the Company	A subsidiary of Coal India Ltd.- Public Sector Undertaking under Central Government (Ministry of Coal)-A Mini-Ratna Company
5	Joint Venture	No

## 1.2 BRIEF DESCRIPTION

Chhal OC – 6.0 MTPA is brown field coal mining project. It is an expansion project form current capacity of 3.5 MTPA to 7.5 MTPA (Peak) in project area of 1342.86 Ha. The project is located south of village Chhal at an approximate distance of 2.5 km on Kharsia - Dharamjaygarh State Highway and 16 km from Kharsia town in Raigarh district of Chhatisgrah.

The project description details is given below:

**Table-1.4: Project location**

(Source- PR of Chhal OC /Form-I/Govt. Agencies)

Particulars	Details
Village(s)	Chandrashekharapur, Chhal, Nawapara, Khedapali, Bandhapali, Pusalda, Lat
Tehsil	Dharamjaigarh
District; State; Pin Code	Raigarh; Chhattisgarh; Pin Code-496665
Bounded Latitudes-North(From & To)	From 22 <sup>0</sup> 4'40"N to 22 <sup>0</sup> 6'27"N
Bounded Longitudes-East(From & To)	From 83 <sup>0</sup> 6'10"E to 83 <sup>0</sup> 9'10"E
Survey of India Topo Sheet No.; copy of Topo Sheet	64 N/4, Soft copy of Toposheet is attached with application (Form-II)
Maximum Elevation Above Means Sea Level(AMSL)	267m
Copy of kml file	Soft copy of KML is attached with application(Form-II)

Particulars	Details
Distance of nearest Highest Flood Level (HFL) from the project boundary within the study area	Mand River is western boundary of project
Seismic Zone	Zone-II as per IS 1893 ( Part 1 ) :2002 (5 <sup>th</sup> revision)
Nearest railway station and Distance from nearest railway station (in Km)	Kharsia Rly station- 16 Km
Nearest Airport and Distance from nearest Airport	Raipur – 250 km Bilaspur- 150 km approx..
Distance from nearest town/city/District head quarter (in Km)	Raigarh -65 Km
Complete postal Address with pin code and Telephone Number	Office of Dy. G.M. (Min)/Sub Area Manager Chhal Sub Area, Raigarh Area At/PO - Chhal, District- Raigarh, Chhattishgarh, Pin -496665. Telephone-07766 – 277625 Fax no. -07766-277629

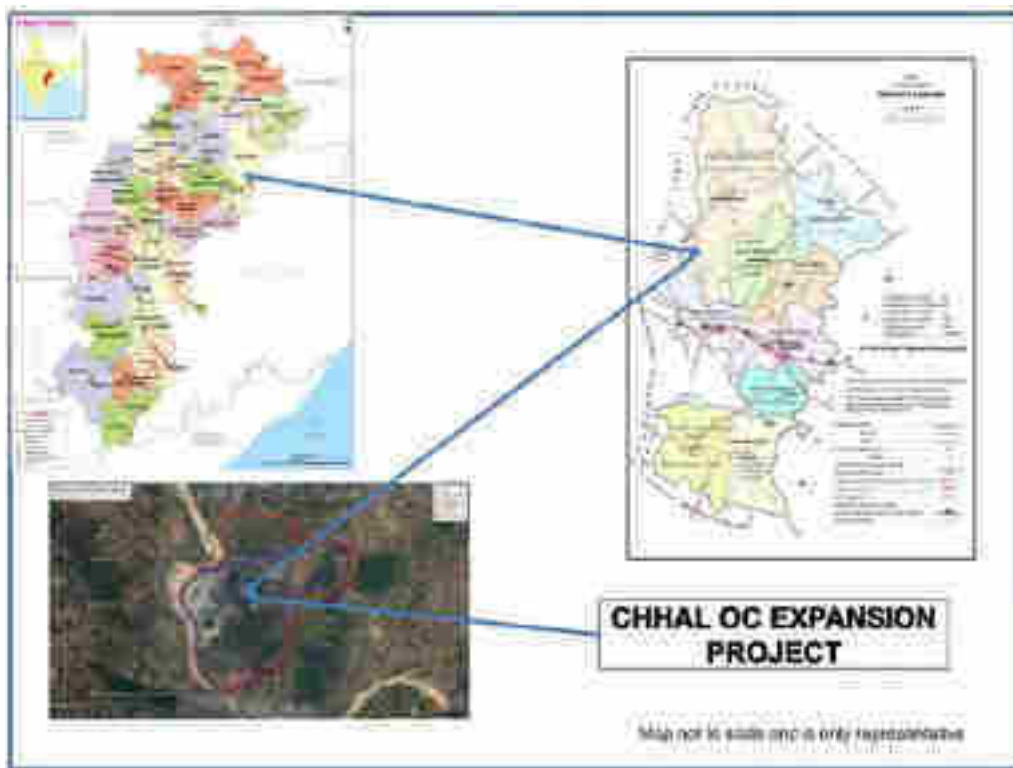


Figure-1.1: Location Map of Chhal OC Expansion Project- Raigarh District, CG

### 1.3 PROJECT BOUNDARY

The KML file image of project is shown below:



**Fig 1.2** KML image of Chhal OC Mine lease boundary

**Ecological sensitivity of the location of project (within 10km of study area of Project)**

**Table-1.5: Ecological sensitivity of the location of project**

Source- Form-I/Toposheet

S. No	Particulars	Details
1	Wildlife sanctuary	Nil
	National Park/ Protected Area/ Biosphere reserve/ Tiger reserve/ Elephant reserves	Nil
	Critically Polluted Area or Severely Polluted Area	Nil

S. No	Particulars	Details																				
	Eco-sensitive area or Eco-sensitive Zone	Nil																				
	Wetlands	Nil																				
	State/UT Boundary	No, Project don't share boundary with state/UT boundary																				
	International Boundary	No																				
	Hilly area	---																				
	Areas protected under international convention / national legislation / local legislation cultural or other related value	No																				
	Coastal zone	No																				
	Pilgrim areas or tourist areas	No																				
	Defence installations	No																				
2	Reserved/Protected forests	<p><b>Core Zone:</b> Project area covers 176.710 Ha. Protected forest and 8.307 Ha. of Revenue forest land.</p> <p><b>Buffer zone:</b></p> <table border="1"> <thead> <tr> <th>Name of PF/RF</th> <th>Distance &amp; Direction</th> </tr> </thead> <tbody> <tr> <td>Lotan RF</td> <td>~4.65km, East</td> </tr> <tr> <td>Suhai RF</td> <td>~7.70km, East</td> </tr> <tr> <td>Dhumapahari RF</td> <td>~4.00km, North-East</td> </tr> <tr> <td>Garainbahari RF</td> <td>~4.65km, North-East</td> </tr> <tr> <td>Bojia RF</td> <td>~6.50km, North-East</td> </tr> <tr> <td>Lamikhar RF</td> <td>~7.25km, North-East</td> </tr> <tr> <td>Andhiari RF</td> <td>~7.65km, North-North-West</td> </tr> <tr> <td>Bangarsuta RF</td> <td>~7.70km, North-North-West</td> </tr> <tr> <td>Gidhmar RF</td> <td>~9.00km, North-West</td> </tr> </tbody> </table>	Name of PF/RF	Distance & Direction	Lotan RF	~4.65km, East	Suhai RF	~7.70km, East	Dhumapahari RF	~4.00km, North-East	Garainbahari RF	~4.65km, North-East	Bojia RF	~6.50km, North-East	Lamikhar RF	~7.25km, North-East	Andhiari RF	~7.65km, North-North-West	Bangarsuta RF	~7.70km, North-North-West	Gidhmar RF	~9.00km, North-West
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Bojia RF	~6.50km, North-East																					
Lamikhar RF	~7.25km, North-East																					
Andhiari RF	~7.65km, North-North-West																					
Bangarsuta RF	~7.70km, North-North-West																					
Gidhmar RF	~9.00km, North-West																					

S. No	Particulars	Details	
		Karam Dongri RF	~9.00km, North-West
		Murkatta RF	~5.65km, West
		Dokrikhal RF	~7.65km, West-South-West
		Bargarh RF	~0.50km, South-West
		Rabo RF	~3.00km, South-East
		Endu RF	~0.20km, East-South-East
3	Water bodies	<p><b>Rivers</b></p> <ol style="list-style-type: none"> <li>1. Mand River share western boundary of project</li> <li>2. Kurket River, ~2.25km, in South-East direction</li> <li>3. Borai River, ~7 km, in West-West-South direction</li> </ol> <p><b>Dam</b></p> <ol style="list-style-type: none"> <li>1. Pelam Dam, ~0.0 km, in East direction</li> <li>2. Nagoi Dam, ~6km, in North-West direction</li> </ol>	

## 1.4 CLIMATE

**Temperature range:** 5<sup>0</sup>C - 44<sup>0</sup>C.

**Rainfall:** 1176 mm (Average)

(Source- IMD & IGAU, Bilaspur)

## 1.5 TOTAL LAND REQUIREMENT

The project envisages 1342.86 Ha of land for quarry, industrial and residential complex, safety zone and external dumps etc. The break-up of the land is as follows:



**Table- 1.6 Land requirement (Pre/Post mining land use)**  
(Pre-mining Land use)

<b>S. No.</b>	<b>Land use</b>	<b>Area in Ha</b>
1.	Tenancy/agricultural land	825.827 Ha.
2.	Forest land	185.017Ha.
3.	Govt. land* <ul style="list-style-type: none"> <li>• Grazing Land: 31.632 Ha.</li> <li>• Water body: 23.426 Ha.</li> <li>• Waste land: 228.649 Ha.</li> <li>• Others: 48.309 Ha.</li> </ul>	332.016 Ha.
	<b>Total</b>	<b>1342.86 Ha</b>

Note: (\*) 55.85 Ha land has been identified as deemed forest and clubbed with initial FC proposal of 185.017 Ha. (Reference - Proposal no. FP/CG/MIN/39334/2019–MoEF&CC)

## **1.6 NATIONAL AND REGIONAL IMPORTANCE OF THE PROJECT**

India is dependent mostly on thermal power, and the project is contributing in production of thermal power hence it is of national importance. In case of regional terms, roads with state transport facilities will be developed. The State Government is being benefited through financial revenues in crores of rupees by the way of royalty, taxes etc., from the direct and indirect operations in the Study area.

## **1.7 CONDITION FOR COMPLIANCE REPORT FOR SEEKING STAGE-II APPROVAL**

Assistant Inspector General of Forests, MoEF&CC submitted a letter to File No.8-15/2021-FC Dated: 06<sup>th</sup> July 2022 to the Principal Secretary (Forests), Government of Chhattisgarh, Mahanadi Bhavan, Nava Raipur (CG) regarding the Proposal for non-forestry use of 240.867 ha, comprising of 185.017 ha Revenue Forest Land and 55.850 ha identified as forest land in terms of dictionary meaning under the Forest (Conservation) Act, 1980 for Chhal Opencast Coal Mining Project in favour of M/s South Eastern Coalfields Limited (SECL) in Raigarh District of Chhattisgarh .

As per direction of the Government of Chhattisgarh's letter no. F 5-18/2018/10-2 dated 08.04.2021 for seeking prior approval of the Central Government under Section 2 of the Forest (Conservation) Act, 1980 and letter no. F-5-18/2018/10-2 dated 24.02.2022 forwarding additional information as sought by the Ministry's letter dated 11.06.2021 and to say that the proposal were examined by the Forest Advisory Committee constituted by the Central Government under Section - 3 of the aforesaid Act.

After examination of the proposal of the State Government and on the basis of the recommendations of the Forest Advisory Committee, and approval of the same by the competent authority of the MoEF&CC, New Delhi, the Central Government hereby accords "***in-principle***" approval for non-forestry use of 240.867 ha, comprising of 185.017 ha of Revenue Forest Land and 55.850 ha of Dictionary meaning forest land under Section-2 of the Forest (Conservation) Act, 1980 for Chhal Opencast Coal Mining Project in favour of M/s South Eastern Coalfields Limited (SECL) in Raigarh District of Chhattisgarh subject to fulfilment of the the several conditions (**Annexure -1**).

***The conditions related to soil-moisture conservation (SMC) are as under:***

Conditions which need to be complied prior to handing over of forest land by the State Forest Department and compliance is to be submitted prior to Stage-II approval:

**Point :**

**A) (iv)** A Soil and Moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local river shall be prepared by the user agency in consultation with the State Forest Department and the same shall be submitted along with Stage-I compliance. Cost of implementation of the provisions of the said Plan will be deposited into the CAMPA and the same shall be intimated to the Ministry before Stage-II approval.

## 1.8 CONSULTATION WITH FOREST OFFICIALS

A meeting between an official of SECL, Team of CMPDI, and **with Sri Bhawani Shankar Pradhan, Divisional Engineer and Sri Ashok Mind, Asst DM, at DFO office, Dharamjaygarh** was held on **18.04.2023** in the office of DFO, **Dharamjaygarh** to discuss the fulfillment of the compliance laid down by the Assistant Inspector General of Forests, MoEF&CC vide **File No.8-15/2021-FC** Dated: 06<sup>th</sup> July 2022 to the Principal Secretary (Forests), Government of Chhattisgarh, Mahanadi Bhavan, Nava Raipur (CG).

The study area has been selected after a discussion with the representative of DFO **Dharamjaygarh** on 18.04.2023. Compartment number **477** and **479** has been selected based on its crown density which was less than 0.40. The total area covering 356.26 Ha lies in forest area near Khedapali & Chitapali village. The bounding coordinate of the area falls between longitude 83° 7'54.33"E to 83° 9'41.59"E and latitude 22° 3'36.93"N to 22° 6'31.69"N.

On the basis of the above meeting, CMPDI undertook UAV based survey for the generation of a high-resolution orthomosaic image, DTM and contour map of the proposed area for SMC study.

## 1.9 SCOPE AND OBJECTIVE OF THE WORK

- ❖ Analysis of existing Land Use Pattern through Satellite imagery.
- ❖ Soil characterization of the area in terms of the type of soil, depth of soil, water holding capacity, humus, and other organic/inorganic ingredients, a key vulnerability for soil erosion.
- ❖ Assessment of Soil moisture Index and soil loss in study area.
- ❖ Micro watershed concept and soil and moisture conservation technique in the concerned area.
- ❖ Recommendation of various activity for soil moisture conservation.
- ❖ Preparation of detailed cost estimate for the implementation SMC plan.

## 1.10 COMPLIANCE TO THE QUERY RAISED

The draft SMC report was submitted to the SECL on dated 27-05-23. After examination of report, DFO, Dharamjaigarh raised a query regarding the one intervention (recharge/catch pit) which was proposed for enhancing the soil moisture in study area.

As per the letter no. 2610 dated 14-06-23 (Annexure-II), DFO, Dharamjaigarh raised his concern that catch pit (2.0 X 1.0 X 0.5) may hinder the free walking of elephants and small animal, also they can fall in such pit, hence, it may be removed. So as per the advice, catch pits are removed and in place of that 2 more ponds have been proposed of size (30.0 X 20.0 X 2.0) in this report. The SMC cost in earlier report was **Rs. 3.43 Crs.** However, due to the addition of two more ponds and removal of catch pits causes increment in SMC cost upto **13 lakhs.** The revised SMC cost shall be **Rs. 3.56 Crs.**

**CHAPTER-2**

---

***Soil Moisture Conservation: An Overview***

## **CHAPTER-2**

# **SOIL MOISTURE CONSERVATION: AN OVERVIEW**

### **2.1 SOIL MOISTURE**

Soil moisture is “the total amount of water, including the water vapor, in an unsaturated soil.” Soil moisture—sometimes also called soil water—represents the water on inland surfaces that are not in rivers, lakes, or groundwater, but instead resides in the pores of the soil. In turn, soil moisture levels affect a range of soil and plant dynamics. Surface soil moisture is the water that is in the upper 10 cm of soil, whereas root zone soil moisture is the water that is available to plants—generally considered to be in the upper 200 cm of soil.

Water that enters a field is removed from a field by runoff, drainage, evaporation, or transpiration. Runoff is the water that flows on the surface to the edge of the field; drainage is the water that flows through the soil downward or toward the edge of the field underground; evaporative water loss from a field is that part of the water that evaporates into the atmosphere directly from the field's surface; transpiration is the loss of water from the field by its evaporation from the plant itself.

Water affects soil formation, structure, stability, and erosion but is of primary concern with respect to plant growth. Water is essential to plants for four reasons:

1. It constitutes 80%-95% of the plant's protoplasm.
2. It is essential for photosynthesis.
3. It is the solvent in which nutrients are carried to, into and throughout the plant.

4. It provides the turgidity by which the plant keeps itself in the proper position.

In addition, water alters the soil profile by dissolving and re-depositing mineral and organic solutes and colloids, often at lower levels, a process called leaching. In a loam soil, solids constitute half the volume, gas one-quarter of the volume, and water one-quarter of the volume of which only half will be available to most plants, with a strong variation according to matric potential.

Water moves in soil under the influence of gravity, osmosis and capillarity. When water enters the soil, it displaces air from interconnected macropores by buoyancy and breaks aggregates into which air is entrapped, a process called slaking. The rate at which soil can absorb water depends on the soil and its other conditions. As a plant grows, its roots remove water from the largest pores (macropores) first. Soon the larger pores hold only air, and the remaining water is found only in the intermediate- and smallest-sized pores (micropores). The water in the smallest pores is so strongly held to particle surfaces that plant roots cannot pull it away. Consequently, not all soil water is available to plants, with a strong dependence on texture. When saturated, the soil may lose nutrients as the water drains. Water moves in a draining field under the influence of pressure where the soil is locally saturated and by capillarity pulls to drier parts of the soil. Most plant water needs are supplied from the suction caused by evaporation from plant leaves (transpiration) and a lower fraction is supplied by suction created by osmotic pressure differences between the plant interior and the soil solution. Plant roots must seek out water and grow preferentially in moister soil microsites, but some parts of the root system are also able to remoisten dry parts of the soil. Insufficient water will damage the yield of a crop. Most of the available water is used in transpiration to pull nutrients into the plant.

## **2.2 SOIL EROSION**

Soil erosion has affected land all over the world from small residential landscaped properties to large forests and deserts. Due to the action of rain and wind, some portion of soil gets eroded and transported naturally and at the same time disintegration of rocks goes on naturally at some places to form the soil. These are continuous processes that naturally balance the erosion and formation of soil.

Soil erosion is described as soil particles being shifted around due to the devastating impact of

- Rainfall
- Wind and
- Ice melts

It is a natural process but, in most cases, human activity speeds up the process. Description of different types of soil erosion has been enumerated below in which the above agencies have the major role: -

## **2.3 RAINFALL EROSION**

The investigation has shown that most of the soil erosion done by water is due to the impact of falling raindrops. The erosion capacity of surface runoff is small and it acts only as a partner.

The water erosion process starts as soon as the rain starts. The two principal erosive agents that become active during the rain storm are:

- (a) Falling rain drops.
- (b) Flowing run-off

### **2.3.1 FALLING RAINDROPS**

When a raindrop strikes the soil surface, it breaks down the clods and the aggregates of the soil and thus, the soil particles are torn loose from their



moorings in the soil mass. The energy of the falling water is applied from the above and is utilized in detaching the soil particles, while the energy of the surface runoff is applied parallel to the surface and is made used in transporting the dislodged soil particles.

The erosion caused by rain storms is also known as **Splash-Erosion-Process**. Another important fact that we must mention here is that the amount of erosion from hilly catchments is always more than that from flat catchments (provided all other conditions remain the same).

This is, because, when rain falls over the flat area, the incoming splash balances the outgoing splash; while when the raindrops strike the sloping land surfaces, a major proportion of the splash moves down. Hence, relatively larger quantities of soil are transported when catchments are sloping than the catchments is flatter.



**Fig No. 2.1: Figure showing splash erosion**

### 2.3.2 FLOWING RUN-OFF

The fraction of the rainfall which does not infiltrate (soak into) the soil will flow downslope under the action of gravity; it is then known as runoff or overland flow.

If the rain continues, the increasing depth of water will eventually increase. Overland flow that is released in this way is likely to flow downslope more quickly and in greater quantities (i.e. possess more flow power as a result of its kinetic energy), and so may be able to begin transporting and even detaching soil particles. Where it does so, the soil's surface will be lowered slightly. Lowered areas form preferential flow paths for subsequent flow, and these flow paths are in turn eroded further.

## **2.4 WIND EROSION**

Soil erosion by wind may occur wherever dry, sandy, or dusty surfaces, inadequately protected by vegetation, are exposed to strong winds. Erosion involves the picking up and blowing away of loose fine-grained material within the soil. Damage from wind erosion is of numerous types. The most serious and significant by far, however, is the change in soil texture caused by wind erosion. Finer soil fractions (silt, clay, and organic matter) are removed and carried away by the wind, leaving the coarser fractions behind. This sorting action not only removes the most important material from the point of productivity and water retention, but leaves a more sandy, and thus a more erodable soil than the original. Wind erosion mainly depends upon the type of storm, speed, and duration.

## **2.5 ICE EROSION**

Snow and glacier melt occur only in areas cold enough for these to form permanently. Typically, snowmelt will peak in the spring and glacier melt in the summer, leading to pronounced maximum flow in rivers affected by them. The determining factor in the rate of melting of snow or glaciers is both air temperature and the duration of sunlight. In high mountain regions, streams frequently rise on sunny days and fall on cloudy ones for this reason. Soil erosion due to ice melting is not applicable in this region because it is a tropical region and temperatures do not go down to the freezing point.

## **2.6 CONSEQUENCES OF SOIL EROSION**

Damage from soil erosion is of numerous types however the most serious and significant consequences are mentioned below-

- 1) Water Pollution
- 2) Improper water availability
- 3) Chocking of Streams
- 4) Change in soil texture

### **2.6.1 WATER POLLUTION**

Water is the most essential requirement after air for the survival of any kind of life which needs more or less some quantity of water. It holds a pivotal position in the total environment so that if its availability is in optimum quantity, it can protect all aspects of the environment and if availability is less or more than the requirement then the quality of all aspects of the environment gets endangered. Water is made available by nature in good quantity and quality in the form of rainwater, underground water, and through the river, Nala, ponds etc. This water gets affected due to disturbance in nature using man's activities associated with construction, mining activities, etc.

Mainly two types of actions cause water pollution.

- a) Mixing foreign substances with natural water causes physical and chemical changes.
- b) Interception or diversion of full or part of any waterway.

The operation of mining and allied activities of this project would have an impact on water quality through the generation of wastewater in the surrounding area in many ways. The source of such a polluted liquid effluent has an impact on water quality and these are discussed elaborately in the EMP report.

### **2.6.2 IMPROPER WATER AVAILABILITY**

A lesser amount of the soil is covered with vegetation, mulches, crop residues, etc., the more the soil is exposed to the impact of raindrops. When a raindrop hits bare soil, the energy of the velocity detaches individual soil particles from soil clods. These particles can clog surface pores and form many thin, rather impermeable layers of sediment at the surface, referred to as surface crusts. They can range from a few millimeters to one cm or more, and they are usually made up of sandy or silty particles. These surface crusts obstruct the passage of rainwater into the ground reservoir and reduce the water holding capacity of the earth a consequence surface runoff increases and cause more soil erosion. This eroded soil is transported and settled at depressed land, pond, streams/Nala, etc, and reduces the water holding capacity. Moreover, due to the low infiltration rate groundwater reservoir does not get a full recharge. So overall water holding capacity of the area gets reduced to a large extent and resulting in a shortage of water in the region during the dry time.

In another scenario, the increased speed and volume of the surface runoff generate at these places create a flood-like situation anywhere on the downstream side. These create improper water availability in the region.

### **2.6.3 CHOKING OF STREAMS**

Rainfall water that does not infiltrate into the soil starts to flow downhill under the action of gravity. Initially, run-off moves down the slope as a thin diffused film of water that has lost virtually all the kinetic energy which it possessed as falling rain. Thus, it moves only slowly, has a low flow power, and is generally incapable of detaching or transporting soil particles.

If the rain continues, the increasing depth of water will eventually increase. Overland flow that is released in this way is likely to flow downhill more quickly and in greater quantities (i.e. possess more flow power as a result of its

kinetic energy), and so it may be able to begin transporting and even detaching and picking up the soil particles. When the speed of runoff is decreased, the carrying capacity of the runoff gets reduced, subsequently, sedimentation takes place, causing the choking of the stream. Following are the main area where maximum soil erosion takes place.

#### **2.6.4 CHANGE IN SOIL TEXTURE**

The most serious and significant effect of soil erosion, by far, is the change in soil texture caused by wind/water erosion. Finer soil fractions (silt, clay, and organic matter) are removed and carried away by the wind, leaving the coarser fractions behind. This sorting action not only removes the most important material from the standpoint of productivity and water retention but leaves a more sandy soil and thus a more erodible soil than the original. Successive removals eventually create such a soil condition wherein plant growth is minimized and erodibility is greatly increased. Damage results both from water erosion and the consequent dust storms. Control becomes more and more difficult. In the extreme, the sand begins to drift and form unstable dunes which encroach on better surrounding lands. Throughout recorded history, huge agricultural areas have been ruined for further agricultural use in this manner

### **2.7 ESTIMATION OF SOIL EROSION**

Erosion is a natural geomorphic process occurring continually over the earth's surface and it largely depends on topography, vegetation, soil, and climatic variation and, therefore, exhibits pronounced spatial variability due to catchments heterogeneity and climatic variation.

Soil erosion is a three-stage process:

- (1) Detachment,
- (2) Transport, and

## (3) Deposition of soil.



**Fig No. 2.2:** Figure showing stages of soil erosion processes

Different energy source agents determine different types of erosion. There are five principal sources of energy that affect erosion such as wind, water, gravity, chemical reactions, and anthropogenic, such as tillage. Soil erosion begins with detachment, which is caused by the breaking down of aggregates by raindrop impact, shearing, or drag force of water and wind. Detached soil particles are transported by flowing water (overland flow and inter-flow) and wind, and deposited when the velocity of water or wind decreases by the effect of slope or ground cover. Three processes viz. dispersion, compaction, and crusting accelerate the natural rate of soil erosion. These processes decrease structural stability, reduce soil strength, exacerbate erodibility and accentuate susceptibility to transport by overland flow, interflow, wind, or gravity. These processes are accentuated by soil disturbance (by tillage, vehicular traffic), lack of ground cover (bare fallow, residue removal or burning), and harsh climate (high rainfall intensity and wind velocity).

The above problems can be circumvented by describing the catchments into approximately homogeneous sub-areas using the Geographic Information System (GIS). In this study, the remote sensing and GIS techniques (through Satellites Imagine and interrelated software) were used for the derivation of spatial information, catchments description, data processing, etc.

## **2.8 SOIL AND MOISTURE CONSERVATION IN THE FOREST AREAS**

The forest is the origin of the streams and rivers; therefore, it is very important to conserve soil and moisture in its catchment area. Soil and moisture Conservation works have become an integral part of Forest Development. Soil Moisture Conservation works in the forest area marked for the plantation activity are carried out on a micro- watershed basis. This approach is aimed at enhancing land productivity and increasing soil moisture availability for a longer period.

## **2.9 NATURE OF SMC WORKS**

Emphasis is to be given to the drainage line treatment. SMC works on the site are carried out as per the site-specific approved treatment plan. Emphasis is to be given to contour line treatment with small and medium SMC works. The SMC and area development works are concerned, the entire area is to be treated as a unit. In an area prone to Soil Erosion and degraded forest, following measures are suggested to increase moisture level:

- Earthen Pits
- Contour Trenches
- Check Dams
- Earthen Ponds
- Grassing

➤ Mulching

Various plantation models such as mangrove plantation, coastal border plantation, plantation as per the provision in different areas, soil and moisture conservation works of forest and plantation areas, maintenance & up-keep of plantation areas with different models are formulated for different areas.



**CHAPTER-3**

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***Soil Characterization & Ecological Survey***

## **CHAPTER-3**

### **SOIL CHARACTERIZATION & ECOLOGICAL SURVEY**

#### **3. INTRODUCTION**

##### **3.1 SOIL QUALITY**

Soil is one of the most significant ecological factors on which plants depend for their nutrients; water and mineral supply. Indiscriminate deforestation, digging for minerals, and destruction of grazing lands for human habitation have done irreparable damage to the environment and even led to harsh climatic change. Some of the dangers posed by soil pollution are due to the fact that while the number of the earth's inhabitants are increasing, the earth's natural resources are by and large fixed as well as limited. Thus, the soil gets heavily polluted day by day by rapid anthropogenic activities and population explosion in developing countries.

Further, major mining activities affect the soil regime of the surrounding areas directly or indirectly. Hence, it becomes important to study soil quality as knowledge of soil parameters is essential for the planning and implementation of afforestation. Keeping the above aspects in view, four locations were selected to represent the entire area study area, and samples were collected from two depths viz. 0-30 and 30-60 cm during the study period.

##### **3.2 METHODOLOGY**

Soil samples were collected by digging a pit at the appropriate location from depths 0-30 and 30-60 cm with the help of a spade/ AGAR and a ' Khurpi'. The samples were brought to the CMPDI's laboratory at Ranchi and air-dried for a

few days. The air-dried samples were then ground in an agate mortar with the help of a wooden hammer and passed through a 2 mm (10mesh) sieve. The coarser materials were rejected and the sieved material was sampled by the standard Coning & quartering method (Ref. Jackson, M.L., 'Soil chemical analysis', Prentice Hall, India 1958).

The processed samples were analyzed for the different parameters according to the standard methods as described under Jackson, M.L., 'Soil Chemical Analysis, Prentice Hall, India 1958; millar, CE, turk, L.M. Foth, H.D. Fundamentals of Soil Science, John Wiley & Sons, Inc., New York, 1962, Indian Council of Agricultural Research, New Delhi, ' Hand Book of Agriculture', IS:2720 (Part IV), 1975 and IS:2720, Part (V), 1970; Methods of Soil Analysis, Part I & II, Black, CA et.al. American society of Agronomy, Inc. USA, 1965.

### **3.3 EQUIPMENT AND INSTRUMENTS USED**

- a. Ion Chromatograph
- b. AAS
- c. pH Meter
- d. Conductivity Meter
- e. Double-Beam Spectrophotometer
- f. Standard Sieves
- g. Oven
- h. Muffle Furnace, etc.

### **3.4 RATIONALE BEHIND SAMPLING**

The main aim of the soil testing is to assess the soil quality of the area for assessment of the production potential, selection of suitable species of plants for the green belt and afforestation as an anti-pollution measures. Thus, to assess the soil quality, eight nos. of samples were collected from different locations at the study area from the depths of 0-30 and 30-60 cm.

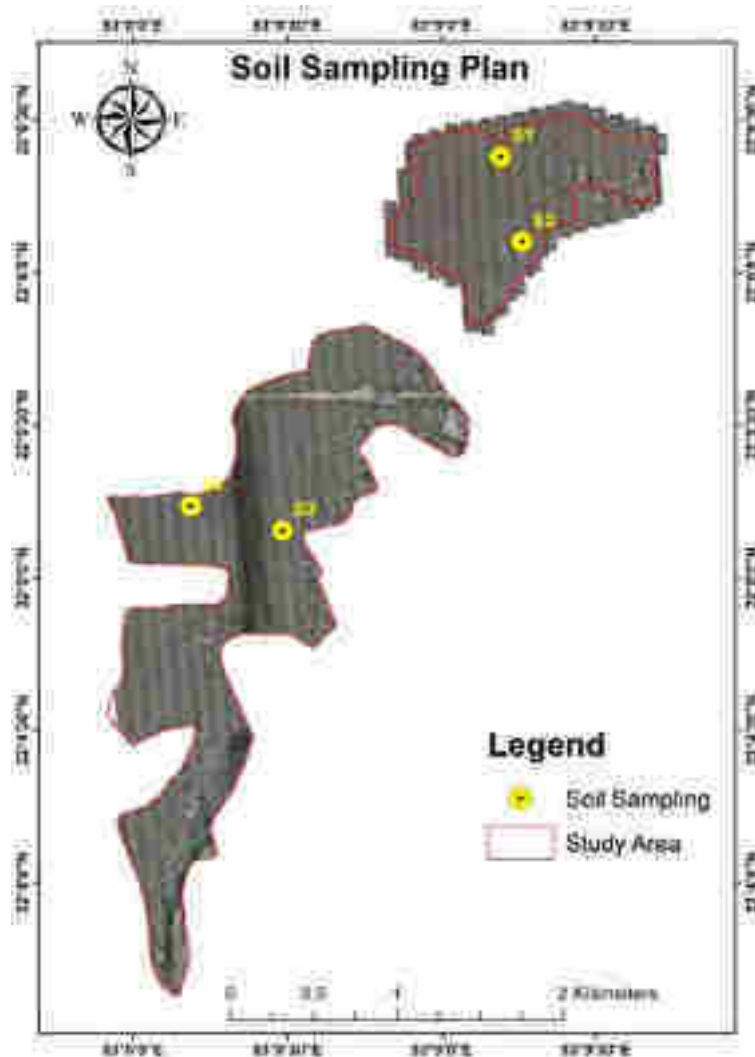
### 3.5 SAMPLING LOCATIONS

Details of sampling location are given below:

**Table-3.1**

Sampling location for soil quality assessment

Sl. No.	Name of Sampling Locations	Longitude	Latitude	Remarks
01.	S-1	83.1532	22.1063	Degraded Land
02.	S-2	83.1543	22.1017	Degraded Land
03.	S-3	83.1414	22.0859	Degraded Land
04.	S-4	83.1365	22.0873	Forest Land
		<b>Total No. of Sample</b>		<b>08</b>



**Fig. 3.1:** Soil Sampling locations

### 3.6 OBSERVATIONS

The observed characteristics of soil samples collected from four different locations are presented hereunder:

**Table-3.2**

Characteristics of soil: Sampling location: S-1, Degraded Land

		<b>Date of Sampling: 19.04.2023</b>	
<b>Sl. No.</b>	<b>Parameters</b>	<b>Observed Value</b>	
		<b>(0-30 cm)</b>	<b>(30-60 cm)</b>
1	Soil Texture	Sandy Clay Loam	Sandy Clay Loam
2	Grain Size, %		
	a) Sand	57.7	56.9
	b) Silt content	16.9	19.0
	c) Clay content	25.4	24.1
3	Porosity, %	31.47	30.78
4	Bulk Density, g/cm <sup>3</sup>	1.32	1.35
5	pH	5.30	5.27
6	Elect. Conductivity (mS/cm at 20°C)	0.13	0.11
7	Water holding capacity (inches of water per foot of soil)	25.51	23.46
8	Infiltration Rate (mm/hr.)	15.12	14.76
9	Cation Exchange Capacity, meq/100 g	29	27
10	Organic Carbon %	0.33	0.30
11	Phosphorous as P <sub>2</sub> O <sub>5</sub> kg/ha	32.51	28.29
12	Potash as K <sub>2</sub> O, kg/ha	160.08	149.08
13	Nitrogen as N, kg/ha	268	255

Table-3.3

Characteristics of soil sampling location: S-2, Degraded Land

Sl. No.	Parameters	Date of Sampling: 19.04.2023	
		Observed Value	
		(0-30 cm)	(30-60 cm)
1	Soil Texture	Sandy Loam	Sandy Loam
2	Grain Size, %		
	a) Sand	74.1	73.0
	b) Silt content	5.6	7.9
	c) Clay content	20.3	19.1
3	Porosity, %	29.72	28.56
4	Bulk Density, g/cm <sup>3</sup>	1.29	1.31
5	pH	5.35	5.27
6	Elect. Conductivity (mS/cm at 20°C)	0.16	0.11
7	Water holding capacity (inches of water per foot of soil)	18.2	17.6
8	Infiltration Rate (mm/hr.)	12.94	12.81
9	Cation Exchange Capacity, meq/100 g	17	14
10	Organic Carbon %	0.34	0.29
11	Phosphorous as P <sub>2</sub> O <sub>5</sub> kg/ha	24.28	21.57
12	Potash as K <sub>2</sub> O, kg/ha	164.98	157.51
13	Nitrogen as N, kg/ha	276	260

**Table-3.4**

Characteristics of soil sampling location: S-3, Degraded Land

Sl. No.	Parameters	Date of Sampling: 20.04.2023	
		Observed Value	
		(0-30 cm)	(30-60 cm)
1	Soil Texture	Sandy Loam	Sandy Loam
2	Grain Size, %		
	a) Sand	76.6	75.2
	b) Silt content	5.4	7.3
	c) Clay content	18.0	17.5
3	Porosity, %	28.07	22.21
4	Bulk Density, g/cm <sup>3</sup>	1.38	1.36
5	pH	5.6	5.4
6	Elect. Conductivity (mS/cm at 20°C)	0.19	0.18
7	Water holding capacity (inches of water per foot of soil)	20.1	18.9
8	Infiltration Rate (mm/hr.)	12.68	14.11
9	Cation Exchange Capacity, meq/100 g	19.0	17.0
10	Organic Carbon %	0.27	0.21
11	Phosphorous as P <sub>2</sub> O <sub>5</sub> kg/ha	24.69	20.84
12	Potash as K <sub>2</sub> O, kg/ha	143.70	139.76
13	Nitrogen as N, kg/ha	270	257

**Table-3.5**

## Characteristics of soil sampling location: S-4, Forest land

		<b>Date of Sampling: 20.04.2023</b>	
		<b>Observed Value</b>	
<b>Sl. No.</b>	<b>Parameters</b>	<b>(0-30 cm)</b>	<b>(30-60 cm)</b>
<b>1</b>	Soil Texture	Sandy Loam	Sandy Loam
<b>2</b>	Grain Size, %		
	a) Sand	65.1	64.2
	b) Silt content	14.6	16.7
	c) Clay content	20.3	19.1
<b>3</b>	Porosity, %	25.08	23.01
<b>4</b>	Bulk Density, g/cm <sup>3</sup>	1.38	1.37
<b>5</b>	pH	5.7	5.5
<b>6</b>	Elect. Conductivity (mS/cm at 20°C)	0.14	0.11
<b>7</b>	Water holding capacity (inches of water per foot of soil)	22.1	21.3
<b>8</b>	Infiltration Rate (mm/hr.)	13.60	14.20
<b>9</b>	Cation Exchange Capacity, meq/100 g	34	29
<b>10</b>	Organic Carbon %	0.45	0.40
<b>11</b>	Phosphorous as P <sub>2</sub> O <sub>5</sub> kg/ha	37.60	35.80
<b>12</b>	Potash as K <sub>2</sub> O, kg/ha	173.15	161.0
<b>13</b>	Nitrogen as N, kg/ha	395.0	387.0



Table-3.6

Soil Fertility Quality Standard w.r.t C:N:P: K

Sl. No.	PARAMETERS	QUALITY STATUS		
		Poor	Medium	Fertile
1	Organic Carbon %	<0.5	0.5 to 0.75	>0.75
2	Nitrogen as N, kg/ha	<280	280 to 560	>560
3	Phosphorus as P <sub>2</sub> O <sub>5</sub> , kg/ha	<23	23 to 57	>57
4	Potash as K <sub>2</sub> O, kg/ha	<133	133 to 337	>337

### 3.7 HIGHLIGHTS OF ANALYTICAL RESULTS

The highlights of some of the parameters as depicted in analytical results presented in are given here under:

**(i) Texture**

The texture of the soils was Sandy Clay Loam and Sandy Loam.

**(ii) pH**

The pH of the soils ranged between 5.27 to 5.7.

**(iii) Electrical Conductivity**

The electrical conductivity varied from 0.11 to 0.19 dS/cm at 20°C.

**(iv) Organic Carbon**

The organic carbon ranged between 0.21 to 0.45 %. Organic carbon is one of the important characteristics of the soil represents for fixation of nitrogen and survival of the various macro and microorganisms. It has been found in the range of poor quality the degraded forest land.

**(v) Phosphorus as P<sub>2</sub>O<sub>5</sub>**

The concentration of Phosphorous varied between 20.84 to 37.60 Kg/ha.

**(vi) Potash as K<sub>2</sub>O**

The concentration of Potash ranged between 139.76 to 173.15 Kg/ha.

**(vii) Nitrogen as N**

The concentration of Nitrogen varied between 255 to 395 Kg/ha.

### 3.8 SOIL TEXTURE DIAGRAM

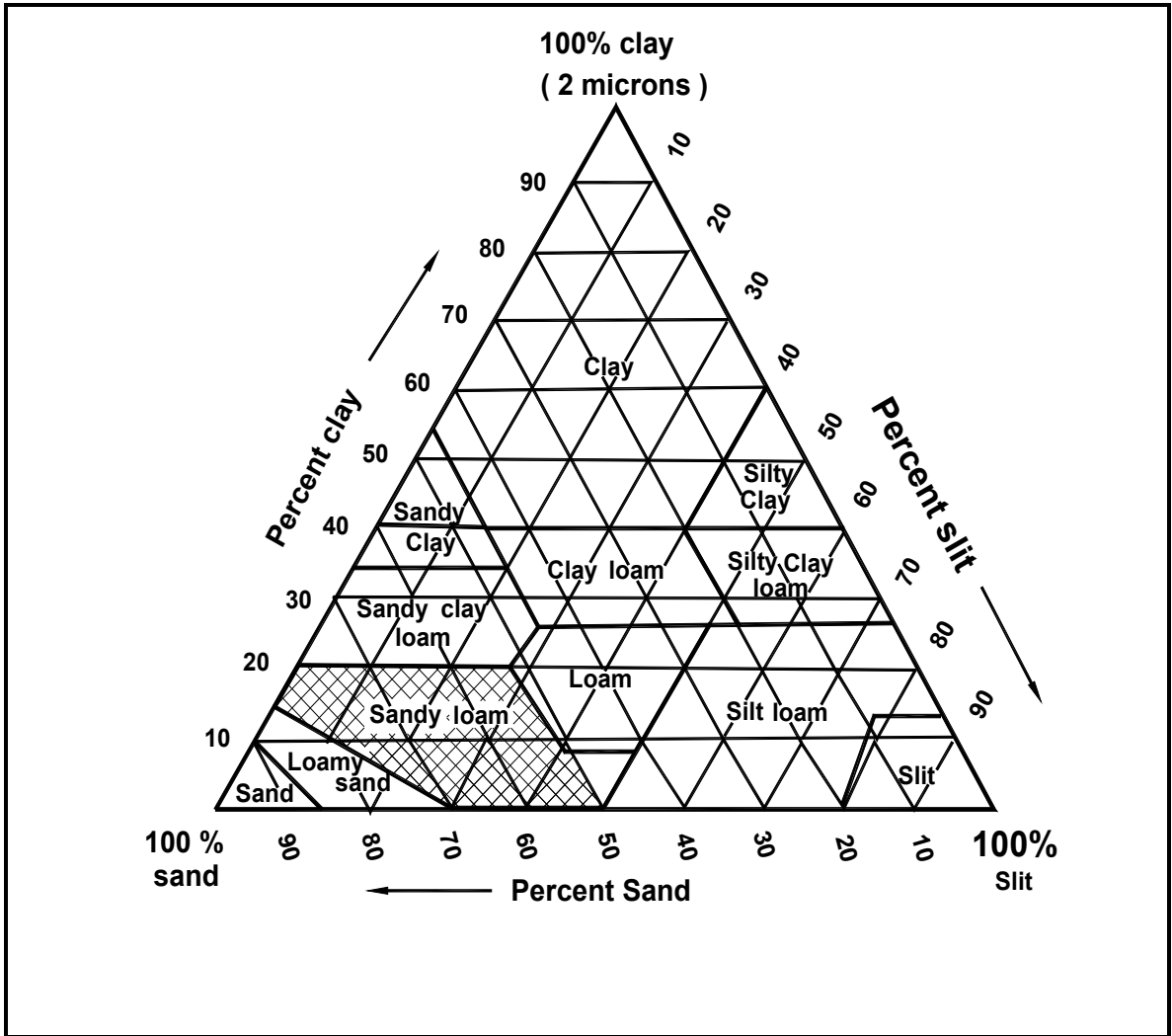





Fig 3.2 Soil Texture Diagram

### 3.9 FLORA DETAILS WITH REFERENCE TO TREE SPECIES.

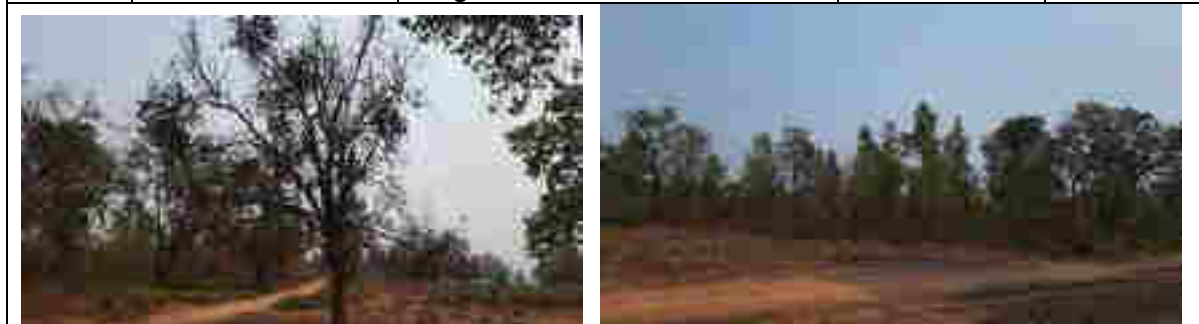
Table. 3.7 Photographs of study area

				
	Com name	Botanical name	GBH(CM)	Height (M)
1	Neem	Azadirachta indica	130	15
2.	Mahua	Madhuca longifolia	120	13
3	Haldu	Haldina cordifolia	120	13
4	Sarai/sal	Shorea roxburghii	130,170	16,17,19
				
1	Sarai/sal	Shorea roxburghii	110	18
2.	Tendu	Diospyros melanoxylon	--	--
				

1	Sarai/sal	Shorea roxburghii	140	18
2	Kurrah	Holarrhena pubescence	20	2
3.	Neem	Azadirachta indica	100	12
4.	Mahua	Madhuca longifolia	100	10
5	Sagwan	Tectona grandis	70	10



	Com name	Botanical name	GBH(CM)	Height (M)
1	Sarai/sal	Shorea roxburghii	140,110,120	18,15,17
2	Sagwan	Tectona grandis	70	10
3	Mohin	Lannaea coromandelica	40	4
4	Chhar	Buchanania cochinchinensis	--	--
5	Wild date	Phoenix sylvestre	--	--
6	Bael	Aegle marmelos	80	11



	Com name	Botanical name	GBH(CM)	Height (M)
1.	Seemal	Bombax ceiba	120	15
2	Bahera	Terminalia bellirica	120	15
3	Saj	Terminalia tomentosa	80	12
4	Kaim	Mitragyna parviflora	80	11
5	Bargath	Fius bengalensis	200	13
6	Bilawa	Semecarpus anacardium	80	11



1	Kusum	Schleichera oleosa	110	12
2	Sarai/sal	Shorea roxburghii	120	18
3	Ber	Ziziphus mauritiana	70	9
4	Babul	Vachillia nilotica	80	9
5	Wild fig	Ficus mollis	70	9
6	fig	Ficus racemosa	120	14
7	Polash	Butea monosperma	80	9
8	Safed babul	Acacia leucophloea	70	9

### 3.10 PHOTOGRAPHS DURING DRONE SURVEY



**Fig. 3.4** Drone on the Site



**Fig. 3.5** Drone flying above the site



**Fig. 3.6** Drone flying above the site

CHAPTER-4

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***Hydrogeological Studies***



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## CHAPTER- 4

# HYDROGEOLOGICAL STUDY

### 4.1 GROUNDWATER OCCURRENCE

The present study area is part of the Mand-Raigarh coalfield in the Raigarh district of Chhattisgarh state, India. Hydrogeological studies provide necessary information to assess baseline conditions, potential impacts due to mining, and effects of surface and ground water to the mining process. There are mainly two type of aquifers found in the area mainly unconfined aquifers (water table aquifers) and semi-confined aquifers. The unconfined aquifer mainly of thin alluvial formation comprising of soil, loose sand, weathered sandstone. The semi-confined aquifer exists below water table zone separated by weak bands of shale and coal. The semi-confined aquifers are less potential in nature and posses secondary porosity. The deeper aquifers behave as an unconfined aquifer at the outcrop region. In the sandstone aquifer, groundwater moves laterally through the inter-granular pore spaces of the sandstone.

The formations within the study area mainly belong to Gondwanas, Talchirs and Metamorphics. Major portion of the area is occupied by Gondwanas and rest is occupied by Supra-Barakars, Talchirs and Metamorphics (**Figure 4.2**).

### 4.2 TOPOGRAPHY AND DRAINAGE

The Chhal exploration block represents almost a flat topography, and a dendritic drainage pattern. The *Mand* River flowing along the western boundary of the Chhal OC project forms the most noticeable drainage in the study area. The west-flowing *Kurket* River meets the south-flowing *Mand* River towards the South of the mine, and both ultimately join the Mahandi River.

In the eastern side of the study area, the *Bojila* streamlet, *Katanganara* streamlet and the *Sukhia* streamlet flow towards and join the Kurket River. In the western part of the study area, the *Dom* streamlet flows south-eastward and joins the right-bank of the Mand River near the south-western boundary of the Chhal OC

project. The south-western part of the study area has a water-divide, which leads to presence of two watersheds in the study area. The *Borai* River flows mostly southwards in the far south-west of the study area.

Drainage network of the study area is extracted from ***SRTM-DEM of 90 m*** spatial resolution (USGS website) by utilizing the Hydrology tool of *ArcGIS* software. The drainage pattern existing in the core and buffer zone of the Chhal OC project is shown in **Figure 4.1**.

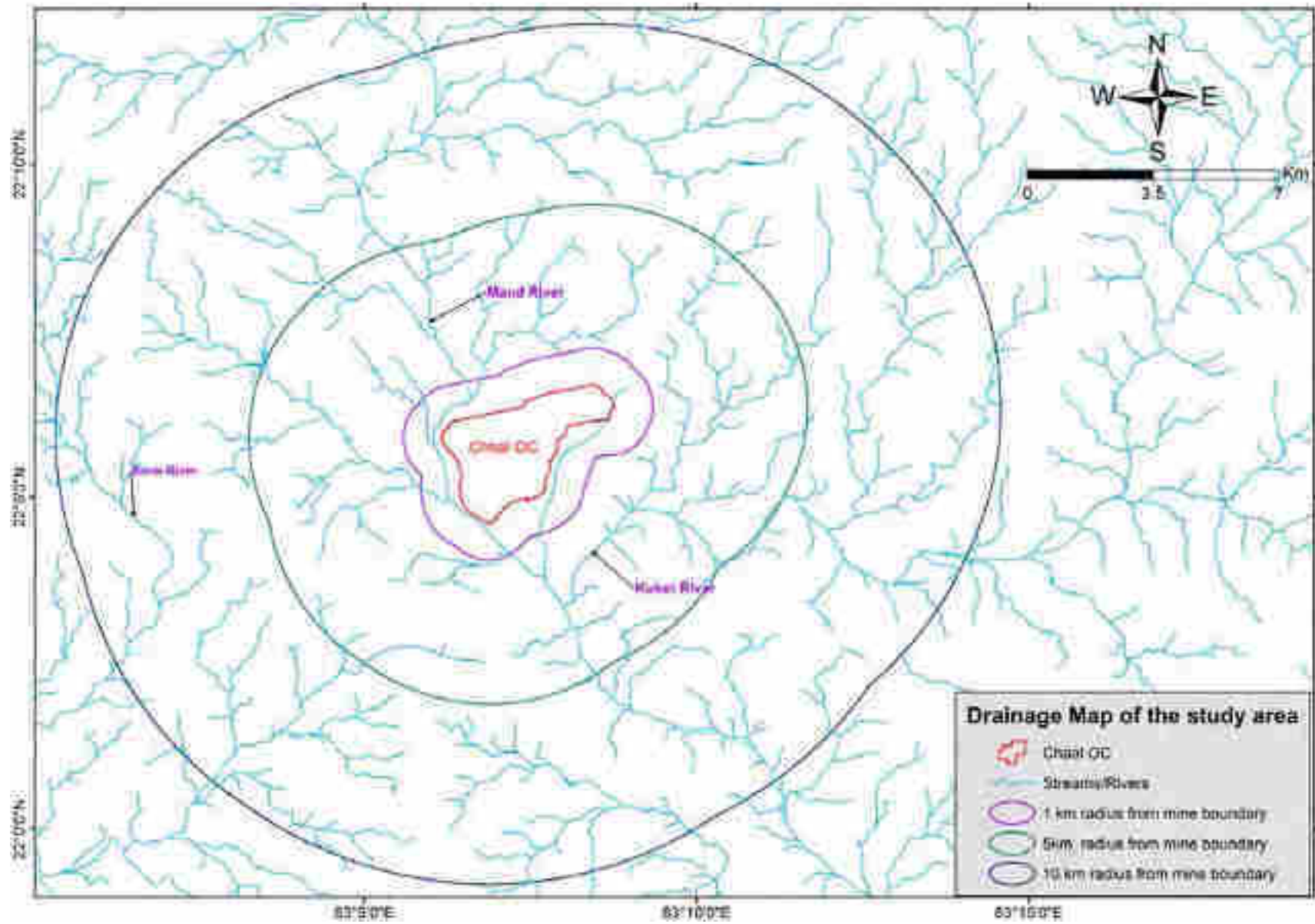


Figure 4.1: Drainage map of the study area in and around Chhal OC, Raigarh Area, SECL.

### 4.3 CLIMATE AND RAINFALL

The area experiences a sub-tropical climate with hot summer followed by well-distributed rainfall through the South-West monsoon season. The winter commences in December and lasts till the mid of February. Season during April to June is the summer with temperature rising to maximum ~45°C in the month of May, July to September is the monsoon season with an average ~1500 mm rainfall. Winter is short and temperature during this season dips to ~5 °C in the month of December.

### 4.4 GEOLOGY AND STRUCTURE

The Mand-Raigarh coalfield spreads over an area of 3700 sq. km, and is underlain by formations belonging to Permian to Triassic period, under a thin alluvial of Quaternary period. Pre-Cambrian formation of the Chhattisgarh group forms the basement in the area. The Mand-Raigarh basin is part of the Ib River-Mand-Raigarh master basin, lying within the Mahanadi basin. It displays a typical NW-SE zone of faulting coinciding with the trend of the Mahanadi-graben and the northern boundary not faulted over the major part.

The generalized stratigraphic sequence of the formations present in the area is given below in **Table 4.1**.

**Table 4.1:** Stratigraphic succession of the Mand-Raigarh coalfield

Age	Formation	Lithology
Recent to sub-recent		Sandy soil and laterite
Lower to Middle Triassic	Kamthi	Coarse to pebbly sandstone, and red clay
-----Unconformity-----		
Upper Permian	Raniganj	Fine to coarse-grained sandstone, siltstone, grey shale, carbonaceous shale, and thin coal seams
Middle Permian	Barren Measures	Grey black to black shale, fine to medium grained sandstone, and their alternations
Lower Permian	Barakar	Coarse, pebbly to conglomeratic sandstone, grey shale, and coal seams
Basal Permian	Talchir	Green, Khaki green to yellow splintery shale
-----Faulted Contact-----		
Pre Cambrian	Chhattisgarh	Quartzite, sandstone, phyllite
-----Unconformity-----		
Archaens		Granites and Pegmatites

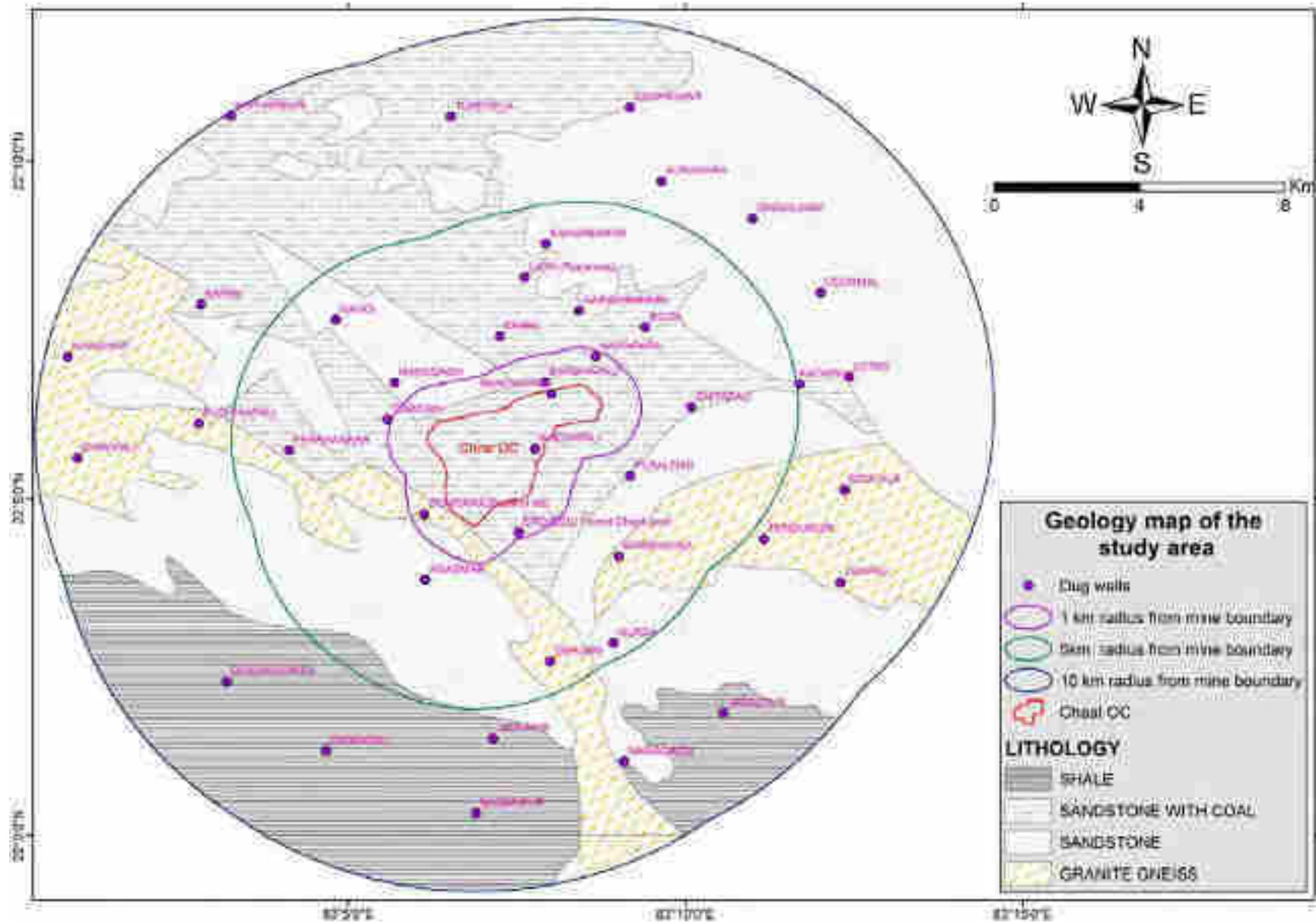


Figure 4.2: Geological Map of the study area

## 4.5 AQUIFER DESCRIPTION

In terms of the hydrogeology of the study area, it is covered by the Lower Barakar Formation comprising of micaceous sandstone frequently associated with grey shale, medium to coarse grained sandstone, and thick coal seams. The aquifer units present in Barakar sandstone are sandwiched between shale and coal beds. Due to sedimentation/ stratification, multi layered aquifer system prevails in the area. The formation comprising mainly of alluvium and sandy soil lying above the coal Seam-VI behave as unconfined aquifer. Whereas, lower formations consisting of compact sandstone mainly with secondary porosity behave as semi-confined/confined aquifer. The permeable sandstone is primarily the aquifer, while adjacent shale beds and coal seams act as aquicludes (**Figure 4.3**).

In the unconfined aquifer, groundwater moves laterally through the inter-granular pore spaces in the sandstone. Whereas, groundwater movement in lower aquifers are mainly restricted through the joints and fractures (i.e. secondary porosity) apart from that of inter-granular pore spaces. With the presence of intercalated shale and carbonaceous shale beds and reduction in permeability with depth, the lower aquifers are very poor in potential. The sandstone beds existing in the roof of the working coal seams are the major source for the inflow of groundwater into the mine workings.

The various hydrogeological units developed in the Chhal OC study area are furnished as follows are in **Table 4.2**.

**Table 4.2:** Various hydrogeological units developed in the Chhal block, Raigarh Area, SECL.

Type of aquifers	Hydrogeological unit	Formation	Thickness (m)
Phreatic aquifer	Aquifer (A)	Alluvium and weathered zone; sandy soil	6.00 - 63.60
Semi-confined aquifers (B, C, D, E & F)	Aquiclude/ Aquitard	Coal Seam-VI, Sandy Shale & Carbonaceous Shale	9.65 - 30.17
	Aquifer (B)	Compact, Fine to Medium grained sandstone with intercalations of shale	15.48 – 35.12
	Aquiclude/ Aquitard	Coal Seam-V, Shale and Carbonaceous Shale	48.51 – 57.67
	Aquifer (C)	Fine to Coarse grained sandstone with shale intercalations	59.92 – 66.60
	Aquiclude/ Aquitard	Coal Seam-IV	3.55 – 7.04
	Aquifer (D)	Fine to Coarse-grained sandstone	18.45 - 27.11
	Aquiclude/ Aquitard	Local Coal Seam	1.60 – 5.01
	Aquifer (E)	Fine to Coarse grained sandstone	2.05 – 45.20
	Aquiclude/ Aquitard	Coal Seam-III (Working Seam)	5.05 – 12.73
	Aquifer (F)	Fine to Coarse grained sandstone	58.25- 69.50
	Aquiclude/ Aquitard	Coal Seam-IIA	0.07 - 2.45

The thickness of unconfined aquifer zone present above coal seam-VI varies from 6.00 - 63.60 m. This layer behaves as phreatic and most potential aquifer. The lower aquifers are usually less potential due to compaction and the ground water flow dominates through secondary porosity developed.



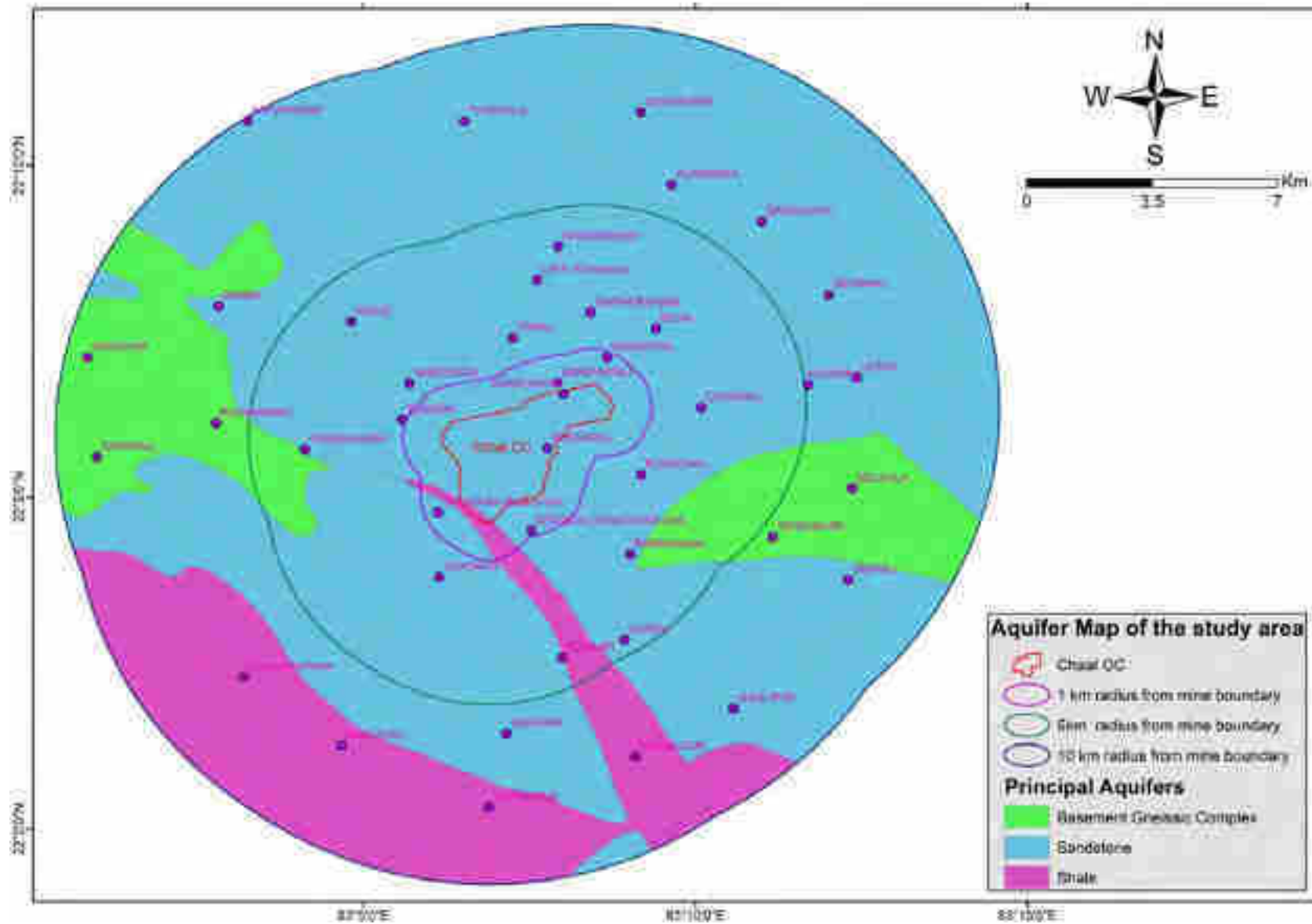


Figure 4.3: Aquifer Map of the study area

## 4.6 GROUNDWATER FLOW AND AQUIFER INTERACTION

Groundwater is a dynamic system. It always remains under the influence of periodic recharging and discharging factors. Due to this continuous influence, water levels of the aquifer system fluctuate and the range depends on the period of influence. The recharge to the ground water system is controlled by many factors such as rainfall, seepage from reservoirs, lakes, ponds, rivers and irrigation, etc. The output from the ground water system includes ground water withdrawal, natural seepage to rivers, evaporation from shallow water table and transpiration through vegetation.

To assess the water table configuration, a monitoring network consisting 48 dug wells, covering most of the villages falling within the core and buffer zone, was selected for the study area. The wells are mostly used for domestic water needs. The water levels in these dug wells were monitored during the post-monsoon period (November 2019).

For the preparation of Water Table (DTW) contour map, the 48 dug wells/ observation well data of the post-monsoon period for the year 2019 are used. Inverse distance weighted (IDW) technique is implemented for interpolating the points (wells) data for generating the raster layer. The Water Table contour map of the study area post-monsoon season (November 2019) depicts that the groundwater table is more or less horizontal with a gentle gradient (0.01-0.02) with an average of 0.12 sloping towards South-West in eastern of the study area, and towards South-Western part in the west of study area, overall covering towards the Mand river (**Figure 4.4**).

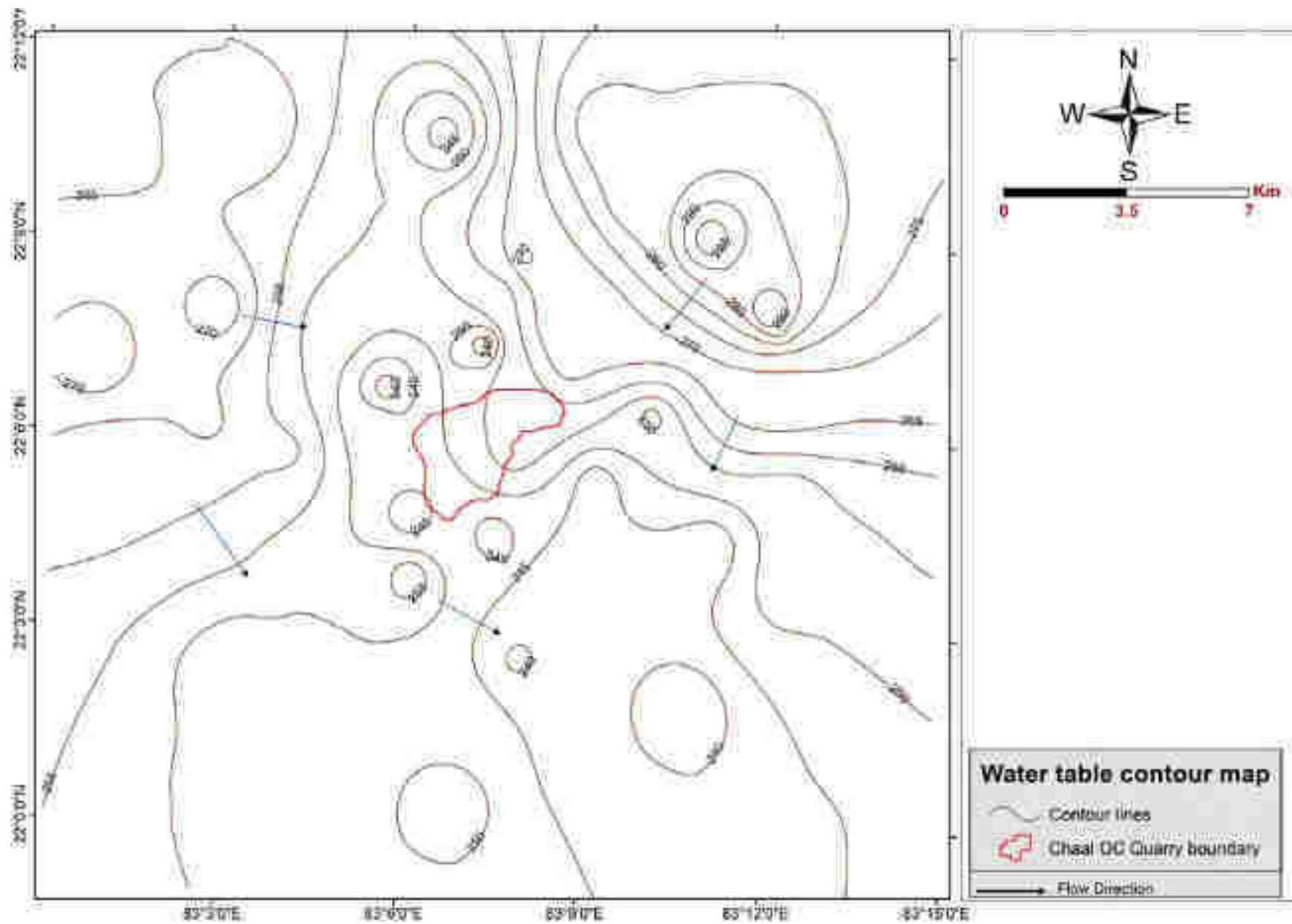
Depth to Water Level contour map of the study area prepared using the post-monsoon water level data (November 2019) is furnished in **Figure 4.5** and the details of monitoring wells and water levels are given in **Table 4.3**. The water level in the study area during the post-monsoon season is observed to vary from a minimum of 0.10 m (Chhal village) to a maximum of 6.80 m (Bandhapali village) in the study area.

Moreover, in recent times, extraction of groundwater for domestic use is happening through the tube wells/ bore wells in the study area due to urbanization and establishment of coal-based allied industries.

**Table 4.3:** Well Inventory details for the study area in and around Chhal OC, Raigarh Area, SECL

Sl. No.	Village	Latitude (°N)	Longitude (°E)	RL (m)	Post-Monsoon Water Level (m bgl)
1	Khedapali	22.0956	83.1295	260.2	2.75
2	Chitapali	22.1058	83.1681	250.8	0.68
3	Bandhapali	22.1092	83.1336	265	6.80
4	Kataipali	22.1116	83.1949	272.1	3.75
5	Lotan	22.1133	83.2072	271.8	2.48
6	Chhal	22.1233	83.1208	244	0.10
7	Bandhapali	22.1121	83.1321	262.7	2.40
8	Lath (Punarwas)	22.1379	83.1270	259.4	0.95
9	Nawapara	22.1184	83.1444	270.6	1.10
10	Garainbahari	22.1297	83.1403	271.9	1.50
11	Bojia	22.1256	83.1568	272.4	3.20
12	Deormal	22.1341	83.2001	297	3.50
13	Kansabhar	22.1462	83.1322	274.9	4.35
14	Singhijhap	22.1524	83.1833	299.1	0.25
15	Auranara	22.1618	83.1608	289.7	6.20
16	Turekela	22.1776	83.1087	246.4	1.95
17	Chuhkimar	22.1800	83.1530	288.3	3.35
18	Kurekela	22.1800	83.1087	240.6	1.10
19	Bangarsuta-li (Bhundbahari)	22.2154	83.0545	269.9	5.55
20	Kapharmar	22.1778	83.0543	272.3	1.95
21	Jobi	22.2154	83.0543	270.9	-0.55
22	Koru	22.2154	83.0543	270.9	6.00
23	Barra	22.1313	83.0469	274.5	0.30
24	Nagoi	22.1274	83.0802	257.5	3.50
25	Khamhar	22.1184	83.0140	275.3	0.45
26	Nandgaon	22.1120	83.0949	238.9	0.80
27	Garapali	22.0934	83.0165	264.6	0.20
28	Puchhiapali	22.1019	83.0464	267.4	0.10
29	Pharkanara	22.0952	83.0687	263.8	1.70
30	Tumidihi	22.1028	83.0930	249.6	2.50
31	DOMNARA (Base Of Hill)	22.0794	83.1021	243.5	0.75
32	Agasmar	22.0632	83.1024	259.5	1.66
33	Podi	22.0632	83.1024	259.5	2.85
34	Dehjari	22.0431	83.1333	241	1.29
35	Dhagarhpara	22.0381	83.0533	248.9	1.50

Sl. No.	Village	Latitude (°N)	Longitude (°E)	RL (m)	Post-Monsoon Water Level (m bgl)
36	BOTALDA (Foot Hills)	22.0384	83.0948	266.5	0.00
37	Parsapali	22.0210	83.0779	248.8	0.70
38	Jamjhar	22.0240	83.1192	251	1.31
39	Madanpur	22.0055	83.1149	254.9	0.36
40	Nawagaon	22.0183	83.1515	243.5	-
41	Jabalpur	22.0303	83.1761	235	-
42	Gurda	22.0476	83.1489	244.8	0.65
43	Barbhauna	22.0690	83.1503	244.4	1.40
44	Tendumuri	22.0733	83.1860	243.7	2.50
45	Jampali	22.0626	83.2050	256	2.46
46	Edukala	22.0855	83.2060	253.3	1.50
47	Pusaldah	22.0889	83.1530	243.2	2.85
48	ERO (EDU) Forest Check Post	22.0749	83.1255	246.9	2.95



**Figure 4.4:** Groundwater flow map of Post-monsoon season around the study area.

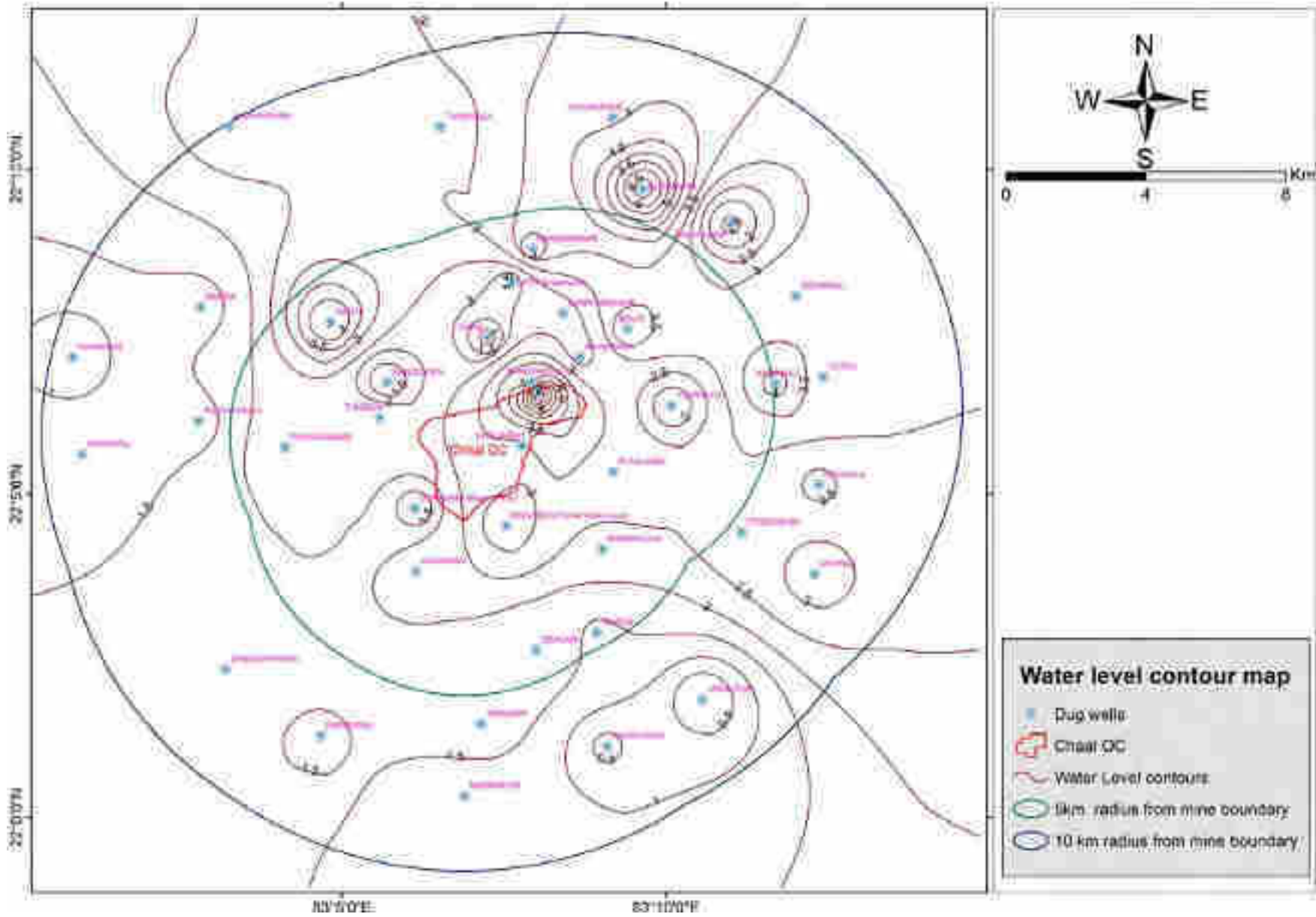


Figure 4.5: Depth to Water Level contour map for post-monsoon season around the study area.

#### 4.7 LONG-TERM GROUNDWATER LEVEL TRENDS

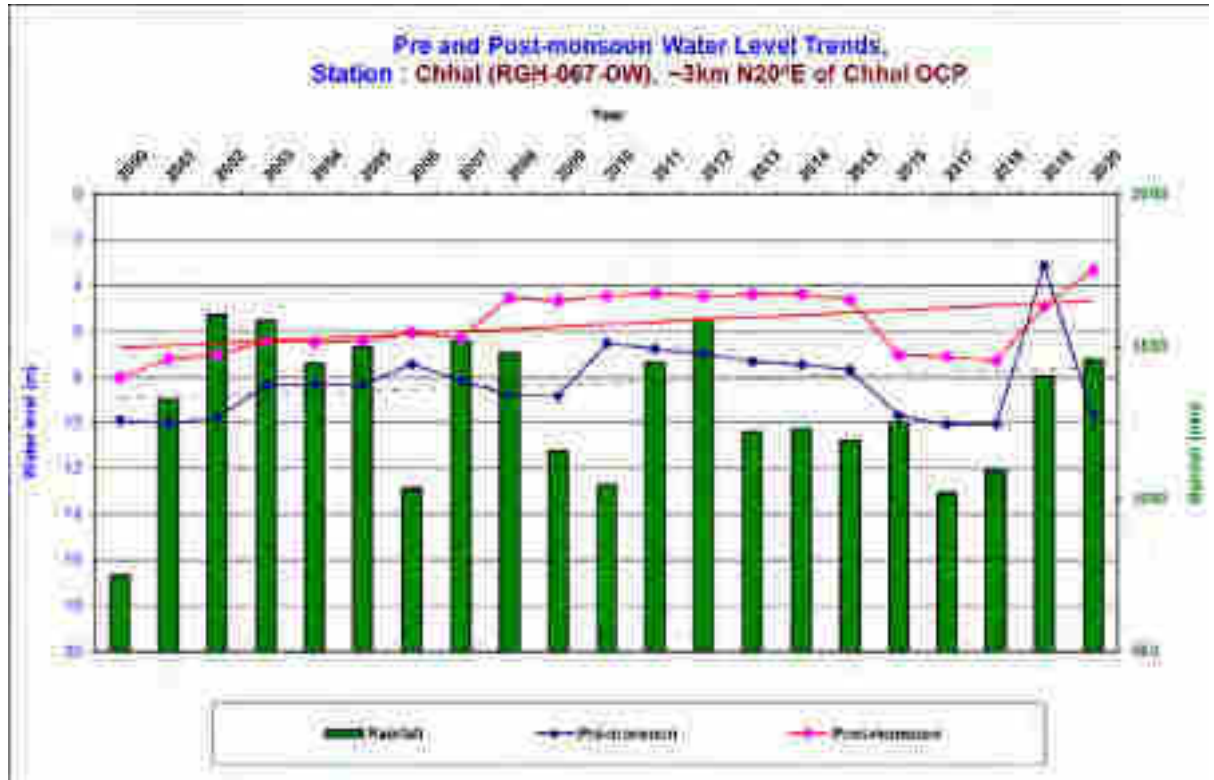
The Divisional Ground Water Survey Unit, Bilaspur (Chhattisgarh) has been monitoring the groundwater levels in the area. As a representative of the core and buffer zones, the pre-monsoon and post-monsoon historical groundwater levels for 21 years (2000 to 2020), recorded at Chhal (RGH-067-OW) and Edu/ Andu (RGH-068-OW) villages, located in the Gharghoda Development Block, Raigarh District were collected and are presented below (**Table 4.4**). The hydrograph water level trends are furnished in **Figure 4.6** and **Figure 4.7**.

**Table 4.4:** Historic groundwater levels of the study area in and around Chhal OC, Raigarh Area, SECL

Hydrograph Station / Year	Chhal (RGH-067-OW)			Edu/ Andu (RGH-068-OW)			Rainfall (m)
	Pre-monsoon	Post-Monsoon	Fluctuation	Pre-monsoon	Post-Monsoon	Fluctuation	
2000	9.92	8.02	1.90	6.15	5.20	0.95	750
2001	10.07	7.15	2.92	7.05	4.80	2.25	1327
2002	9.77	7.02	2.75	6.19	3.88	1.10	1607
2003	8.34	6.42	1.92	6.12	2.95	3.17	1587
2004	8.27	6.47	1.80	6.66	4.66	2.00	1447
2005	8.30	6.40	1.90	7.25	6.00	1.25	1501
2006	7.40	6.05	1.35	6.15	5.30	0.85	1036
2007	8.10	6.27	1.83	7.05	4.35	2.70	1520
2008	8.75	4.52	4.23	6.15	4.40	1.75	1480
2009	8.80	4.65	4.15	6.30	4.50	1.80	1157
2010	6.50	4.45	2.05	6.40	4.85	1.55	1046
2011	6.75	4.30	2.45	6.45	4.25	2.20	1450
2012	6.95	4.45	2.50	6.60	4.46	2.14	1593
2013	7.30	4.35	2.95	6.53	4.51	2.02	1221
2014	7.43	4.36	3.07	6.63	4.58	2.05	1228
2015	7.66	4.61	3.05	6.88	4.65	2.23	1192
2016	9.70	7.00	2.70	7.30	3.90	3.40	1252
2017	10.05	7.10	2.95	6.15	4.15	2.00	1021
2018	10.05	7.25	2.80	6.90	4.45	2.45	1093
2019	3.15	4.90	-1.75	6.90	4.20	2.70	1405
2020	9.70	3.30	6.40	6.80	3.90	2.90	1459
<b>Average</b>	<b>6.65</b>	<b>4.58</b>	<b>2.07</b>	<b>5.33</b>	<b>3.61</b>	<b>1.67</b>	<b>1052.74</b>

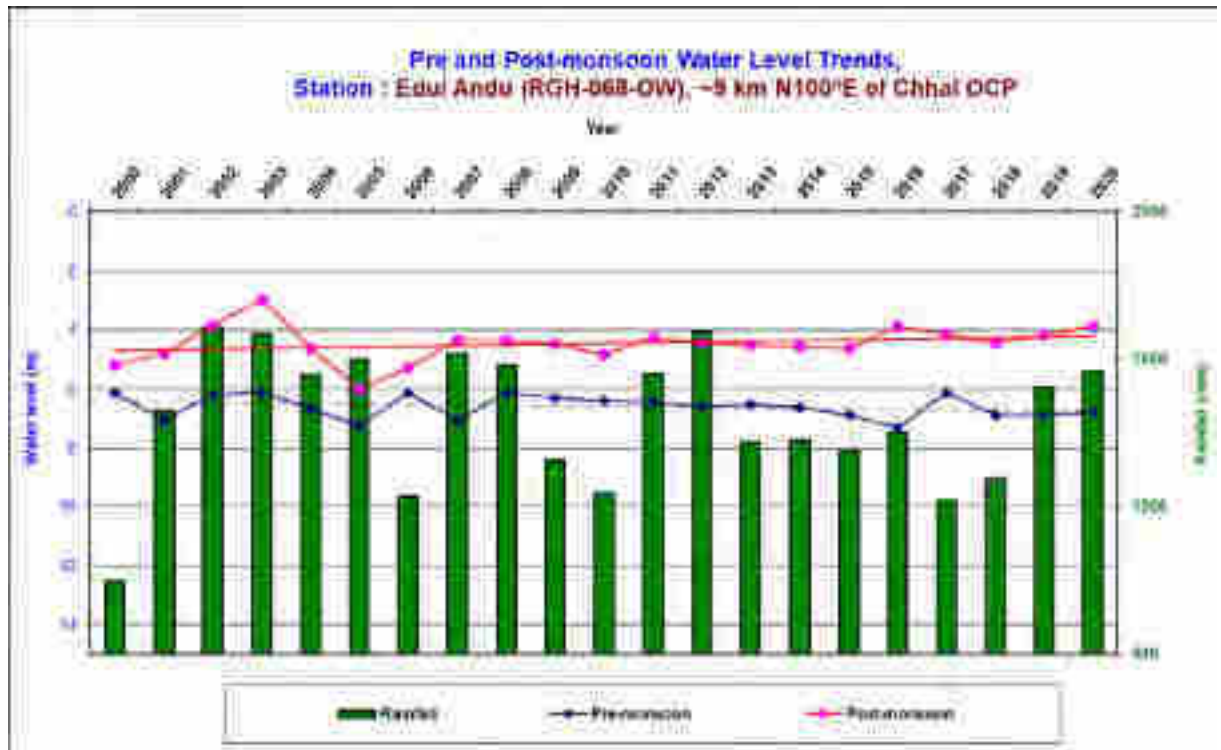
[Water level in meters below ground level (b.g.l)]

The historical groundwater levels monitored at Chhal and Andu hydrograph station reveal that the pre-monsoon water levels vary from 3.15 m (Chhal, 2019) to 10.07 m (Chhal, 2001) with an average of 5.99 m. The post-monsoon water levels in the area vary from 2.95 m (Andu, 2003) to 8.02 m (Chhal, 2000) with an average of 4.10 m. And the average water level fluctuation in the area varies from 0.85 m (Andu, 2006) to 6.40 m (Chhal, 2020) with an average of 1.91 m.



**Figure 4.6:** Pre and Post-monsoon groundwater level trends at Chhal station.





**Figure 4.7:** Pre and Post-monsoon water level trends at Andu/ Edu station.

## 4.8 WATER ENVIRONMENT

The water quality characterization has been conducted by collecting water samples from the surface water of the forest area. The various purposes of surface water monitoring are to assess the water quality characteristics for critical parameters; to facilitate predication of the impact on water quality by the area.

### 4.8.1 METHODOLOGY

The grab sampling method was adopted for the collection of the surface water samples from different sources of water bodies.

Three nos. of surface water were collected as representative samples to assess the water quality of the area during the study period. The sampling locations were selected from the available water body in the area. These samples were analyzed as per the “Standard Method for the Examination of Water & Waste Water” published by the American Public Health Association (APHA: 22<sup>nd</sup> Edition, 2012).

Samples for chemical analysis were collected in polyethylene containers. Samples collected for metal content were acidified with 1 ml. Conc. HNO<sub>3</sub> per liter. Samples for bacteriological analysis were collected in sterilized glass bottles. Some of the parameters such as temperature, pH, DO, alkalinity, total hardness and chloride, etc., which were liable to change with time were analyzed at the site with the help of an analytical kit, and one set of "Preserved" samples were brought to CMPDI's laboratory at Ranchi for detailed analysis of the remaining parameters stated in the tables.

#### **4.8.2 MAJOR INSTRUMENTS USED**

- Double-Beam Spectrophotometer
- Nephelometer
- Atomic Absorption Spectro - Photometer
- Conductivity Meter
- pH Meter
- Analytical Balance (Mettler)
- BOD Incubator
- High Speed Centrifuge
- Oven
- Muffle Furnace
- Ion Chromatography etc.

#### **4.8.3 RATIONALE BEHIND SAMPLING**

Any adverse impact or pollution consequence of water will have a serious effect on the environment. Thus, to assess the surface water quality, samples from different water bodies were collected from 3 different locations and analyzed for physicochemical and heavy metal parameters.

#### 4.8.4 Sampling Locations

Details of sampling location are given :

##### Sampling Location for Surface Water

Sl. No	Name of Sampling Locations	Code
01.	Mand River (Upstream)	SW1
02.	Mand River (Downstream)	SW2

#### 4.8.5 CHARACTERISTICS OF SURFACE WATER SAMPLES

The Physicochemical characteristics of two nos. of surface water samples collected locations have been presented below:

##### ➤ Physico-Chemical Characteristics Of Surface Water Quality

*(Wherever not specified, characteristics are expressed in mg/l)*

**Date of Sampling:** 19.04.2023 & 20.04.23

**Table 4.4 :** Analysis result of Surface Water

Sl.No	Parameter			Detection Limit
		SW-1	SW-2	
1	Arsenic (as As), mg/l, Max	<0.002	<0.002	0.002
2	BOD (3 days 27°C), mg/l, Max	<2.0	<2.0	2.00
3	Cadmium(as Cd), mg/l, Max	<0.0004	<0.0004	0.0004
4	Chlorides (as Cl), mg/l, Max	5.5	<2.00	2.00
5	Copper (as Cu), mg/l, Max	<0.02	<0.02	0.02
6	Disolved Oxygen, min.	7.1	6.9	0.10
7	Fluoride (as F) mg/l, Max	0.18	0.30	0.02
8	Hexavalent Chromium, mg/l, Max	<0.01	<0.01	0.01
9	Iron (as Fe), mg/l, Max	<0.04	<0.04	0.04
10	Lead (as Pb), mg/l, Max	<0.001	<0.001	0.001
11	Nitrate (as NO <sub>3</sub> ), mg/l, Max	0.72	0.61	0.50
12	pH value	7.02	7.16	1.0
13	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max	<0.001	<0.001	0.001
14	Selenium (as Se), mg/l, Max	<0.0005	<0.0005	0.0005
15	Sulphate (as SO <sub>4</sub> ) mg/l, Max	4	5	2.00
16	Total Dissolved Solids, mg/l, Max	105	100	25.00

17	Total Suspended Solids, mg/l, Max	<10.00	<10.00	10.00
18	Zinc (as Zn), mg/l, Max	<0.005	<0.005	0.005

#### 4.8.6 RESULTS & DISCUSSION

The physicochemical characteristics of the surface water samples collected from the 2 locations have shown great resemblance with respect to the characteristics like temperature, turbidity, pH, color, odor, chloride, sulphate, total alkalinity, total hardness, TDS and heavy metals, etc.

From the results presented above in, it may safely be concluded that the Physico-chemical characteristics of the surface water samples had a good resemblance with respect to almost all the parameters.

#### 4.8.7 Groundwater Quality

The suitability of groundwater for drinking/irrigation/industrial purposes is determined keeping in view the effects of various chemical constituents present in water. The ranges of different chemical constituents present in groundwater in nearby villages are given in Table 4.5.

**Table – 4.5 : Groundwater Quality Data**

Sl.No	Parameter	Sampling Stations		Detection Limit	IS:10500 Standards
		DW-1	DW-2		
1	Boron (as B), mg/l, Max	<0.2	<0.2	0.20	0.5
2	Cadmium (as Cd), mg/l, Max	<0.0004	<0.0004	0.0004	0.003
3	Calcium (as Ca), mg/l, Max	32	19.2	1.60	75
4	Chloride (as Cl), mg/l, Max	4	6	2.00	250
5	Copper (as Cu), mg/l, Max	<0.02	<0.02	0.02	0.05
6	Fluoride (as F) mg/l, Max	0.22	0.19	0.02	1.0
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	0.02	0.2
8	Iron (as Fe), mg/l, Max	<0.04	<0.04	0.04	1.0
9	Lead (as Pb), mg/l, Max	<0.001	<0.001	0.001	0.01
10	Manganese (as Mn), mg/l, Max	0.04	0.02	0.01	0.1
11	Nickel (as Ni), mg/l, Max	<0.003	<0.003	0.003	0.02
12	Nitrate (as NO <sub>3</sub> ), mg/l, Max	0.5	6.51	0.5	45
13	Odour	Agreeable	Agreeable	Qualitative	Agreeable

14	pH value	8.0	7.9	1.0	6.5 to 8.5
15	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max	<0.001	<0.001	0.001	0.001
16	Selenium (as Se), mg/l, Max	<0.0005	<0.0005	0.0005	0.01
17	Sulphate (as SO <sub>4</sub> ) mg/l, Max	7	4	2.00	200
18	Total Alkalinity (c <sub>a</sub> CO <sub>3</sub> ),mg/l, Max	116	44	4.00	200
19	Total Arsenic (as As), mg/l, Max	<0.002	<0.002	0.002	0.01
20	Total Chromium (as Cr), mg/l, Max	<0.002	<0.002	0.002	0.05
21	Total Dissolved Solids, mg/l, Max	134	71	25.00	500
22	Total Hardness (c <sub>a</sub> CO <sub>3</sub> ), mg/l, Max	124	60	4.00	200
23	Turbidity, NTU, Max	1	1	1.0	1
24	Zinc (as Zn), mg/l, Max	<0.005	0.01	0.005	5.0

All the parameters of drinking water samples are well within the permissible limit of IS 10,500: 2012

**CHAPTER-5**

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**Soil Moisture Index and Soil loss estimation**

## **CHAPTER-5**

# **SOIL MOISTURE INDEX AND SOIL LOSS ESTIMATION**

### **5.0 DRONE SURVEY**

In Chhal coal block CMPDI undertook UAV based survey for generation of high resolution orthomosaic image, DSM, and contour map of the proposed area for SMC study. The study area has been selected after a discussion with Mr Bhawani Shankar Pradhan, Divisional Engineer & Mr Ashok Mind, Asst. DM, at DFO Office, Dharamjaygarh, Raigarh dated 18.04.2023 and the total area covering 356.26 Ha lies in forest area near Khedapali & Chitapali village. The bounding coordinate of the area falls between longitude 83° 7'54.33"E to 83° 9'41.59"E and latitude 22° 3'36.93"N to 22° 6'31.69"N. Location of study area for UAV survey has been illustrated in the map (Fig 5.1). GCPs has been precisely measured on the ground using Leica DGPS, and the post-processing of the data has been done using Survey office software. As the area lies in the forest, number of GCPs had been restricted by approachability issues.



Fig 5.1: Location map and GCP plan of the study area

## 5.1 METHODOLOGY FOR DRONE SURVEY

Small category 50-volt battery operated quad-copter UAV with almost 60 min endurance along with Sony oblique camera as payload has been used by CMPDI for this project (Fig 5.2). The total weight of the drone was near about 14-15 kg and it can cover approximately 1 to 1.5 sq km area in a single flight, depending on the shape of the area, take-off location, weather condition and type of the terrain. However, considering the extreme heat at Raigarh in the summer season, only 45 to 50 min flying time has been performed for the safety of the equipment..





**Fig 5.2:** Image of Quad-copter Drone

Flight planning has to be executed prior to drone survey. KML of the study area has been opened in Google Earth and then GCPs were planned in such a way that it should be approachable and well distributed within the study area (Fig - 5.1). Total 6 GCPs for the upper block and 7 GCPs for the lower block has been planned. Proper marking of GCPs has been done in the ground, so that later they could be identified in the drone image also (Fig 5.3). Below image is showing one GCP marked as white cross at the middle of the image.

The take-off location or the home location has been chosen in a flat open surface near the study area. The radio antenna with the signal range of 4 km and ground control station has been set up near the home location. From east to west the study area seems to be extended approx. 3.10 kms and from north to south it is 5.27 kms. Hence, total three take off locations, two for the lower block and one for the upper block has been carefully chosen in such a way that UAV can cover the entire area, without having signal loss with the Ground Control Stations (GCS). After planning and placing all the GCPs in the ground, flight planning has been done using Dhaksha Space software. For this project, the flying height has been

kept at 120 m with 1.9 cm GSD. A sample drone image with the trees and a dug out area has been shown below (Fig 5.3).



**Fig 5.3:** Sample drone image of the area

The final flight plan has to be uploaded in the drone auto pilot before every single flight. After completion of a single flight, the POS data, which stores the positional information and image timing in excel format must be downloaded from the drone autopilot. The images from memory card have also been copied and stored sequentially in a folder. All the images acquired through UAV survey has been processed using Pix 4D software. DGPS location of the GCPs has been used during data processing for geo-referencing of the images and generation of orthomosaic (Fig 5.4). Contours has been generated at 2m interval as per the specifications of the project (Fig 5.5). The resultant orthomosaic is having a Ground Sampling Distance (GSD) of approx. 1.9 cm.

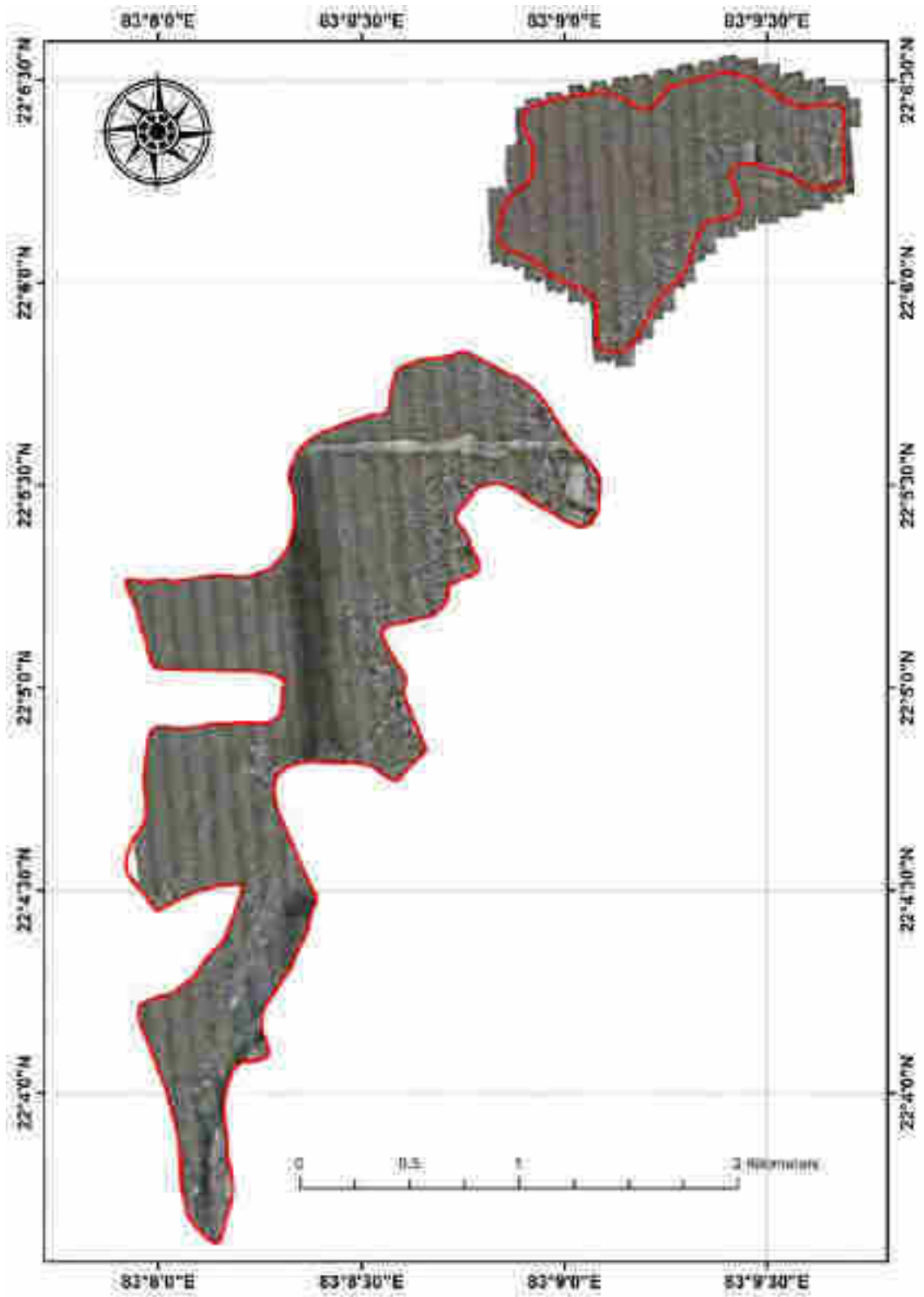


Fig 5.4: Orthomosaic of the study area

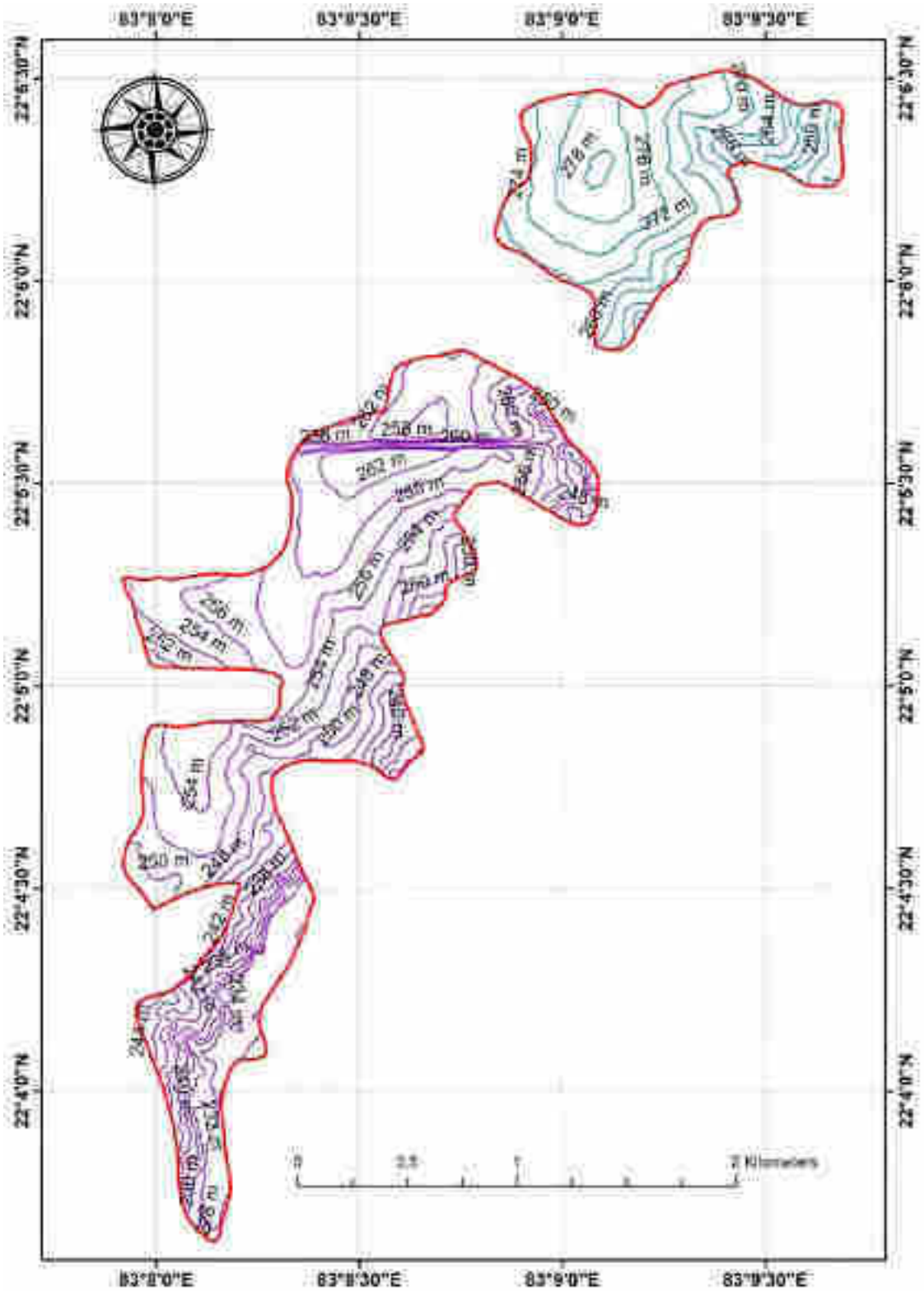


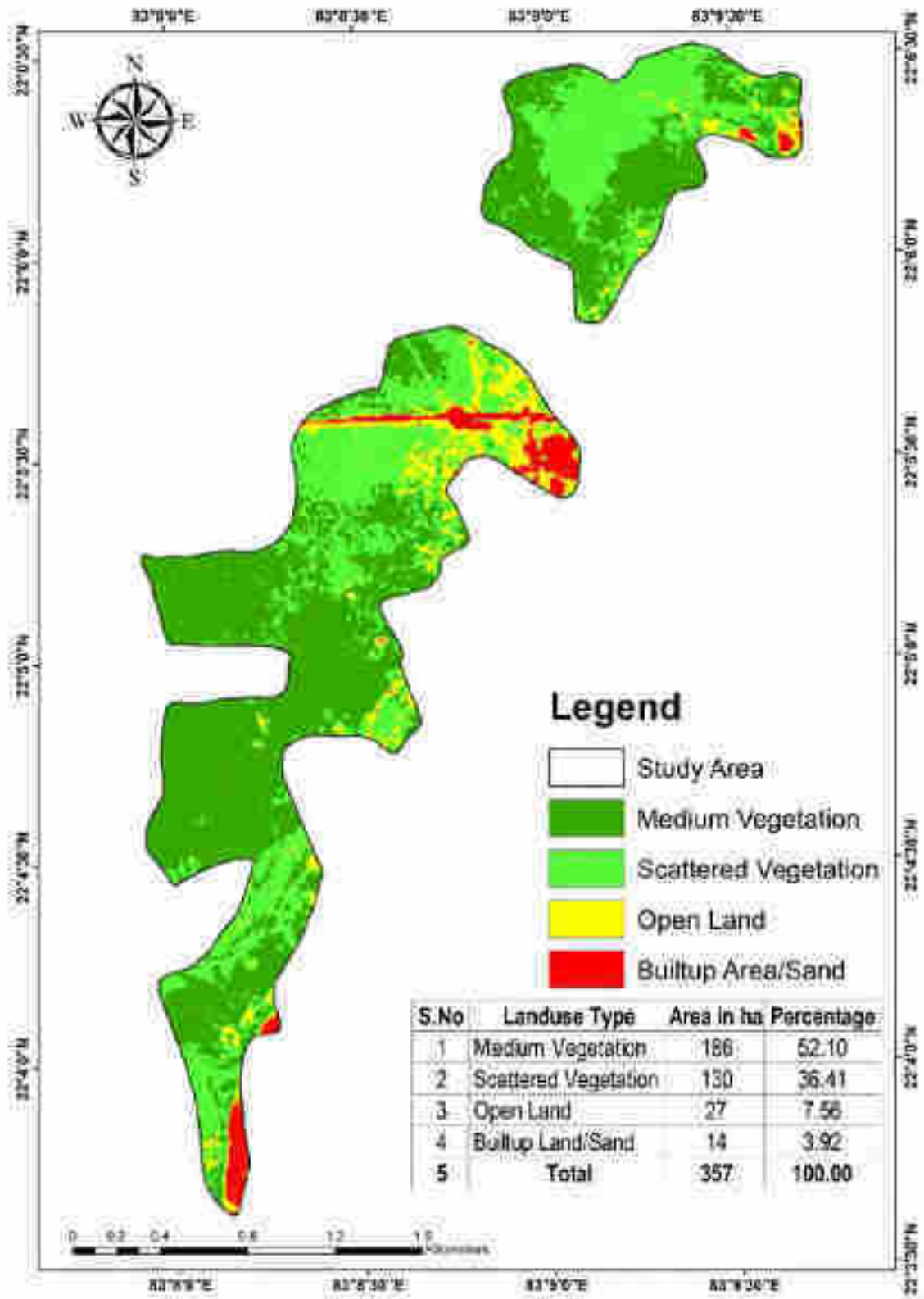
Fig 5.5: contour map of the study area

## 5.2 LAND USE OF STUDY AREA

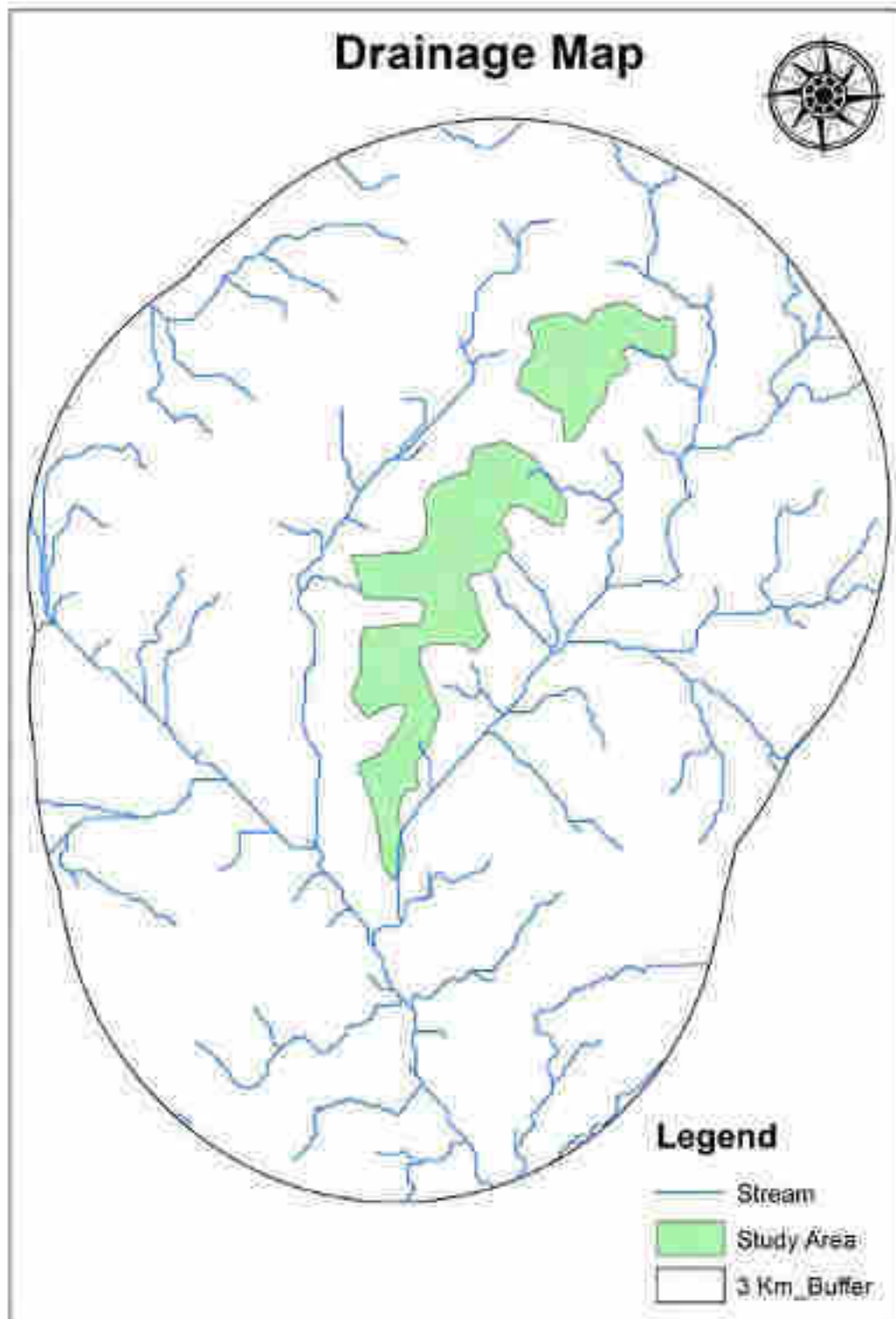
The proposed area for soil moisture conservation is 356.26 Ha of land which can be categorized into four main categories based on signatures got through sentinel images (Fig-5.6). A total of 186.00 ha of land falls in the medium vegetation category where some vegetation was available, 130.00 ha of land falls under scattered vegetation of land was available where scattered vegetation has been noticed and 27 ha of land falls under the open land area where very less or no vegetation was available. In the study area, 14.00 ha land was built-up area.

The drainage map of the study area has been shown in fig-5.7-a. It can be seen from the figure 5.7-a that there is no major or minor stream are passing through study area only two minor streams are touching the study area in northern part of both the segment. Although two major rivers are passing near to the study area in east as well as west side. The name of river in west side is Maand river and in east side Kurkut river.

The topography of study area is undulating. The elevation in study area varies from 278 m to 228 m (fig-5.7-b). Northern side of study area is elevated and slope is towards the south side. Major drainage of area is governed by the Maand and Kurkut river



**Fig-5.6** Land use map of the study area using sentinel satellite image (04-06-2022)



**Fig-5.7(a):** Drainage map of the study area

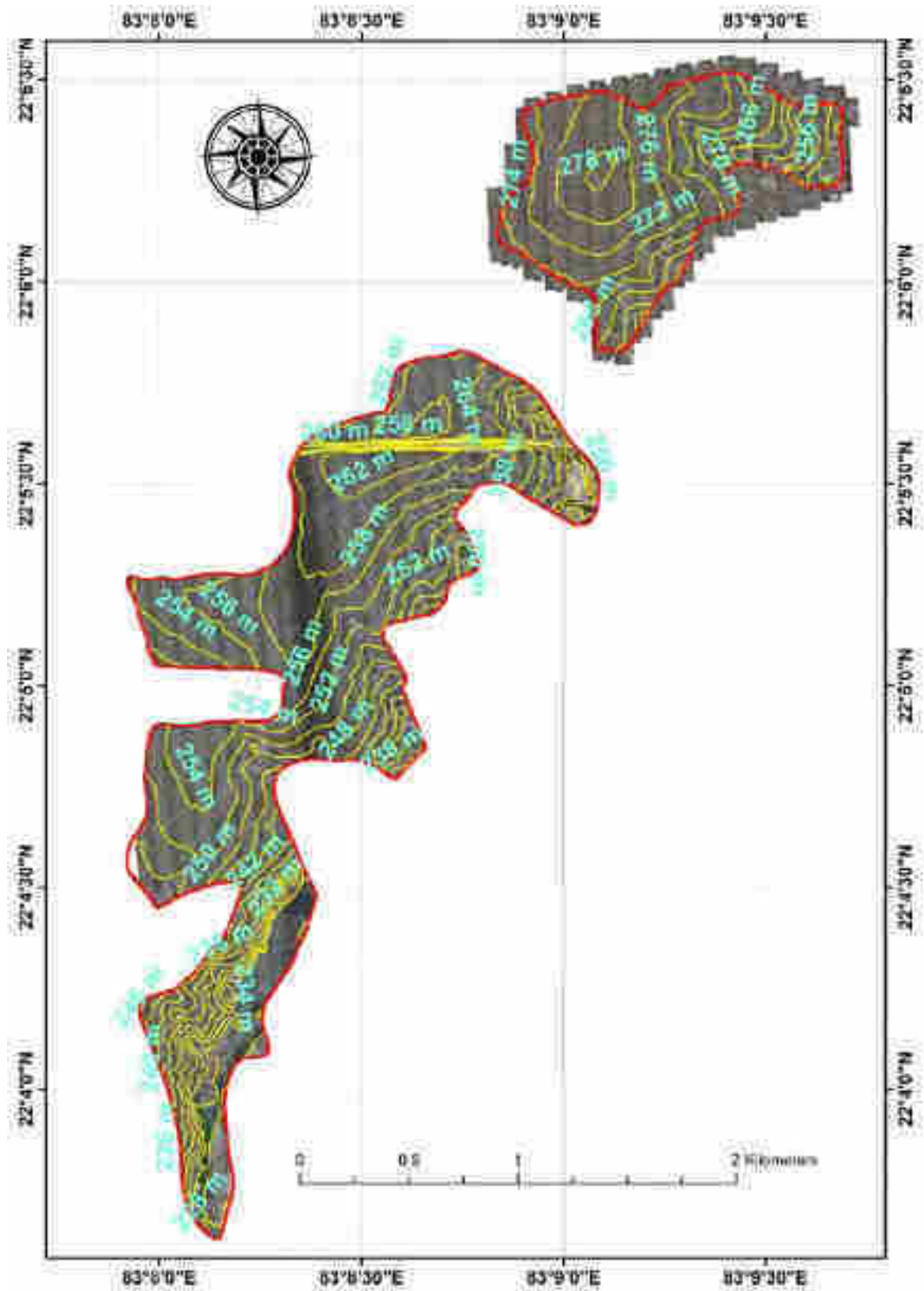


Fig-5.7(b): Contour map of the study area



## 5.3 SOIL MOISTURE INDEX

### 5.3.1 INTRODUCTION

Soil moisture is a key parameter that directly or indirectly influences the water cycle. The existence of forest cover and agriculture production mainly depend on rainfed areas as well as irrigation practices of the area. Climate change and the trend of increasing temperatures have a significant impact on forest cover. It is linked to various hydrological phenomena, such as drought, climate, and vegetation. The data collected for soil moisture analysis taken below the surface over the long term as well as higher temporal and spatial resolution data are valuable for assessing the extent and severity of drought quite accurately. Surface soil moisture is very sensitive and varies with space and time. Various studies have been done to assess soil moisture. Two methods of soil moisture measurement through remote sensing are based on the microwave part of the electro-magnetic spectrum and thermal, infrared observation.

In situ measurements can provide an accurate estimation of soil moisture, but they are both time-consuming and expensive, and only represent a small area (a few square decimeters). Nevertheless, a number of strategies can be adopted to upscale the spatially sparse ground-based observations, which are invaluable for calibrating and validating land surface models and satellite-based soil moisture retrievals.

The soil moisture index (SMI) is defined as the proportion of the difference between the current soil moisture and the permanent wilting point to the field capacity and the residual soil moisture. The index values range from 0 to 1 with 0 indicating extreme dry conditions and 1 indicating extreme wet conditions.

### 5.3.2 METHODOLOGY

The soil moisture index is based on empirical parameterization of the relationship between land surface temperature (LST) and normalized difference vegetation index (NDVI) and calculated using Equation (5.1)

$$SMI = (LST_{max} - LST) / (LST_{max} - LST_{min}) \quad 5.1$$

where  $LST_{max}$  and  $LST_{min}$  are the maximum and minimum surface temperature for a given NDVI and  $LST$  is Land Surface Temperature. The surface temperature of a pixel for a given NDVI is derived using remote sensing data.  $LST_{max}$  and  $LST_{min}$  are calculated using Equations (5.2) and (5.3), respectively.

$$LST_{max} = a1 * NDVI + b1 \quad 5.2)$$

$$LST_{min} = a2 * NDVI + b2 \quad 5.3)$$

where  $a1$ ,  $a2$ ,  $b1$ , and  $b2$  are the empirical parameters obtained by the linear regression ( $a$  present slope and  $b$  present intercept) defining both warm and cold edges of the data. First step in SMI calculation is the conversion of digital number (DN) to spectral radiance ( $L$  W/m<sup>2</sup>/sr/μm) using Equation (5.4):

$$L = LST_{min} + (((LST_{max} - LST_{min}) / (QCAL_{max} - QCAL_{min})) * (DN - QCAL_{min})) \quad \text{---(5.4)}$$

where,  $LST_{min}$  and  $LST_{max}$  are spectral radiance calibration constants (Table 5.1);  $QCAL_{max}$  and  $QCAL_{min}$  are the highest and lowest quantized calibration pixel values, and DN is the Digital Number.

**Table 5.1**

Spectral radiance ( $L_{min}$  and  $L_{max}$ ) values for thermal bands of Landsat imagery.(May-2022)

Landsat 5 (Band 6)		Landsat 8 (Band 10 and 11)	
Radiance maximum	Radiance minimum	Radiance maximum	Radiance minimum
1.238	15.303	0.1003	22.0018

Two inputs must be calculated ( $LST$  and  $NDVI$ ) to be able to calculate  $LST_{max}$  and  $LST_{min}$ .  $LST$  (K) is calculated using Landsat 5 and Landsat 8 Thermal bands using Equation (5.5):

$$LST = Tb / [1 + (\lambda * Tb / C2) * \ln(\epsilon)] \quad (5.5)$$

where  $Tb$  (Equation (5.6)) is At-Satellite Brightness Temperature,  $\lambda$  is the wavelength of emitted radiance,  $C2 = 1.4388 * 10^{-2}$  m K and it is presented with

Equation (5.7) and  $\epsilon$  is emissivity (typically 0.95).

$$Tb = (K2/(\ln (K1 * \epsilon/L + 1))) \quad (5.6)$$

where  $K1$  is the sensor-dependent calibration constant 1 and  $K2$  is the sensor-dependent calibration constant 2 (Table 5.2).  $E$  is emissivity (typically 0.95), and  $L$  is the spectral radiance.

$$C2 = h * c/s \quad (5.7)$$

where,  $h$  is Planck's constant =  $6.626 \times 10^{-34}$  J s;  $c$  is the velocity of light =  $2.998 \times 10^8$  m/s, and  $s$  is the Boltzmann constant =  $1.38 \times 10^{-23}$  J/K.

**Table 5.2**  
Landsat 5 and 8 thermal infrared (TIRS) thermal constant

Landsat 8 (Band 10)		Landsat 8 (Band 11)	
K1	K2	K1	K2
774.89	1321.08	480.89	1201.14

The ratio of the reflectivity differences for the NIR and the red band to their sum (NDVI) is calculated using Equation (5.8) :

$$NDVI = (NIR - Red)/(NIR + Red) \quad (5.8)$$

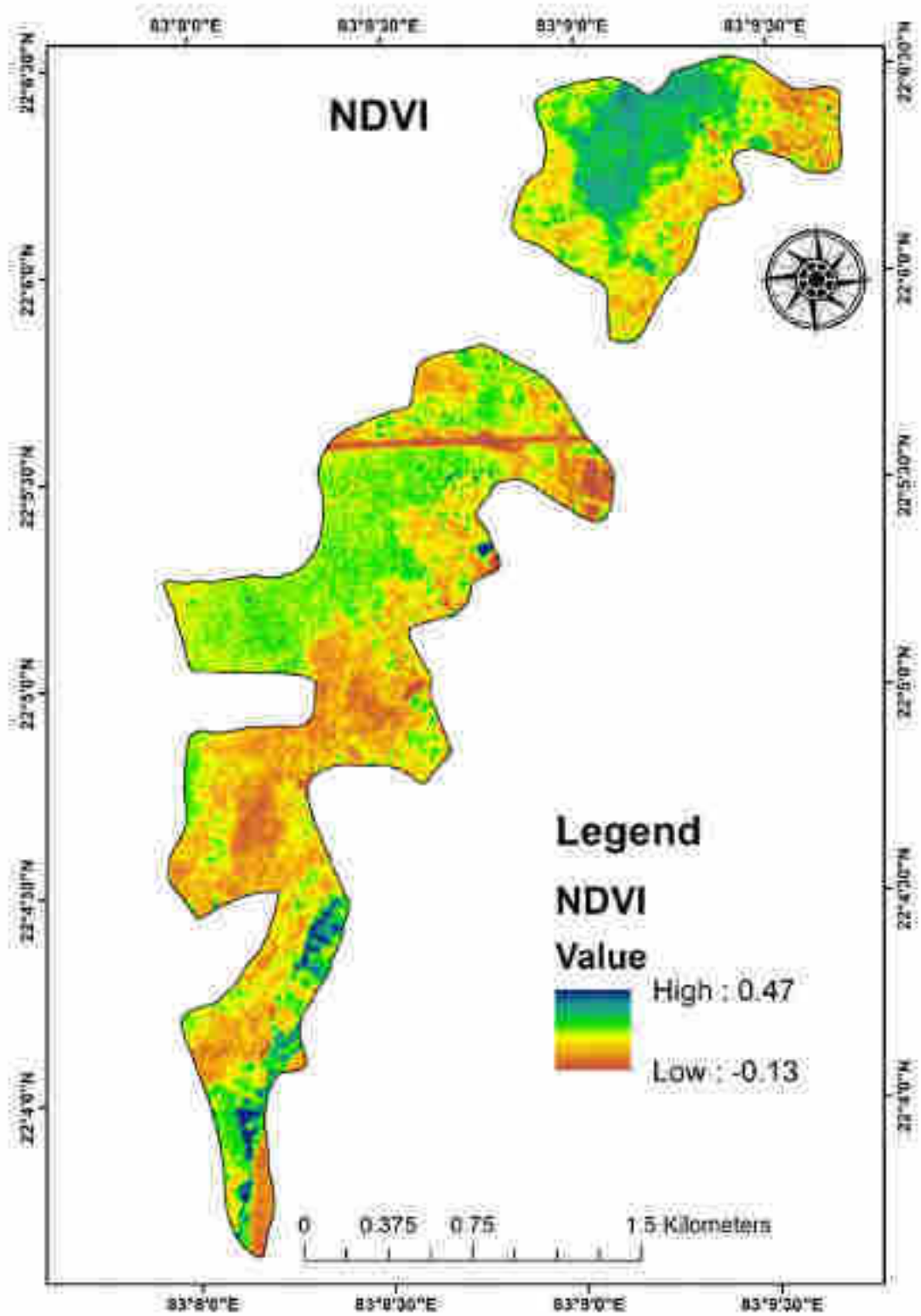
The final step in the data collecting is the determination of empirical parameters by linear regression. To do so, statistical software was developed which was able to process the data for the same pixel from two raster sets, LST and NDVI.

### 5.3.3 RESULTS AND DISCUSSION

NDVI (Figure 5.8) and LST (Figure 5.9) are calculated based on essential data to obtain SMI calculation. NDVI values vary in the range of -1 to 1 where negative value indicate the absence of vegetation or poor vegetative cover, while positive values show dense and good vegetative cover. LST values are the temperature of the surface which is measured in °C. The SMI result is accessible

with the values range within 0 to 1, where values close to 1 are regions with a lower vegetation cover and surface temperature which indicates that the surface has low infiltration and present a higher amount of soil moisture. the values close to 0 are the areas with a major vegetation cover and surface temperature and present a low level of soil moisture and increased infiltration capacity of the soil surface.

NDVI value in the study area is within the range of -0.13 to 0.47 as shown in Figure 5.8. Land surface temperature (Fig-5.9) value varies between a minimum of 30.15 °C and a maximum of 38.22 °C. The results of the soil moisture index map (Fig-5.10) of 14 May 2023 indicate the soil moisture index was in the range of 0.19 to 0.30 as classified in different color gradients. Few parts of the study area, as shown in Figure 5.10 are lying in very water stressed zone. Overall, the soil moisture in study area is not optimal for forest growth. The values near 0.30 (blue color) are near to waterbody which is the reason for good moisture content at those areas. The yellow zones are water deficit area compare to the other parts of the study area. As per the index, value 1 represents a higher presence of water or moisture like such as waterbody like river or pond, and zero indicates minimum moisture content, such as drought areas. The SMI below 0.2 needs immediate intervention for the restoration of good health of the forest.



**Figure 5.8:** Normalized difference vegetation index (NDVI) map.

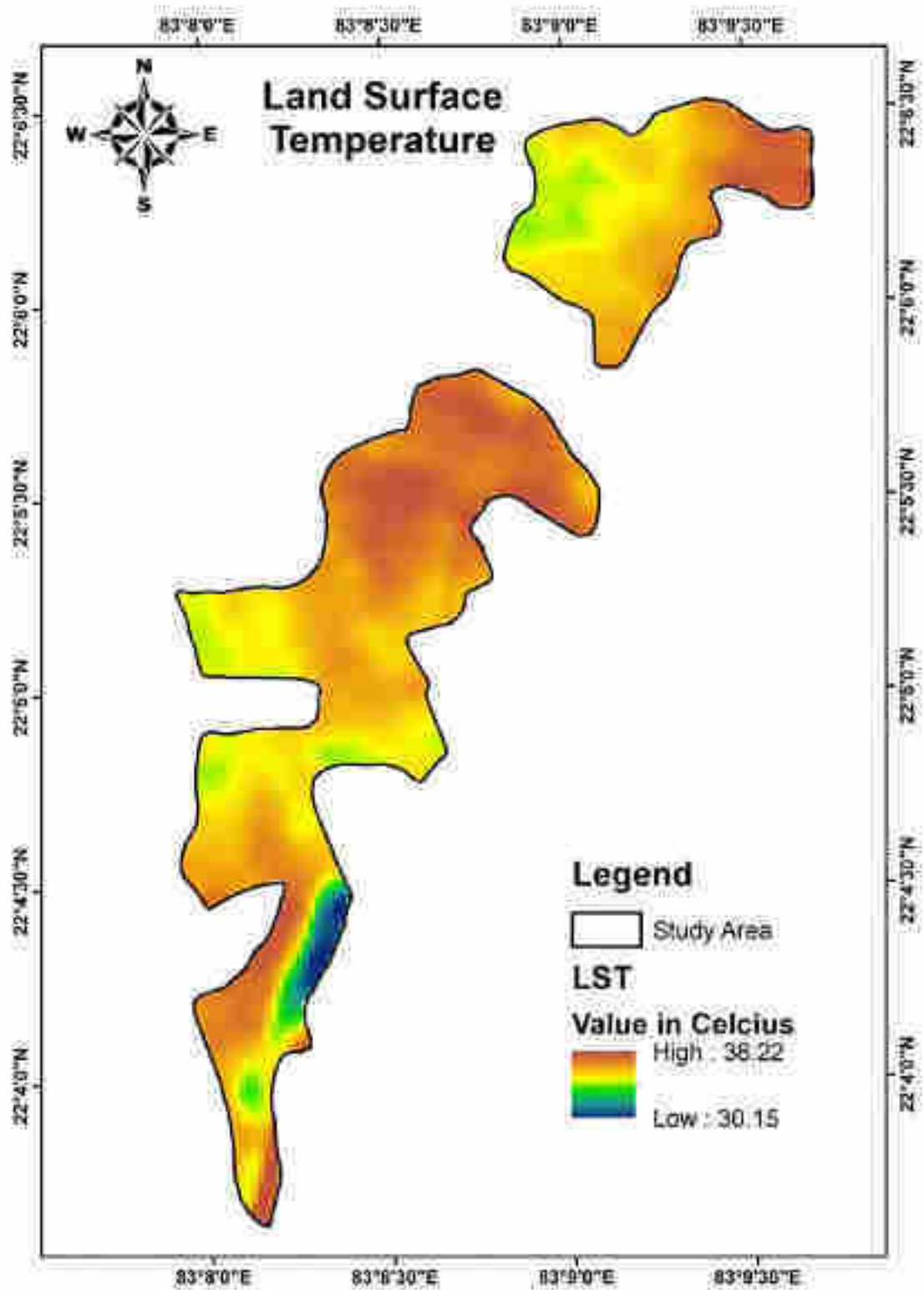


Figure 5.9: Land surface temperature (LST) map. (14-05-23)

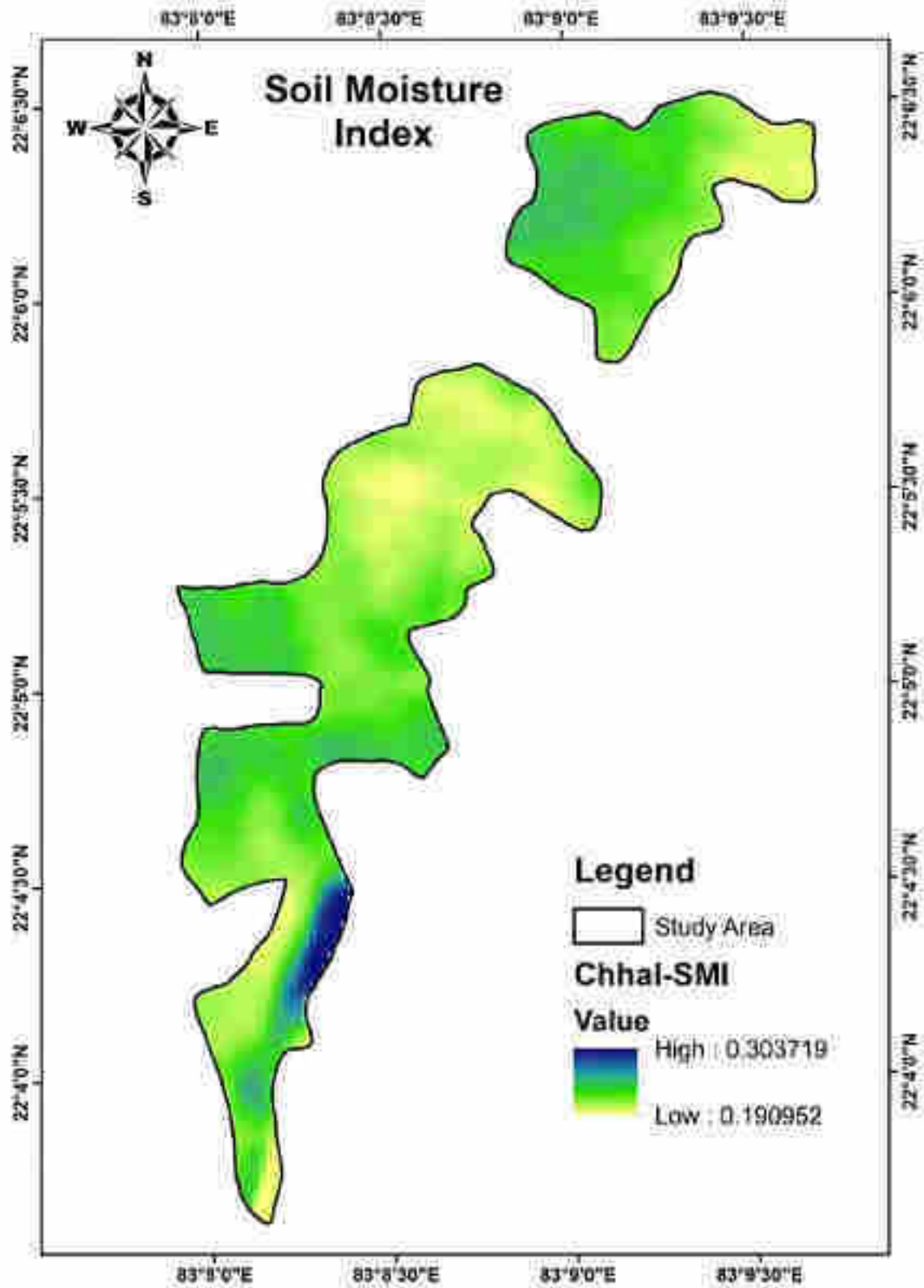


Figure 5.10.: Soil moisture index map of the study area (14-05-23)

## **5.4 REVISED UNIVERSAL SOIL LOSS**

### **5.4.1 SOIL EROSION PROCESS**

Soil erosion is a quite complex phenomenon that is governed by some natural processes where the end result is decreased soil fertility, depleted water quality, and above all reduced crop yields or loss in vegetation. Biophysical factors that comprise soil, climate, ground cover, terrain, and their interactions modify the soil erosion process. Terrain characteristics that affect soil erosion include slope gradient, slope length, aspect, and shape. The runoff mechanism is greatly influenced by the slope gradient impact and aspect. As the slope gradient increases, the infiltration component reduces, and generated runoff runs down the slope, the end result is more erosion. Soil erosion is described as a natural geomorphic (both ends process whose occurrence on the land's surface is quite continuous, and above all, it is more frequent and well distributed. This is because the surface of the Earth is exposed to water, wind, ice action, and gravitational forces at various spatiotemporal scales. Soil erosion process is accelerated by anthropogenic perturbations and improper land use practices, whose impacts are felt on soil and environment. Farming, habitation, terracing, deforestation, and overgrazing are some of the activities which lead to increased soil erosion rates. Soil erosion process has three distinct phases: detachability, transportability, and deposition. Soil erosion process begins with detachment, where breakdown of soil particles occurs due to raindrop impact, shearing, and/or the drag force possessed by wind or even through forces that result from tillage activities. Detached soil particles are transported and thereafter get deposited as the force of the eroding agent subsides.

Water-induced soil erosion is reported to be the most extensive among the other soil erosion causes. This form of erosion is much dependent on land cover, surface gradient, and type of soil. Water erosion has a significant contribution to depletion of organic matter content and important soil nutrients; hence, the functionality of the soil is largely affected. According to Pimentel, farmlands are



washed at a rate of between 10 and 40 tonnes, which is much more than the rate of soil replacement. Water erosion has been identified as a worldwide problem because of the interrelationship between natural resources, population, and climate change.

#### **5.4.2 SOIL EROSION MODELS**

Soil erosion models make use of mathematical expressions so as to relate dominant parameters and processes that occur on land's surface. The parameters involved include terrain characteristics, soil properties, land use/land cover, and weather variables. Soil erosion models describe detachment, transport, and deposition phases, which comprise the soil erosion process. Soil erosion models serve as important tools for planning because they enable the prediction of soil loss. Above all, models create a clear understanding of the entire soil erosion phenomenon and the resulting impacts. However, the choice of appropriate models for a particular soil erosion study is based on the objectives, catchment characteristics, and data available on the model's efficiency. Consequently, models differ based on complexity, involved processes, and data required to calibrate and use the model. In this study empirical model Revised Universal Soil Loss Equation (RUSLE).

#### **5.4.3 REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE)**

RUSLE model is a good example of an empirical model which is well recognized, widely accepted, and very much implemented in soil erosion studies. It is derived from the USLE model, and its application spans over 40 years. The model was designed and developed by a team of high-ranking scientists and some soil conservationists having vast experience in matters relating to soil erosion. It comprises mathematical equations that quantify the average soil loss on an annual basis at different geospatial scales. Many researchers had cited it as the best technology ever for estimation of soil loss in undisturbed areas characterized by overland flow, land surface experiencing disturbance, and recently or already reclaimed lands. Additionally, the model is very well applicable in ungauged

catchments, its demand for data is quite moderate, and above all, it integrates well with GIS enabling upscaling of the soil erosion process. The results of the RUSLE model are a representation of the sediment amount lost from a user-defined landscape. The superiority of the model is brought about by its prowess in accounting for different control management actions with minimal data requirements. The basic assumption that forms the foundation of the RUSLE model is that detachability and deposition processes are a function of sediment content. It is argued that until sediment load attains threshold capacity, soil detachment cannot occur. Therefore, the process of soil erosion is influenced by the flow carrying capacity and not by its source. Recent breakthroughs in spatial information technologies have augmented the prevailing methods in monitoring, analyzing, and above all managing resources. The spatial variation of soil erosion risk is brought about by heterogeneity in topography, geomorphology, geology, land cover, soil types, and land use. Such spatial variability of soil erosion parameters is easily and efficiently handled by geographic information systems (GIS). The trend has improved the accuracy, costs, and scales of application. The state-of-the-art technology geographic information system provides essential mapping interpolation techniques for creating a database that comprises input datasets for modeling soil erosion. Management of large datasets is made easier with the use of GIS; therefore, such spatial techniques provide a basis for the management of land upon the estimation of soil loss rates. In RUSLE, soil loss is predicted by converting the input data (rainfall data, soil data, digital elevation model, and land use) into a geographical information system format, following which it is implemented in the geospatial framework.

Many researchers worldwide have adopted this methodology to carry out soil erosion studies at different spatial scales. For instance, the following researchers studied soil loss in catchment areas by applying the RUSLE model, GIS, and remote sensing. The studies revealed that, apart from estimating soil erosion, the methodology was found to be satisfactory in identifying areas that had higher soil erosion risks. Further, geospatial tools facilitated the extraction of important information, which was deemed critical in implementing plans for soil

conservation.

#### 5.4.4 RUSLE Model Parameterization.

The model quantifies average annual soil loss (A) using five important factors, notably rainfall erosivity (R), soil erodibility (K), slope length and slope steepness (LS), cover management (C), and support practice (P).

$$A = R \times K \times LS \times C \times P \quad (5.9)$$

Where, A is the mean annual soil loss in t/ha/yr, R is the rainfall erosivity (MJ mm/ha/yr), K is the soil erodibility factor (t-ha-h/ MJ/mm), LS is the slope length and slope steepness factor (dimensionless), C is the cover management factor (dimensionless), and P is the support practice factor (dimensionless).

Rainfall is a precondition for any form of water erosion to materialize. The amount and even intensity of rainfall are the two important attributes of rainfall. Waterborne erosion is more pronounced when the two rainfall attributes are on the higher side. The rainfall erosivity factor (R) quantifies the erosive power possessed by rainfall, and it much depends on the rainfall's intensity and amount. The R factor is expressed as the sum of EI-values for each particular storm for a year and averaged over long periods of time (more than 20 years) so as to accommodate discernible recurring rainfall patterns. The abbreviation EI refers to the product of energy and maximum intensity of rainfall in 30 minutes. The amount of soil loss is proportional to the product of the total storm's energy, E (MJ/ha), and the storm's maximum intensity in a time of 30 min, I<sub>30</sub> (mm/h). The resulting product is known as the EI<sub>30</sub> index or commonly as the storm erosivity index expressed in MJmm/ha/h. The storm erosivity index reflects the amalgamated effect of soil particle dislodgement and runoff transportability to cause net erosion. The mean of the annual sums for the period under consideration gives the rainfall erosivity factor (R factor). Different researchers have developed equations from which the R factor has been derived and applied in different regions. For India following equation(5.10) can be used:

$$R = 50 + 0.389 \times P \quad (5.10)$$

Where, P is annual rainfall in mm. In present study average annual rainfall has been considered 1170 mm (IMD, IGAU Bilaspur).

#### 5.4.5 SOIL ERODIBILITY FACTOR (K).

Different soils show varying degrees of resistance to water-related erosion. Soil erodibility is an essential requirement when estimating soil loss and also when implementing soil conservation activities. The characteristics of soil and its properties have a pronounced influence on soil erosion. There is effect is well represented by the soil erodibility factor. Hence, the K factor is affected by a variety of the soil's physicochemical properties. The K factor is simply defined as the inherent susceptibility of soil-to-soil erosion. The RUSLE model identifies the distribution of particle size, permeability, organic matter content, and structure of the soil as the critical physicochemical properties which affect erodibility. Quantitative determination of physicochemical properties of soils is carried out using conventional procedures in laboratories. Generally, soils that have low silt levels have less erodibility regardless of high fractions of both sand and clay. Different K factor algorithms have been developed and applied based on suitability and requirement (Table 5.3).

**Table: 5.3:** K-Factor for different soil type

Sl no	Type of soil	K - Factor
1	Sand	0.02
2	Low Clay	0.05
3	High Clay	0.15
4	Sandy Soil	0.1-0.2
5	Silty Clay	0.26
6	Silty Loam	0.25-0.4
7	Silty Soil	0.4

#### 5.4.6 TOPOGRAPHIC (LS) FACTOR

Slope length and slope steepness is the other main factor for estimating the soil loss which measures the sediment transport capacity of the flow. LS does not consider the 3D complexity of the topography but simply assumes soil loss

increases with slope length and/or upslope contributing area. The LS- factor is calculated based on Eq. (5.11):

$$LS = \left( \text{Flow Accumulation} \times \frac{\text{Cell Size}}{22.13} \right)^{0.9} \times \left( \frac{\sin(\text{Slope})}{0.0896} \right)^{1.4} \quad \text{-- 5.11}$$

The slope length (L) and slope steepness (S) define the landscape's topography, which mostly influences the extent of soil erosion. L and S are the two most important parameters with regard to soil erosion modeling and most importantly when calculating the transporting power of surface runoff. The LS factor, therefore, combines the effects of slope length and slope steepness, both of which account for the landscape's topographical effects on erosion. Hence, terrain effects on erosion processes are accounted for by the LS factor within the RUSLE model. Soil erosion is noted to increase when both the slope angle and length increase. This explains the sensitivity of terrain effects on soil erosion, and therefore determination of the LS factor needs to be accurate.

#### 5.4.7 COVER MANAGEMENT FACTOR (C).

Vegetation cover ranks second behind terrain effects in influencing soil erosion rate. The parameters that define vegetation cover are mainly ground cover and plant canopy cover, respectively. Spatial distribution of vegetation cover fraction requires accurate estimation and is of utmost importance in soil erosion matters. Vegetation cover prevents the soil from the impact of raindrops by dissipating the amount of energy they possess before reaching the soil surface. Moreover, vegetation cover intercepts rainfall, thereby encouraging more infiltration. In the RUSLE model, vegetation cover effects are accounted for by the cover management factor (C). The C factor is defined as the ratio of soil lost from cropped land under specified conditions to that lost from bare soil. It is much influenced by vegetation type, growth stage, and percent cover. The crop management factor is indicative of the influence of vegetation cover and specified management practices on soil erosion. The values have a range of between 0 and 1 depending on land cover types. C factor strongly relates to vegetation cover

because it can be influenced by human beings to reduce erosion. The C factor is derived based on prior land uses, canopy shading factor, percent soil cover by crop remains, soil surface roughness, and above all soil moisture. Within the RUSLE model, the crop management factor is calculated using some empirical relationships that contain ground cover information. Satellite image information is an important input in the preparation of land cover maps, and as such, it has become an integral component in natural resources management. Traditionally, the C factor values have been spatially estimated by assigning values to land cover classes identified using remote sensing. Researchers have developed numerous methods for estimating the C factor based on normalized difference vegetation index (NDVI) for the assessment of soil loss using the RUSLE model. These methods make use of regression analysis to establish the correlation between C factor values (obtained from fieldwork or developed guide tables) and NDVI values obtained from remote sensing images. The regression equations (linear/ nonlinear) are generated by correlating NDVI values with corresponding C factor values (Eq-5.12).

$$C = 0.431 - 0.805 \text{ NDVI} \quad \text{-- 5.12}$$

#### 5.4.8 SUPPORT PRACTICE FACTOR (P).

Support Practice Factor (P). The support practice (P) factor is regarded as one of the most uncertain factors of the RUSLE model. &e support practice factor relates strongly to the cover management factor because both reflect positive impacts resulting from management interventions in controlling soil erosion. The two factors differ in that the support practice factor quantifies the effects of some implementation that targets reducing the runoff and eventual soil loss. The most common support practices include the use of contours, terraces, crop strips, grassed waterways, and cross-slope cultivation. The P factor is expressed as the ratio between the rate and the amount of soil lost when a specific support practice is used and similar soil loss when row farming is executed in an up-and downslope manner. Typical P factor values range between 0 and 1. A value of 1 corresponds to lands without any support practice (especially grasslands and bare lands), while values which approach 0 are indicative of lands under specified support practices.

Lower P factor values are indicative of effectiveness in conservation practices.

**Table:5.4**  
Values of Crop Management factor

<b>S.No</b>	<b>Cover %</b>	<b>Factor</b>
1.	10	0.7
2.	20	0.5
3.	30	0.36
4.	40	0.26
5.	50	0.20
6.	60	0.15
7.	70	0.12
8.	80	0.10
9.	90	0.085
10.	100	0.075
11.	Waffle wall/ counterling	0.45
12.	Grass	0.17
13.	Terracing	0.9

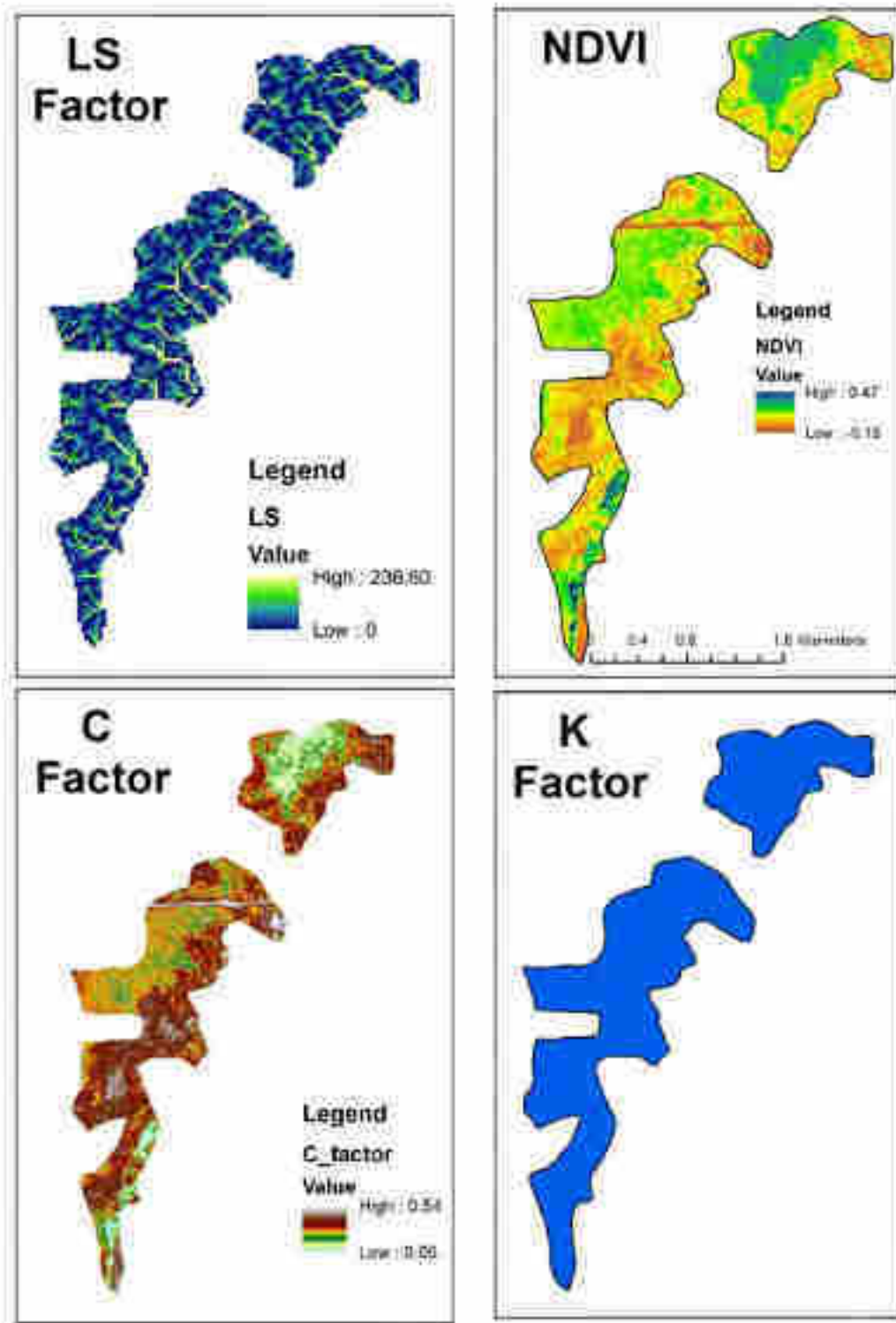


Fig 5.11 Derived factors for the study area



**5.4.9 SOIL EROSION ESTIMATION.**

The soil erosion severity map (Figure-5.12) was generated by overlaying all the parameter layers of RUSLE. Results indicated that the proposed area has a soil loss with a range of 0 to >51 t/ha/yr. Based on the soil erosion classification used, the estimated soil erosion was classified into four classes, namely, very slight (<5 t/ha), slight (5–15 t/ha), moderate (15-30 t/ha), sever (30-50 t/ha) and very severe (>50 t/ha) per annum. Out of total 357 ha, 178 ha of the area falls in the very slight erosion zone and 183 ha area comes under very sever zone where proper conservation is required.

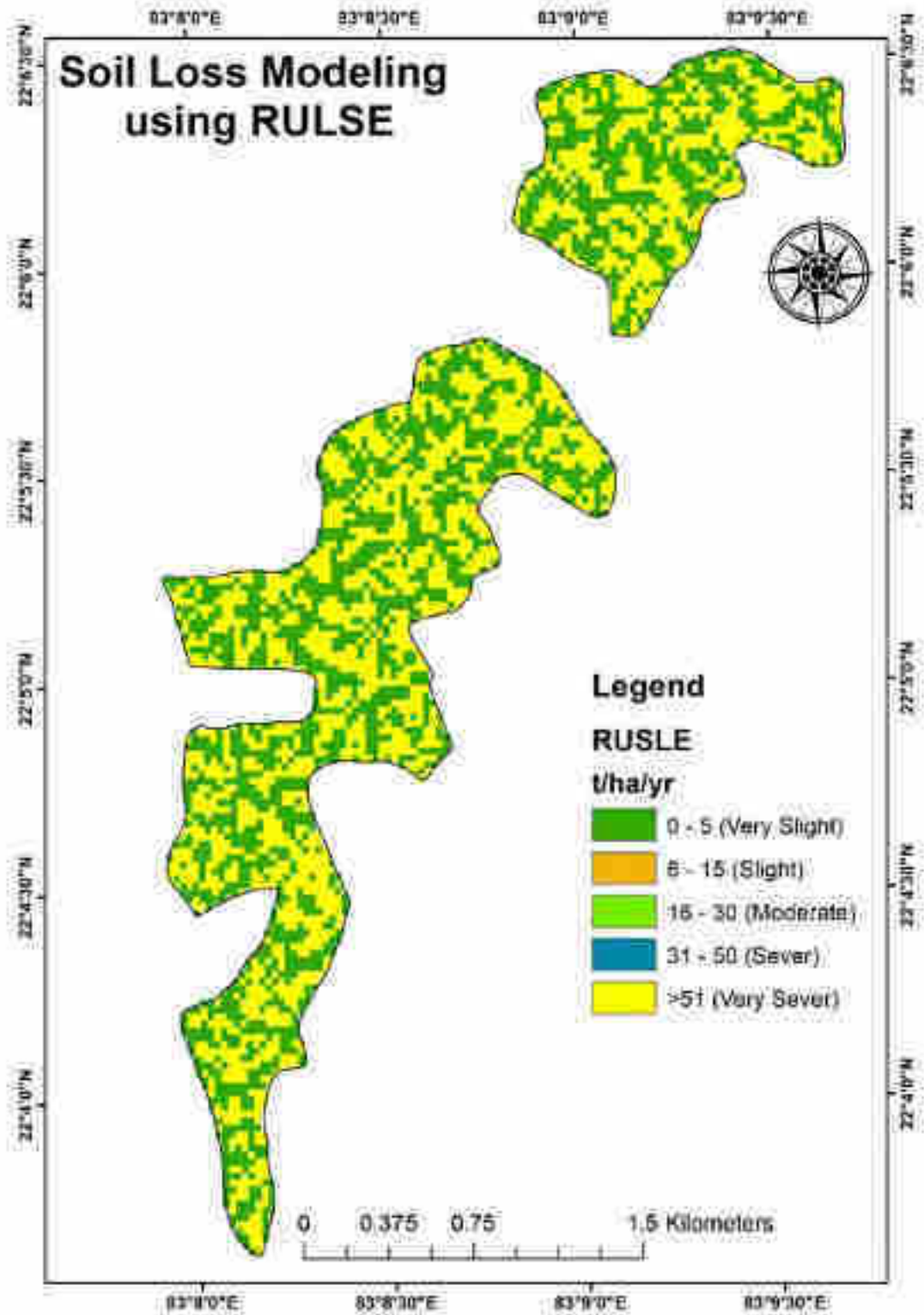


Fig 5.12 Soil loss from the study area



## CHAPTER-6

# MITIGATION MEASURES AND COST ESTIMATION

### 6.1 MITIGATIVE MEASURES

There are three methods for Soil Moisture Conservation (SMC) in the catchments, namely,

1. Agronomical Measures
2. Mechanical Measures
  - Catchment conservation works other than water harvesting structures: Those are implemented to minimize the soil erosion around the structures. In addition, those are also implemented to prolong the life span of water harvesting structures (check dams). Representative conservation works are as follows: Gully plugging works, contour trench works, terrace works, contour bunding works, mulching, plantation and filter strip works along the river, river/stream bank protection works etc.
  - Water harvesting structures: check dams (construction of embankment)
3. Non-structural measures: Land use regulation, public awareness for the forest, livelihood assistance/poverty alleviation, etc.

### 6.2 MECHANICAL MEASURES

- I. **Contour Bund:** Contour bunds are mechanical barriers built across the slope for the safe diversion of excess runoff and retention of eroded soil. The land area in between the two bunds get levelled in due course of time. Due to the deposition of eroded soil along the bund, the latter takes the shape of a riser. These risers should be planted with grasses to check their erosion.

- II. Graded Bunds:** The graded bund is a small earthen bund with a slight grade constructed across the slope for safe disposal of runoff. The graded bunds are recommended up to to 10% slope for areas where annual rainfall exceeds 800 mm, particularly on clayey and black soils with poor drainage. However, the efficacy of graded bunds gets reduced gradually beyond the 4% slope. The purpose of grading is to reduce the velocity of runoff water, for in-situ conservation of rainwater, and to minimize soil erosion.
- III. Bench Terrace:** Bench terraces are flat beds constructed on the hills across the slope. The height of the riser should not be more than one meter and the width of the bench terrace depends on the degree of slope. The bench terraces are important because they promote uniform distribution of soil moisture, irrigation water, etc. and control soil erosion. The bench terrace may be table top (level), outward sloping or inward sloping, with or without mild longitudinal grades. On steep slopes, it is better to construct terraces on the foothills for agricultural crops when soil depth is more than one meter.
- IV. Half Moon terrace:** Half-moon terraces are semi-circular beds of appropriate diameter with a shape resembling a half-moon. These terraces are recommended for fruit trees or other plantation crops on steep slopes.
- V. Grassed Waterways:** Grasses are well-known for their soil binding characteristics. They are most effective in moderating the flow and reducing the erosive velocity of runoff water, particularly on the rolling topography. The runoff water moves with high velocity down the slope, carrying with it soil and nutrients. If some suitable grasses are planted on the runoff route or natural channels, the soil and nutrient losses can be reduced. These grassed waterways are laid on the natural drainage lines in the watershed. Stilling basins or water ponds are constructed *en route* at appropriate locations, with earthen

and boulder pitched bunds for the retention of runoff water. By reducing the velocity of runoff water, erosion losses can be minimized.

- VI. Water Harvesting Ponds:** Water harvesting structures can be dug out for retaining runoff water on a seasonal or perennial basis. These are generally constructed down the slope. Earthen dams should be used for retaining silt load at an appropriate location on the slope of a watershed. The water thus harvested or stored can be used for pisciculture and other purposes.
- VII. Conservation Bench Terraces (CBT):** These are used to stabilize the yield of rainfed - crops by inter-field water harvesting. A part of the field is leveled to retain the runoff originating from the rest of the field.
- VIII. Gully Control Structures:** Gully control structures are provided to (i) reduce the erosive velocity of runoff water, (ii) facilitate the establishment of vegetation, and (iii) provide protection at points that cannot be adequately protected by other methods. Loose boulder check-dams perform well in gullies that do not carry much runoff and it also helps in silt deposition, thereby helping the stabilization of gully beds. Permanent gully control strati-fifes are constructed to control the overfalls either at the gully head or in the gully bed. Erosion from the extending heads and sides of the gully and main channel are the major sources of sediment. There is also a need to construct diversion bunds to divert surplus water to water harvesting structures or to the grassed waterways.
- IX. Contour Trenches:** Contour trenches are dug out, piling up the dugout earth on the lower side of the trench, for trapping, sediment, and runoff at the early stage of their movement. These trenches also improve soil moisture and favor the quick growth of trees and grasses.

- 
- X. Stream Bank and Torrents Control:** The vulnerable stream banks should be protected by providing spurs and retaining walls, etc. To control torrents, structures like bar-rages, paved channels, etc. need to be provided.

### 6.3 AGRONOMICAL MEASURES:

For preventing soil erosion on cultivated lands, proper choice of crops and cropping patterns is necessary, particularly on hill slopes. The protection through the vegetative shield, forest cover, grasses, crops and mulches, etc. are some important measures to prevent soil erosion. Such protection by absorbing the energy of rain impact prevents the loss of both water and soil. The following crop management practices can be useful in minimizing the erosion of soil and nutrients.

- I. **Cropping Systems** — Crops with the ability to develop canopy quickly provide early protection to the soil. Inter-planting of erosion-resistant crops like cowpea, soybean, etc. are also useful. Strip cropping of erosion-resistant legumes along with cereals can conserve rainwater and reduce the velocity of runoff.
- II. **Crop Geometry** — It is essential to manipulate the crop layout in the field in a manner that may prevent soil erosion. Closer spacing of rows across the slope can help in this regard.
- III. **Contour Cultivation** — Contour cultivation reduces the runoff to a large extent, thereby reducing the soil and nutrient losses. Contour cultivation, as well as furrows and ridges, have been found useful.
- IV. Low-intensity tillage favors the consolidation of soil through better structure, infiltration, and pore distribution. This imparts erosion resistance. A study of the conventional method of cultivation of maize 'with- zero tillage, with or without live mulch, has shown that runoff and soil losses are greatly

reduced with low-intensity tillage.

- V. **Grasses** - Grasses are perhaps the best friend of soil conservationists. Low and evenly distributed canopy and fibrous root systems with much binding capacity make grasses highly effective in controlling soil erosion. The performance of various grass species in controlling soil erosion and runoff losses at 9% and 11% slopes. The selection of grasses should be based on their production potential considering edaphic conditions and local preferences.
- VI. **Mulching:** Mulching is the placement of any organic or inorganic material over the top of a soil surface to protect it. Some of the benefits include reduced soil erosion, less compaction, moisture conservation, increased control of soil temperature, and a reduction in weed growth.

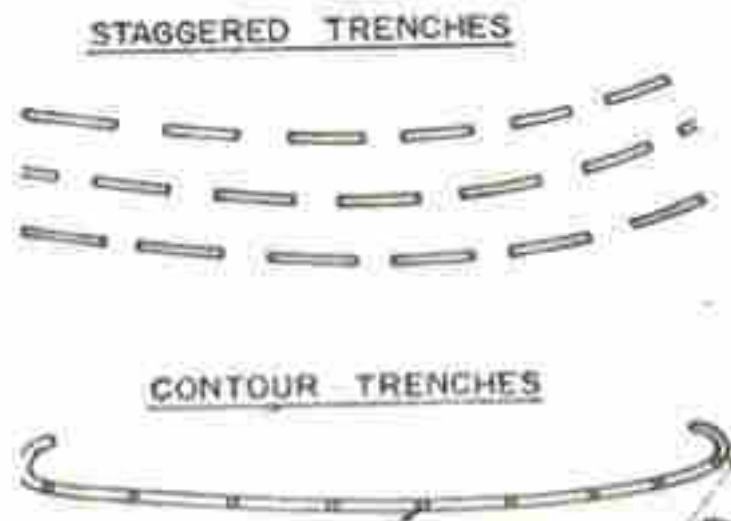


## 6.4 CONTOUR TRENCH WORKS

### 6.4.1 OBJECTIVE/FUNCTION

The contour trench works are the method of constructing the trenches along the contour lines of the slope. The objectives of the trench works are to retain water and sediment on the slope, to increase the water infiltration, to improve local soil moisture, and as the result, to reduce the runoff discharge and sediment to the downstream watershed.

There are three (3) types of contour trenches, that is continuous trenches, and interrupted (line and staggered) trenches. The continuous contour trenches are essentially used for moisture conservation in low rainfall areas. The staggered trenches are commonly used in Forest, in consideration of the rainfall condition of the study area.



**Fig. 6.1** Continuous and Staggered Contour Trenches

## 6.5 MULCHING

Mulching is an SMC practice in which a covering of cut grass, crop residues, or other organic materials is spread over the ground between rows of crops or around the trunks of trees. This practice helps to retain soil moisture to intercept the direct impact of raindrops on bare soil to reduce runoff and soil loss, to prevent weed growth, to reduce labor costs of weeding and enhance soil structure.

### 6.5.1 CLASSIFICATION OF MULCHES

#### (A) On the basis of organic matter

- a. **Organic mulches:** Organic mulches can be made of naturally occurring various substances which contain organic matter in it. Common examples of organic mulching are bark clippings, grass clippings, compost, dry leaves, straw etc.
- b. **Inorganic mulches:** Inorganic mulches are made up of inorganic substances which do not contains organic matter in it. Inorganic mulches include stones and gravels, polyethylene films, landscape materials, and rubbers.

#### (B) On the basis of living matter

- a. **Natural mulches:** Natural mulches are generally made up of naturally occurring materials. Organic mulches are also known as natural mulches. No prerequisite for the replacement of natural mulches because it decomposes readily.
- b. **Synthetic mulches:** Synthetic mulches are made of artificial non-living substances. Various types of synthetic mulch materials are available in the market for use in crop fields such as plastic films, plain and oiled paper, spun materials etc.

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**6.5.2 ORGANIC MULCHES**

Organic mulches comprise materials like animal compost, grass clippings, straw of various crops, dried leaves, tree bark clippings and sawdust. It has an easily degradable capacity because nature of appealing slugs, insects, and worms that eat them and help them in rapid degradation, which results in the addition of some quantity of nutrient and organic material in the soil. Organic mulch has a large number of helpful features. Some of them are: soil moisture conservation by reducing the rate of evaporation, moderates soil temperature, lessening soil erosion, hindering the growth of weeds, cheers the growth of beneficial soil bio-organisms, and diminishing the blowout of soil-borne pathogens. Organic mulches after decomposition over time improve soil structure and increase the nutrient content of the soil. The illustration of different organic mulches and their usages are given below:

**(A) Bark clippings**

Bark clippings are long-lasting materials and permit appropriate aeration of the soil. It can be used properly in dry as well as wet regions and has more water holding capacity. In the wet region, if rain is too much the wood bark will reduce waterlogging condition after absorbing the excess water and if rain is too little, the wood bark will release the holding water, providing water to the plants in dry times also.

**I. Bark (hardwood):**

Hardwood bark clipping is the derivative of paper and timber industries and differs in sizes ranging from chips to bigger nuggets. It is mostly used nearby the shrubs and trees. Both colored and natural varieties of bark are obtainable. Colored varieties are generally a mixture of recycled wood waste comprising non-natural peroxides. Hardwood bark clippings have more nutrients than softwood but bark clippings are not effortlessly and plentifully

available and also phytotoxicity is caused by some bark products. These barks are slightly alkaline in nature.

**II. Bark (softwood):**

It is similarly a derivative of the wood and paper industries. A common example is pine bark and it is commonly used under large shrubs and trees. It is somewhat acidic in behaviour and takes more time to decay. These barks are obtainable in several sizes and generally applied to 2 to 4 inches of depth.

**(B) Tree waste:**

Generally, this mulch outcome from larger lumps of timbers. At the time of decomposition, the fresh tree chunks will utilize larger sums of nitrogen inside the soil. This type of mulch is specifically useful for making pathways.

**(C) Leaf mulch:**

Leaves are decent for mulching which is easily and profusely available. However, leaves are good for shielding inactive plants during the winter season by keeping them warm and it helps in starting germination throughout the winter season but they may be blown away even by the little speed of wind due to its lightweight. Bark, stone, or any other material which are useful in reducing wind speed, should be used to lessen these problems. It can be made at home by composting shredded leaves. Leaf mulch can be used in all types of gardens. Leaves infected with disease should be disposed instead of composting. The proper thickness of the leaf mulching is about 3 to 4 inches.

**(D) Grass clippings:**

Grass clippings are effortlessly and profusely available mulch materials in agriculture. It provides some quantity of nitrogen and

organic material into the soil if freshly incorporated in the soil. If green grass clippings are added to the soil, it can develop its root system and can create damage to the growth and development of crops. So, the use of dry grass is more favourable as mulch material. Grass clippings should be spread in thin layers for better results across perennial and vegetable beds and concave at the end of the growing season. Before adding extra layers let every layer dry. Grass clippings will mat if a thick layer of clipping is applied instead of thin layers. Grass clippings were taken from lawns which are treated with insecticides or herbicides never be used. It should apply at a depth of 2 to 3 inches.

**(E) Composted animal manure:**

The composted animal manure is an excellent choice for mulching material which advances the soil health, increases the population of microbes or bio-organisms, and adds nutrients to the soil. Compost is slightly acidic in nature. Compost does not have a better capability of weed suppression which is one noticeable drawback of composted animal manure. The use of fresh manure in crop fields sometimes results in the burning of plant roots. Before using as mulch manure should be well decomposed at temperatures between 54°C to 60 °C for a minimum of one week and 4 to 6 months of composting to eradicate potential disease micro-organisms. It is too used as mulching material in various nutrient-consuming florae like roses. 3-4 inches of depth is favourable for compost used as a mulch.

**(F) Newspaper:**

Newspaper mulching is helpful in adding some organic matter to the soil and controlling weeds. A thickness of 1 to 2 cm of newspaper sheet is required for mulching and the edge of the paper should be fastened with stones, gravel, pebbles, etc. Suppression of weed is done by the layers of white and black newspapers. Apply 2 to 3

layers of newspaper at a time and cover it with leaf mulch or grass clippings or any other organic materials so that it cannot blow away by the winds. Newsprint will ultimately decay and can be merged into the soil.

**(G) Straw mulches:**

Some examples of straw mulches are groundnut shells, cotton shells, Straws of paddy and wheat, crop stubbles, etc. which are used as mulches for moisture conservation on the soil surface. Even though nutrient content is less in straw but soil converts more productive after the decomposition of straw mulches. Straw mulches reduce the amount and rate of evaporation and lessen the amount of energy captivated by the soil.

**(H) Sawdust:**

Sawdust is obtained from the wood and furniture-making industry and is very deprived of nutritive value. It is slowly decomposable. It is acidic in nature so it should not be used in acidic soils.

### **6.5.3 BENEFITS OF ORGANIC MULCHING**

A vital role is played by organic mulch in reflecting solar radiation. It reduces the rate of evaporation and keeps soil cooler. Prevent germination and growth of weeds, lessens erosion of soil, reduces runoff, increases moisture-retaining power of the soil, improves infiltration and percolation of water, advances the soil condition, makes soil porous, and augments better growth of roots. It can also maintain the soil temperature.

### **6.5.4 INORGANIC MULCHES**

Inorganic mulches are commonly used to obstruct the germination of weeds and are also used for decoration. Inorganic mulches like stones, gravel, and rocks do not decompose voluntarily, so they do not participate in improving soil conditions but bio-degradable and photo-degradable plastic mulches are

readily decomposable and improve the soil condition as well after decomposition, because they are made from plant sugar or starches. Heat can be absorbed and reflected by rocks which are useful in dry and hot environmental conditions.

#### **6.5.5 DISADVANTAGE OF INORGANIC MULCHING**

Inorganic mulches, except in biodegradable plastic mulches, do not augment any nutrient in the soil because they do not decompose. In several cases, inorganic mulch will get damaged by the sun in several cases and starts looking damaged with time. It can increase the temperature of soil if established in large areas. Inorganic mulches like rubber may create harm to plants as it is toxic in nature.

## 6.6 SUGGESTIONS AND RECOMMENDATIONS

As per our investigation, the study area is having less soil moisture and also fall in category of sever soil erosion zone. Hence, it is proposed to use mechanical measures like contour trench, recharge pit, surface pond and check dam etc. and agronomical measure like mulching from locally available materials like straw, dry leaves, stubble, or similar materials.

### 6.6.1 MECHANICAL MEASURES

- A. **Contour Trench:** 20 number of trenches of size  $L_m \times 1m \times W \times 0.6 m$  D shall be constructed along the specified contour as shown in (Fig. 6.2). The details about the length and latitude and longitude of stating point, mid point and end point is given in table no-6.1.

**Table: -6.1** Details of contour trenches with GPS location

SI No	Shape_Length	X_Start	Y_Start	X_Mid	Y_Mid	X_End	Y_End	Name
1	1553	83.13885	22.09246	83.14127	22.08895	83.14717	22.09273	CT1
2	491	83.13245	22.08661	83.1344	22.08534	83.13635	22.08408	CT2
3	252	83.14902	22.09523	83.14883	22.09435	83.1496	22.09347	CT3
4	192	83.14946	22.09319	83.14966	22.09234	83.14986	22.09149	CT4
5	2476	83.1455	22.09019	83.13945	22.08205	83.13368	22.08166	CT5
6	430	83.1324	22.07688	83.1335	22.07536	83.1342	22.07467	CT6
7	953	83.13528	22.07509	83.13714	22.07895	83.1397	22.08066	CT7
8	560	83.1405	22.08082	83.14163	22.08295	83.14321	22.08426	CT8
9	300	83.13682	22.0749	83.13778	22.07592	83.13874	22.07694	CT9
10	338	83.14227	22.08006	83.1427	22.08148	83.14342	22.08284	CT10
11	344	83.1333	22.06776	83.13362	22.06928	83.13394	22.07081	CT11
12	1309	83.13396	22.06588	83.13542	22.07152	83.13895	22.07635	CT12
13	223	83.14267	22.07982	83.14336	22.0806	83.14404	22.08138	CT13
14	1630	83.13445	22.06223	83.13567	22.06942	83.1393	22.07567	CT14
15	1384	83.15076	22.10756	83.15138	22.10247	83.15237	22.10749	CT15
16	1777	83.14748	22.10272	83.15372	22.10177	83.1551	22.10817	CT16
17	334	83.15224	22.09721	83.1525	22.09862	83.15365	22.09913	CT17
18	87	83.1546	22.1002	83.1547	22.10059	83.15502	22.10079	CT18
19	571	83.15696	22.10478	83.1573	22.10602	83.15871	22.10775	CT19
20	511	83.15991	22.10401	83.16023	22.10522	83.16048	22.1073	CT20



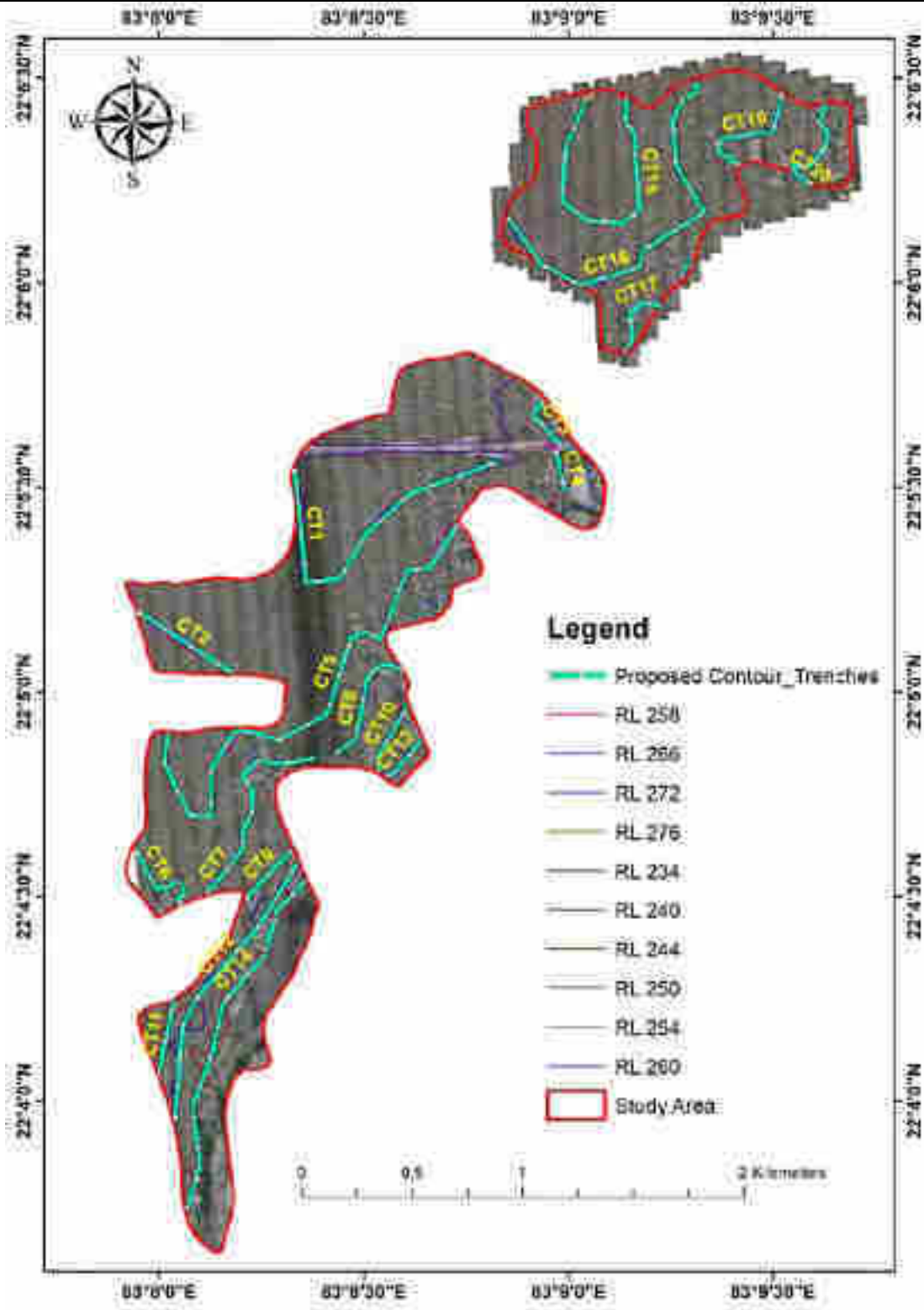


Fig 6.2: Figure showing proposed location of Contour trench

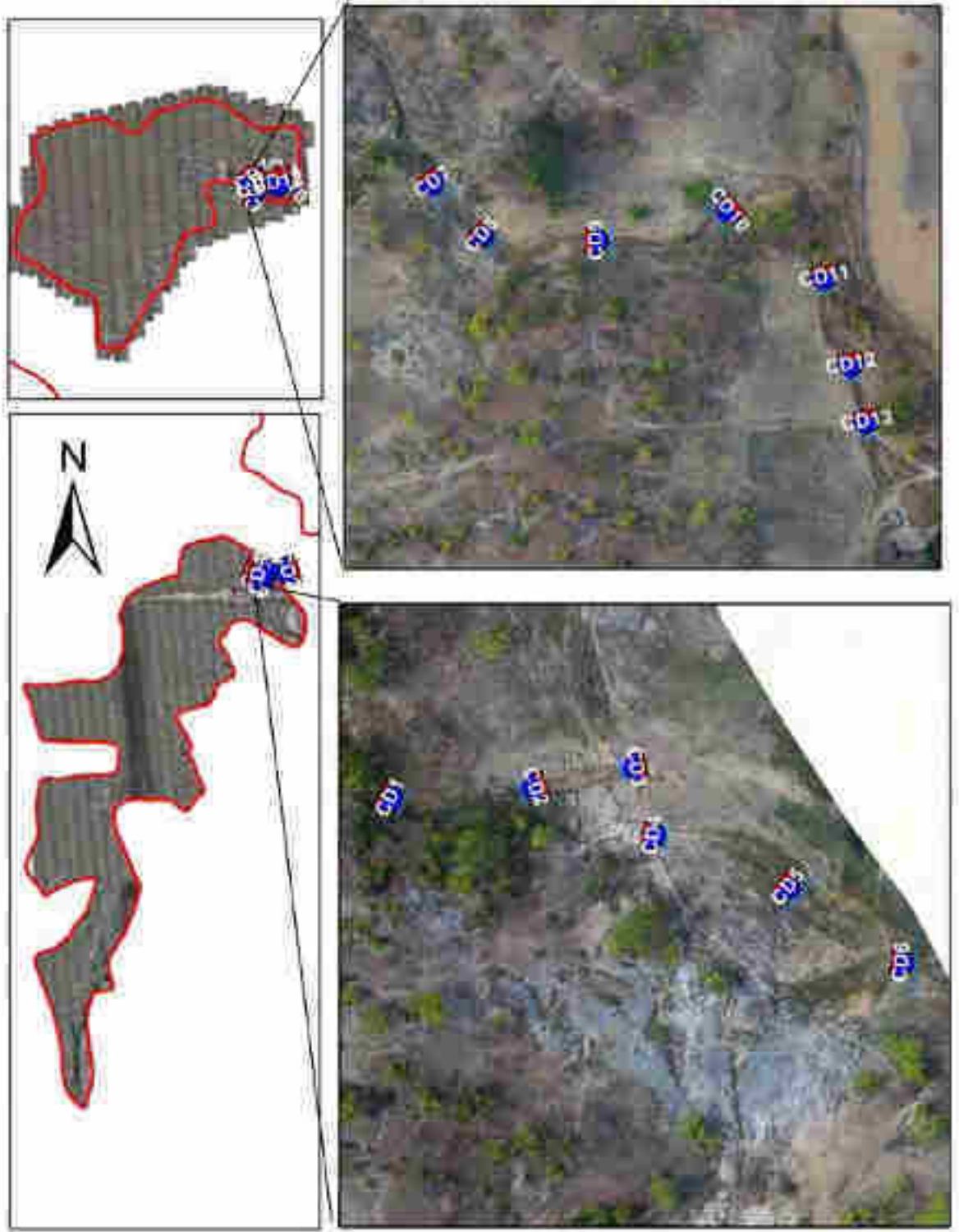
B. **Check Dam:** In the proposed study area there were no major or minor streams has been identified. Only in north part of the compartment two streams origin point is identified which further travel very less distance in study area. Major drainage is governed by the Maand and Kurkut river. 13 nos. of check dam of different size have been suggested L (5-10 m) × 0.5 m W × (0.6) m H which shall be constructed across the stream at the location specified in table 6.2 and also shown in Fig.6.3. The provision of apron size (5-10 m) L x (1.5 m) W x 0.15 m has been kept for the control of erosion. The length of check dams are as given below:

A) 5 m-8 Nos

B)10 m- 5 Nos

**Table: -6.2** Details of Check Dams with GPS location

S.No	Name	Length in m	Breath in m	Height in m	X_Centroid	Y_Centroid
1	CD1	5	0.5	0.6	83.149	22.0945
2	CD2	5	0.5	0.6	83.1492	22.0945
3	CD3	5	0.5	0.6	83.1493	22.0946
4	CD4	5	0.5	0.6	83.1494	22.0945
5	CD5	10	0.5	0.6	83.1495	22.0944
6	CD6	10	0.5	0.6	83.1497	22.0943
7	CD7	5	0.5	0.6	83.1596	22.1044
8	CD8	10	0.5	0.6	83.1597	22.1043
9	CD9	10	0.5	0.6	83.1599	22.1043
10	CD10	10	0.5	0.6	83.1602	22.1044
11	CD11	5	0.5	0.6	83.1604	22.1042
12	CD12	5	0.5	0.6	83.1604	22.1041
13	CD13	5	0.5	0.6	83.1605	22.104



**Fig 6.3:** Figure showing proposed location of check dams

- C. **Surface Pond:** Three nos. of surface pond with stone pitching of size 50 m L × 30 m W × 2.5 m D and Two nos. of surface pond with stone pitching of size 30 m L × 20 m W × 2.0 m D shall be constructed at the location specified in table 6.3 and also shown in Fig.6.5

**Table: -6.3** Details of Ponds with GPS location

Sl. No	Name	X_Centroid	Y_Centroid	Size (LBH) in m
1	P1	83.14478	22.0907	50X30X2.5
2	P2	83.14217	22.0837	50X30X2.5
3	P3	83.15999	22.1052	50X30X2.5
4	P4	83.13695	22.07995	30X20X2.0
5	P5	83.15353	22.10107	30X20X2.0

### Design Criteria

Three ponds in study area have been suggested of capacity of 3300 cum capacity (free board of 30 cm) and two pond of 1080 cum capacity (free board of 20 cm) The total water collected in the proposed ponds through rainfall will be around 175 cum/year. The calculation has been shown in table 6.4

**Table 6.4:** Capacity of Proposed Ponds

Pond	C	A (in m <sup>2</sup> )	I (in m annually)	Q (m <sup>3</sup> /year)
P1	1.00	1500	0.1170	175.5
P2	1.00	1500	0.1170	175.5
P3	1.00	1500	0.1170	175.5
P4	1.00	600	0.1170	70.2
P5	1.00	600	0.1170	70.2

The rest water in pond will come through surface run-off from the micro-watershed. Inlet for each is proposed in south direction considering the slope of the micro-watershed. The excess water of micro watershed will join the stream through natural slope of the area.

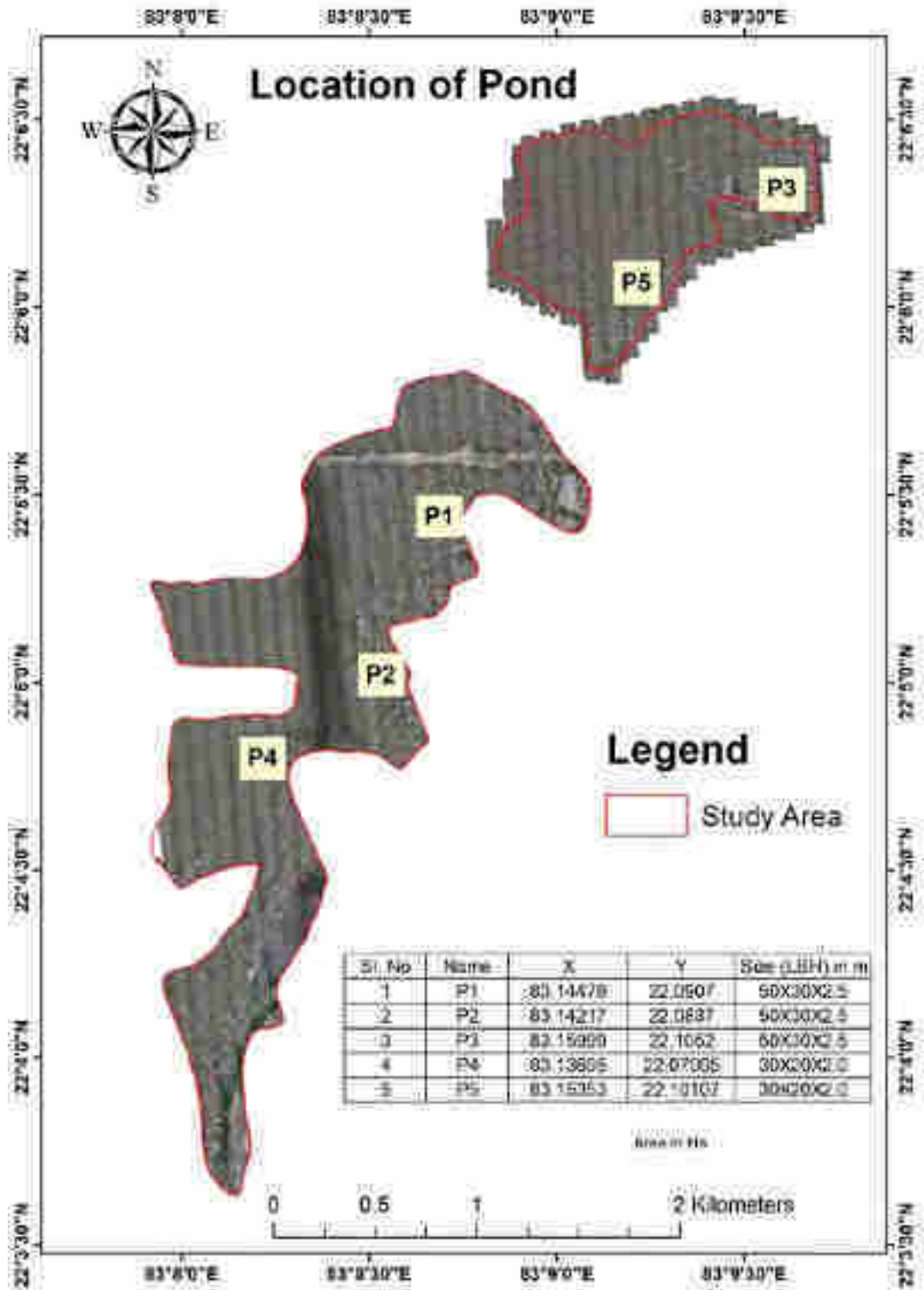


Fig 6.4: Figure showing proposed locations of Ponds

**6.6.2 AGRONOMICAL MEASURES:**

- A. Mulching:** Organic mulches comprising of materials like animal compost, cow dung, straw of various crops, dried leaves, or similar locally available material of 50 mm thickness shall be applied over an area of 45.75 ha land specified in table:6.5 and also shown in **Fig.6.6**

Table 6.5: Mulching Area

<b>FID</b>	<b>Name</b>	<b>Area</b>
1	M1	12.79
2	M2	0.58
3	M3	2.65
4	M4	3.36
5	M5	6.34
6	M6	6.02
7	M7	2.69
8	M8	6.70
9	M9	4.62
Total		45.76

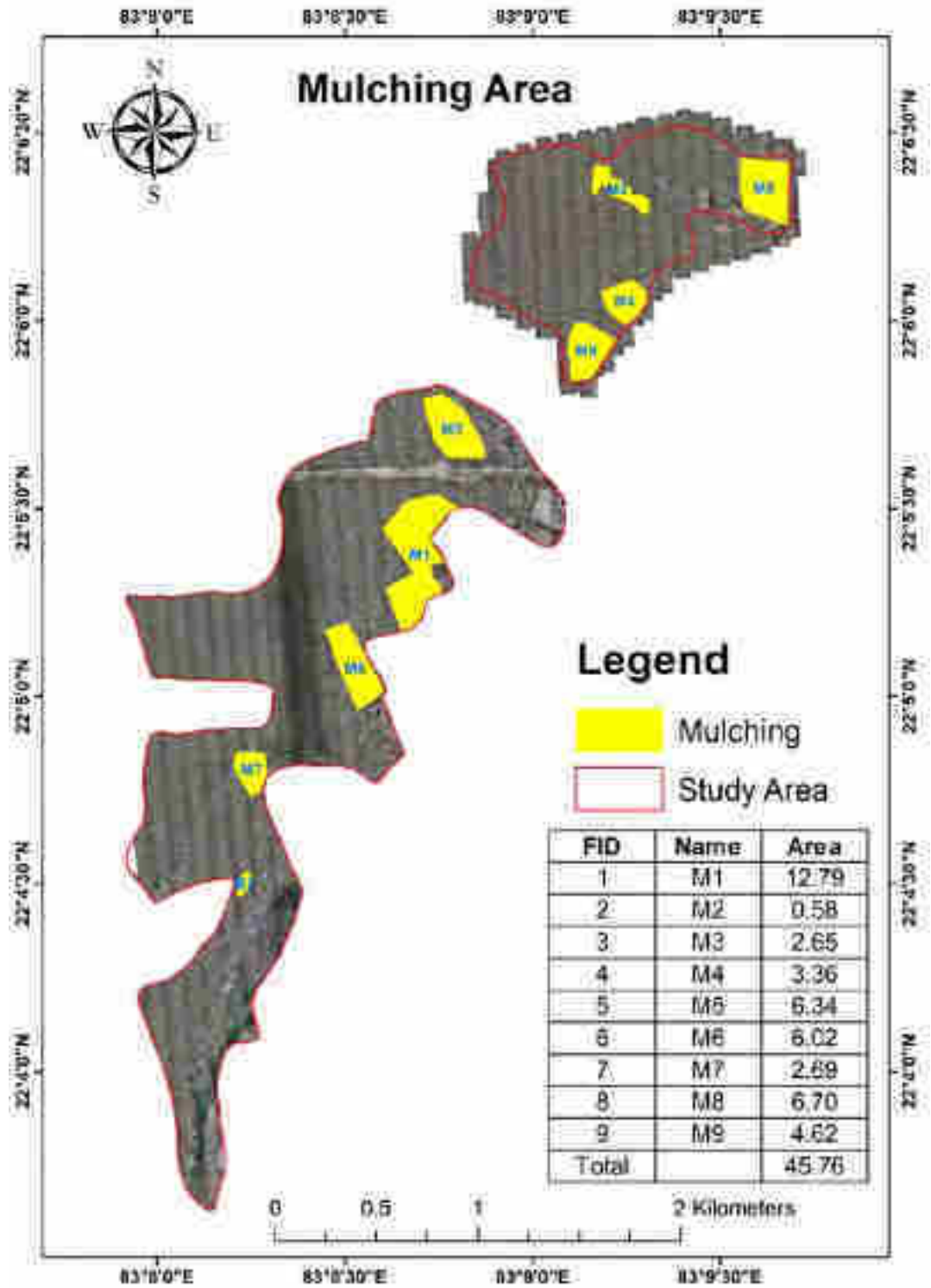
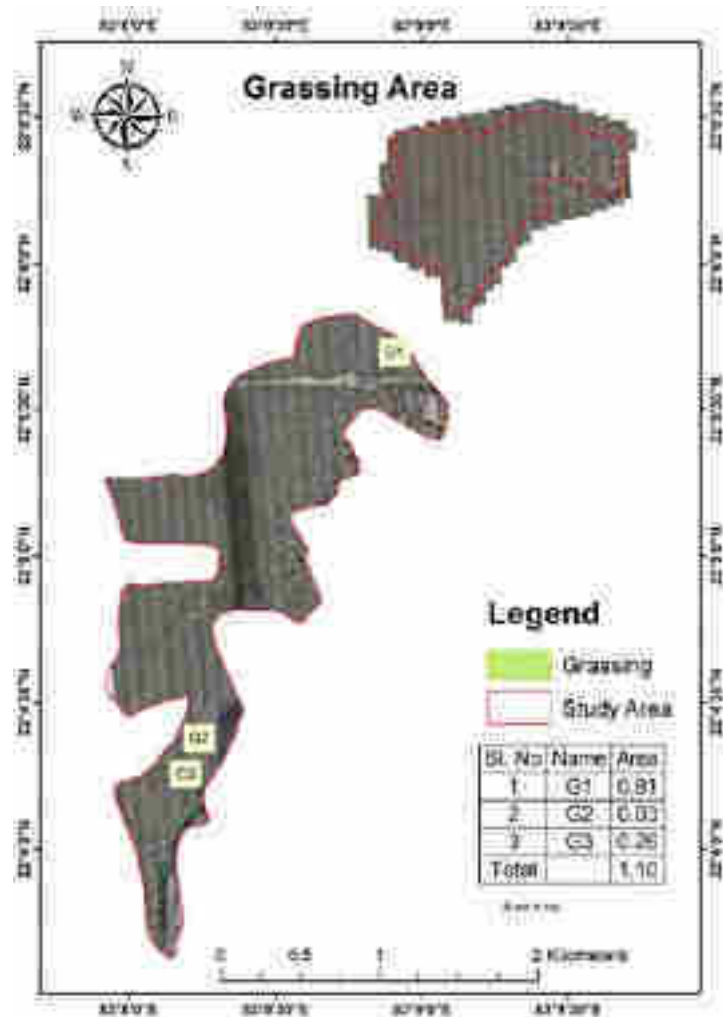


Fig 6.5: Figure showing the location of mulching

- B. Grassing:** Grassing with indigenous grass species over hatched area (1.10 ha) of degraded and open land as specified in **Fig.6.7**

Table 6.6: Grassing Area

Sl. No	Name	Area
1	G1	0.81
2	G2	0.029
3	G3	0.25
Total		1.10



**Fig 6.6:** Figure showing the location of grassing



## 6.7 COST ESTIMATE

## (A)-Year wise Abstract of SMC Measures

SI No	Year	Total Cost for the SMC work without GST (In Rs.)	Maintenance of SMC structures @ 15% without GST (in Rs.)	GST @18% (in Rs.)	Total Cost including GST (in Rs.)	Monitoring & Supervision @ 5% (in Rs)	GRAND TOTAL COST including GST and 5% Supervision (in Rs.)
1	1st Year (2023-24)	1,56,27,765.00		28,12,998.00	1,84,40,763.00	9,22,038.00	1,93,62,801.00
2	2nd Year (2024-25)		23,44,165.00	4,21,950.00	27,66,115.00	1,38,306.00	29,04,421.00
3	3rd Year (2025-26)		23,44,165.00	4,21,950.00	27,66,115.00	1,38,306.00	29,04,421.00
4	4th Year (2026-27)		23,44,165.00	4,21,950.00	27,66,115.00	1,38,306.00	29,04,421.00
5	5th Year (2027-28)		23,44,165.00	4,21,950.00	27,66,115.00	1,38,306.00	29,04,421.00
6	6 the Year (2027-28)		23,44,165.00	4,21,950.00	27,66,115.00	1,38,306.00	29,04,421.00
	<b>Total</b>	<b>1,56,27,765.00</b>	<b>11720825</b>	<b>49,22,748.00</b>	<b>3,22,71,338.00</b>	<b>16,13,568.00</b>	<b>3,38,84,906.00</b>

## (B)-Cost of the Proposed vehicle for Monitoring &amp; Supervision:

SI No.	Year	Description	No.	Cost (Rs.)
1	1st Year (2023-24)	4-Wheeler	1	1500000
2	1st Year (2023-24)	2-Wheeler	2	300000
		<b>Total cost for Vehicle</b>		<b>1800000</b>

**Total for SMC Work (A+B) (Rs. 3,38,84,906.00 +Rs. 18,00,000.00) = Rs. 3,56,84,906.00**

**NRM ENGINEER  
FOREST DIVISION  
DHARAMJAIGARH**

**उप वन सहायिका  
धरमजयगढ़ उप वन मण्डल 113**

**परिसर रक्षक  
एडु**

**वन परिक्षेत्राधिकारी  
छात्र परिक्षेत्र**

**उप सहायिका  
उप वन मण्डल  
धरमजयगढ़ (उ.म.)**

**Table 6.7: Year Wise Implementation Cost for Soil Moisture Conservation Measures**

Sl. No.	Description	Item of Works	Unit	Quantity	Rate (DSR 2021)	Total Cost	Location Reference
<b>1st Year (2023-24)</b>							
1	Contour Trench	Earth Work in Soil	Cum	5658	180.14	10,19,207.37	CT1 to CT20
		Earth Work in Ordinary Rock	Cum	5658	362.07	20,48,584.48	
2	Surface Pond	Earth Work in Soil	Cum	6825	180.14	12,29,425.64	P1, P2, P3, P4, P5
		Earth Work in Ordinary Rock	Cum	6825	362.07	24,71,118.61	
		Stone Pitching	SqMtr	2260.09	720.67	16,28,784.84	
3	Check Dams	Earth Work in Soil	Cum	81	180.14	14,590.99	C1 to C13
		Earth Work in Ordinary Rock	Cum	81	362.07	29,327.56	
		Sand Filling Below Plinth	Cum	12.15	1894.91	23,023.15	
		PCC below Plinth	Cum	12.15	5546.59	67,391.07	
		RCC below Plinth	Cum	49.95	7333.61	3,66,313.87	
		RCC above Plinth	Cum	27.00	8930.11	2,41,112.87	
		PCC above Plinth (Apron)	Cum	20.25	6824.59	1,38,198.01	
		Reinforcement for RCC work of 37.5 Cum @ 100kg/Cum	Kg	7695.00	78.60	6,04,856.54	
		Shuttering Walls	SqMtr	288.00	587.05	1,69,070.94	
Shuttering Footing	SqMtr	45.00	270.01	12,150.28			
4	Grassing	Grassing	SqMtr	11000.00	42.70	4,69,700.00	G1 to G3
5	Mulching/ Manuring	Mulching	Cum	22879.75	102.35	23,41,742.41	M1 to M9
		Manure	Cum	550.00	254.15	1,39,782.50	
		Manure Spreading	Cum	550.00	52.35	28,792.50	

Sl. No.	Description	Item of Works	Unit	Quantity	Rate (DSR 2021)	Total Cost	Location Reference
6	Survey/ Demarcation	Survey/Demarcation	L/s			4,00,000.00	
<b>Sub Total (As on June 2021)</b>						1,34,43,174	
<b>Current Updated Cost (@ 12.865% WPI) as on April 2023</b>						1,51,72,587.00	
Contingencies @ 3%						4,55,178.00	
Sub Total-A for SMC structures as on April 2023 without GST						1,56,27,765.00	
Add GST @18%						28,12,998.00	
Sub Total-B for SMC structures as on April 2023 with GST						1,84,40,763.00	
Supervision & Monitoring, Evaluation & Documentation Cost @ 5%						9,22,038.00	
<b>Grand Total (For 1st Year)</b>						<b>1,93,62,801.00</b>	
<b>2nd Year (2024-25)</b>							
8	Maintenance of SMC structures @ 15% of initial year cost		L/s			23,44,164.75	
Sub Total (A) without GST						23,44,165.00	
Add GST @18%						3,70,249.00	
Sub Total (A) with GST						27,66,115.00	
Supervision & Monitoring , Evaluation & Documentation Cost @ 5%						1,38,306.00	
<b>Grand Total (For 2nd Year)</b>						<b>29,04,421.00</b>	
<b>3<sup>rd</sup> Year (2025-26)</b>							
9	Maintenance of SMC structures @ 15% of initial year cost		L/s			23,44,164.75	

Sl. No.	Description	Item of Works	Unit	Quantity	Rate (DSR 2021)	Total Cost	Location Reference
	Sub Total (A) without GST					23,44,165.00	
	Add GST @18%					18,45,325.00	
	Sub Total (A) with GST					27,66,115.00	
	Supervision & Monitoring, Evaluation & Documentation Cost @ 5%					1,38,306.00	
	<b>Grand Total (For 3rd Year)</b>					<b>29,04,421.00</b>	
<b>4<sup>th</sup> Year (2026-27)</b>							
10	Maintenance of SMC structures @ 15% of initial year cost		L/s			23,44,164.75	
	Sub Total (A) without GST					23,44,165.00	
	Add GST @18%					19,37,591.00	
	Sub Total (A) with GST					27,66,115.00	
	Supervision & Monitoring, Evaluation & Documentation Cost @ 5%					1,38,306.00	
	<b>Grand Total (For 4th Year)</b>					<b>29,04,421.00</b>	
<b>5<sup>th</sup> Year (2027-28)</b>							
11	Maintenance of SMC structures @ 15% of initial year cost		L/s			23,44,164.75	
	Sub Total (A) without GST					23,44,165.00	
	Add GST @18%					20,34,471.00	
	Sub Total (A) with GST					27,66,115.00	
	Supervision & Monitoring, Evaluation & Documentation Cost @ 5%					1,38,306.00	
	<b>Grand Total (For 5th Year)</b>					<b>29,04,421.00</b>	
<b>6<sup>th</sup> Year (2028-29)</b>							

Sl. No.	Description	Item of Works	Unit	Quantity	Rate (DSR 2021)	Total Cost	Location Reference
12	Maintenance of SMC structures @ 15% of Second year cost		L/s			23,44,165.00	
	Add GST @18%					11,42,476.00	
	Sub Total (A) with GST					27,66,115.00	
	Supervision & Monitoring, Evaluation & Documentation Cost @ 5%					1,38,306.00	
	Grand Total (For 6th Year)					29,04,421.00	
	Grand Total from 1st Year to 6th Year					3,38,84,906.00	

  
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परिसर रक्षक  
एंडु

  
उप वन मण्डलाधिकारी  
धरमजयगढ़ उप वन मण्डल  
जिला धरमजयगढ़ (R.P.)

  
वन परिक्षेत्राधिकारी  
छाता परिक्षेत्र



**Table 6.8: Proposed Estimate for Soil Moisture Conservation Structures**

S.No.	Description	Unit	Qty.	Rate excluding GST (Rs.)	Amount (Rs.)
1	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge. All kinds of soil	Cum	12564.00	180.14	2263223.99
2	Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.	Cum	12564.00	362.07	4549030.65
3	Dry stone pitching 22.5 cm thick including supply of stones and preparing surface complete.	Sqm	2260.09	720.67	1628784.84
4	Supplying and filling in plinth with sand under floors, including watering, ramming, consolidating and dressing complete.	Cum	12.15	1894.91	23023.15
5	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:4:8 (1 Cement : 4 coarse sand (zone-III) derived from natural sources : 8 graded stone aggregate 40 mm nominal size derived from natural sources)	Cum	12.15	5546.59	67391.07
6	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level : 1:1.5:3 (1 cement : 1.5 coarse sand (zone-III): 3 graded stone aggregate 20 mm nominal size)	Cum	49.95	7333.61	366313.87
7	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III)	Cum	27.00	8930.11	241112.87

## Chapter-6

## Mitigation Measures and Cost Estimation

S.No.	Description	Unit	Qty.	Rate excluding GST (Rs.)	Amount (Rs.)
	: 3 graded stone aggregate 20 mm nominal size)				
8	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:1½:3 (1 Cement: 1½ coarse sand (zone-III) : 3 graded stone aggregate 20 mm nominal size)	Cum	20.25	6824.59	138198.01
9	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete	Kg	7695.00	78.60	604856.54
10	Centering and shuttering including strutting, propping etc. and removal of form for : Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	Sqm	288.00	587.05	169070.94
11	Centering and shuttering including strutting, propping etc. and removal of form for: Foundations, footings, bases of columns, etc. for mass concrete	Sqm	45.00	270.01	12150.28
12	Providing & laying Selection no. 1 grass turf with earth 50mm to 60mm thickness of existing ground prepared with proper level and ramming with required tools wooden and than rolling the surface with light roller make the surface smoothen and light watering the same including maintenance for 30 days or more till the grass establish properly,as per direction of officer in charge	Sqm	11000.00	42.70	469700.00
13	Mulching of land using cow dung/dry leaves/straw or similar items as per direction of officer in charge	Cum	22879.75	102.35	2341742.41
14	Supplying and stacking at site dump manure from approved source, including carriage upto 5 km lead complete	Cum	550.00	254.15	139782.50
15	Spreading of sludge, dump manure and/or good earth in required thickness as per direction of officer-in-charge (cost of sludge, dump manure and/ or good earth to be paid separately).	Cum	550.00	52.35	28792.50
16	Survey/demarcation cost	LS			400000.00
	<b>SUB-TOTAL as on June 2021 excluding</b>				<b>13443174.00</b>

S.No.	Description	Unit	Qty.	Rate excluding GST (Rs.)	Amount (Rs.)
	<b>GST:</b>				
	<b>Add GST @ 18%</b>				<b>2419771.00</b>
	<b>SUB-TOTAL as on June 2021 including GST:</b>				<b>15862945.00</b>
	<b>Current Updated Cost</b>				<b>17903653.00</b>
	<b>Contingencies @3%</b>				<b>537110.00</b>
	<b>GRAND TOTAL</b>				<b>18440763.00</b>
Note: Estimate is based on DSOR 2021					
	WPI as on June 2021		133.7		
	WPI as on April 2023		150.9		
	% Increase		12.865		

**Table 6.9:** Detailed calculation of Items Proposed

S. No.	Description	Nos.	Length (m)	Coefficient	Breadth (m)	Depth (m)	Quantity	Unit
	Earthwork							
	Contour trench	1.00	1553.36	1.20	1.00	0.60	1118.42	
		1.00	490.79	1.20	1.00	0.60	353.37	
		1.00	251.75	1.20	1.00	0.60	181.26	
		1.00	192.33	1.20	1.00	0.60	138.48	
		1.00	2476.30	1.20	1.00	0.60	1782.94	
		1.00	429.58	1.20	1.00	0.60	309.30	
		1.00	953.11	1.20	1.00	0.60	686.24	
		1.00	560.19	1.20	1.00	0.60	403.34	
		1.00	300.46	1.20	1.00	0.60	216.33	
		1.00	337.99	1.20	1.00	0.60	243.35	
		1.00	343.88	1.20	1.00	0.60	247.59	
		1.00	1308.84	1.20	1.00	0.60	942.37	
		1.00	223.39	1.20	1.00	0.60	160.84	
		1.00	1630.15	1.20	1.00	0.60	1173.71	
		1.00	1384.20	1.20	1.00	0.60	996.62	
		1.00	1777.32	1.20	1.00	0.60	1279.67	
		1.00	333.97	1.20	1.00	0.60	240.46	
		1.00	86.68	1.20	1.00	0.60	62.41	
		1.00	570.98	1.20	1.00	0.60	411.11	
		1.00	511.00	1.20	1.00	0.60	367.92	
	Surface Pond	3.00	50.00		30.00	2.50	11250.00	
		2.00	30.00		20.00	2.00	2400.00	
	Check Dam	8.00	5.00		1.80	1.00	72.00	



S. No.	Description	Nos.	Length (m)	Coefficient	Breadth (m)	Depth (m)	Quantity	Unit
		5.00	10.00		1.80	1.00	90.00	
						<b>Total</b>	25127.72	
						<b>Say</b>	<b>25128.00</b>	<b>Cum</b>
1	Earthwork in soil	50 % of	24728.00				<b>12564.00</b>	<b>Cum</b>
2	Earthwork in ordinary rock	50 % of	24728.00				<b>12564.00</b>	<b>Cum</b>
3	Stone pitching Surface Pond	6.00	50.00		3.53		1059.00	<b>Sqm</b>
		6.00	30.00		3.53		635.40	<b>Sqm</b>
		4.00	30.00		2.83		339.41	<b>Sqm</b>
		4.00	20.00		2.83		226.27	<b>Sqm</b>
						<b>Total</b>	<b>2260.09</b>	<b>Sqm</b>
4	Sand Filling Check Dam	8.00	5.00		1.80	0.08	5.40	
		5.00	10.00		1.80	0.08	6.75	
						<b>Total</b>	<b>12.15</b>	<b>Cum</b>
5	PCC below plinth 1:4:8 Check Dam	8.00	5.00		1.80	0.08	5.40	
		5.00	10.00		1.80	0.08	6.75	
						<b>Total</b>	<b>12.15</b>	<b>Cum</b>
6	RCC below plinth Check Dam							
	Footing	8.00	5.00		1.50	0.25	<b>15.00</b>	<b>Cum</b>
		5.00	10.00		1.50	0.25	<b>18.75</b>	<b>Cum</b>
	Pedestal	8.00	5.00		0.30	0.60	<b>7.20</b>	<b>Cum</b>
		5.00	10.00		0.30	0.60	<b>9.00</b>	<b>Cum</b>
						<b>Total</b>	<b>49.95</b>	<b>Cum</b>
7	RCC above plinth Check Dam	8.00	5.00		0.30	1.00	<b>12.00</b>	<b>Cum</b>
		5.00	10.00		0.30	1.00	<b>15.00</b>	<b>Cum</b>
						<b>Total</b>	<b>27.00</b>	<b>Cum</b>
8	PCC below plinth 1:1.5:3 For check dam apron	8.00	5.00		1.50	0.15	<b>9.00</b>	<b>Cum</b>
		5.00	10.00		1.50	0.15	<b>11.25</b>	<b>Cum</b>
						<b>Total</b>	<b>20.25</b>	<b>Cum</b>

S. No.	Description	Nos.	Length (m)	Coefficient	Breadth (m)	Depth (m)	Quantity	Unit
9	Reinforcement for R.C.C. work	76.95 m <sup>3</sup> @	100 kg/m <sup>3</sup>			=	<b>7695.00</b>	<b>Kg</b>
10	Shuttering							
	Check Dam Wall	16.00	5.00		1.60		128.00	<b>Sqm</b>
		10.00	10.00		1.60		160.00	<b>Sqm</b>
						<b>Total</b>	<b>288.00</b>	<b>Sqm</b>
11	Shuttering							
	Check Dam Footing	16.00	5.00		0.25		<b>20.00</b>	<b>Sqm</b>
		10.00	10.00		0.25		<b>25.00</b>	<b>Sqm</b>
						<b>Total</b>	<b>45.00</b>	<b>Sqm</b>
12	Grassing							
	As shown in map					<b>Total</b>	1.10	Hectare
							<b>11000.00</b>	<b>Sqm</b>
13	Mulching							
	As per Map shown		457595.00		0.05		<b>22879.75</b>	<b>Cum</b>
14	Manure		11000.00		0.05		<b>550.00</b>	<b>Cum</b>
15	Manure Spreading		11000.00		0.05		<b>550.00</b>	<b>Cum</b>

**CHAPTER-7**

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**Disclosure of the Consultant Engaged**

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## CHAPTER-7

### DISCLOSURE OF THE CONSULTANT ENGAGED

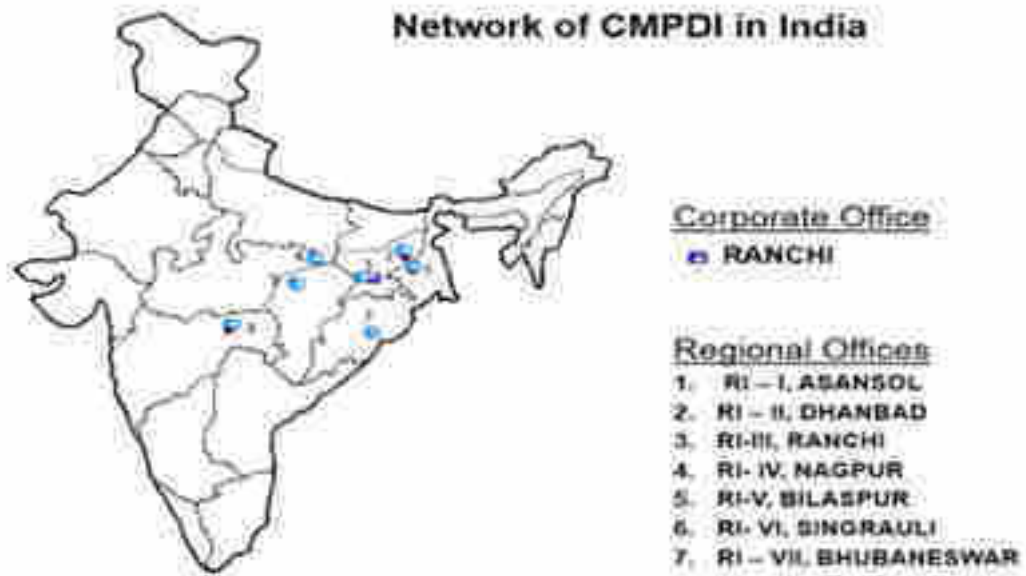
#### About CMPDI



**FIG. – 7.1 CMPDI Corporate Office, Ranchi**

Central Mine Planning & Design Institute Limited (CMPDIL) is a Government of India enterprise having its corporate headquarters at Ranchi in India. It is a fully owned subsidiary of Coal India Limited (CIL) and a Schedule – B Company. It is a Mini Ratna (Category I) company since June, 2019. CMPDI is also an ISO 9001: 2015 certified since 28th March, 2017. There are seven Regional Institutes (Asansol, Dhanbad, Ranchi, Nagpur, Bilaspur, Singrauli & Bhubaneswar) headed by Regional Directors. The highest authority of CMPDI is Chairman cum Managing Director (CMD).

Its registered Corporate office is situated at Gondwana Place, Kanke Road, Ranchi-834 008, a capital city of Jharkhand state. It operates through seven strategically located Regional Institutes over six states territories of India.



**FIG. – 7.2** Locations of Regional Institute of CMPDI

Details of all the seven institutes including its corporate office are given as below:

Sl. No.	Offices	Addresses		Tel / Fax
		Postal	Website	
1	Corporate, Ranchi	Gondwana Place, Kanke Road, Ranchi-834 008, Jharkhand	<a href="http://www.cmpdi.co.in">http://www.cmpdi.co.in</a>	+91 651 2230483, 2230116 / +91 651 2231447, 2232249
2	Regional Institute-I, Asansol	West End, GT Road. Asansol-713 301, West Bengal.	<a href="http://www.cmpdi.co.in">http://www.cmpdi.co.in</a>	+91 341 2253504 / +91 341 2250935
3	Regional Institute-II, Dhanbad	Koyala Bhawan, Koyla Nagar, Dhanbad-826 005, Jharkhand	<a href="http://www.cmpdi.co.in">http://www.cmpdi.co.in</a>	+91 326 2230789, 2230850, 2230103, 2230105/+9132 6 2265575

Sl. No.	Offices	Addresses		Tel / Fax
		Postal	Website	
4	Regional Institute-III, Ranchi	Gondwana Place, Kanke Road, Ranchi-834 008, Jharkhand	<a href="http://www.cmpdi.co.in">http://www.cmpdi.co.in</a>	+91 6512231506 / +91 651 2231501
5	Regional Institute-IV, Nagpur	Kasturba Nagar, Jaripatka, Nagpur-440 014, Maharashtra.	<a href="http://www.cmpdi.co.in">http://www.cmpdi.co.in</a>	+91 0712 2642134 / +91 0712 2643231
6	Regional Institute-V, Bilaspur	SECL Complex, Seepat Road, Bilapur, Chhattisgarh.	<a href="http://www.cmpdi.co.in">http://www.cmpdi.co.in</a>	+91 7752 246482 / +91 7752 246481
7	Regional Institute-VI, Singrauli	CWS Colony, P.O. Jayant Colliery, Sidhi-486 890, Madhya Pradesh.	<a href="http://www.cmpdi.co.in">http://www.cmpdi.co.in</a>	+91 7805 222172 / +91 7805 277600
8	Regional Institute-VII, Bhubaneswar	Samantapuri, Near Janta Maidan, Bhubaneswar-751 013, Orissa.	<a href="http://www.cmpdi.co.in">http://www.cmpdi.co.in</a>	+91 0674 2394760, 2394357, / +91 0674 2395128

All the above regional institutes are dedicated to rendering services to seven subsidiaries of the CIL as flows:

Sl. No.	Institutes	Dedicated to
1	Regional Institute-I, Asansol	Eastern Coal fields Ltd.(ECL)
2	Regional Institute-II, Dhanbad	Bharat Coking Coal Ltd.(BCCL)
3	Regional Institute-III, Ranchi	Central Coalfields Ltd(CCL)
4	Regional Institute-IV, Nagpur	Western Coalfields Ltd(WCL)
5	Regional Institute-V, Bilaspur	South Eastern Coalfields Ltd(SECL)
6	Regional Institute-VI, Singrauli	Northern Coalfields Ltd.(NCL)
7	Regional Institute-VII, Bhubaneswar	Mahanadi Coalfields Ltd(MCL)

CMPDI (HQ.) Ranchi renders services to NEC & Non-CIL clients and specialized assignments for both CIL & non-CIL clients.

### **Establishment background**

The company was formerly known as Coal Mines Authority Limited. And, the Central Mine Planning & Design Institute Limited (herein after called as CMPDI) is a planning & design division of Coal India Limited (hereinafter called as CIL) as per Memorandum of Association of the company. The CIL is a holding company since November 01, 1975, and the CMPDIL is one of its subsidiaries since then. It is under Ministry of Coal, Government of India.

### **Strength & Resources**

#### ***Manpower***

CMPDI has total Manpower 2977 (832 Executives , 2145 Non Executives) as on 01.05.2022. It has multidisciplinary technical executive professionals who combine innovation and initiative to deliver faster and effective solutions in planning, implementation and management of projects.

#### ***Resources***

CMPDI is equipped with modern laboratory facilities for undertaking various analytical works to supplement its services. It has well equipped network of six environmental laboratories located in various coalfields to regularly monitor air, water, Soil and noise parameters. **The Environment Laboratory at Ranchi is accredited with NABL (National Accreditation Board for Testing and Calibration Laboratories).** The environment lab is also having recognition of CPCB since 1997 and also working under ISO-9001:2015 Certification. Besides its own strength, CMPDI has access to the vast resources with its principal, CIL, India's largest coal producer and a **Maharatna Company**.



**Fig: 7.3** Environment Laboratory at CMPDI HQ, Ranchi

### Recognition

CMPDI is recognized as preferred consultant by Indian and overseas clients, United Nation agencies and international financial institutions, and the company is registered with



- World Bank
- Asian Development Bank
- African Development Bank
- United Nations Development Programme

### **Main Functional area**

The main functional area of the CMPDI is to provide adequate and up-to-date planning, design and technological supports to the CIL and its coal producing subsidiaries to enable them to produce the planned quantity of coal efficiently and economically with due attention to safety, conservation, quality and environment. In addition to these, CMPDI also provides necessary consultancy for clients outside the CIL in India and abroad. The Quality Management System of CMPDI, Ranchi is certified under international standard-ISO 9001:2015, Services covered under are as follows:

1. Consultancy in Mineral Exploration and Environmental Management.
2. Planning & Design in Mining, Civil & Architectural Engineering, Coal Preparation & Utilization, Electrical & Mechanical Engineering, Mining Electronics, Geomatics and Mine Construction.
3. Laboratory testing facilities for the above.
4. Technical & Management Training in Mineral & Mining Sector.

### **Nature of consultancy rendered**

CMPDI has been offering services in the fields enumerated in table below:

<b>Sl.No.</b>	<b>Services offered</b>
1	Exploration & Resource Evaluation
2	Mine Planning & Design Services
3	Infrastructures Engineering
4	Environmental Services
5	Beneficiation Services

Sl.No.	Services offered
6	Management Services
7	Specialized Services
8	Laboratory Services
9	ITC in Mining
10	Research & Development

### Exploration & resource Evaluation

New generation exploration technology coupled with skilled manpower has made CMPDI a twenty first century leader in mineral exploration, deposit modeling, resource evaluation, resource management, mining geology, hydro-geological & geophysical studies, engineering geological investigations, etc. Services rendered under this head are described in brief :

Sl. No.	Subheads of Services	Services rendered in
1	Geological Support for mining	Production support or mine development drilling and prediction of faults and pinch / wash outs
		Delineation of roof / floor and dirt bands
2	Drilling	Coring-Diamond rotary drills up to a capacity of 1280 m depth
		Non-coring-Direct rotary and DTH drills for hydro-geological investigations, dewatering, etc.
3	Deposit modelling	Using geo-statistical and geological software packages including MINEX and in-house developed CEMPGEODOC and SASLINT software
4	Resource Evaluation	Deposits of coal, lignite, manganese, iron ore (magnetite and hematite), phosphorite, coal bed methane, etc.
5	Resource Management	Strategic planning for future exploration depending upon market demand.
		Updating of reserve / resource of individual blocks or coalfields.
6	Hydro-geological studies	Systematic ground water investigations.
		Mining hydro-geological studies.

Sl. No.	Subheads of Services	Services rendered in
7	Geo-engineering works	Determination of strength properties of rocks and coal and RQD (Rock Quality Designation) to assess strength characteristics of strata.
8	Master Planning for assessment of resource potential-with respect to CBM (Coal Bed Methane) globally an emerging environment friendly alternate energy source.	Creation of data packages of potential CBM blocks
		Resource evaluation of CBM / CMM / AMM.
		Formulation of policy guidelines for harnessing CB resources.
		Implementation of CIL-ONGC Consortiums venture in developing CBM in coalfields.

To provide quality services, CMPDI is effectively utilizing technology like remote sensing, combination drilling (coring and non-coring), multi-probe geophysical borehole logging, seismic refraction survey, etc.

CMPDI has already undertaken over 500 integrated exploration projects in varying geological and terrain conditions.

### **Mine Planning & Design Services**

CMPDI is a premier consultant in open pit and underground mine planning & design in coal, lignite and other minerals. It has prepared more than 950 mining project reports with individual capacity up to 70 Million tonne per annum. CMPDI uses advance software like MINEX for resource modeling, mine planning and scheduling of open cast and underground mine projects. It has helped its subsidiaries to achieve unprecedented production growth from open cast mines in their organizations. Its experience in mechanized underground mining technology spans exploitation of coal seams from 1.00 m to 20 m thickness, at different gradients from flat to 75<sup>0</sup>; with soft to extremely hard coal; liable to spontaneous heating and gassiness and under varying roof strata conditions. Services offered to are manifold and are enumerated briefly blow:

SI No.	Services Offered
1	Master planning of coalfield
2	Perspective planning
3	Conceptual engineering studies
4	Techno-economic feasibility studies
5	Detailed project reports
6	Detailed engineering with working drawings
7	Mine ventilation and transport planning
8	Operational planning
9	Mining plans for mining lease
10	Mine capacity assessment
11	Performance analysis of equipment
12	Prediction of surface subsidence through numerical modeling software.
13	Geo-physical logging, Seismic survey, Resistivity survey etc.

### Infrastructure Engineering

CMPDI provides engineering logistic or support services for development of infrastructure. It has developed multi-disciplinary engineering skills for implementing projects of various complexities. In particular, it has offered complete planning and design services for architectural planning, civil, structural, electrical and mechanical engineering in various projects; important of them are enumerated here:

SI No.	Services Offered
1	Planning of large capacity, high speed bulk material handling plants.
2	Turnkey execution of coal handling plants.
3	Planning of high voltage sub-stations.
4	Planning of workshops of various types and capacities.
5	Township planning including roads, water supply, water supply system, drainage, water / sewerage treatment plants and detailed planning and design of all township infrastructure.
6	Site selection for pit head thermal power plants based on remote sensing data.
7	Rail corridor alignment through remote sensing

8	Techno-economic feasibility study of captive power plants based on pulverized coal and FBC technology.
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### **Environmental Services**

CMPDI holds a position of eminence in the field of environmental planning, impact assessment, management and environmental engineering in coal and other sectors. **CMPDI is accredited by National Board of Education and Training (NABET), an organ of Quality Council of India (QCI), New Delhi as an EIA consulting organization for four sectors namely Mining of Minerals including opencast/underground mining, Offshore and Onshore oil and Gas exploration, development & production, Thermal power plants and Coal Washeries.** CMPDI has prepared more than 600 EMPs for coal mining projects (incl. washery & clusters) and obtained Environment Clearance for more than 450 projects. Also, CMPDI has prepared Mine Closure Plans for more than 425.

### **Environmental Services Rendered by CMPDI:**

- Environmental Impact Assessment/ Environmental Management Plan
- Regional Environmental Management Plan
- Routine Environmental Monitoring and Base data generation.
- Planning & design of Sewage Treatment Plants (STPs)
- Design of Effluent Treatment Plants (ETPs) for coal projects
- Schemes for Rainwater Harvesting
- Environmental Statements (Audit Report)
- S&T / R&D studies
- Final Mine Closure Plan for UG & OC projects
- OB Dump Reclamation Action Plan for OC projects
- Study of Environmental Problems of Eco-Sensitive Regions
- Studies related to disposal of fly ash in abandoned mines

A few of the new areas in which CMPDI has diversified are environmental & hydrogeological studies for disposal of fly ash, development of air quality model,

bio-treatment of industrial effluents, carrying capacity base development planning, watershed modeling and rain water harvesting. Services offered with respect to environmental quality; monitoring, engineering, management and planning are briefly given as below:

Sl. No.	Subheads of Services	Services rendered
1	Environmental Monitoring	Air quality
		Water quality
		Noise level
		Soil Quality
		Micro-meteorological studies
		Stack monitoring
2	Environmental Laboratory facilities	<b>Air Analysis:</b>
		Suspended Particulate Matter Respirable Particulate Matter (PM <sub>10</sub> & PM <sub>2.5</sub> ) Oxides of Sulphur (SO <sub>x</sub> ) Oxides of Nitrogen (NO <sub>x</sub> ) Carbon Monoxide (CO) Total Hydro Carbon (C <sub>n</sub> H <sub>n</sub> ) Total Dust (Settleable)
		<b>Water Analysis:</b>
		Physical Parameter - pH, Colour, Temp, Turbidity Suspended Solids, Dissolved Solids, etc. Chemical and Biological (BOD, COD, Heavy Metals and trace elements as per statutory requirement)
		<b>Soil:</b> Soil Texture, Porosity, Bulk Density, pH Elect. Conductivity, Water holding capacity, Infiltration Rate Cation Exchange Capacity, Organic Carbon, Phosphorous, Potash Nitrogen etc.
		<b>Noise:</b>
		Noise Intensity Survey Leq Value of Noise
3	Environmental Engineering	Water treatment plants
		Industrial / Municipal effluent treatment and recycling plants
		Hazardous waste disposal site engineering
		Municipal effluent disposal site engineering
4	Natural Resource management	Land use planning
		Rain water harvesting
		Watershed management plans

Sl. No.	Subheads of Services	Services rendered
5	Regional planning	Regional environment management plans
		Regional environment status plans
6	Environment Assessment plans	Environment Assessment plans
7	Special studies	Review of existing mining and environment policies, legislations, standards and mechanisms for monitoring compliance, institutional strengthening for regulatory and counterpart institutions.
		Study of environmental problems and action plan for restoration of environmental quality. Mine closure planning.

### Beneficiation Services

CMPDI specializes in planning, design and construction of new washeries and modification of existing washeries for coal and mineral beneficiation. Services with respect to beneficiation offered to are given as below:

SI No.	Services Offered to for
1	Planning of coal and mineral beneficiation plants.
2	Preparation of feasibility / project reports including macro level analysis, washability studies, environmental impact assessment and techno-economic analysis.
3	Technical studies, performance evaluation and operation & maintenance related consultancy for existing washeries.
4	Pilot scale studies and trials.

### Management Services

Following descript management services enumerated in table below, have been offered by CMPDI to different organizations or bodies.

Sl. No.	Subheads of Services	Services rendered for
1	Coal Investment promotion Services	Assistance to Government of India in identification and assessment of coal mining properties for investments through private sector participation.
2	Quality Management Services	Consultancy for implementation, certification and maintenance of ISO 9001 Quality Management System and its industry specific translations
3	Human Resource Management	Creating knowledge and skill based workforce, CMPDI through its Staff Training College (STC) imparts training to its clients' personnel. Under UNDP, CMPDI has trained professionals from Nigeria, Sultanate of Oman and North Korea. Through its STC it has organized training programmes under five major categories such as (i) Technical (ii) Managerial (iii) Computer application, (iv) Quality Skills, (v) Quality System, etc. It has also organized & conducted off-campus training programmes with respect to Quality System at various subsidiaries of the CIL

CMPDI diversified into management system consultancy in 1998. While continuing to provide consultancy for ISO 9001 Quality Management System (QMS) and ISO 14000 Environmental Management System (EMS), it made forays into consultancy for ISO 17025:2017 (Testing and calibrating laboratories) under consultancy scope as:

- Creation of Management system.
- Providing training support.
- Implementation, certification and post certification support.

### Specialized Services

With a view to catering to specific requirements of clients, CMPDI has been providing field oriented specialized services to its clients. Descript services rendered under this category have been remote sensing, terrestrial survey, blasting, ventilation design & gas assessment in underground mines, energy



audit and non-destructive testing. Main services rendered are described in brief here:

Sl. No.	Subheads of Services	Services rendered in
1	Geomatics	Geomatics services in mining sector ranging from topographical survey, base line data generation and monitoring of land use / land cover for environmental management, water resource survey and coal mine fire mapping. It has also imparted expertise services in the fields of remote sensing applications, terrain mapping, co-relation survey for underground mines, GPS / GIS survey, cartography and digital image processing.
2	Blasting	Carrying out controlled blasting & ground vibration study, vibration monitoring, fragmentation improvement studies, random sampling and testing of explosive and accessories and performance evaluation of new explosives with sophisticated testing equipment in both coal and non-coal sectors.
3	Non-destructive Testing (NDT)	Services for Non-destructive testing of components of machinery, installations and other structural elements have been provided on site during periodic maintenance to avoid accidental failure.
4	Ventilation and Gas Survey	CMPDI has been offering services for ventilation monitoring, planning and design of ventilation system including gas assessment and testing for underground mines.
5	Energy Audit	CMPDI is empaneled as an accredited energy auditor with Govt. of West Bengal and Petroleum Conservation Research Association (PCRA) under ministry of Petroleum and Natural Gas, Govt. of India. Over 130 reports on electrical and diesel energy conservation have been prepared.
6	Inspection Services	CMPDI has been rendering pre-dispatch third party inspection services for plants and equipment at the manufacturers workstations for materials procured by its clients.
7	Captive power plants	Reports on optimum utilization, conceptual notes and tender documents.

#### Laboratory Services

CMPDI has well-equipped laboratories for carrying out investigations and analysis for geo-chemical, petrography, coal washability and geo-mechanic

properties.

For coal and lignite characterization, CMPDI has laboratories with highly skilled manpower and state of art equipment. The data generated by these laboratories form basis for characterization and grading of coal in exploration, mine feasibility reports, washery designs and down-stream utilization. Brief description of Laboratory Services rendered by CMPDI is given as below:

Sl. No.	Subheads of Services	Services rendered in
1.	Environment Laboratory	CMPDI has a well-equipped environmental laboratory to undertake the entire spectrum of environmental studies. The environmental laboratory is recognized by NABL & Central Pollution Control Board, Ministry of Environment & Forests, Government of India and accredited with ISO-9001:2015 certification.
2	Geo-chemical Laboratory	CMPDI has been rendering geo-chemical analysis like proximate & ultimate analysis, GCV determination of coal and lignite and other special tests through microprocessor based automatic calorimeter and analyzer.
3	Petrographic Laboratory	CMPDI has been carrying out evaluation for hydro carbons, oil shales and coal bed methane for coal coke and source rock through sophisticated microscopes, identifying mineral phases in coal, rocks and metals through X-Ray diffractometer, and Micro-area analysis & cleat studies for CBM through Scanning Electron Microscope accredited by International Committee for Coal and Organic Petrology (ICCP).
4	Mining Laboratory	CMPDI has been determining physico-mechanical properties of rocks for design inputs for mine planning and other technical services and undertaking testing of roof supports and building materials for design support systems for underground workings.
5	Washery Laboratory	CMPDI has been determining washability characteristics of course, small and fine coal and shattering & pulverizing characteristics of coal for assistance in planning and design of coal beneficiation plants.

#### **ITC Services in Mining**

CMPDI has been gearing up itself fully meet challenges of IT sector requisite for mining industries as per IT implementation scheme with a view to revolutionizing

mining industry and mining operations in coming years. IT services provided by CMPDI have been as tabulated here:

SI No.	Services Offered to for
1	Mine communication and mine safety systems
2	Establishing internet and internet facilities
3	Real time fleet management system for large opencast mines using GIS & GPS.
4	Land information system using enterprise GIS.

### R & D Services

The Research & Development activities in coal and lignite is being administered through the Scientific Advisory Committee (SSRC) with Secretary (Coal) as its Chairman. The committee is entrusted with the task of planning, budgeting and overseeing the implementation of R & D programme in coal & lignite sector and also for application of research findings. And, CMPDI is the Nodal Agency to coordinate S & T / R &D activities in coal and lignite Sector and assist SSRC in areas mentioned herein after.

CMPDI applied research and development in the field of mining, beneficiation, utilization, environment, exploration, etc. serving as nodal agency for all S & T schemes funded by Ministry of Coal and R & D schemes funded by R & D Board of the CIL (constituted in August 1995). Field oriented research projects including transfer and absorption of new technology concerning main areas of coal research have been as follows:

- Production, productivity and safety.
- Coal beneficiation and utilization.
- Environment and Ecology.

**ANNEXURES**

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## ANNEXURE-I

File No. S-15/2021-FC

Government of India  
Ministry of Environment, Forest and Climate Change  
(Forest Conservation Division)

Indira Paryayatan Bhawan,  
Jorbagh Road, Aliganj,  
New Delhi - 110002.

Dated: The July 6<sup>th</sup>, 2022

To  
The Principal Secretary (Forests),  
Government of Chhattisgarh,  
Mahanadi Bhawan,  
Nava Raipur (CG).

**Subj: Proposal for non-forestry use of 240.867 ha, comprising of 185.017 ha Revenue Forest Land and 55.850 ha identified as forest land in terms of dictionary meaning under the Forest (Conservation) Act, 1980 for Chhal Opencast Coal Mining Project in favour of M/s South Eastern Coalfields Limited (SECL) in Raigarh District of Chhattisgarh - reg.**

Sir,

I am directed to refer to the Government of Chhattisgarh's letter no. F-5-18/2018/10-2 dated 08.04.2021 on the above subject for seeking prior approval of the Central Government under Section 3 of the Forest (Conservation) Act, 1980 and letter no. F-5-18/2018/10-2 dated 24.02.2022 forwarding additional information as sought by the Ministry's letter dated 11.06.2021 and to say that the proposal has been examined by the Forest Advisory Committee constituted by the Central Government under Section - 3 of the aforesaid Act.

After careful examination of the proposal of the State Government and on the basis of the recommendations of the Forest Advisory Committee, and approval of the same by the competent authority of the MoEF&CC, New Delhi, the Central Government hereby accords **"in-principle"** approval for non-forestry use of 240.867 ha, comprising of 185.017 ha of Revenue Forest Land and 55.850 ha of Dictionary meaning forest land under Section-2 of the Forest (Conservation) Act, 1980 for Chhal Opencast Coal Mining Project in favour of M/s South Eastern Coalfields Limited (SECL) in Raigarh District of Chhattisgarh subject to fulfilment of the following conditions:

**A. Conditions which need to be complied prior to handing over of forest land by the State Forest Department and compliance is to be submitted prior to Stage-II approval:**

- i. **Compensatory Afforestation:** The cost of compensatory afforestation at the prevailing wage rates in per compensatory afforestation scheme and the cost of survey, demarcation and erection of permanent pillars, if required on the CA land, shall be deposited in advance with the Forest Department by the user agency. The CA will be maintained for 30 years. The scheme may include appropriate provision for anticipated cost increase for works scheduled for subsequent years;
- ii. The KML files of diverted area, the CA areas, the proposed SMC treatment area and the WLAGP area shall be uploaded on the e-Green

## File No.8-15/2021-FC

- watch portal with all requisite details prior to Stage II approval;
- iii. Land identified for raising compensatory afforestation shall be notified as PF under the Indian Forest Act, 1927 or local Forest Act before grant of Stage-II approval, if applicable;
  - iv. *A Soil and Moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local river shall be prepared by the user agency in consultation with the State Forest Department and the same shall be submitted along with Stage-I compliance. Cost of implementation of the provisions of the said Plan will be deposited into the CAMPA and the same shall be intimated to the Ministry before Stage-II approval.*
  - v. *Elephant/Wildlife Management Plans should be prepared keeping in view the locality factors, occurrence of wildlife, management interventions required for areas. State Government may also get the Plan verified by the Project Elephant Division of the Ministry. Cost of implementation of the Plan so finalized shall be deposited into State CAMPA and detail of the same along with approved Plan shall be submitted to the Ministry before Stage-II approval.*
  - vi. *Proposal involves displacement from non-forest land. A copy of approved R&R plan, prepared in consonance with the R&R policy of the State, shall be submitted along with the compliance of Stage-I approval.*
  - vii. *The user agency shall prepare and submit a consolidated Reclamation Plan of the areas mined out completely which are not required for future mining and areas to be reclaimed in future in consonance with the Progressive Mine Closure Plan and detail of the same shall be submitted along with compliance of Stage-I approval.*
  - viii. *The User Agency shall transfer online, the Net Present Value (NPV) of the forest land being diverted under this proposal, as per the guidelines issued by this Ministry vide its letters No. 5-3/2011-FC (Vol.) dated 06.01.2022 read with letter dated 22.03.2022. The requisite funds shall be transferred through online portal into National Authority (CAMPA) account of the State Concerned; new NPV guidelines;*
  - ix. *Compensatory levies to be realized from the User Agency under the project shall be transferred/ deposited, through e-challan, in to the account of CAMPA pertaining to the State concerned through e-portal (<https://parivesh.nic.in/>);*
  - x. *Following activities, as per approved plan / schemes, shall be undertaken in the lease area by the User Agency under the supervision of the State Forest Department. Approved scheme/plan shall be submitted to the Ministry along with compliance of Stage-I approval:*
    - a. *Mitigative measures to minimize soil erosion and choking of stream shall be implemented within a period of three year with effect from the issue of Stage-II clearance in accordance with the approved Plan in consultation with the State Forest Department.*
    - b. *Planting of adequate drought hardy plant species and sowing of seeds, in the appropriate area within the mining lease to arrest soil erosion in accordance with the approved scheme;*

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- c. Construction of check dams, retention /toe walls to arrest sliding down of the excavated material along the contour in accordance with the approved scheme;
  - d. Stabilize the overburden dumps by appropriate grading/benching, in accordance with the approved scheme, so as to ensure that angles of repose at any given place is less than  $28^{\circ}$ ; and
  - e. No damage shall be caused to the top-soil and the user agency will follow the top soil management plan.
- xi. User agency either himself or through the State Forest Department shall undertake gap planting and soil & moisture conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.40), if any, located in the area within 100 meter from outer perimeter of the mining lease. The plan for plantation and SMC activities will be prepared and submitted to MoEF &CC before Stage-II Clearance;
- xii. The User Agency shall prepare a list of existing village tanks and other water bodies with GPS co-ordinates located within five km from the mine lease boundary. This list is to be duly verified by the concerned Divisional Forest Officer. The User Agency shall regularly undertake desilting of these village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/water bodies. A detailed approved plan for desilting of identified ponds and water bodies to be prepared in consultation with forest department and shall be submitted to MoEF & CC before Stage-II approval;
- xiii. **Safety Zone Management:** Following activities, at project cost, shall be undertaken by the user agency for the management of safety zone as per relevant guidelines issued by the Ministry's guidelines:
- a. User agency shall ensure demarcation of safety zone (7.5 meter strip all along the inner boundary of the mining lease area), and its fencing, protection and regeneration by erecting adequate number of 6 feet high RCC boundary pillars inscribed with DGPS coordinates with barbed wire fencing and deploying adequate number of watchers under the supervision of the State Forest Department;
  - b. Boundary of the safety zone of the mining lease, adjacent to habitation/roads, should be properly fenced by the user agency;
  - c. Safety zone shall be maintained as green belt around mining lease and to ensure dense canopy in the area, regeneration shall be taken up in this area by the user agency at project cost under the supervision of the State Forest Department;
  - d. The State Government and the user agency shall ensure that safety zone is maintained as per the prescribed norms;
  - e. The cost of felling of trees shall be deposited by the User Agency with the State Forest Department;
- xiv. State Government shall complete settlement of rights, in term of the Scheduled Tribes and Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, if any, on the forest land to be diverted and submit the documentary evidence as prescribed by this Ministry's letter No. 11-9/1998-FC (Pt.) dated 03.08.2009 read with 05.07.2013, in support thereof; and

File No.8-15/2021-FC

xv. The complete compliance report of the conditions stipulated in this approval shall be uploaded on e-portal (<https://parivesh.nic.in/>).

**B. Conditions which need to be complied on field after handing over of forest land to the user agency by the State Forest Department but the compliance in form of undertaking shall be submitted prior to Stage-II approval**

- i. Legal status of the diverted forest land shall remain unchanged;
- ii. Compensatory afforestation over orange forest land, double in extent to the forest land being diverted, shall be raised by the State Forest Department at the project cost within three years from the date of grant of Stage - II approval;
- iii. The user agency shall keep minimum of 120 meters distance from the bank of Mand River as intact and no mining should be carried out in this area. Embankment should be constructed to ensue protection of river and its hydrology from the mining;
- iv. At the time of payment of the Net Present Value (NPV) at the present rate, the user agency shall furnish an undertaking to pay the additional amount of NPV, if so determined, as per the final decision of the Hon'ble Supreme Court of India;
- v. Trees should be felled in phased manner as per the requirement in the approved Mining Plan with prior permission of concerned DFO;
- vi. The user agency shall explore the possibility of translocation of maximum number of trees identified to be felled and shall ensure that any tree felling shall be done only when it is unavoidable and that too under strict supervision of the State Forest Department.
- vii. The User Agency shall comply with the Hon'ble Supreme Court order on re-grassing, and re-grass the mining area and any other areas which may have been disturbed due to mining to restore them to a condition which is fit for growth of fodder, flora, fauna, etc. in a timely manner;
- viii. The User Agency shall undertake mining in a phased manner after taking due care for reclamation of the mined over area. The concurrent reclamation plan as per the approved mining plan shall be executed by the User Agency from the very first year, and an annual report on implementation thereof shall be submitted to the Nodal Officer, Forest (Conservation) Act, 1980, in the concerned State Government and the concerned Integrated Regional Office of the Ministry. If it is found from the annual report that the activities indicated in the concurrent reclamation plan are not being executed by the User Agency, the Nodal Officer or the concern Head of the Integrated Regional Office may direct that the mining activities shall remain suspended till such time, such reclamation activities area satisfactorily executed.
- ix. Period of diversion of the said forest land under this approval shall be for a period co-terminus with the period of the mining lease proposed to be granted under the Mines and Minerals (Development and Regulation) Act, 1957, as amended and the Rules framed there-under;
- x. The User Agency shall obtain the Environment Clearance as per the



**File No.8-15/2021-FC**

- provisions of the Environmental (Protection) Act, 1986, if required;
- xi. No labour camp shall be established on the forest land and the User Agency shall provide fuels preferably alternate fuels to the labourers and the staff working at the site so as to avoid any damage and pressure on the nearby forest areas;
  - xii. The boundary of the diverted forest land, mining lease and safety zone, as applicable, shall be demarcated on ground at the project cost, by erecting four feet high reinforced cement concrete pillars, each inscribed with its serial number, distance from pillar to pillar and GPS coordinates;
  - xiii. The layout plan of the mining plan/ proposal shall not be changed without the prior approval of the Central Government and the forest land shall not be used for any purpose other than that specified in the proposal;
  - xiv. The forest land proposed to be diverted shall under no circumstances be transferred to any other agency, department or person without prior approval of the Central Government;
  - xv. No damage to the flora and fauna of the adjoining area shall be caused;
  - xvi. Any other condition that the concerned Regional Office of this Ministry may stipulate with the approval of competent authority in the interest of conservation, protection and development of forests & wildlife; and
  - xvii. The user agency shall comply all the provisions of the all Acts, Rules, Regulations, Guidelines, Hon'ble Court Order (s) and NGT Order (s) pertaining to this project, if any, for the time being in force, as applicable to the project.
  - xviii. Violation of any of these conditions will amount to violation of Forest (Conservation) Act, 1980 and action would be taken as prescribed in para 1.21 of Chapter 1 of the Handbook of comprehensive guidelines of Forest (Conservation) Act, 1980 as issued by this Ministry's letter No. 5-2/2017-FC dated 28.03.2019.
  - xix. The User Agency shall submit the annual self-compliance report in respect of the above stated conditions to the State Government, concerned Regional Office and to this Ministry by the end of March every year regularly;

After receipt of compliance report on fulfilment of the conditions mentioned above, the proposal shall be considered for final approval under Section-2 of the Forest (Conservation) Act, 1980. Transfer of forest land shall not be affected till final approval is granted by the Central Government in this regard.

Yours faithfully,

File No.8-15/2021-FC

**(Sandeep Sharma)**

Assistant Inspector General of Forests

**Copy to:**

1. Principal Chief Conservator of Forests (PCCF) Aranya Bhawan, Sector 19, North Block, New Raipur, 492002 Chhattisgarh.
2. Regional Officer, Integrated Regional Office, MoEF&CC, Naya Raipur.
3. The Adtl. PCCF & Nodal Officer (PCA), Jail Road, Aranya Bhawan, Raipur.
4. User Agency
5. Monitoring Cell, Forest Conservation Division, MoEF&CC
6. Guard file

Digitaly Signed by Sandeep  
Sharma  
Date: 07-07-2022 10:39:59  
Reason: Approval

## ANNEXURE-II



## कार्यालय वनमण्डलाधिकारी, धरमजयगढ़

रायगढ़ रोड, धरमजयगढ़, जिला रायगढ़ [छ.ग.-498116]

[Email - dharamajygarh@rediffmail.com / Phone No - 07760-260591, 07760-260739]

क्रमांक / DM / 2023 / 2611  
प्रति,

धरमजयगढ़, दिनांक 14.06.2023

उप महासमयक  
राज्य इन्स्टीट्यूट ऑफ फॉरेस्ट्स डिस्ट्रिक्ट  
ऑफ इन्फॉर्मेशन एंड रिजोर्न्स, ऑफिस जिला- रायगढ़ (छ.ग.)

- विषय - Proposal for new forestry use of 240.867 ha. (185.017) ha. Revenue Forest Land + 55.850 ha. Deemed Forest) forest land under Forest (Conservation) Act, 1980 for Chhatra OC team III & MTY project of SECL in Raigarh District of Chhattisgarh.
- संदर्भ - 1. भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, डेप्युटी पर्यावरण सचिव, नई दिल्ली का पत्र क्र./ File No. FC-11/43/2021-FC दिनांक 07.06.2022 एवं क्षेत्रीय कार्यालय रायपुर का पत्र क्र./ File No. 8-15/2021-FC दिनांक 06.07.2022  
2. उपर प्रदान मूल्य वनसंज्ञक (मु-प्रक) नया रायपुर का पत्र क्र./ मु-प्रक/छमिज /321-259/860 दिनांक 03.03.2023  
3. आवका पत्र क्र./ SECL/RGH/SAM/2023/1395 दिनांक 27.05.2023

उपरोक्त विषयार्थगत सम्मिलित पत्र एवं अत्यवधान करे प्रकरण में SECL द्वारा कुल 240.867 हे. (संरक्षित वनभूमि-185.017 हे. एवं संरक्षित वनभूमि 55.850 हे.) हेतु वनभूमि को गैर-वाणिज्यी प्रकरण एवं जतिविक्रय क्षेत्र क्रमांक 55.850 हे. (Deemed Forest) कुल क्रमांक 240.867 हे. प्रकरण में भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, क्षेत्रीय कार्यालय रायपुर का पत्र क्र./ File No. 8-15/2021-FC दिनांक 06.07.2022 द्वारा प्रेषण करने की स्वीकृति जारी की गई है।

प्रदान प्रदान प्रेषित प्रतिवेदन में 10 विन्दुओं की जतिविक्रय जानकारी पायी गई है, जिसमें बिन्दु क्र. 6 हेतु SMC Plan तैयार किया जाता है, जिसमें उपर प्रस्तुत SMC Plan में संशोधित कार्य जिसमें 2 बी.ए., 1बी.बी., 0.5बी. गडवाई की गड़दा प्रस्तावित होने से वन कमी एवं वन्य प्राणियों को विपत्ता में आना ही भी राधा भविष्य चक्र गड़दों में वन्यप्राणियों को विपत्ती की संभावना बनी रहती। इस हेतु भौतिक स्तर से जांचको पूर्व में ही निर्देश दिया गया है।

अतः आपको ज्ञेय किया जाता है कि, उपर संशोधित कार्यों के अर्थों पर अन्य कार्य अस्तावित करें।

  
वनमण्डलाधिकारी  
धरमजयगढ़ वनमंडल

/ धरमजयगढ़, दिनांक 14.06.2023

पु. क्रमांक / DM / 2023 / 2611  
प्रतिप्रति :-

1. उपर प्रदान मूल्य वनसंज्ञक (मु-प्रक) नया रायपुर धरमजयगढ़ की ओर सूचनाएं सम्प्रेषित।
2. मूल्य वन संज्ञक विजासपुर एवं विजासपुर की ओर सूचनाएं सम्प्रेषित।

  
वनमण्डलाधिकारी  
धरमजयगढ़ वनमंडल

# ***Plates***

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PLATE-1: LOCATION MAP

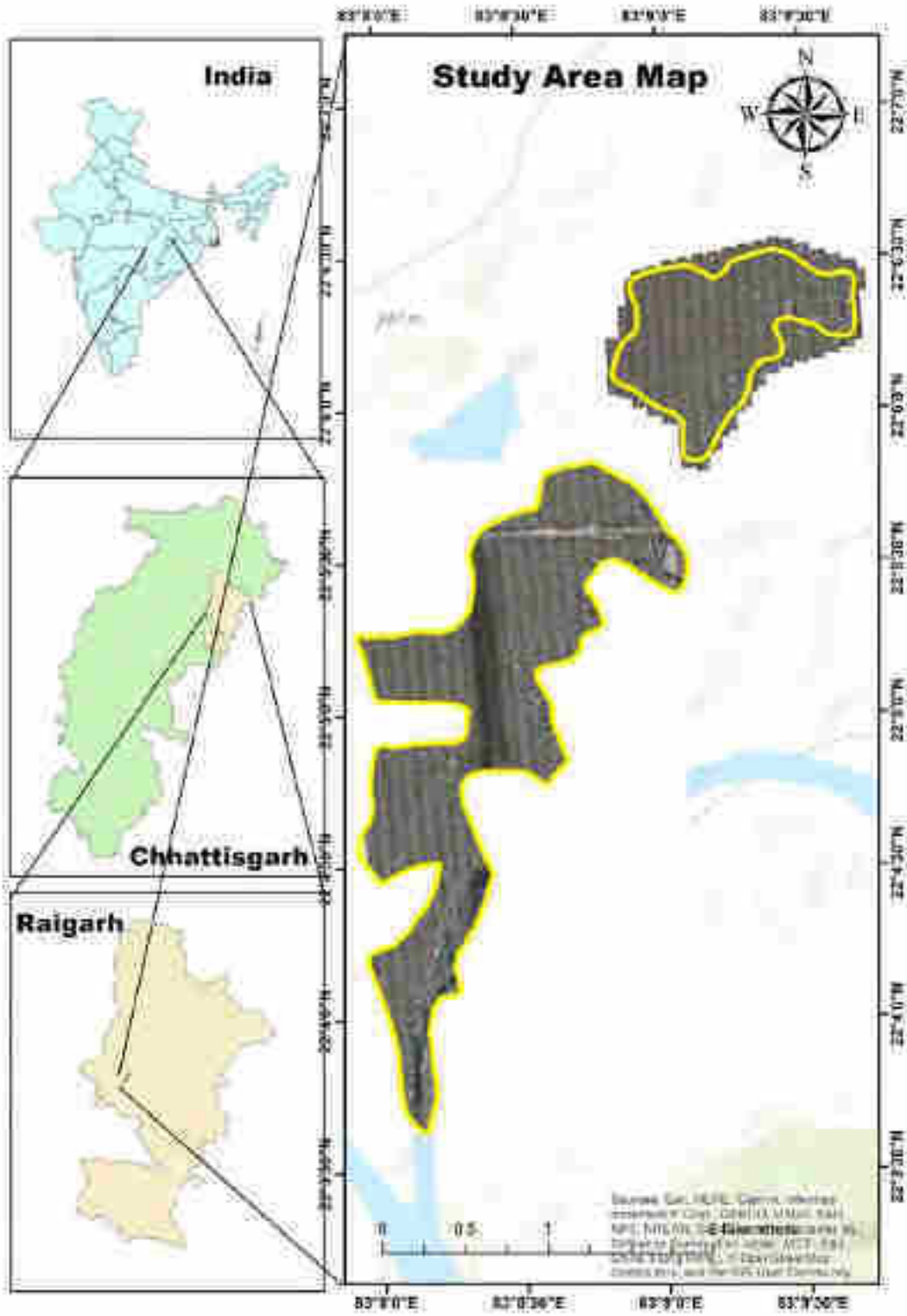


PLATE-2: TOPOSHEET MAP

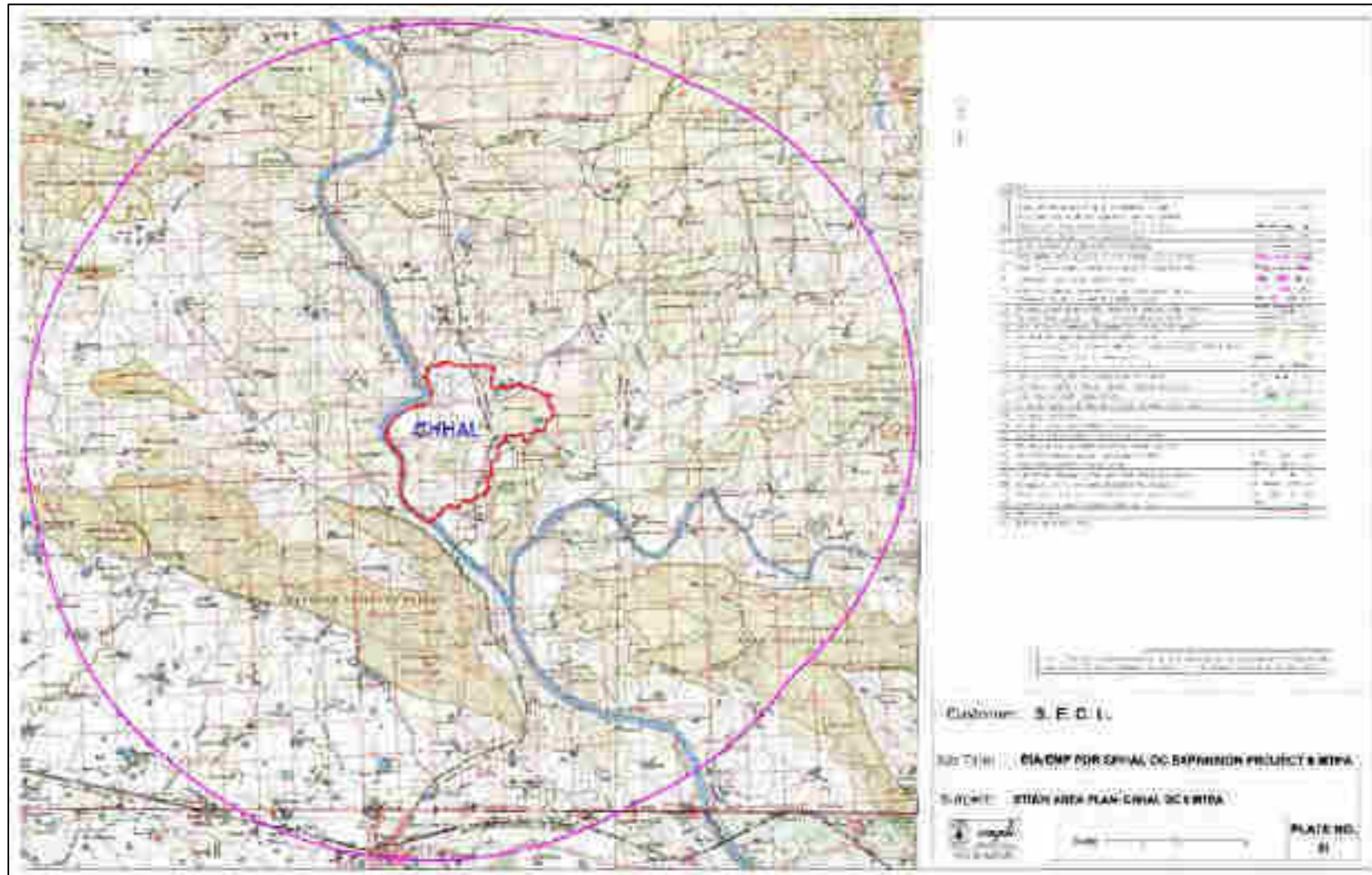


PLATE-3: ORTHOMOSIC IMAGE

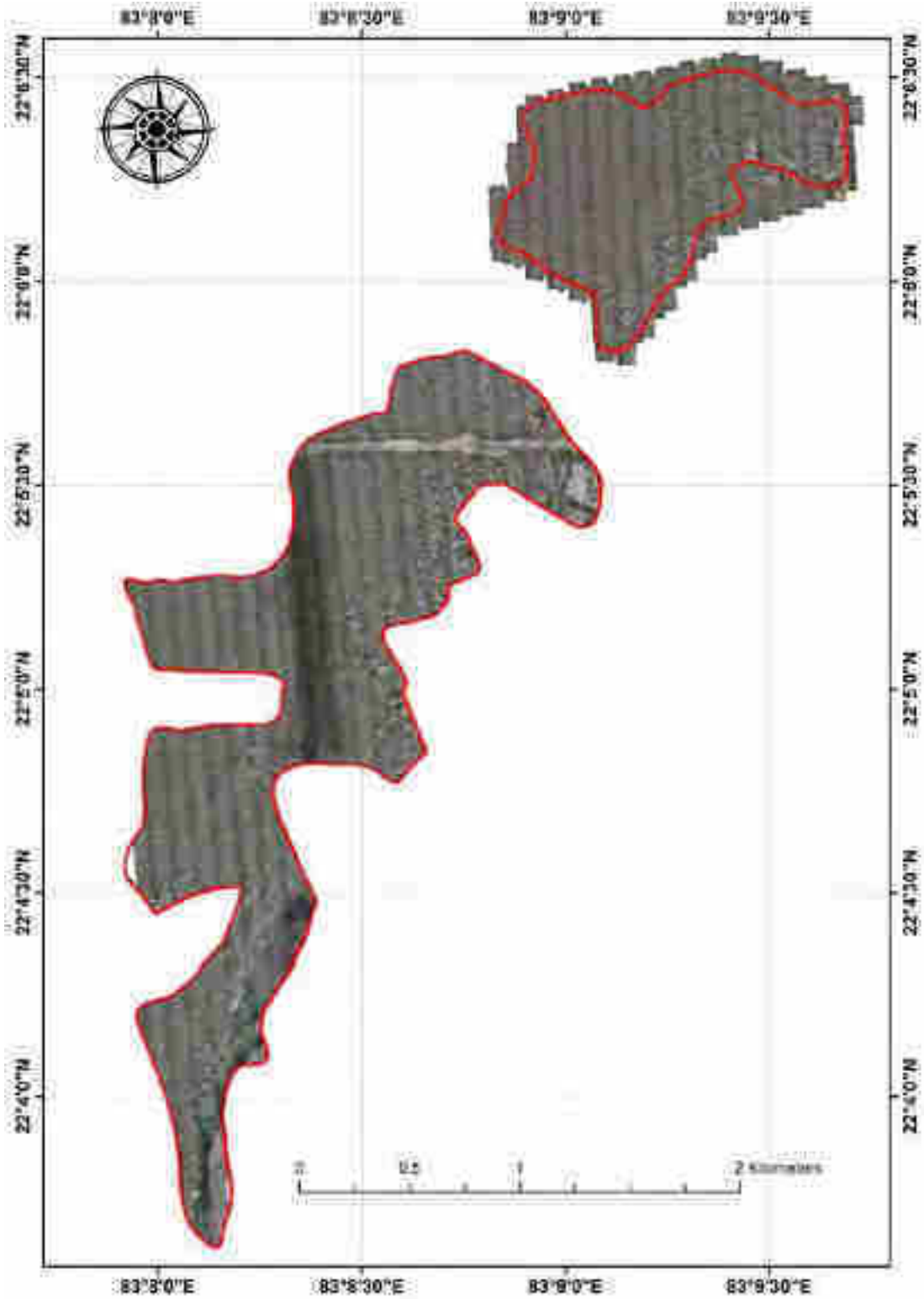


PLATE-4: CONTOUR MAP

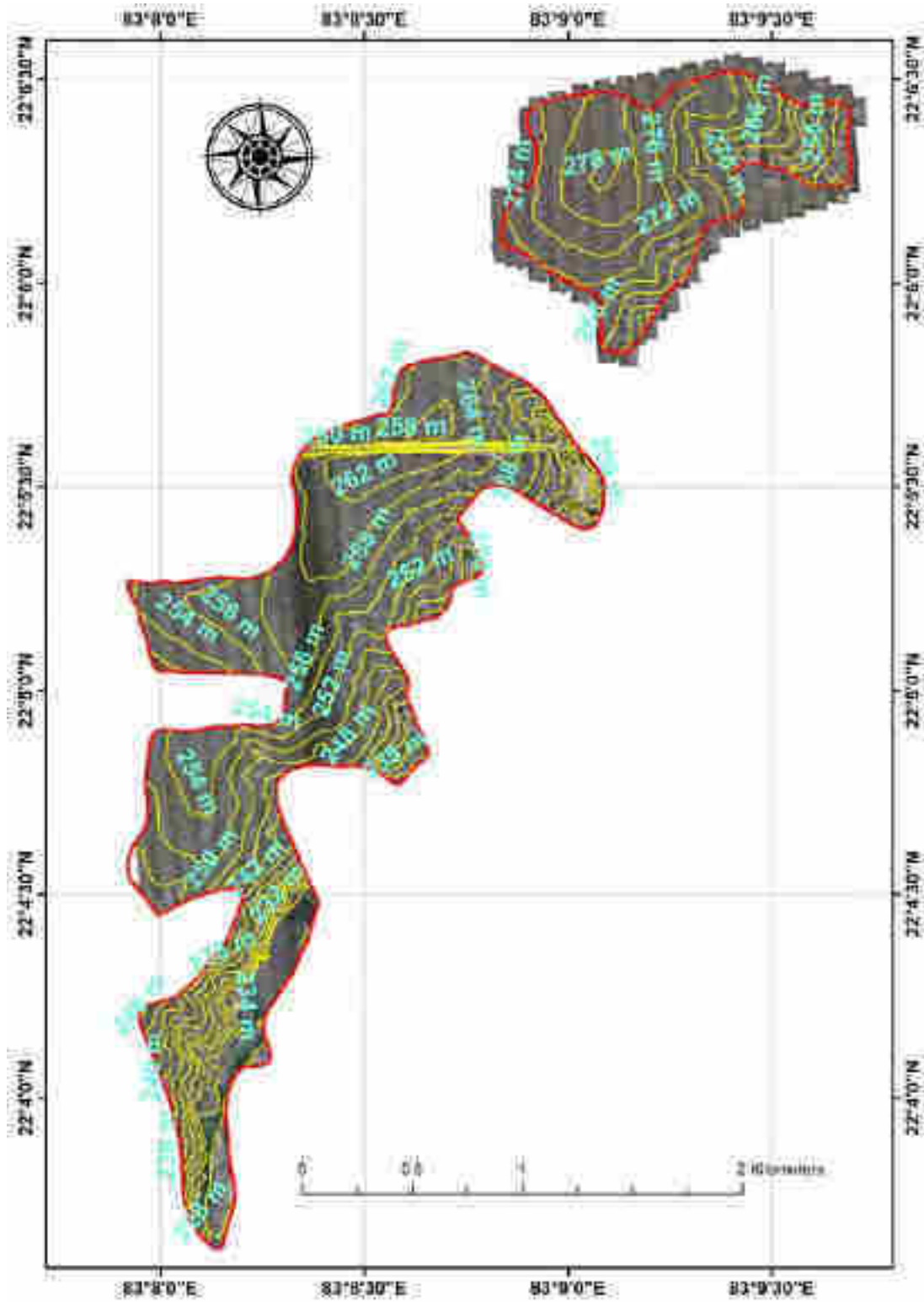
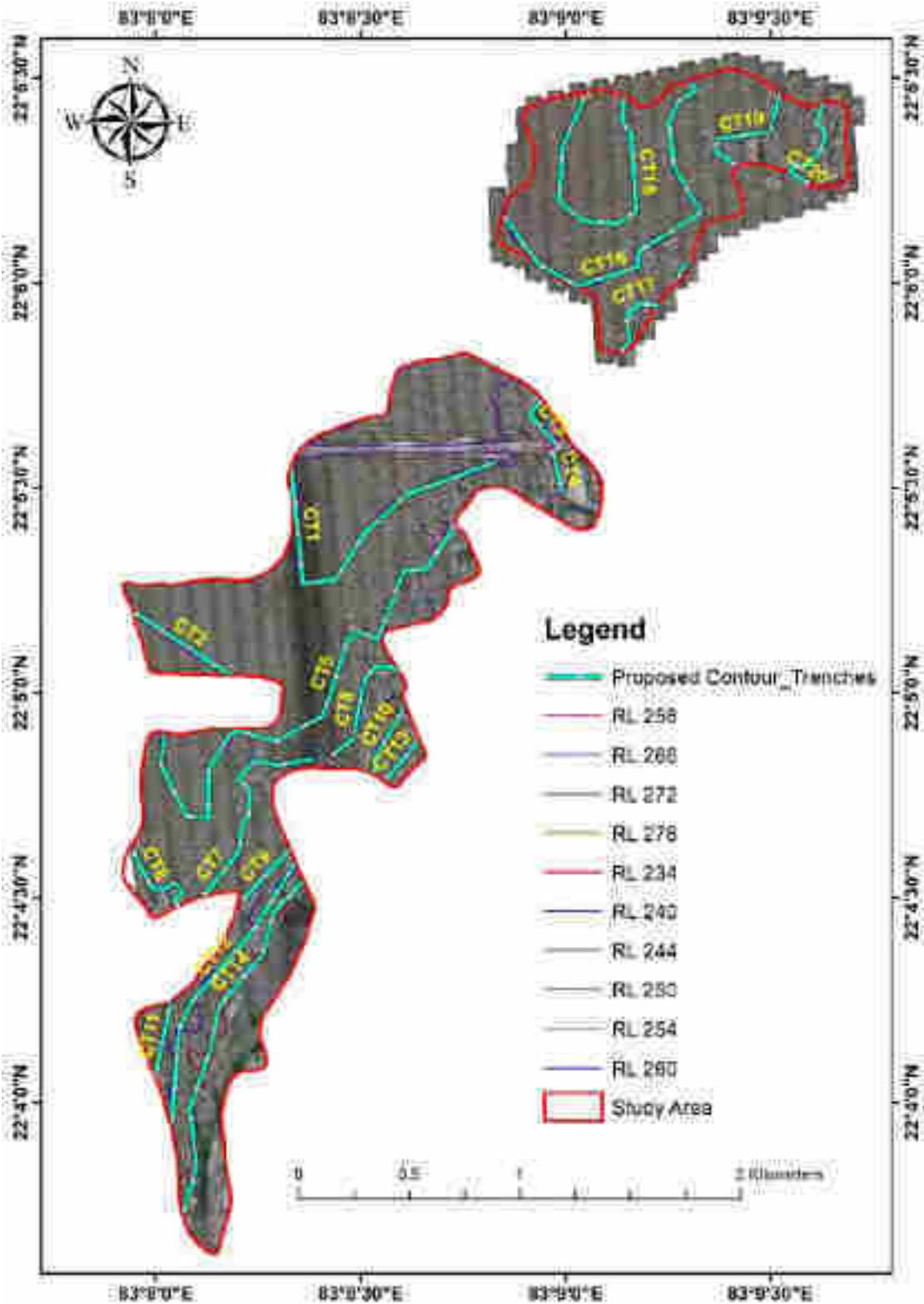




PLATE-5 LOCATION OF PROPOSED CONTOUR TRENCHES



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**PLATE-6 LOCATION OF PROPOSED CHECK DAMS**

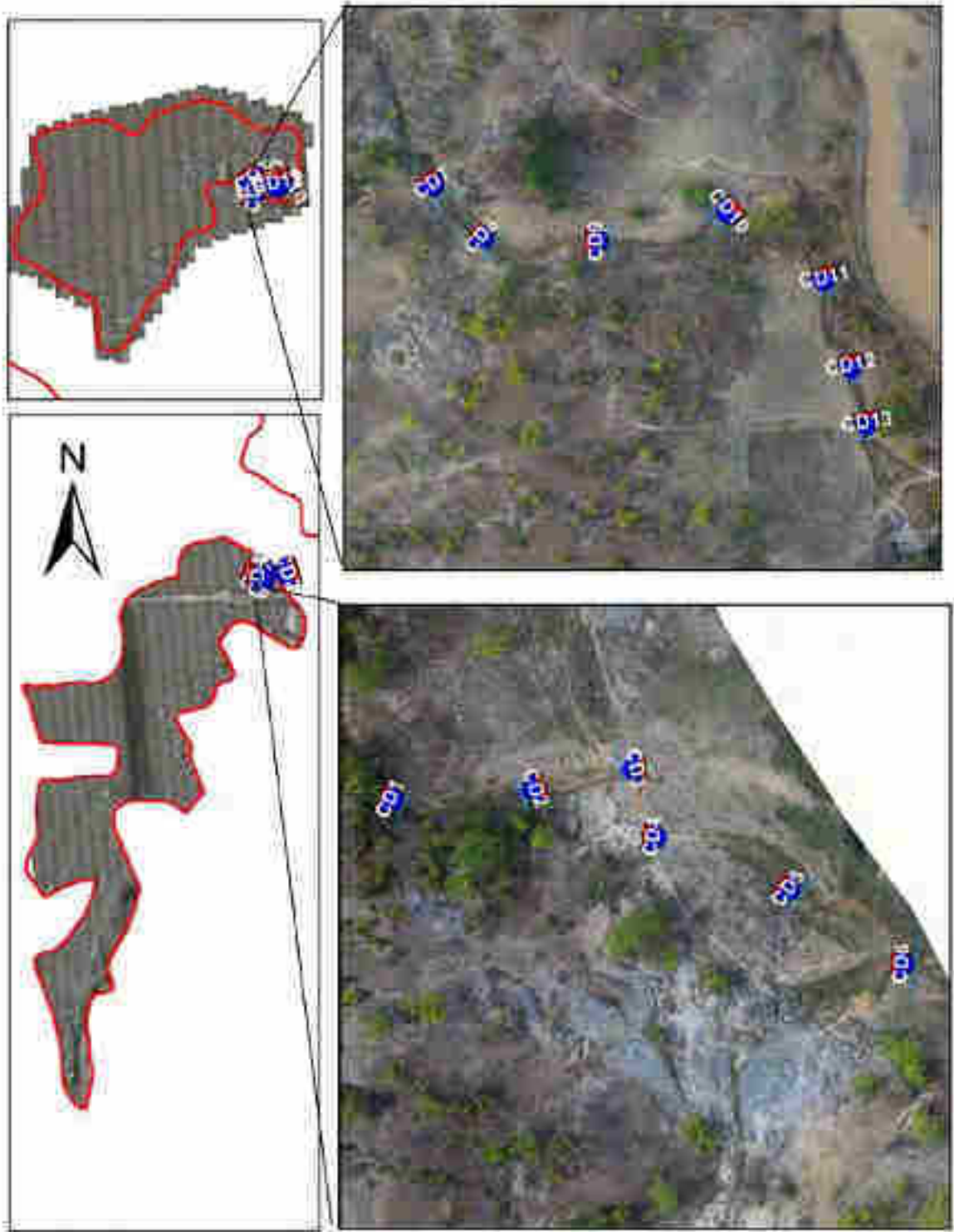


PLATE-7 LOCATION OF PROPOSED PONDS

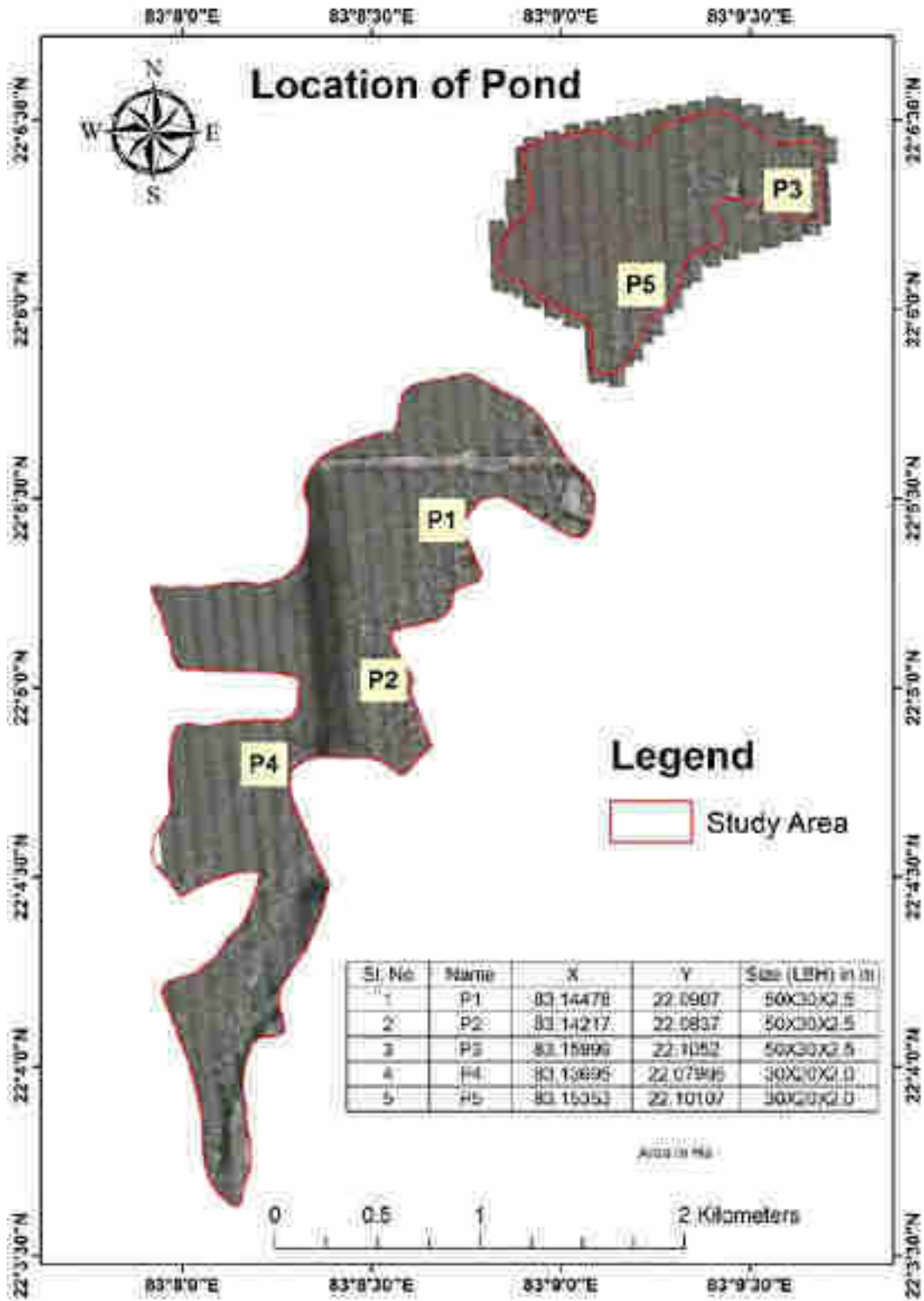
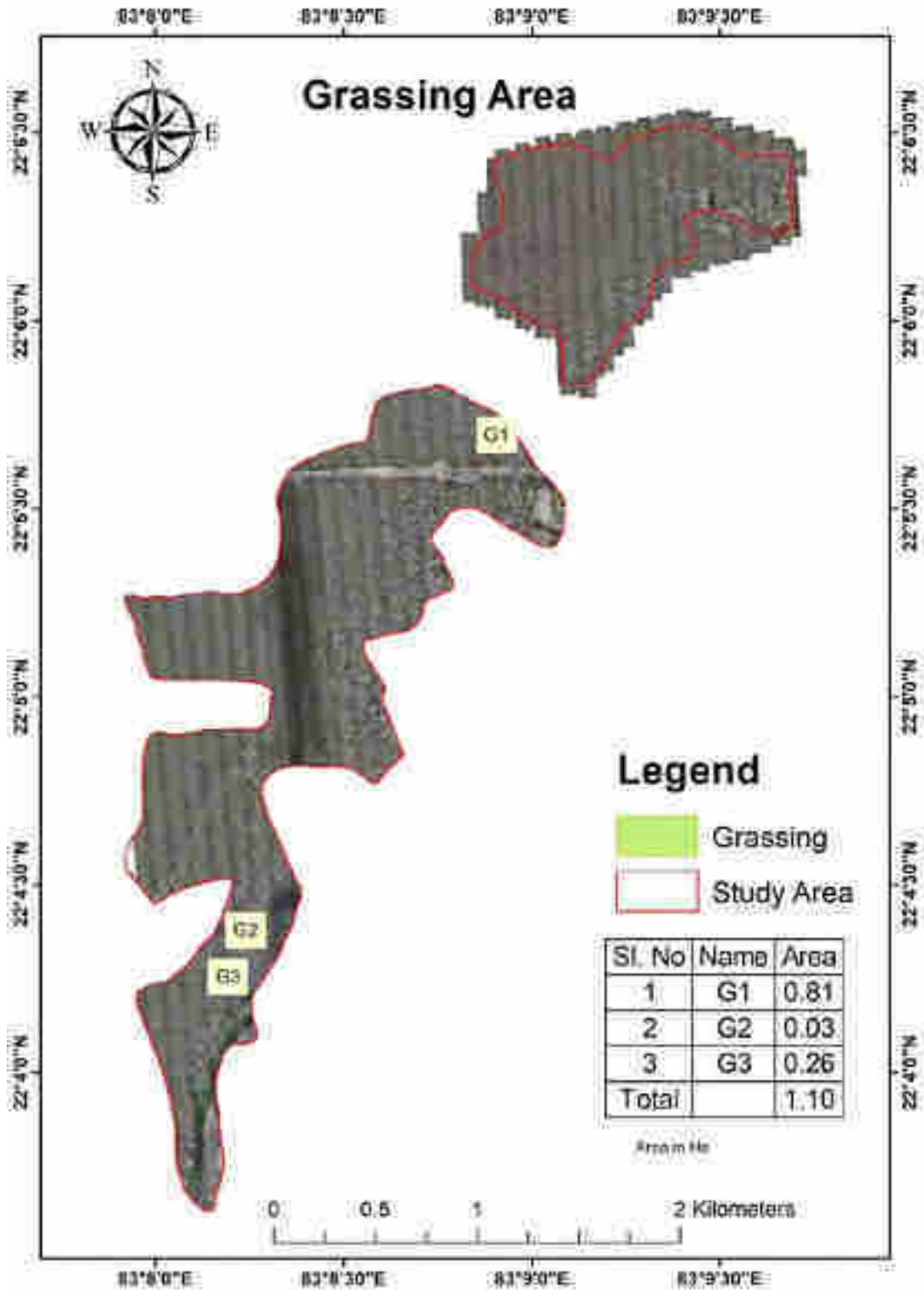


PLATE-8 PROPOSED LOCATION FOR GRASSING



**PLATE-9 PROPOSED LOCATION FOR MULCHING**

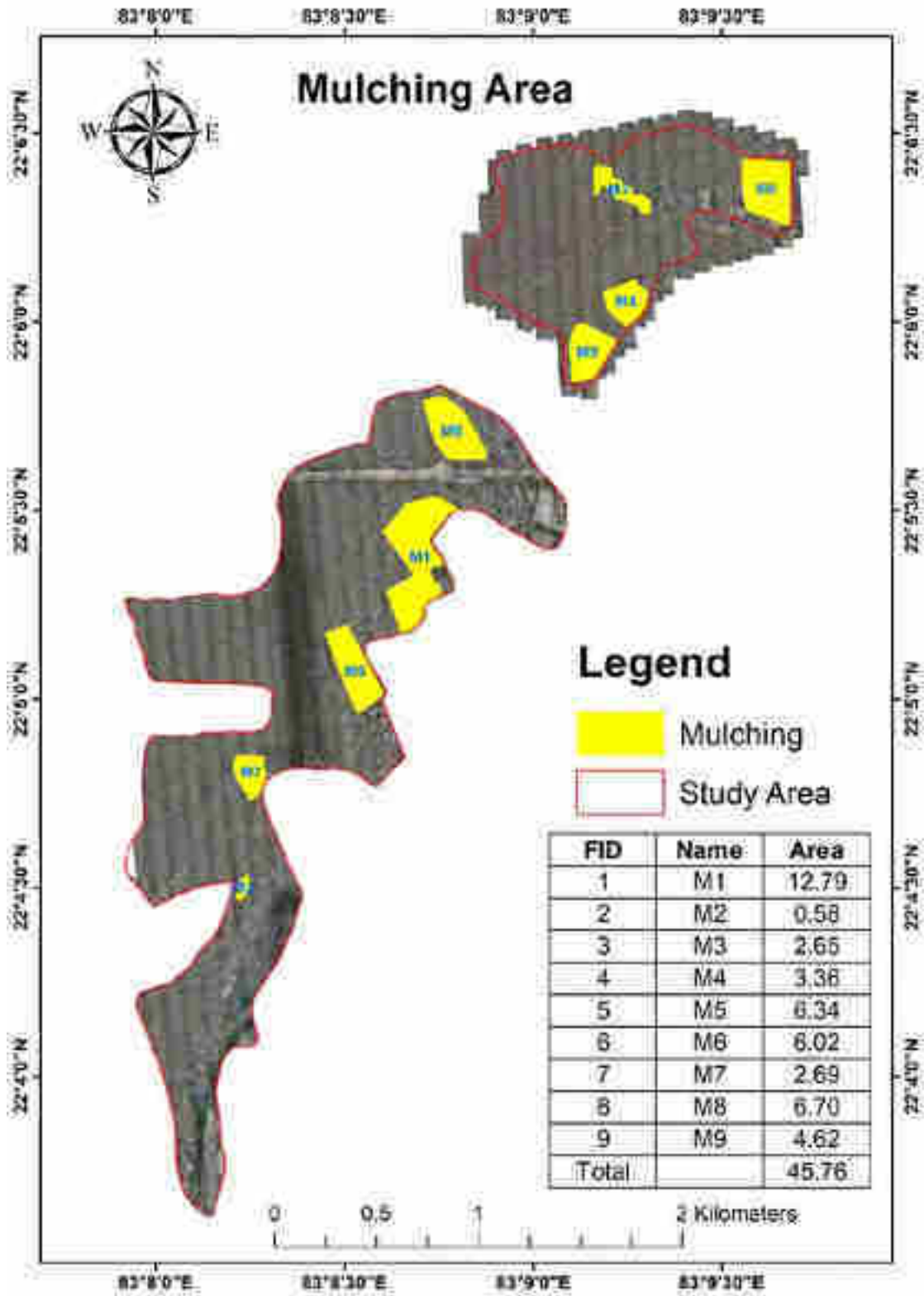
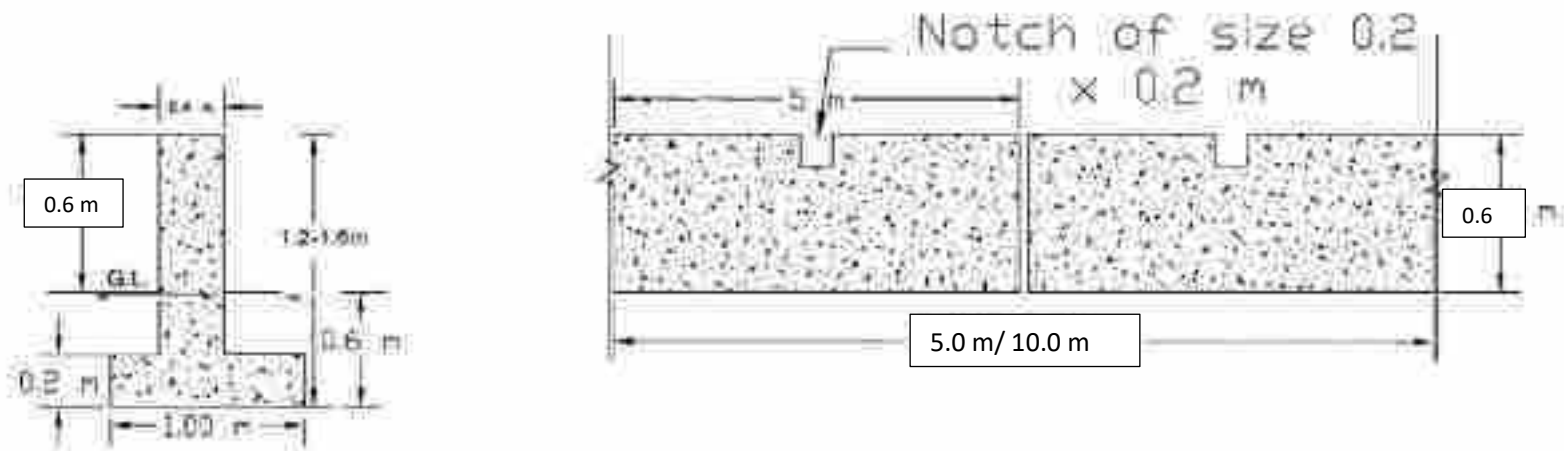
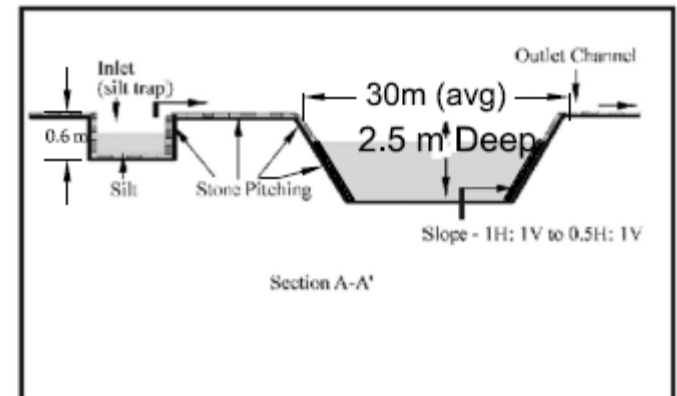
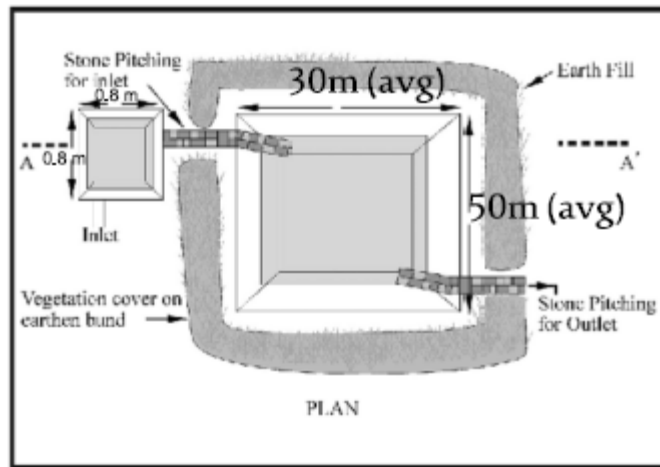


PLATE-10 TYPICAL SECTION OF CHECK DAM



TYPICAL SECTION OF CHECK DAM


PLATE- 11: TYPICAL SECTION OF SURFACE POND



TYPICAL SECTION OF SURFACE POND

(ii) With regard to condition no. A(v) the State Government informed that the user agency has submitted an undertaking. However, Elephant/Wildlife Management Plan approved from competent authority and verified from PE Division of this Ministry is not submitted with the compliance report. The same need to be submitted.

SFRTI रायपुर से 1222.91 लाख का Wildlife Management Plan तैयार कराया गया है। उक्त Wildlife Management Plan को PCCF WL से approved की कार्यवाही प्रक्रियाधीन है। approved उपरान्त approved Wildlife Management Plan एवं अंतर की राशि वन विभाग के मांग अनुसार शीघ्र जमा किया जावेगा।

  
NADAL OFFICER (FOREST)  
RAIGARH AREA, S.E.C.L.





**“WILDLIFE CONSERVATION PLAN INCLUDING ALTERNATIVE  
HABITAT DEVELOPMENT PLAN FOR THE AFFECTED AVIFAUNA  
OF CORE AREA OF OCP CHAAL, RAIGARH AREA”**

**REVISED**



Published by



**STATE FOREST RESEARCH & TRAINING INSTITUTE  
RAIPUR, CHHATTISGARH**

आदेश द्वारा सुधीर कुमार अग्रवाल, भा.व.सं. प्रधान मुख्य वन संरक्षक,  
(वन्यप्राणी एवं जैव विविधता संरक्षण) सह मुख्य वन्यप्राणी  
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//आदेश//

आदेश क्रमांक/व.प्रा./प्रबंध-500/208

नवा रायपुर, दिनांक - 21.07.2023

कार्यालय निदेशक, राज्य वन अनुसंधान एवं प्रशिक्षण संस्थान, रायपुर का पत्र क्र. /1451 दिनांक 19.07.2023 द्वारा रायगढ़ वनमंडल अंतर्गत एस.ई.सी.एल. को आवंटित छाल खुली खदान के संबंध में भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, नई दिल्ली का पत्र दिनांक 08.07.2022 में प्रस्ताव के प्रथम चरण स्वीकृति में अधिरोपित शर्त क्रमांक (v) के पालनार्थ पक्षी संवर्धन/वन्यप्राणी संरक्षण योजना तैयार कर इस कार्यालय को प्रस्तुत किया गया है।

राज्य वन अनुसंधान एवं प्रशिक्षण संस्थान, रायपुर ने अपने पत्र क्र./1353 दिनांक 28.06.2023 के माध्यम से वनमंडलाधिकारी, धरमजयगढ़ एवं एस.ई.सी.एल. रायगढ़ एरिया के द्वारा पूर्व में प्रेषित राशि रु. 3.74 करोड़ के प्रबंधन योजना का पुनरीक्षण कर वर्तमान में वन्यप्राणी प्रबंधन योजना राशि रु. 12.30 करोड़ तैयार कर टीप हेतु इस कार्यालय को प्रस्तुत किया गया था, जिसके परिप्रेक्ष्य में आवश्यक संशोधन करने हेतु कार्यालयीन पत्र क्र./3213 दिनांक 12.07.2023 द्वारा राज्य वन अनुसंधान एवं प्रशिक्षण संस्थान, रायपुर को लेख किया गया था।

प्रस्तुत पक्षी संवर्धन/वन्यप्राणी संरक्षण योजना का गहन परीक्षण किया गया। आवेदक संस्थान द्वारा प्रस्तुत पक्षी संवर्धन योजना में हाथी एवं भालू वन्यप्राणियों की सुरक्षा हेतु बजट आवंटन किया गया है। अनुमोदित योजना में वन्यप्राणियों के आहार, जल स्रोत निर्माण, बिजली तारों का इन्सुलेशन, पर्यावरण विकास कार्य, हाथी मित्र दल के लिये वाहन उपलब्ध कराना इत्यादि संबंधित राशि का विवरण परिशिष्ट-1 में संलग्न है।

उक्त पक्षी संवर्धन/वन्यप्राणी संरक्षण योजना की लागत राशि 12.30 करोड़ वर्तमान दरो पर है। परियोजना में देरी होने से समय लागत बढ़ेगी, जिसमें ग्राईस इन्डेक्स के हिसाब से वृद्धि होगी। परियोजना के क्रियान्वयन के समय जो भी लागत आवेगी वह प्रस्तावको को वन विभाग में एकमुश्त जमा करानी होगी, जिससे मूल्य वृद्धि के प्रभाव को समाप्त किया जा सके। वन विभाग इस प्रकार जमा की गई राशि से पक्षी संवर्धन/वन्यप्राणी संरक्षण योजना में दर्शाये समय सारणी के अनुसार क्रियान्वित करेगा।



अनुमोदित पक्षी संवर्धन/वन्यप्राणी संरक्षण योजना में दशांशे गये उपरोक्त घटकों के संगत फील्ड में किये जाने वाले कार्यों का कार्यवार/स्थलवार प्रोजेक्ट संबंधित वनमंडलाधिकारी के द्वारा तत्समय प्रचलित मार्गदर्शी सिद्धांतों (व्यय नामस, कार्य की प्रकृति, वन्यप्राणी प्रकृति के संबंध में लागू होने वाले अन्य तकनीकी तथ्यों व निर्देशों) के अनुरूप तैयार कर सक्षमतानुसार तकनीकी स्वीकृति/अनुमोदन हेतु अनुशंसा सहित संबंधित मुख्य वन संरक्षक को प्रेषित किया जावेगा। संबंधित मुख्य वन संरक्षक द्वारा प्रोजेक्ट की तकनीकी स्वीकृति/अनुमोदन की अनुशंसा के साथ मुख्य वन्यप्राणी अभिरक्षक छत्तीसगढ़ को प्रेषित किया जावेगा। प्रोजेक्ट का परीक्षण पक्षी संवर्धन/वन्यप्राणी संरक्षण योजना की उपयुक्तता की दृष्टि से किया जाकर मुख्य वन्यप्राणी अभिरक्षक के द्वारा कार्य हेतु प्रशासकीय स्वीकृति जारी किये जाने के साथ प्रोजेक्ट, प्रशासकीय स्वीकृति/बजट आवंटन करने हेतु सहाय अधिकारी को प्रेषित किया जावेगा। प्रशासकीय स्वीकृति आदेश जारी किये जाने के पश्चात् ही कार्यों का क्रियान्वयन वनमंडलाधिकारी द्वारा किया जावेगा।

पक्षी संवर्धन/वन्यप्राणी संरक्षण योजना के कार्यों की मॉनिटरिंग का कार्य संबंधित मुख्य वन संरक्षक व मुख्य वन्यप्राणी अभिरक्षक छ.ग. द्वारा किया जावेगा। किये जा रहे कार्यों की भीतिक व आर्थिक प्रगति से मुख्य वन्यप्राणी अभिरक्षक को प्रतिमाह वनमंडलाधिकारी द्वारा अवगत कराया जावेगा।

प्रधान मुख्य वन संरक्षक (व.प्रा.) सह मुख्य वन्यप्राणी  
अभिरक्षक, छत्तीसगढ़, नवा रायपुर

नवा रायपुर, दिनांक - 21.07.2023

पृ.क्रमांक/व.प्रा./प्रबंध-500/3367

प्रतिलिपि सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित :-


1. अपर प्रधान मुख्य वन संरक्षक (मू-प्रबंध) नवा रायपुर। कृपया पक्षी संवर्धन/वन्यप्राणी संरक्षण योजना में प्रावधानित सशि 12.30 करोड़ एकमुस्त जमा करने हेतु परियोजना प्रस्तावकों को आदेशित करें।
2. मुख्य वन संरक्षक, बिलासपुर वृत्त, बिलासपुर।
3. मुख्य वन संरक्षक वन्यजीवन और क्षेत्रीय निदेशक, अचानकमार टाउनर रिजर्व, बिलासपुर।
4. वनमंडलाधिकारी, धरमजयागढ़ वनमंडल।
5. महाप्रबंधक, एस.ई.सी.एल. रायगढ़ क्षेत्र।

प्रधान मुख्य वन संरक्षक (व.प्रा.) सह मुख्य वन्यप्राणी  
अभिरक्षक, छत्तीसगढ़, नवा रायपुर

**FINANCIAL PROPOSAL FOR WILDLIFE CONSERVATION PLAN INCLUDING  
ALTERNATIVE HABITAT DEVELOPMENT FOR AVIFAUNA, ELEPHANTS AND OTHER  
WILD ANIMALS OF IMPACT AREA OF OCP CHHAI.**

S.No.	Description of Item of Work	Unit (No./ha)	Yearwise Estimated Requirement of Budget						Total
			1st	2nd	3rd	4th	5th	6th	
<b>1</b>	<b>Habitat Improvement Activities</b>								
1.1	Food resource enhancement for elephant, sloth bear and birds and other species with 4 year of maintenance. Species which are to be chosen for silvi pasture can be referred from chapter no. 6 (para 6.3.0)	As per norms and sanctional paper by competent officer	200.00	40.00	30.00	30.00	-	-	300.00
1.2	Improvement of water availability by digging of ponds/water holes and maintenance of existing water holes for elephants, sloth bear and other animals.	LS	50.00	100.00	50.00	-	-	-	200.00
<b>2</b>	<b>Human Elephant Conflict Mitigation Activities</b>								
2.1	Insulation of electricity lines in elephant habitats/corridor.	LS	100.00	150.00	150.00	-	-	-	400.00
<b>3</b>	<b>Eco Development in Villages</b>								
3.1	Eco development works in 15 villages	LS	20.00	20.00	20.00	20.00	20.00	-	100.00
<b>4</b>	<b>Training &amp; Workshops/Awareness Program</b>								
4.1	Hathi Mitra Dal, Public awareness, Training etc. and miscellaneous work/activities that may be developed subsequently to reduce human wildlife conflicts.	LS	8.00	8.00	8.00	8.00	6.00	5.00	43.00
4.2	Arrangement of utility vehicle "Gajraj Vahan" for the field in transport of man, materials used in human wildlife conflict situation with POL.	LS	8.00	8.00	8.00	8.00	8.00	8.00	48.00
4.3	Purchase of Elephant rescue vehicle	LS	-	60.00	-	-	-	-	60.00
<b>5</b>	<b>Purchase of Equipments</b>								
5.1	Purchase of protective Equipments like Flare gun, Night vision Camera, Binoculars, Tracking equipments and essential rescue equipments/materials.	LS	5.00	5.00					10.00
<b>6</b>	<b>Monitoring and evaluation of works</b>								
6.1	Monitoring and evaluation of works.	LS	-	-	-	3.00	3.00	3.00	9.00
6.2	Consultant for elephant habitat / human elephant conflicts management.	LS	12.00	12.00	12.00	12.00	12.00	-	60.00
<b>GRAND TOTAL</b>								<b>1230.00</b>	

Rupees in word: Twelve Crore Thirty Lakh only.

  
 Principal Chief Conservator of Forest (Wildlife) cum  
 Chief Wildlife Warden  
 Chhattisgarh, Naya Raipur

*Published by: State Forest Research and Training Institute  
Raipur, Chhattisgarh  
Revised Plan Published in June 2023*

*Front Cover:*

*Red Vented Bulbul, Oriental Magpie-robin, Elephant and Sloth Bear in core mining area of OCP Chhal, Dharamjaigarh, C.G.*

*Back Cover:*

*Group of Elephant (*Elephas maximus*) in Forest of Chhal, Dharamjaigarh, C.G.*

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## ACKNOWLEDGEMENT

Alternative Habitat Development Plan for affected Avifauna and Wildlife Conservation Plan for affected wildlife species of OCP Chhal, SECL Raigarh, Chhattisgarh was prepared in July 2019 under the leadership of Shri M.K. Singh then PCCF & Director SFRTI & Shri S.S. Bajaj APCCF SFRTI and his team. Preface and acknowledgement of that publication are reproduced verbatim. The cost of implementation of this plan was proposed as Rs. 3.74 Cr.

The SECL vide their letter No. SECL/ GM/ RGH/ S.O. (P&P) /2023/139 Dated 28.02.2023 requested to revise the plan to include wildlife conservation also. The cost of plan was also required to be revised to Rs. 12.20 Cr.

Thus the team of SFRTI led by **Dr. Manoj Kumar Kashyap** and **Shri. Rajendra Kumar Patley** visited Dharamjaygarh forest division and extensive consultations with the DFO Dharamjaygarh and the field staff of division and OCP Chhal SECL. The plan was revised to the extent of including chapters pertaining to wildlife conservation particularly elephant and bear. The previous plan pertaining to avifauna has been included without any changes.

Implementation of this plan will help to mitigate the adverse effects of mining on the human population and wildlife habitat.



**(Ashish Kumar Bhatt, IFS)**  
**PCCF & Director**  
**State Forest Research and Training**  
**Institute Raipur, Chhattisgarh**

## PREFACE

This project is a scientific and systematic study of real site-specific issues related to the conservation of wildlife and avifauna with the application of management concept and expertise. The project “Alternative Habitat Development Plan for affected Avifauna and Wildlife Conservation Plan for affected wildlife species of OCP Chhal, SECL Raigarh, Chhattisgarh” was proposed by the South Eastern Coalfield Limited (Coal India Limited), Open Cast Project Chhal, SECL Raigarh, for stage II clearance for the diversion of 185.155 hectare of Protected Forest and Revenue Forest land for Chhal Open Cast Mine (OCM) in Chhal Forest Range, Raigarh District, Chhattisgarh in favour of SECL and the project was undertaken by State Forest Research and Training Institute, Raipur (C.G).

The major objectives were:

1. To survey and documentation of the existing wildlife (mammals, reptiles) of OCP Chhal area (core and buffer zone).
2. To estimate species diversity and population dynamics of avifauna in the OCP Chhal area (core and buffer zone).
3. To study the habit, habitat and nesting pattern of different species of avifauna of core and buffer zone.
4. GPS survey of the densities, water bodies, nesting areas, migratory birds area, and wildlife corridor of any in the proposed study area.
5. To study the presence and movement of animals and birds by seasonal survey.
6. To study the impact assessment of proposed mining activities along with the existing biotic pressure on habit and habitat of the existing wildlife species including avifauna of the core zone.
7. Pilot testing, evaluation and monitoring of appropriate measures for the desired site.



8. Preparation of habitat enrichment/development plan for the wildlife species and avifauna of the core zone for preferential adoption of the surrounding area as alternative habitat.
9. Initial monitoring and guidance to the executing agency (Forest Department) for the implementation of the plan.

The research teams of State Forest Research and Training Institute Raipur (C.G) have conducted extensive scientific surveys and conceptualized the alternative plan for the avian species and the conservation plan for the affected wildlife species in the study area.

As result of three seasonal studies, 1653 individual from 106 different species of 32 families' avifauna were recorded in the affected area, which indicates the rich diversity of avian species in the study area. The alternative habitat as per the developed action plan is to be provided. The primary data analysis was based on “**Lines Transect Methodology**” in which the avian biodiversity as well as their habitat were studied and analyzed.

The project report attempts to bring under one cover the entire hard work and dedication put in by the research team for the completion of this work.

The key findings and recommendations have been provided in the document, which we trust, will be useful for all the stakeholders and decision makers associated with the OCP Chhal area. The final conclusion and the recommendations, along with the conservation plan and budget proposal have also been prepared for the implementation of the project.

I hope this report will help, not only the management of OCP Chhal but also help the Forest Department to conserve and protect the wildlife, avifauna and their habitat.



**(S.S Bajaj IFS)**  
**APCCF**

**State Forest Research and Training Institute**  
**Raipur, Chhattisgarh**

## **Acknowledgement**

The preparation of Wildlife Conservation Plan including Alternative Habitat Development Plan for Avifauna within the OCP Chhal lease area and its surroundings would not have taken shape but, for the valuable inputs, suggestions, guidance, support and efforts of a number of resource persons.

I would like to thank Shri Mudit Kumar Singh IFS, PCCF & HoFF, Director, State Forest Research and Training Institute for his continuous support, valuable suggestions and guidance.

I would also like to thank Shri A.B Minz IFS, Ex-Additional Director, SFRTI, and Smt. Nirmala Xess A.C.F, SFRTI for their help and support.

I would like to appreciate the efforts of Shri M.M Ujjaini, Technical Assistant and Project in-charge, Shri Jeevan Shirin Toppo S.R.F, Shri Vijay Kumar Bhagat J.R.F, Shri Kamlesh Kumar Dadsena J.R.F, Shri Amit Kumar Baghel J.R.F, Shri Rajesh Kumar Toppo F.A. and Shri Ashutosh Pandey Ex-S.R.F. in field survey, data collection, analysis and report writing.

My special thanks to Chief Conservator of Forest, Bilaspur, Divisional Forest Officer, Dharamjaigarh Forest Division, and his field staffs, General Manager SECL Raigarh, Sub-area Manager of OCP Chhal and Nodal officer SECL Raigarh and the officers involved with the project for sparing their valuable time and providing facilities for the research team.

The Conservation Management Plan remains open to alteration so as to offer protection to the local birds, wildlife species and their habitat. It should be interpreted as a static design remaining flexible to inputs from the concerned authorities, of whom I am appreciative in advance.

I hope this report will be helpful to develop alternative habitat for avifauna. Wildlife Conservation Plan will also ensure efficient protection, conservation & management for avifauna and wildlife species of the OCP Chhal mining area.



**(S.S Bajaj IFS)**  
**APCCF**

**State Forest Research and Training Institute  
Raipur, Chhattisgarh.**



**TEAM MEMBERS  
FOR**

***Preparation of Wildlife Conservation Plan including Alternative Habitat Development Plan for affected Avifauna of core mining area of OCP Chhal, Dharamjaigarh, area C.G***

S. No.	Name	Designation
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2.	Shri S. S Bajaj, IFS	APCCF, State Forest Research and Training Institute
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12.	Shri Dewasish Biswas	Data Entry Operator, SFRTI



***State Forest Research and Training Institute (SFRTI)  
Raipur, Chhattisgarh***

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## Abbreviations

<b>OCP</b>	Open Cast Project
<b>SFRTI</b>	State Forest Research and Training Institute Raipur, C.G.
<b>ESMP</b>	Environmental and Social Mitigation Project
<b>MoEF</b>	Ministry of Environment and Forest
<b>CC</b>	Climate Change
<b>EIA</b>	Environmental Impact Assessment
<b>EMP</b>	Environmental Management Plan
<b>CIL</b>	Coal India Limited
<b>SECL</b>	South Eastern Coal Field Limited
<b>SC</b>	Scheduled Caste
<b>ST</b>	Scheduled Tribe
<b>FRA</b>	Forest Reclamation Approach
<b>SEIAA</b>	State Environment Impact Assessment Authority
<b>SPM</b>	Suspended Particulate Matter
<b>OB</b>	Overburden
<b>GLC</b>	Ground Level Concentrations
<b>NTFP</b>	Non Timber Forest Produce
<b>PPE</b>	Personal Protective Equipment
<b>LC</b>	Least Concern
<b>GPS</b>	Global Positioning System
<b>Hec</b>	Hectare
<b>CSBSAP</b>	Chhattisgarh Biodiversity Strategy and Action Plan
<b>IUCN</b>	International union for Conservation of Nature and Natural resources
<b>EX</b>	Extinct
<b>EW</b>	Extinct in the Wild
<b>CR</b>	Critically Endangered
<b>EN</b>	Endangered
<b>VU</b>	Vulnerable
<b>NT</b>	Near Threatened
<b>LC</b>	Least Concern
<b>DD</b>	Data Deficient
<b>NE</b>	Not Evaluated
<b>Land Cover Related Abbreviations Used in Datasheets</b>	
<b>R</b>	Resident
<b>B</b>	Barren land
<b>A</b>	Agriculture land



<b>G</b>	Grassland
<b>W</b>	Woodland
<b>S</b>	Scrubland
<b>Human settlement related Abbreviations used in datasheets</b>	
<b>S</b>	Settlement
<b>R</b>	Metal Road
<b>E</b>	Electricity
<b>P</b>	Pond
<b>W</b>	Well/Tube well
<b>Observations related Abbreviations used in datasheets</b>	
<b>1</b>	Illicit Felling
<b>2</b>	Girdling
<b>3</b>	Dead Tree
<b>4</b>	Living / Healthy Tree
<b>5</b>	Diseased Tree

## **EXECUTIVE SUMMARY**

Chhattisgarh state is identified as having one of the richest biodiversity habitats in the country; it has one of the densest forests in India, rich flora and fauna, several species of exotic flora and fauna and abundant non-timber forest products (NTFP's), with tremendous potential for value addition.

The variability among living organisms from all sources including Terrestrial, Marine and other Aquatic ecosystems and the ecological complexes to which they are part of, includes diversity within species, between species, and Ecosystems. Diversity within species (or genetic diversity) refers to variability in the functional units of heredity present in any material of plant, animal, microbial or another origin. Species diversity is used to describe the variety of species, whether wild or domesticated within a geographical area.

Similarly, Chhattisgarh is one of the richest Indian State in terms of mineral wealth, with 28 varieties of major minerals, including diamonds and rank second in the country in mineral production. The state holds a major share of coal deposits in India, which has led to the state also being a major power producer and being power surplus state.

The environmental impact of the coal industry involves issues like land degradation, waste disposal, water, air and noise pollution etc. caused by mining, processing and uses of coal products. In addition to atmospheric pollution, coal burning produces hundreds of millions of tons of solid waste products annually, including fly ash, bottom ash, and flue gas desulfurization sludge, that contain mercury, uranium, thorium, arsenic, and other heavy metals.

The removal of vegetative cover and activities associated with the construction of haul roads, stockpiling of topsoil, displacement of overburden and hauling of soil and coal increase the quantity of dust around mining operations. Dust degrades air quality in the immediate area, has an adverse impact on vegetative life, and creates health and safety hazards for mine workers and nearby residents.

Surface mining may affect groundwater in numerous ways like draining of usable water from shallow aquifers, lowering of water levels in adjacent areas and change in flow direction within aquifers, contamination of usable aquifers below mining area due to infiltration of poor quality mine water; and increased infiltration of rainwater on spoil piles.

Surface mining of coal causes direct and indirect damage to wildlife. The impact on wildlife stems primarily from disturbing, removing and redistributing the land surface. The most direct impact on wildlife is destruction or displacement of species in areas of excavation and spoils piling. Pit and spoil areas are not capable of providing food and cover for most species of wildlife. More sedentary animals like invertebrates, reptiles, burrowing rodents and small mammals may also disappear or destroyed due to mining activities.

Displacement of wildlife population from the mine site is another direct impact of mining. As mining proceeds on a site, wildlife moves to adjacent areas and establishes territories and home ranges.

In some species, reproduction is likely to be affected during the breeding season, when displacement occurs. Wildlife response to post-mining reclamation is based on the wildlife species in question, their habitat requirements, and presence of a source population to colonize the mine site and the structure and composition of the vegetation on the mine site post-reclamation and in the surrounding landscape. The majority of studies on wildlife response were focused simply on documenting the numerical response of species in question on the mine site for a brief period of post-reclamation.

Therefore the Ministry of Environment, Forest and Climate Change has notified the Environmental Impact Assessment (EIA) notification, 2006 under the provisions of the Environment (Protection) Act, 1986, which regulates development and their expansion/modernization of 39 sectors/activities listed in the schedule to the EIA notification, 2006. The Government of Chhattisgarh has identified the State Forest Department as nodal agency to prepare the Chhattisgarh Biodiversity Strategy and Action Plan i.e. CSBSAP.

The study involved detailed systematic and scientific processes of identifying, predicting, evaluating and analyzing the potential impacts of Open Cast Mining on avian bird species, wildlife and its habitat within the OCP Chhal boundary and surrounding area of Dharamjaigarh Forest Division. Extensive field studies were undertaken within the mining lease boundary of OCP Chhal and observations were made during the course of first and second seasonal field visits that formed the foundation of a conservation management plan for the betterment of affected species.

The major objectives were:

1. To survey and documentation of the existing wildlife (mammals, reptiles) of OCP Chhal area (core and buffer zone).
2. To estimate species diversity and population dynamics of avifauna in the OCP Chhal area (core and buffer zone).
3. To study the habit, habitat and nesting pattern of different species of avifauna of core and buffer zone.
4. GPS survey of the densities, water bodies, nesting areas, migratory birds area, and wildlife corridor of any in the proposed study area.
5. To study the presence and movement of animals and birds by seasonal survey.
6. To study the impact assessment of proposed mining activities along with the existing biotic pressure on habit and habitat of the existing wildlife species including avifauna of the core zone.
7. Pilot testing, evaluation and monitoring of appropriate measures for the desired site.
8. Preparation of habitat enrichment/development plan for the wildlife species and avifauna of the core zone for preferential adoption of the surrounding area as alternative habitat.
9. Initial monitoring and guidance to the executing agency (Forest Department) for the implementation of the plan.

The proposed mining area is located in the south of village Chhal at an approximate distance of 2.5 km on Kharsia - Dharamjaigarh State Highway and 16 km from Kharsia town. The block is bounded by latitude 22°04'40" and 22°06'27" and longitudes 83°06'10" and 83°09'10" and is included in the Survey of India Topo Sheet No. 64 N/4. It is situated in the Raigarh district of Chhattisgarh. There are about 826.07 hectare area lands to be acquired out of which 185.155 hectare of forest land in mining area will be proposed to acquire. Out of 185.155 hectare land 176 ha land including the protected forest area and rest 9.155 hectare area will be proposed from revenue forest area. Only one compartment should fall under proposed mining area namely comp. no. 478 PF.

Line transect method has been applied for the bird count and their habitat survey. Line-transect distance sampling methods were also used to estimate the abundance of many biological populations such as animals, birds and plant species including nonliving things. Total of 26 transects have been taken during the three seasonal field survey in the core and buffer zone. Distance sampling in every 300 m and 10 m circular quadrates have been taken for observation of vegetation composition (Grass, herb, shrub and regeneration).

On the basis of three seasonal field surveys, **total 1653 individuals of 106 different bird species** have been recorded. The 1653 individuals belongs to 106 species they are categorized on the basis of nesting pattern, the population of avifauna abundant by Purple Sun Bird, Jungle Babbler, Indian Silver Bill, Red Vented Bulbul, Green Bee Eater, Cattle Egret, Black Drongo, Eurasian Collared Dove, Sulphur Bellied Warbler and Common Myna etc. Mostly the birds found during the survey are endemic and resident. In the study area, dominated floral species found mainly Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Saja (*Terminalia tomentosa*), Dhawda (*Anogeissus latifolia*), Koriya (*Pinus koraiensi*), Teak (*Tectona grandis*), Bhelwa (*Semecarpus anacardium*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Tendu (*Diospyros melanoxylon*),

Kekat (*Garuga pinnata*), Plash (*Butea monosperma*), Anjan (*Hardwickia binata*), Bargad (*Ficus bengalensis*), Harra (*Terminalia chebula*), Baheda (*Terminalia bellerica*), Semal (*Bombax ceiba*), Jamun (*Syzygium cumini*) and Mahaneem (*Ailanthus excelsa*) etc.

The overall ecological value of an area, where mining is carried out, must also be considered. This should include the interconnections between habitats in the vicinity of the mining project which may be affected by fragmentation of the habitat. Many species, particularly avifauna, mammals and their dynamic territories that extend beyond site boundaries, making them vulnerable to changes in external or local environmental conditions.

The proposed coal mine would create an impact on the environment in two distinct phases; during the development phase, which may be regarded as temporary or short term. During the operation which would have long term effects. These impacts will have a negative effect on the avifauna of the area.

To minimize the impacts of mining on different environmental factors with reference to avifauna and wildlife species, recommendations are given as follows:

1. Maintenance of ecological balance through preservation and restoration of wherever it has been disturbed due to project development activities.
2. The wastage coal dust particles in the dumping site of coal mine's should be managed properly to reduce air pollution and loss of avifaunal diversity & habitats.
3. Biological reclamation should be done to transform the degraded land and waste dump into a self - sustaining ecologically stable land form. Re-vegetation of waste dump is recommended to the slope stability, enhances the infiltration of rain water to increase the soil fertility.
4. Habitat enhancement in project impact zone by taking of forestation and soil conservation measures.
5. Top soil management is needed to maintain the top soil stockpile to retain fertility. Excavated top soil can be dumped for future use such as meadow

development and plantation purpose in order to further mitigation for habitat conservation of wildlife and avifauna.

6. Fruit bearing and feeder tree species that are preferred by the birds available in the area, to be needed to plant in the buffer zone for plantation of avifauna conservation. Some of the tree species to be planted are: Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Pipal (*Ficus religiosa*), Bargad (*Ficus benghalensis*), Bhelwa (*Semecarpus anacardium*), Gular (*Ficus glomerata*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Baheda (*Terminalia bellerica*), Harra (*Terminalia chebula*), Tendu (*Diospyros melanoxylon*), Dhawda (*Anogeissus latifolia*) and Amaltas (*Cassia fistula*) etc.
7. Multiple water storage facilities are to be developed in the buffer boundaries to assure the water availability throughout the year. The existing ponds, river, dam and canals water resources recharge should be maintained.
8. The mining in the buffer zone along the river bank of Mand River must be avoided to insure of the river changing the path.
9. The social awareness program should be conducted among the local communities and villagers to provide information & awareness about birds and wild life their contribution in ecosystem and environment.
10. Artificial nest made up of local, light and fine wood materials. Nests will be prepared with the help of active JFM Committee and local forest staff and placed in the buffer area for the affected avifauna of core zone.
11. Assisted natural regeneration (ANR) should be done for the regeneration and reclamation, protection and preservation of natural tree seedlings in forest areas.
12. Best practices from forest department should be implemented for the prevention of forest fire.
13. Plantation and conservation efforts should be monitor regularly during various growth stages of site.
14. Establishment of artificial avifauna habitat “Pakshi Vihar” on dumping site.

## CHAPTER 1

### INTRODUCTION

Chhattisgarh state is identified as having one of the richest biodiversity habitats in the country; it has one of the densest forests in India, rich flora and fauna, several species of exotic flora and fauna and abundant non-timber forest products (NTFP's), with tremendous potential for value addition. Chhattisgarh state falls under the Deccan biodiversity area. The forests of the state fall under two major forest types, i.e. Tropical Moist Deciduous forest and the Tropical Dry Deciduous forest.

Chhattisgarh has 55,674 sq km of forests, which is 41.18 percent of its geographical area. It has the third largest area under forest cover after Madhya Pradesh and Arunachal Pradesh. Of this, three percent is under very dense forest, 25.82 percent is moderately dense, 12.28 percent is open forest and 0.09 percent is scrub (Fig.1.1). The forest ecosystem of the state has very rich biodiversity comprises primarily with Sal dominated forests, followed by Teak forests and mixed forest ecosystem. As per the latest status of Chhattisgarh Forest policy report 2011, there has been a net decrease of 192 sq.km in the forest cover from 2009 (Forest Survey report 2013).

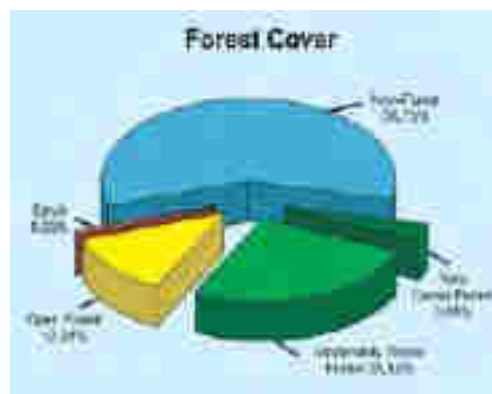


Fig.1.1 Forest cover in Chhattisgarh (State Action)

Chhattisgarh is among the richest Indian states in terms of mineral wealth, with 28 varieties of major minerals, including diamonds and ranks second in the country in mineral production. The state holds a major share of coal deposits in India, which has led to the state also being a major power producer and being power surplus. It is the only state in India to have tin ore reserves. About one-fifth of the iron-ore in the country is mined in the state and one of the best-quality, iron-ore deposits in the world is found at the Bailadila mines in the south of Chhattisgarh from where it is exported to Japan and other countries (table 1.1). Rich deposits of bauxite, limestone, dolomite, and



corundum are also found in the state, making it the ideal location for low-cost of production of end products such as cement and aluminum. During 2009-10, the state had contributed 14.09 per cent in the national revenue from minerals (State Action Plan 2011).

**Table No1.1: Production of key minerals**

<b>Mineral</b>	<b>Production – 2008-09 (Million Tons)</b>
<b>Coal</b>	97.0
<b>Iron Ore</b>	32.9
<b>Limestone</b>	15.6
<b>Dolomite</b>	1.2
<b>Bauxite</b>	1.6
<b>Tin ore (Concentrate)</b>	57500*

\* In Kilogram

Chhattisgarh state has richest of energy resources such as Coal, Mineral this state is the second largest coal producing region after Jharkhand in India. The environmental impact of the coal industry includes issues such as land use, waste management, water, and air pollution, caused by coal mining, processing and the use of its products. In addition to atmospheric pollution, coal burning produces hundreds of millions of tons of solid waste products annually, including fly ash, bottom ash, and flue-gas desulfurization sludge, that contain mercury, uranium, thorium, arsenic, and other heavy metals.

Coal is the only natural energy resource and fossil fuel available in abundance in India. The major environmental challenges encountering the coal industry are impacts of mine fires, dust suppression and control particularly haul road dust consolidation, treatment of mine waters containing heavy metals/acid mine drainage, restoration of water table and quality of ground and surface water, augmentation of pumped out mine water for drinking purpose, reclamation of mined out areas with pre-determined land use patterns conducive to the local populations etc. The biggest environmental challenge facing the coal industry is the issue of greenhouse gases and acid rain. Overall environmental management improvement has been taking place with the implementation of state of art environmental management schemes particularly under

Environmental and Social Mitigation Project (ESMP) of (CIL) Coal India Limited (*Dr. Gurdeep Singh, June 2008*).

Chhattisgarh state is rich in energy resources. The main energy resource is coal. The state produces 15% of total coal of the country; the main coal-producing areas are: Korba - Produces 75% coal of the state and 11% of the country. The main coal producing areas are Hasdeo-Rampur Colliery, Mand-Raigarh Colliery, Vishrampur Colliery, Lakhanpur Colliery, Tatapani-Ramkola Colliery, Jhilmili Colliery, Sonhat Colliery, Jhagrakhand Colliery, Chirmiri-Kurasiya Colliery (*Chhattisgarh Biodiversity plan*).

The environmental impact of the coal industry includes issues such as land use, waste management, water, and air pollution, caused by coal mining, processing and the use of its products. In addition to atmospheric pollution, coal burning produces hundreds of millions of tons of solid waste products annually, including fly-ash, bottom-ash, and flue-gas de-sulfurization sludge, that contain mercury, uranium, thorium, arsenic, and other heavy metals.

The removal of vegetative cover and activities associated with the construction of haul roads, stockpiling of topsoil, displacement of overburden and hauling of soil and coal increase the quantity of dust around mining operations. Dust degrades air quality in the immediate area, has an adverse impact on vegetative life, and constitutes health and safety hazards for mine workers and nearby residents.

Surface mining of coal causes direct and indirect damage to wildlife. The impact on wildlife primarily from disturbing, removing and redistributing the land surface. Some impacts are short-term, and confined to the mine site; others have far-reaching, long-term effects. The most direct effect on wildlife is destruction or displacement of species in areas of excavation and spoils piling. Pit and spoil areas are not capable of providing food and cover for most species of wildlife. Mobile wildlife species like game animals, birds, and predators leave these areas. More sedentary animals like invertebrates, reptiles, burrowing rodents and small mammals may be destroyed (*Anurag et al. 2018*).

As per MoEF clearance regarding a condition (Clause 9) “The user

agency in consultation with the state government, shall create and maintain alternate habitat/ home for avifauna, their nesting trees are to be cleared under this project. Birds nests will be artificially made out of eco-friendly material, placed in the area including the forest area and human settlements; adjoining the forest area being diverted for the project.”

To overcome the impact of mining activities on avifauna and wildlife found in Chhal Range, Dharamjaigarh Forest Division Chhattisgarh, SECL Raigarh had given an assignment to SFRTI, Raipur to prepare a Wildlife Conservation Plan including alternative habitat development plan for affected avifauna.

### **1.1 BIODIVERSITY**

The variability among living organisms from all sources including inter alia, Terrestrial, Marine and other Aquatic Ecosystems and the Ecological Complexes of which they are part; includes diversity within species, between species and of Ecosystems.

Diversity within species (or genetic diversity) refers to variability in the functional units of heredity present in any material of plant, animal, microbial or other origins. Species diversity is used to describe the variety of species-whether wild or domesticated) within a geographical area. Estimates of the total number of species (defined as a population of organisms which are able to interbreed freely under natural conditions) range from 2 to 100 million, though less than 1.5 million have actually been described. Ecosystem diversity refers to the enormous variety of plant, animal and micro-organism communities and ecological processes that make them function. In short, biodiversity refers to the variety of life on earth. This variety provides the building blocks to adapt to changing environmental conditions in the future.

### **1.2 WILDLIFE CONSERVATION**

Wildlife Conservation is the practice of protecting animal species and their habitats. In order to survive, a species requires adequate food, water, shelter, space, and opportunities to reproduce. Wildlife conservation refers to the considered practice of ensuring protection for wild fauna species, their

habitats, and plants. It has sustainable effort to maintain and use natural resources including wildlife in ways they ensure that those resources will be available in the future.

“Wildlife Conservation is the application of ecological knowledge to populations of vertebrate animals and their plant and animal associates in a manner that strikes a balance between the needs of those populations and the needs of people” (*Robinson and Bolen 1999*).

Wildlife Conservation aims to stop the progress of the loss in the ecological biodiversity by taking into consideration ecological principles such as carrying capacity, disturbance and succession and environmental conditions such as food, water, shelter, space, and opportunities to reproduce with the aim of balancing the needs of wildlife with the needs of people. Wildlife is best preserved in their natural habitat. Wildlife wing of the forest department has adopted two-pronged strategies for the Wildlife Conservation: protection and awareness generation.

The government of Chhattisgarh has identified the state forest department as a nodal agency to prepare the Chhattisgarh Biodiversity Strategy and Action Plan i.e. CSBSAP.

### **1.3 PROJECT BACKGROUND**

A Project Report for Chhal OCP in Chhal Geological block was prepared in March 2003, and was approved in May 2003 for a targeted capacity of 1.00 MTY at a capital expenditure of Rs.19.99 crores.

The proposed Chhal opencast falls under the administrative control of Raigarh area of SECL. The project report is based on the “Geological report on Chhal block” prepared by CMPDI in March 1991. Eight coal seams, namely, VI, V (T), V (B), Local, IV, III, II, II (A) and I occur within the block. Of these, older seams I, II and IIA are generally thin and impersistent. In Dharam and Chhal Underground Mines, Seam III is being exploited.

During the discussion of Planning Committee Meeting, it was decided that as no firm linkage is available for the coal from this project, a project report of annual production capacity (1.00 MTY) may be prepared. In future if demand

arises and firm linkage is established, annual production capacity may be revised, considering remaining promising areas.

With an increased demand projected on SECL in XIth plan, Chhal OCP was proposed to expand from 1.0 MTY to 3.0 MTY.

Accordingly, an expansion PR of Chhal OCP (1.0 – 3.0 MTY) was prepared and approved in September 2007 within the sanctioned mine boundary with an initial capital requirement of Rs. 50.38 crores. This report was completed March 2010 at a completion cost of Rs. 46.95 crores.

Liberalization of power sector has resulted in a sharp increase in demand for power grade coal. Expansion of Chhal opencast is, again therefore, proposed with a view to fulfill the growth in demand. In this context, this project named Chhal OCP (Seam-III) Project (6.0 MTY) has been conceived.

#### **1.4 HISTORY OF MINING**

The proposed area under consideration falls in Mand - Raigarh Coalfield of Raigarh district (Chhattisgarh). Mining activities in the area started long back in 1940 but remained confined to very small manual quarrying. The coalfield is almost virgin barring two small opencast mines i.e. Domnara in the south-west and barod in the north-east. Domnara opencast mine was closed due to lack of demand of grade 'G' coal produced by this mine. Baroud opencast mine is running.

#### **1.5 PROJECT SITE INFORMATION OCP CHHAL**

##### **1.5.1 LOCATION**

The project is located south of village Chhal at an approximate distance of 2.5 km on Kharsia - Dharamjaigarh State Highway and 16 km from Kharsia town. The block is bounded by latitude 22<sup>0</sup>04'40" and 22<sup>0</sup>06'27" and longitudes 83<sup>0</sup> 06'10" and 83<sup>0</sup>09'10" and is included in the Survey of India Topo Sheet No. 64 N/4. It is situated in the Raigarh district of Chhattisgarh.

##### **1.5.2 CLIMATE**

The area is characterized by tropical climate with well defined summer from April to June, rainy season from July to September and winter from November to February. May and up to mid June is the hottest month when the temperature rises to a maximum of 48<sup>0</sup>C. December and January are the coldest

month, the temperature falls to a minimum of 7<sup>0</sup>C.

The average annual rainfall is about 1500 mm. The wind direction is generally westerly to north westerly. Relative humidity during monsoon ranges from 75% to 80% and in summer ranges from 18% to 60%.

### 1.5.3 PHYSIOGRAPHY

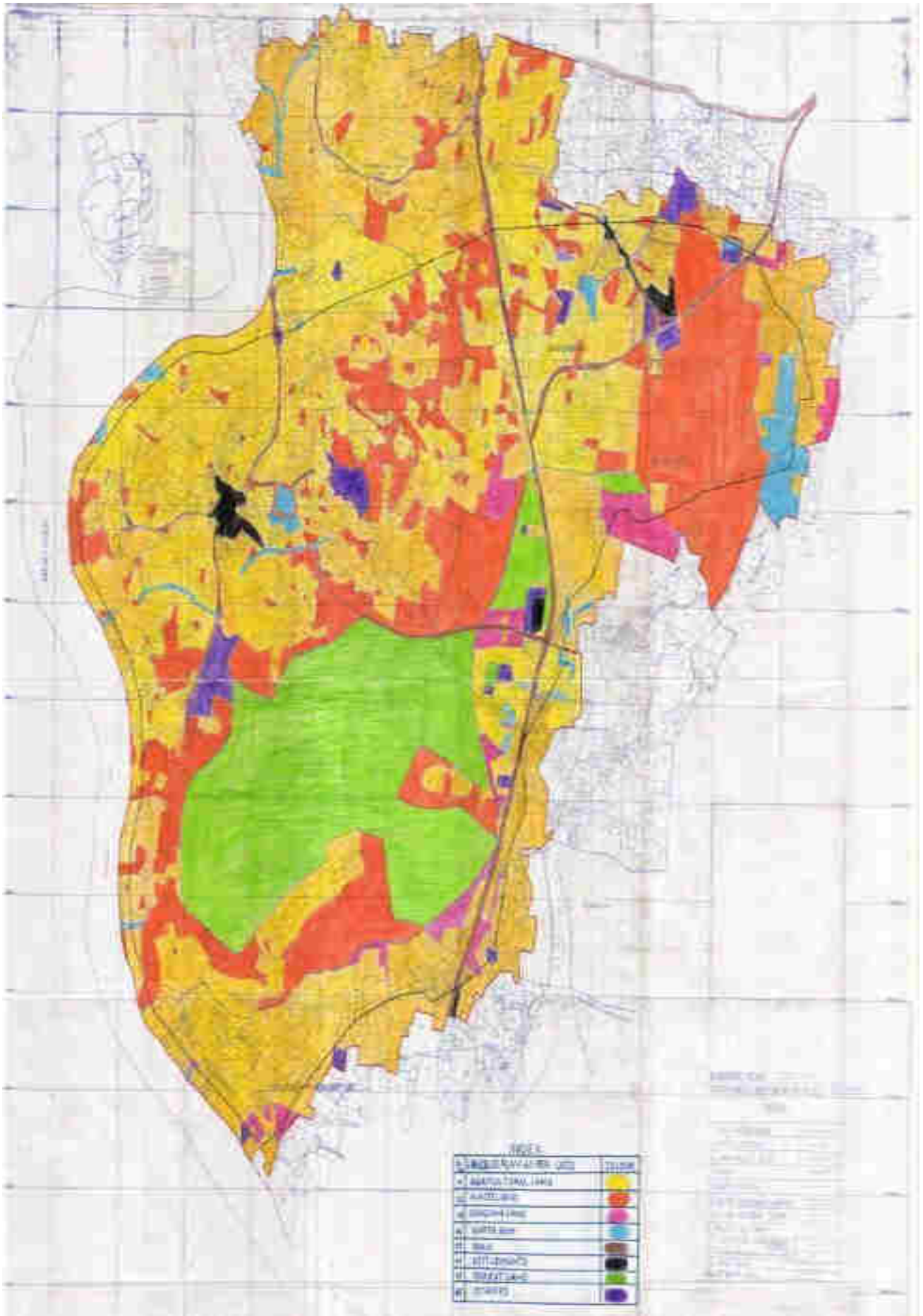
The Chhal Block is largely characterized by a plain country. The altitude varies between 231 m in the west to 267 m above MSL in the north eastern part of the block. The elevation of the ground varies between 255 m to 267 m along a linear patch running NE-SW in the central part of the property. The ground has a general slope towards NE, SE & SW. Most of the area is covered by soil and cultivate land. The southerly flowing Mand River and westerly flowing Kurket River with their tributaries form the main drainage of the Chhal Block. A small earthen dam has been constructed for the purpose of irrigation near village Khedapali in the eastern part of the block.

### 1.5.4 LAND USE PLAN

The project envisages 1342.86 Ha of land for quarry, industrial and residential complex, safety zone and external dumps etc. This includes 516.59 Ha of land already acquired/under process and, 826.07Ha of land to be acquired. The break-up of the land is as follows:-

**Table No 1.2: Requirement of land in hec.**

REQUIREMENT OF LAND IN Ha							
S.N.	Particulars	Land already acquired	Land to be acquired				Total land requirement
			Tenancy / agriculture land	Forest land	Govt. Land	Total	
1	Land for quarry	516.79	16.64	185.155	156.42	358.22	875.00
2	For external dump	-	110.73		20.00	130.73	130.73
3	Surface industrial developments rely. Siding, colony, approach road, etc.	-	50	-	-	50	50.00
4	Land for homestead/family	-	50	-	-	50	50
5	Land for environment and safety	-	92.65	-	-	92.65	92.65
6	Safety zone	-	144.47	-	-	144.47	144.47
	<b>TOTAL LAND</b>	<b>516.79</b>	<b>464.49</b>	<b>185.16</b>	<b>176.42</b>	<b>826.07</b>	<b>1342.86</b>



Land use plan of OCP Chhal

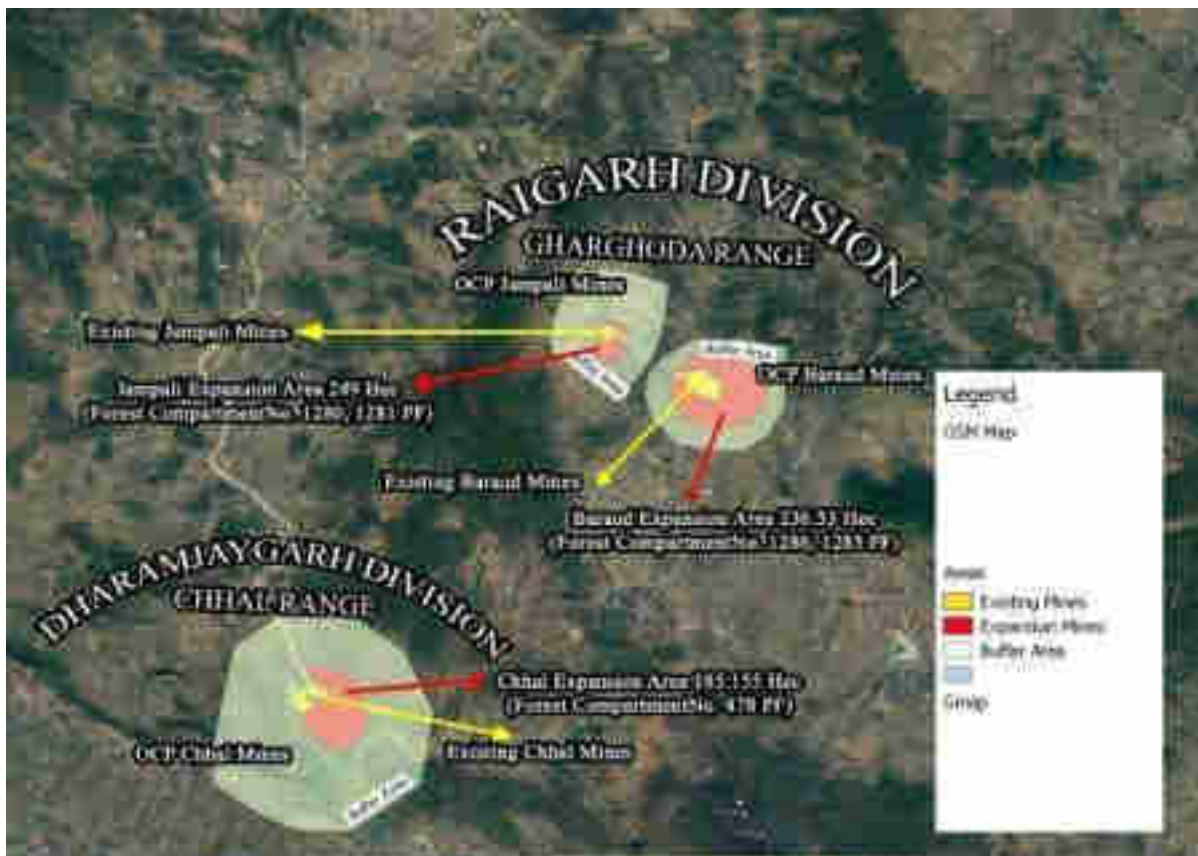


Fig 1.2: Google map of mining area of OCP Jampali, Bharaud & Chhal

### 1.5.5 IMPACT ON LAND USE

#### FOREST

There are about **826.07 ha** area land to be acquired out of which **185.155 ha. of forest land** in mining area will be proposed to acquire. Out of 185.155 ha land 176 ha land including the protected forest area and rest 9.155 ha area will be proposed from revenue forest area. Only one compartment should fall under proposed mining area namely comp. no. 478 PF.

The inventory of forest resource is made based on the guidelines of the forest department. The pilot survey is pre-requisite to finalized the most efficient survey design about 40 to 50 sample plot is lead out to cover up entire range variation existing within the forest population of the working plan area.

The earlier survey of flora & fauna in the proposed mining area was done by CMPDI and they adopted a similar methodology as applied in working plan therefore, the shape of the sampling unit is square. Sizes of the sampling selected are 0.1 ha. or 0.16 ha.

The field survey technique to observe the abundance of wildlife, avifauna, habitat, nesting pattern & surrounding vegetation in core zone applied



seasonally; to estimate the current status of species diversity of avifauna & wildlife in the mining area. On the basis of species of wildlife & avifaunal diversity survey; it should be easy to determine the ecological behavior of each individual species and resulting to develop alternate habitat of affected avifauna & wildlife conservation plan at the 15 km periphery or buffer zone of the mining area.

The proposed plan is nearby villages of Bangarsuta, Kudekela, Banhar, Rilo, Chuhkimar, Lath, Bojiya, Gadainabhri, Lamikhar, Bandhapali, Cheetapali, Puslda, Nawapara, Khedapali, and Chhal. No any wildlife Sanctuary, National park and other eco sensitive zone are situated in the proposed Project area. Topography of project area and impact zone (15 Km radius) falls within the reserve, protected forest and revenue land of Dharamjaigarh forest Division where the terrain mostly flat to gentle slope. Some part in Dharamjaigarh division features small hillock with gentle slopes.

The impact zone spread in 36616 ha. This includes 2237.73 ha. of Protected Forest, 5674.87 ha of Reserve Forest and 28703.40 ha. of Revenue land. The breakup of land is as follows:-

S.N.	PF		RF		Revenue	Villages
	Comp. No.	Area (Ha.)	Comp. No.	Area (Ha.)	Area (Ha.)	
1	538	261.99	543	129.46	28703.4	Bangarsuta, Kudekela, Banhar, Rilo, Chuhkimar, Lath, Bojiya, Gadainabhri, Lamikhar, Bandhapali, Cheetapali, Puslda, Nawapara, Khedapali, and Chhal.
2	537	167.29	542	249.86		
3	536	185.8	541	263.96		
4	525	127.25	539	210.97		
5	523	18.7	534	255.39		
6	524	47.56	535	216.33		
7	522	51.62	533	217.05		
8	521	38.43	532	166.25		
9	491	214.08	519	309.74		
10	501	15.7	575	114.4		
11	500	22.83	520	204.59		
12	499	20.27	518	206.23		
13	498	33.62	517	292.57		
14	495	142.07	502	359.32		

15	490	12.5	497	148.8		
16	488	51.3	496	230.63		
17	489	13.52	493	160.73		
18	487	39.31	494	31.7		
19	495	142.07	479	96.6		
20	486	62.7	477	258.94		
21	485	36.3	482	153.2		
22	484	53.47	483	117.97		
23	481	49.8	516	238.11		
24	480	11.97	514	154.7		
25	503	14.3	513	213.8		
26	504	60.3	512	233.5		
27	505	141.65	511	205.89		
28	506	70.98	510	202.62		
29	507	112.9	508	31.56		
30	509	17.45				
<b>Total</b>		<b>2237.73</b>		<b>5674.87</b>	<b>28703.4</b>	

**Total impact area of Dharamjaigarh Division = 36616 ha.**



**Fig. 1.3- Impact zone of OCP Chhal**

## CHAPTER 2

### REVIEW OF LITERATURE

---

The mining of coal in India has significant effects on wildlife populations and their habitats. The extraction of coal by various means (deep mining, long wall mining, contour mining, area mining or mountain top removal mining with valley fill) has a significant impact on terrestrial and aquatic ecosystems which can be felt for decades. Given the difficulty in extracting coal from geologic strata that are generally not readily accessible from the surface, it is inevitable that there will be some significant changes in the flora and fauna of the area within and surrounding the mine site.

The impacts of coal mining on wildlife populations occur at two primary levels:

- 1) Immediate, direct effects of mining in terms of direct mortality, disturbance and displacement of wildlife populations during mining activities, and
- 2) Changes in wildlife populations associated with long-term changes in land cover associated with mine sites and their reclamation.

#### **The goals of this literature review are to**

- 1) Review the extant literature on the effects of coal mining on aquatic and terrestrial Avifauna populations and habitat;
- 2) Review the literature relative to the effectiveness of reclamation practices in restoring conditions conducive for avifauna habitat; and
- 3) Identify areas where research is needed to further the science needed to better mitigate the impacts of mining on avian resources.

#### **2.1 DIRECT EFFECTS OF MINING ON WILDLIFE**

Very little literature exists on the direct effects of coal mining on wildlife. Mining certainly has direct effects as individuals and populations of species that occurred on the site pre-mining may sometimes be killed or displaced. Direct mortality will occur when the species in question is not mobile enough to avoid mining equipment, especially young ones. We did not find any literature that estimates the rate of direct mortality for any potentially affected species.

Displacement of wildlife populations from the mine site is another direct effect of mining. As mining proceeds on a site, wildlife moves to adjacent areas and establishes territories and home ranges. We were unable to locate any studies that documented the extent of this displacement and the implications in terms of survival and reproduction for coal mining in the Chhal. Some studies have been conducted on this topic in the Korba (C.G). In some species, reproduction is likely interrupted during the breeding season in which the displacement occurs. Survival of displaced individuals may be lower than survival would have been during the pre-mining period because displaced individuals may experience greater competition for resources in unfamiliar areas and may experience greater predation rates initially as they learn how to adjust to new surroundings.

## **2.2 WILDLIFE RESPONSE TO POST-MINING RECLAMATION**

Wildlife response to post-mining reclamation is based on the wildlife species in question, their habitat requirements, and presence of a source population to colonize the mine site, and the structure and composition of the vegetation on the mine site post-reclamation and in the surrounding landscape. Wildlife response can be characterized in a variety of ways, including relative abundance on the site, survival, reproduction, movements, foraging behavior, and other behavioural traits. The majority of studies on wildlife response focused simply on documenting the numerical response of species in question on the mine site during some time period post-reclamation. To understand the full implications of wildlife response and effects on habitat quality, more in-depth research is needed to document the demography (reproduction, survival, immigration, emigration) of the species that colonize mine sites post-reclamation.

## **2.3 AVIFAUNA**

Birds provide several ecological functions such as pest control, pollination, seed dispersal and plant reproduction in thousands of economically and culturally important plant species through its consumption of various terrestrial, aquatic and aerial resources (*Whelan et al., 2015*). Foraging ecology of birds contribute regulating services such as scavenging carcasses and nutrient

cycling (*Whelan et al., 2008*). Bird communities also provide a reliable ecological indicator of forest condition (*Canterbury et al., 2000*) due to their sensitivity to environmental perturbations, relevance to ecosystem functioning (e.g., in pollination and seed dispersal), and relative ease in sampling (*Brown, 1991*). Moreover, birds are associated with singular habitats, they are short-lived species so any change in the composition may manifest shortly after a disturbance. Hence, they can be used to develop habitat associations which are predictors of relative human disturbance levels and may be affected by some tourist activities (*Higginbottom et al., 2003; Newsome et al., 2004*). The bird population is an indication of environmental changes as they respond fast to threats and changing environment conditions (*Barov, 2011*).

As significant as being one of the mega diverse countries, Mining and mineral processing have the potential to be important sources of income and driving forces behind broader economic development (*Eggert, 2001*). With this, the country is faced with a great challenge in utilizing the rich available mineral resources for economic growth and development without compromising its ecological integrity and species diversity.

#### **2.4 AVIFAUNA RESPONSE TO POST-MINING RECLAMATION**

The vast majority of studies conducted on wildlife response have focused on birds in part because birds are easily monitored using various count-based surveys. The effects of mining on avian communities occur initially by the removal of vegetation in preparation for mining. If the site is forested, vegetation removal occurs through timber harvest or clearing. Although few studies have been done to specifically evaluate the changes associated with mine sites from pre-mining to post-mining land uses, there is substantial literature of the effects of timber harvest on avian communities and populations-see review in (*Sallabanks et al. 2000*). There are substantial differences in avian response to timber harvest for forest regeneration and avian response to timber harvest or clearing in preparation for mining because of the nature and timing of the re-vegetation that occurs. In timber harvest for forest management, tree regeneration begins within the first growing season post-harvest on the site and

birds respond relatively quickly to the vigorous flush of woody re-growth. On mine sites, the reclamation process takes more time, and the vegetation responds more slowly, especially if the site is being reclaimed with shrubs and trees for reforestation.

On reclaimed mine lands which were originally forested, avian communities shift from forest bird communities to communities associated with early succession habitats, grassland birds and scrub-shrub birds. These changes in bird communities have conservation implications because in some cases there are forest bird species present that have declining populations and are of high conservation concern, such as the Cerulean Warbler (*Setophaga cerulea*) in the Appalachian Mountains (Buehler et al. 2006). Negative impacts on forest bird populations have to be weighed against positive gains in early succession bird populations. Many species associated with early successional habitats, such as the Henslow's Sparrow (*Ammodramus henslowii*) and the Golden-winged Warbler (*Vermivora chrysoptera*) are also of high conservation priority (Hunter et al. 2001, Buehler et al. 2007).

Coal mining in the eastern United States seldom encounters bird species that are federally listed as threatened or endangered but most of the bird studies associated with mining have focused on characterizing songbird communities post-reclamation. Post-mining songbird studies have documented grassland bird response to reclamation when the reclamation has resulted in grassland cover. In general, grassland mine reclamation has been successful in creating habitat suitable for grassland bird's use. The grassland species attracted to reclaim mine lands include a diversity of songbirds and grassland raptors such as Northern Harriers (*Circus cyaneus*) and Short-eared Owls (*Asio flammeus*) (Rohrbaugh and Yahner 1996, Vukovich 2004, Vukovich et al. 2006).

Reclaimed mine sites in Pennsylvania, Kentucky, Illinois, Indiana, West Virginia, and Ohio are supporting breeding populations of Henslow's Sparrows (Bajema et al. 2001, Bajema and Lima 2001, DeVault et al. 2002, Scott et al. 2002, Mattice et al. 2005, Monroe and Ritchison 2005, Stauffer 2008, Stauffer et al. 2011) and/or Grasshopper Sparrows (*Ammodramus*

*savannarum*) (Whitmore 1979, Whitmore 1981, Wray et al. 1982, DeVault et al. 2002, Scott et al. 2002, Ammer 2003, Mattice et al. 2005, Galligan et al. 2006, Stauffer 2008, Stauffer et al. 2011), two grassland species of conservation concern. Reproductive rates by these species were comparable to reproduction in other settings (Ammer 2003, Monroe and Ritchison 2005, Galligan et al. 2006, Stauffer et al. 2011). No published survival data are available for grassland songbirds breeding on reclaimed mine lands. Adult and juvenile survival data are generally unavailable for most grassland songbirds (Perlut et al. 2008), because adult dispersal, depending on the species, may be high and return rates in ephemeral grassland habitats is often very poor (Jones et al. 2007). Without survival data, it is impossible to accurately determine whether reclaimed mine lands are providing conditions conducive for supporting source populations for priority species (Anders and Marshall 2005). Several authors have noted that reclaimed coal mine lands in the region were providing important grassland habitat contributing significantly to grassland bird conservation range-wide (Rohrbaugh and Yahner 1996, Bajema et al. 2001, Mattice et al. 2005, Monroe and Ritchison 2005, Stauffer et al. 2011).

Golden-winged Warbler populations have been declining precipitously in the Appalachian region (Buehler et al. 2007), and the species has been petitioned for listing under the Endangered Species Act in 2010 (USFWS 2011). Golden-winged populations occupy shrubby, early succession habitats often associated with reclamation of contour and area mines (Bulluck and Buehler 2008). Plant succession on mine lands is often slow, which provides for a prolonged period in which habitat conditions are conducive for Golden-winged Warblers.

Succession on mine lands post-reclamation can be successfully set back by prescribed burning to further prolong the period of suitability for Golden-winged (D. Buehler and K. Percy, unpubl. data). In some cases, however, recent coal mining may compromise Golden-winged habitat where remaining is occurring on old contour and area mine sites that are currently occupied by Golden-winged (D. Buehler, unpubl. data). A mine land reclamation

prescription is being developed for Golden-winged Warbler habitat restoration to address this issue (D. Buehler and K. Percy, unpubl. data).

Although grassland and scrub-shrub birds benefit from the early successional habitat developed from post-mining reclamation, forest-dwelling birds are adversely affected by land use change from forest to grassland, regardless of the origin of the change. Concern has been expressed related to habitat loss for Cerulean Warblers in the Appalachian Mountains associated with deforestation from coal mining (*Buehler et al. 2006, Wood et al. 2006, Bulluck 2007*).

Mining also affects forest songbirds in adjacent forested areas because of the creation of edge effects and because of forest fragmentation. Cerulean Warbler abundance, for example, was lower in forests adjacent to mountaintop removal mining with valley fill (*Wood et al. 2006*), although edges associated with contour mines in Tennessee were not associated with lower cerulean abundance (*Beachy 2008*). Cerulean Warbler reproduction was lower adjacent to forest disturbances from timber harvest than in undisturbed forest stands (*Boves 2011*). Similar relationships with cerulean reproduction and edges created by mining might be expected, although these relationships need to be documented.

Reclaimed coal mine lands can also provide habitat that supports upland game bird populations, including Northern Bobwhite (*Colinus virginiana*) (*Beckerle 2004*), American Woodcock (*Scolopax minor*) (*Gregg 1997*), Eastern Wild Turkey (*Meleagris gallopavo*) (*Rice 1986*), and Ruffed Grouse (*Bonasa umbellus*) (*Kimmel and Samuel 1984*). Although the potential for mine lands to contribute to Northern Bobwhite population recovery is cited in the National Bobwhite Conservation Initiative revised plan (*Palmer et al. 2011*), we were unable to locate any literature that demonstrated how this might be accomplished. Kentucky Department of Fish and Wildlife Resources (KDFWR), in

with the University of Tennessee, is conducting a northern bobwhite population ecology and habitat management project on Peabody Wildlife



Management area, a reclaimed coal mining area, which will generate information on how bobwhites are doing on reclaimed mine grasslands and how to enhance their habitat (J. Morgan, KDFWR, pers. comm.). Reclamation of mine lands in grasses and legumes provided poor quality grouse brood habitat, although later successional stages provided better brood habitat quality (*Kimmel and Samuel 1984*). Wild Turkeys used reclaimed mine lands extensively and densities on mine lands exceeded densities on nearby control areas (*Rice 1986*).

## 2.5 ECOLOGICAL EFFECTS OF PAVED ROADS INSIDE THE FOREST ON BIRDS

While the most obvious threat of paved roads to individual birds is injury or mortality due to vehicle collisions, this is often considered less compelling when compared to the more insidious effects of roads, such as behaviour modification or decreased population density, diversity, and/or breeding success (*Reijnen and Foppen 1994, Forman and Alexander 1998, Jacobson 2005, Ramp et al. 2006, Reijnen and Foppen 2006*). However, in some cases, direct road mortality is the major threat to a population (*Mumme et al. 2000, Ramsden 2003, Reijnen and Foppen 2006*). Given the vast network of roads in combination with other persistent anthropogenic factors at work (e.g., habitat loss, fragmentation, non-native species invasions, climate change), the potential impact of road mortality on specific wildlife populations should not be dismissed (*Erritzoe et al. 2003, Glista et al. 2008*).

Many studies report that certain species of birds avoid roads, paved or otherwise, when selecting habitat during some part of their life cycle (*Ferrer and Harte 1997, Parrish et al. 2001, Sara and DiVittorio 2003, Bollinger and Gavin 2004, Arcos and Salvadores 2005, Balbontin 2005, Carrascal et al. 2006, Gavashelishvili and McGrady 2006*). The risk of nest abandonment can also increase near roads (*Gorog et al. 2005*). In an extreme case, Great Bustard populations in Portugal appear to be concentrating themselves geographically, with new road building responsible for three of the local population declines (*Pinto et al. 2005*). Long-term trends suggest the Portuguese population may ultimately become confined to a single high-quality site, thereby increasing the probability of extinction (*Pinto et al. 2005*). For those species which use

roadways as habitat, maintenance activities to roads and ditches can inadvertently destroy nests, a particular concern for declining species such as the Burrowing Owl (*Catlin and Rosenberg 2006*).

Road-related threats to bird populations deserve more attention, however, conservation or mitigation action is often considered to be warranted only after a population-level decline can be demonstrated (*Reijnen and Foppen 2006*). Many road-related bird studies are conducted in or adjacent to protected areas, illustrating there may be no panacea that escapes road-related impacts (*Reijnen and Foppen 1994, Bard et al. 2002, Gutzwiller and Barrow 2003, Clevenger et al. 2003, Frey and Conover 2006, Ramp et al. 2006*).

## 2.6 RECLAMATION PRACTICES

Coal mining results in large landscape changes as soils and vegetation are removed. Changes to forested areas can shift habitat availability and bird communities (*James and Wamer, 1982; Hardt and Forman, 1989; Bolger et al., 1991; Winter et al., 2000; Herzog et al., 2001; Galligan et al., 2006; Wickham et al., 2007; and Loss et al., 2009*). Several bird species have benefited in recent decades from the reclamation of surface coal mines (*Bajema et al. 2001, DeVault et al. 2002, Ingold 2002*). Burger (2011) defined four periods of reclamation: tree-planting by hand, grassland, shrub/scrub, and the Forest Reclamation Approach (FRA) (*Angel et al., 2005*).

Managing and reclaiming land to establish vegetation patches (e.g., grasslands, forest, wetlands, early succession) of different stages can provide habitat for diverse wildlife and aquatic species. Restoring a diverse community of native and site-adapted vegetation that includes a variety of structural features is the first step to attract wildlife species (*Brenner and Kelly 1981; Camenzind 1984; Parmenter and MacMahon 1990*).

Birds are generally one of the first types of wildlife to visit a mine site following reclamation due to their mobility and active search for suitable habitat (*Brändle et al. 2003*). Many bird species are not restricted to a single vegetation type, but rather depend on some combination of early successional habitat, open

areas, and young and mature forests to find food and shelter and raise young (*Hunter et al. 2001*).

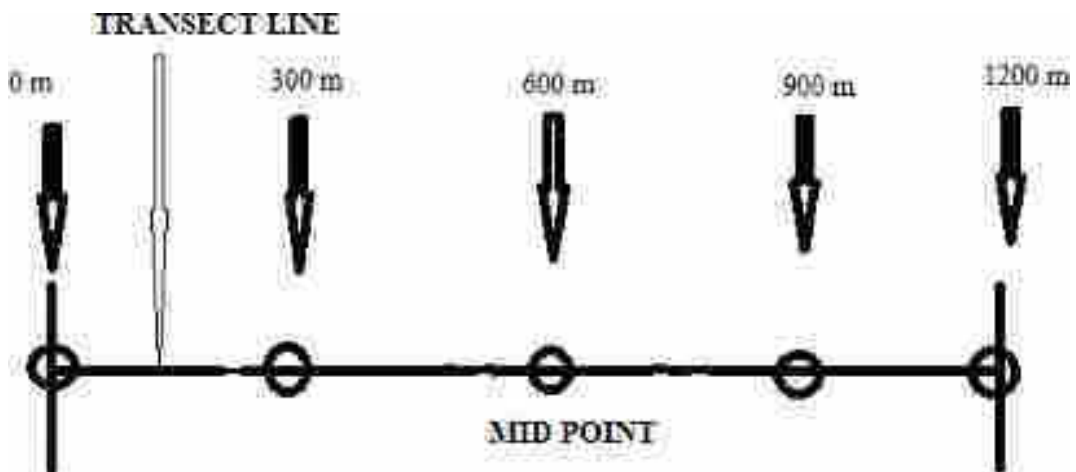
Although mining activities can have several negative impacts on wildlife populations, animals can return to reclaimed areas after mining if reclamation produces suitable habitat and individuals that can serve as colonists persist in the surrounding area. Site characteristics created by reclamation and the development of post-mining vegetation and habitat features influence the types of wildlife that use mined sites. The reclamation process provides habitat management opportunities for some species; through various reclamation techniques and procedures, mine lands can be manipulated to attract and support desired wildlife species (*Scott and Zimmerman 1984*).

## CHAPTER 3

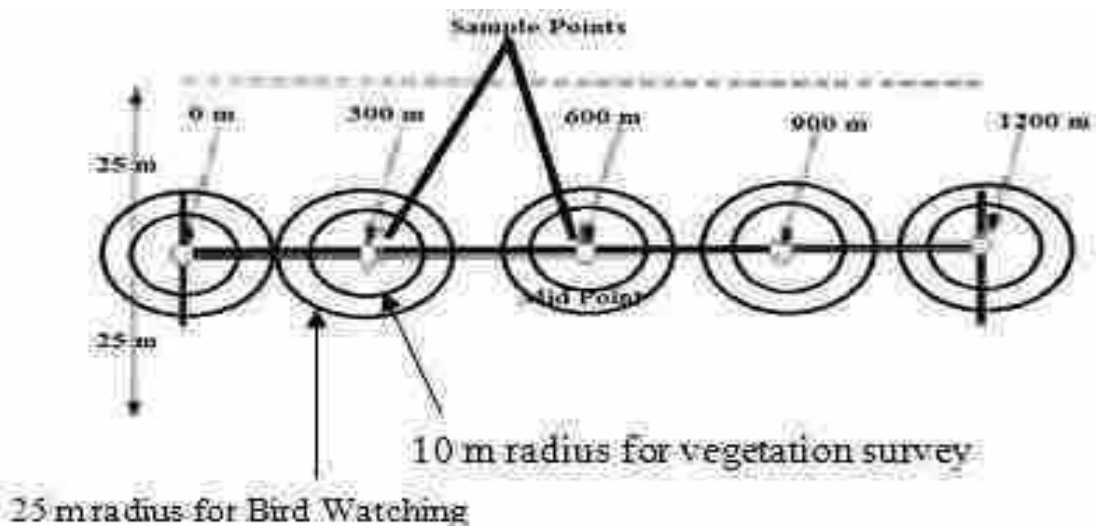
### METHODOLOGY

#### 3.1 Line Transect Methodology:

Line transects method had been applied for the bird count and their habitat survey. Line-transect distance sampling methods were also used to estimate the abundance of many biological populations such as animals, birds and plant species including nonliving things. In a line-transect survey method, an observer moves along a transect line and note the location of all birds detected to the line (*Bird census and survey techniques, Richard D. Gregory, David W. Gibbons, and Paul F. Donald, 2004*).



**Fig 3.1: Line Transect Methodology**



**Fig 3.2: Detail survey methodology of Line Transect Methodology**

### 3.2 Basic procedures in line transect sampling

Two types of data are recorded in line transect sampling, as shown in data collection point page no. 20. These are either (1) the perpendicular distances from the transect line  $x$  or (2) the sighting distances  $r$  and angles  $\theta$ . However, studies based on sighting distances and angles have been found to be subject to biases and are only discussed briefly here.

The usual assumptions made with line transect sampling are the following:

1. All objects on the transect line are detected.
2. Objects do not move in response to the observer before the detection is recorded.
3. Objects are only counted once.
4. Objects are recorded at the point of initial detection.
5. Distances are measured without errors.
6. Transect lines are randomly located in the study area.
7. Sightings are independent events, and the number of objects detected follows a Poisson distribution.

### 3.3 Field survey

The field survey technique to observe the abundance of wildlife, avifauna, habitat, nesting pattern & surrounding vegetation in core zone applied seasonally; to estimate the current status of species diversity of avifauna & wildlife in the mining area. On the basis of species of wildlife & avifaunal diversity survey; it should be easy to determine the ecological behavior of each individual species and resulting to develop alternate habitat of affected avifauna & wildlife conservation plan at the 5-10 km periphery or buffer zone of the mining area.

Total 26 line transect was taken in the core and buffer zone during the first second and third seasonal survey i.e. summer, winter and autumn Season. During the field surveys, we made a line transect of 1200 m (mostly used a path

/ trail followed by the villagers to enter in the forest) in which distance sampling were taken in every 300 m in the transect to estimate the population of avifauna, its habit, habitat and nesting pattern including the floral diversity of the proposed mining area. A circular sample plot of 10 m radius had been taken in each transect at an interval of 300 m i.e. total 5 sample plots made in one transect namely 0m, 300m, 600m, 900m, 1200m in which vegetation composition (grass, herb, shrub and regeneration) and all tree species data had been taken including height and girth along with the counting of avifauna & wildlife. The data sheets used during the field survey are as follows:

**Table N0. 3.1: Datasheet for bird status survey**

Date: ..... Cell-ID: ..... Team: ..... Trail-length: \_\_\_\_\_

GPS at every 300 m			Sighting information					Remark	
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing			Observation
						A	T		

**Table No 3.2: Datasheet for habitat study at every 300 m on the transect line**

Date: ..... Cell-ID: ..... Team: ..... Trail-length: \_\_\_\_\_

S N	GPS Location		Time (hrs .)	Land cover (100 m radius)	Vegetation (3 dominantspecies)			Vegetation composition			Human structure (500m radius)		
	Lat.	Long.			B / A / G / W / S	Tree spp.	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub	Regeneration	S/H/R /E /W/P

\* Land cover – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

\*\* Human structure – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

\*\*\* Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

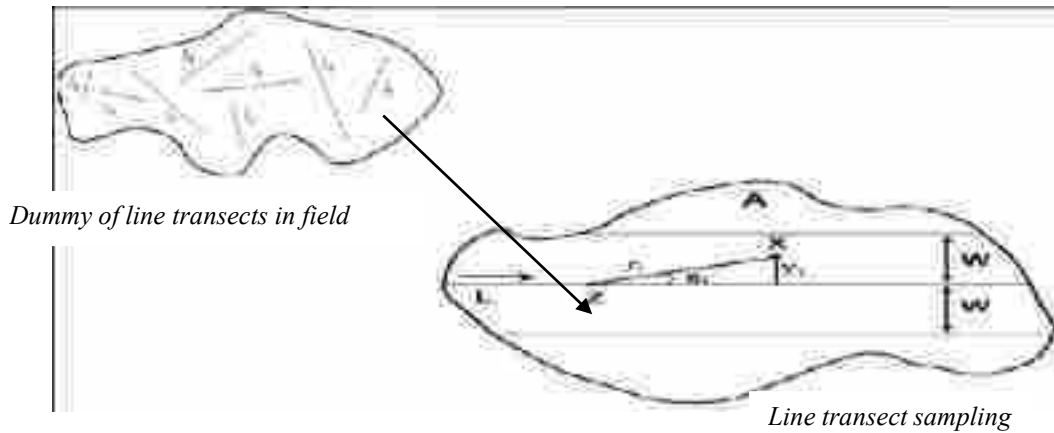
**Table No 3.3: Datasheet for wildlife study on transect line**

Date: \_\_\_\_\_ Cell-ID: \_\_\_\_\_ Team: \_\_\_\_\_ Trail-length: \_\_\_\_\_

GPS at every 300 m			Sighting information							
S. N.	Latitude	Longitude	Wildlife Species			Perp. Dist.	Bearing		Type of Species	Observation
			Direct Sighting	Indirect Sighting	Number		A	T		

**Basic concepts of line-transect sampling**

**a) Data collection (overview)**



$L$  = transect line,  $Z$  = position of observer,  $X$  = position of object,  $W$  = strip width ( $1/2$ ),  $r_i$  = sighting distance (flushing distance),  $\theta_i$  (theta) = sighting angle,  $y_i$  = perpendicular distance (note:  $y_i = r_i \sin \theta_i$ )

## CHAPTER 4

### OBSERVATIONS, DATA COLLECTION AND ANALYSIS

#### 4.1 SUMMER SEASON SURVEY

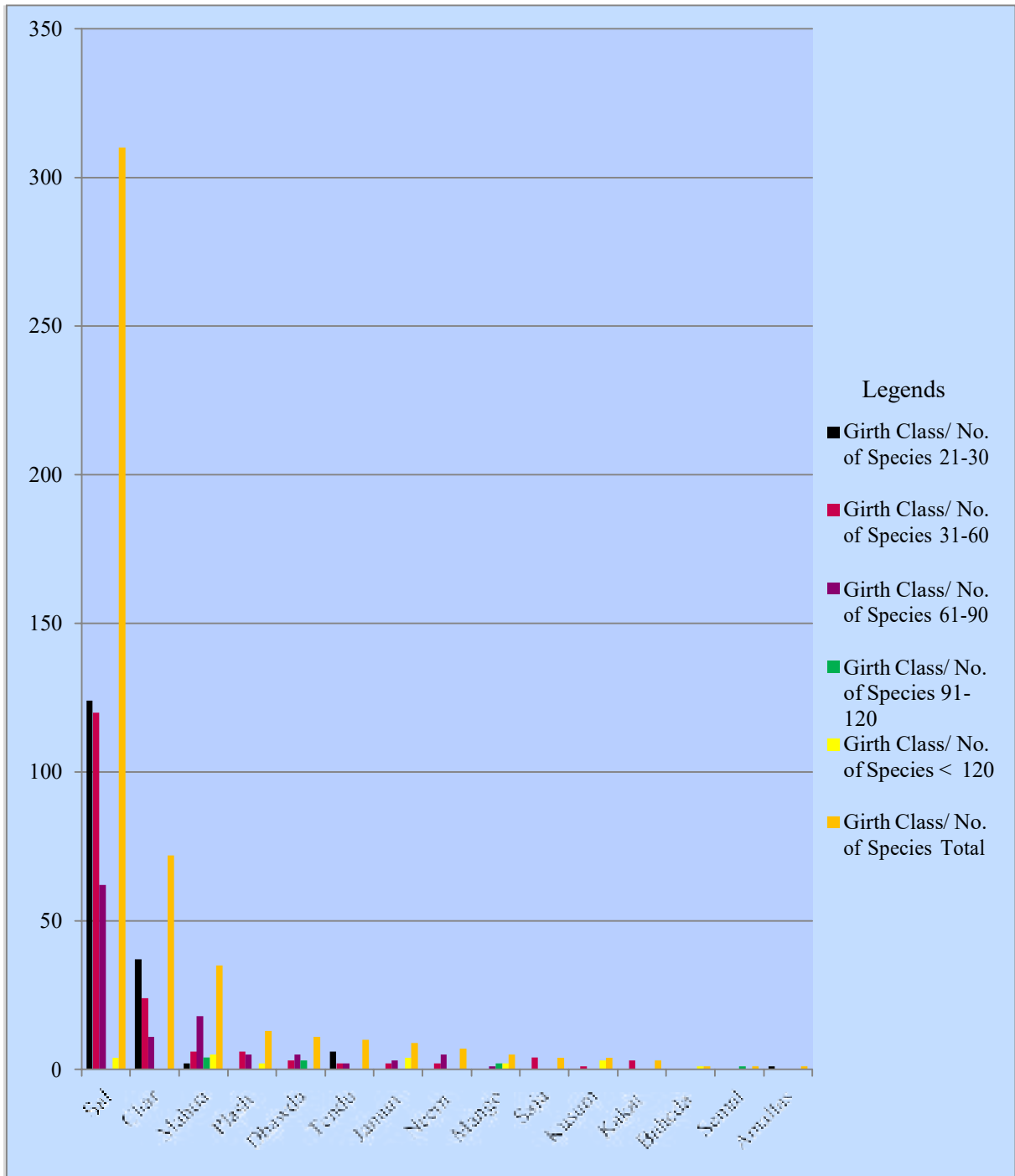
##### 4.1.1 Floral diversity of study site

On the basis of the field survey, the data have been collected and analyzed. The core and buffer zone vegetation of study area are mainly surrounded by dominated tree species i.e. Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Palash (*Butea monosperma*), Dhawda (*Anogeissus latifolia*), Tendu (*Diospyros melanoxylon*), Jamun (*Syzygium cumini*), Neem (*Azadirachta indica*), Mango (*Mangifera indica*), Saja (*Terminalia tomentosa*), Kusum (*Schleichera oleosa*), Kekat (*Garuga pinnata*), Baheda (*Terminalia bellerica*), Semal (*Bombax ceiba*) and Amaltash (*Cassia fistula*) etc. Floral diversity data have been recorded and tabulated during the seasonal field survey of core and buffer zone of proposed mining site is given below in table no 4.1

**Table No. 4.1: Floral diversity along with girth class of study site**

Summary of available tree species in 35 sample plot (Total area = 10,995.6 m square)								
S. no.	Tree Species	Girth Class						Regeneration Status
		21-30	31-60	61-90	91-120	< 120	Total	Up to 20 cm
1	Sal	124	120	62	0	4	310	10
2	Char	37	24	11	0	0	72	47
3	Mahua	2	6	18	4	5	35	1
4	Palash	0	6	5		2	13	0
5	Dhawda	0	3	5	3	0	11	8
6	Tendu	6	2	2	0	0	10	4
7	Jamun	0	2	3	0	4	9	0
8	Neem	0	2	5	0	0	7	3
9	Mango	0	0	1	2	2	5	0
10	Saja	0	4	0	0	0	4	0
11	Kusum	0	1	0	0	3	4	0
12	Kakat	0	3	0	0	0	3	0
13	Baheda	0	0	0	0	1	1	0
14	Semal	0	0	0	1	0	1	0
15	Amaltash	1	0	0	0	0	1	0
<b>Area details : Total number of transect = 7; Total number of plots = 7x5 = 35; Area of one sample plot = 314.16 m Square</b>								





**Graph 4.1: Floral diversity along with girth class of study site**

**Overall vegetation cover** - The data of all 7 transect have been recorded which is given in table no 4.2

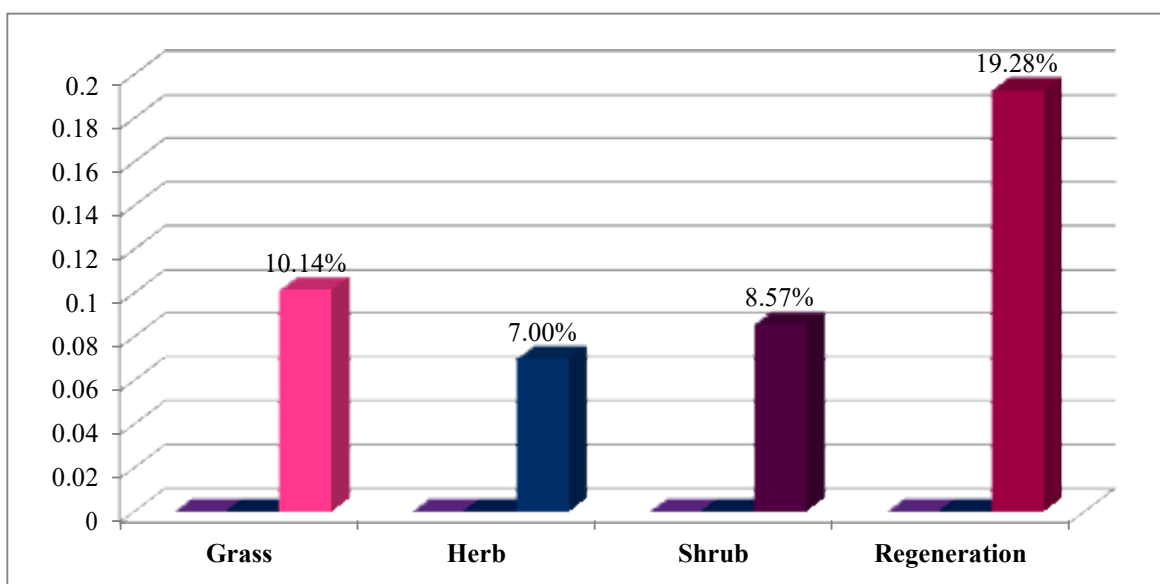
**Table No. 4.2: Average vegetation percentage of study site**

Transect No.	Grass	Herb	Shrub	Reg.
1	9%	9%	8%	25%
2	7%	8%	12%	31%
3	5%	9%	10%	28%
4	3%	5%	6%	2%
5	7%	13%	9%	19%
6	32%	10%	5%	15%

7	8%	11%	10%	14%
<b>Average</b>	<b>71%</b>	<b>65%</b>	<b>60%</b>	<b>135%</b>
<b>% (Total average divided by 7)</b>	<b>10.14%</b>	<b>7.00%</b>	<b>8.57%</b>	<b>19.28%</b>

**Table no. 4.3 Overall vegetation cover of study site**

<b>Vegetation</b>	<b>Average</b>
<b>Grass</b>	<b>10.14%</b>
<b>Herb</b>	<b>7.00%</b>
<b>Shrub</b>	<b>8.57%</b>
<b>Regeneration</b>	<b>19.28%</b>



**Graph 4.2: Overall status of vegetation average percentage**

According to vegetation survey, it has been analyzed that the diversity of tree species categorized under five girth classes i.e. 21-30 cm, 31-60 cm, 61-90 cm, 91-120 cm followed by <120 cm whereas the overall vegetation comparison of floral diversity other than tree species have been analyzed in average percent i.e. grassland 10.14 %, herbs 7.00 %, shrubs 8.57 % and the regeneration average percentage is 19.28% (Table no. 4.3 and Graph 4.2).

#### **4.1.2 Avifauna**

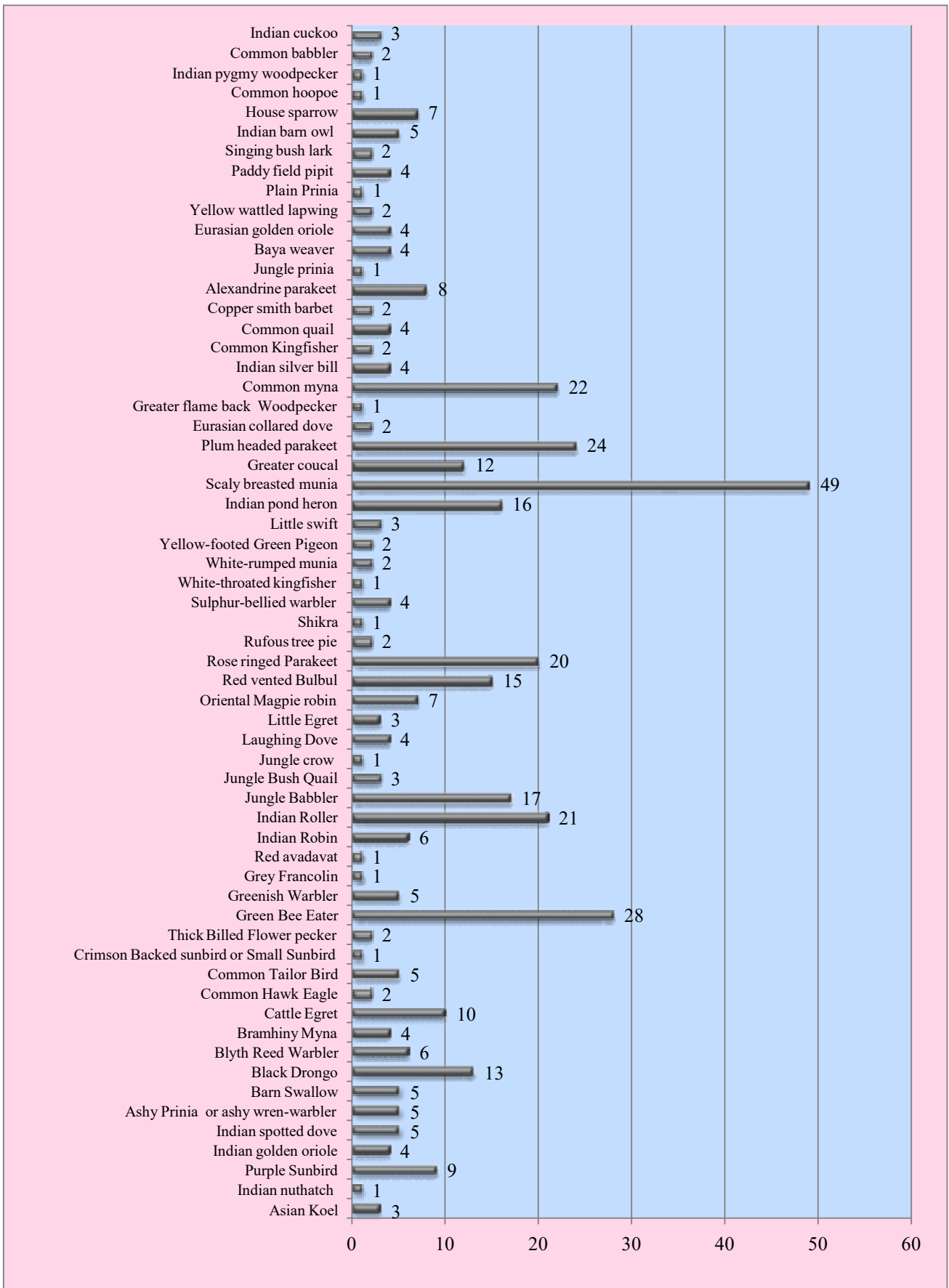
According to seasonal survey, 405 individual belongs to 61 different bird species has been recorded. As per recorded data, it has been analyzed that the population of avifauna dominated by Scaly Breasted Munia, Green Bee Eater, Rose Ringed Parakeet, Red Vented Bulbul, Indian Roller, Common Myna and Black Drongo etc. Mostly the birds found during the survey are endemic and

resident. The avifaunal diversity of study site have been tabulated in table no 4.4 and graph 4.3.

**Table No. 4.4: Check list of birds species in summer season**

S. No.	Common Name	Local Name	Zoological Name	Number of Birds	Family	IUCN Status
1	Asian Koel	Koel, Cuckoo	<i>Eudynamys scolopacea</i>	03	Cuculidae	LC
2	Indian Nuthatch	-	<i>Sitta casetana</i>	01	Sittidae	LC
3	Purple Sunbird	-	<i>Nectarania asiatica</i>	09	Nectariniini	LC
4	Indian Golden Oriole	-	<i>Oriolus oriolus kundoo</i>	04	Oriolidae	LC
5	Indian Spotted Dove	Padki	<i>Streptopelia chinensis</i>	05	Columbidae	LC
6	Ashy Prinia or Ashy Wren-warbler	-	<i>Prinia socialis</i>	05	Cisticolidae	LC
7	Barn Swallow	-	<i>Hirundo rustica</i>	05	Hirundinidae	LC
8	Black Drongo	Karrauna	<i>Dicrurus macrocercus</i>	13	Dicruridae	LC
9	Blyth Reed Warbler	-	<i>Acrocephalus dumetorum</i>	06	Acrocephalidae	LC
10	Bramhiny Myna	Maina	<i>Sturnia pagodarum</i>	04	Sturnidae	LC
11	Cattle Egret	Gay Bagula	<i>Bubulcus ibis</i>	10	Ardeidae	LC
12	Common Hawk Eagle	Cheel	<i>Hierococyx varius</i>	02	Cuculidae	LC
13	Common Tailor Bird	-	<i>Orthotomus sutorius</i>	05	Cisticolidae	LC
14	Crimson Backed Sunbird or Small Sunbird	-	<i>Leptocoma minima</i>	01	Nectariniidae	LC
15	Thick Billed Flower	-	<i>Dicaeum agile</i>	02	Dicaeidae	LC
16	Green Bee Eater	Patinga	<i>Merops orientalis</i>	28	Meropidae	LC
17	Greenish Warbler	-	<i>Phylloscopus trochiloides</i>	05	Phylloscopidae	LC
18	Grey Francolin	-	<i>Francolinus</i>	01	Phasianidae	LC
19	Red Avadavat	-	<i>Amandava amandava</i>	01	Estrildidae	LC
20	Indian Robin	Chirak	<i>Saxicoloides fulicatus</i>	06	Muscicapidae	LC
21	Indian Roller	Nilkanth/teohra	<i>Coracias benghalensis</i>	21	Coraciidae	LC
22	Jungle Babbler	Satbhaiya	<i>Turdoides striata</i>	17	Leiothrichidae	LC
23	Jungle Bush Quail	Titar	<i>Perdica asiatica</i>	03	Phasianidae	LC
24	Jungle Crow	Koua	<i>Corvus culminatus</i>	01	Corvidae	LC
25	Laughing Dove	Padki	<i>Spilopelia senegalensis</i>	04	Columbidae	LC
26	Little Egret	Kokda	<i>Egretta garzetta</i>	03	Ardeidae	LC
27	Oriental Magpie-robin	-	<i>Copsychus saularis</i>	07	Muscicapidae	LC
28	Red Vented Bulbul	Fikkadlow	<i>Pycnonotus cafer</i>	15	Pycnonotidae	LC
29	Rose Ringed Parakeet	Tota/Sua	<i>Psittacula krameri</i>	20	Psittaculidae	LC
30	Rufous Tree Pie	-	<i>Dendrocitta vagabunda</i>	02	Corvini	LC
31	Shikra	Cheel	<i>Accipiter badius</i>	01	Accipitridae	LC
32	Sulphur-Bellied Warbler	-	<i>Phylloscopus griseolus</i>	04	Acrocephalidae	LC
33	White-Throated Kingfisher	Kilkila	<i>Halcyon smyrnensis</i>	01	Alcedinidae	LC
34	White-Rumped Munia	-	<i>Lonchura striata</i>	02	Estrildidae	LC
35	Yellow-Footed Green	Kabootar	<i>Treron phoenicoptera</i>	02	Columbidae	LC
36	Little Swift	-	<i>Apus affinis</i>	03	Apodidae	LC
37	Indian Pond Heron	Khokho bakli	<i>Ardeola grayii</i>	16	Ardeidae	LC
38	Scaly Breasted Munia	-	<i>Lonchura punctulata</i>	49	Estrildidae	LC
39	Greater Coucal	Koyal	<i>Centropus sinensis</i>	12	Cuculidae	LC
40	Plum Headed Parakeet	Tota/Sua	<i>Psittacula cyanocephala</i>	24	Psittacidae	LC
41	Eurasian Collared Dove	Padki	<i>Streptopelia decaocto</i>	02	Columbidae	LC
42	Greater Flame Back	Katpodva	<i>Dryocopus martius</i>	01	Picidae	LC
43	Common Myna	Salhai/desimyna	<i>Acridotheres tristis</i>	22	Sturnidae	LC

44	Indian Silver Bill	-	<i>Euodice malabarica</i>	04	Estrildidae	LC
45	Common Kingfisher	Kilkila	<i>Alcedo atthis</i>	02	Alcedinidae	LC
46	Common Quail	Titar	<i>Coturnix coturnix</i>	04	Phasianidae	LC
47	Copper Smith Barbet	-	<i>Psilopogon</i>	02	Megalaimidae	LC
48	Alexandrine Parakeet	-	<i>Psittacula eupatria</i>	08	Psittacidae	LC
49	Jungle Prinia	-	<i>Prinia sylvatica</i>	01	Cisticolidae	LC
50	Baya Weaver	Gauraiya	<i>Ploceus philippinus</i>	04	Ploceidae	LC
51	Eurasian Golden Oriole	-	<i>Oriolus oriolus</i>	04	Oriolidae	LC
52	Yellow Wattled Lapwing	-	<i>Vanellus malabaricus</i>	02	Charadriidae	LC
53	Plain Prinia	-	<i>Prinia inornata</i>	01	Cisticolidae	LC
54	Paddy Field Pipit	-	<i>Anthus rufulus</i>	04	Motacillidae	LC
55	Singing Bush Lark	-	<i>Mirafra javanica</i>	02	Alaudidae	LC
56	Indian Barn Owl	-	<i>Tyto alba</i>	05	Tytonidae	LC
57	House Sparrow	Gouriya	<i>Passer domesticus</i>	07	Passeridae	LC
58	Common Hoopoe		<i>Upupa epops</i>	01	Upupidae	LC
59	Indian Pygmy	-	<i>Yungipicus nanus</i>	01	Picidae	LC
60	Common Babbler	-	<i>Turdoides caudate</i>	02	Lieothrichidae	LC
61	Indian Cuckoo	-	<i>Cuculus micropterus</i>	03	cuculidae	LC
<b>Total</b>				<b>405</b>		



**Graph No. 4.3: Status of individual avifauna species found in OCP Chhal**

## 4.2 WINTER SEASON SURVEY

### 4.2.1 Floral diversity of study site

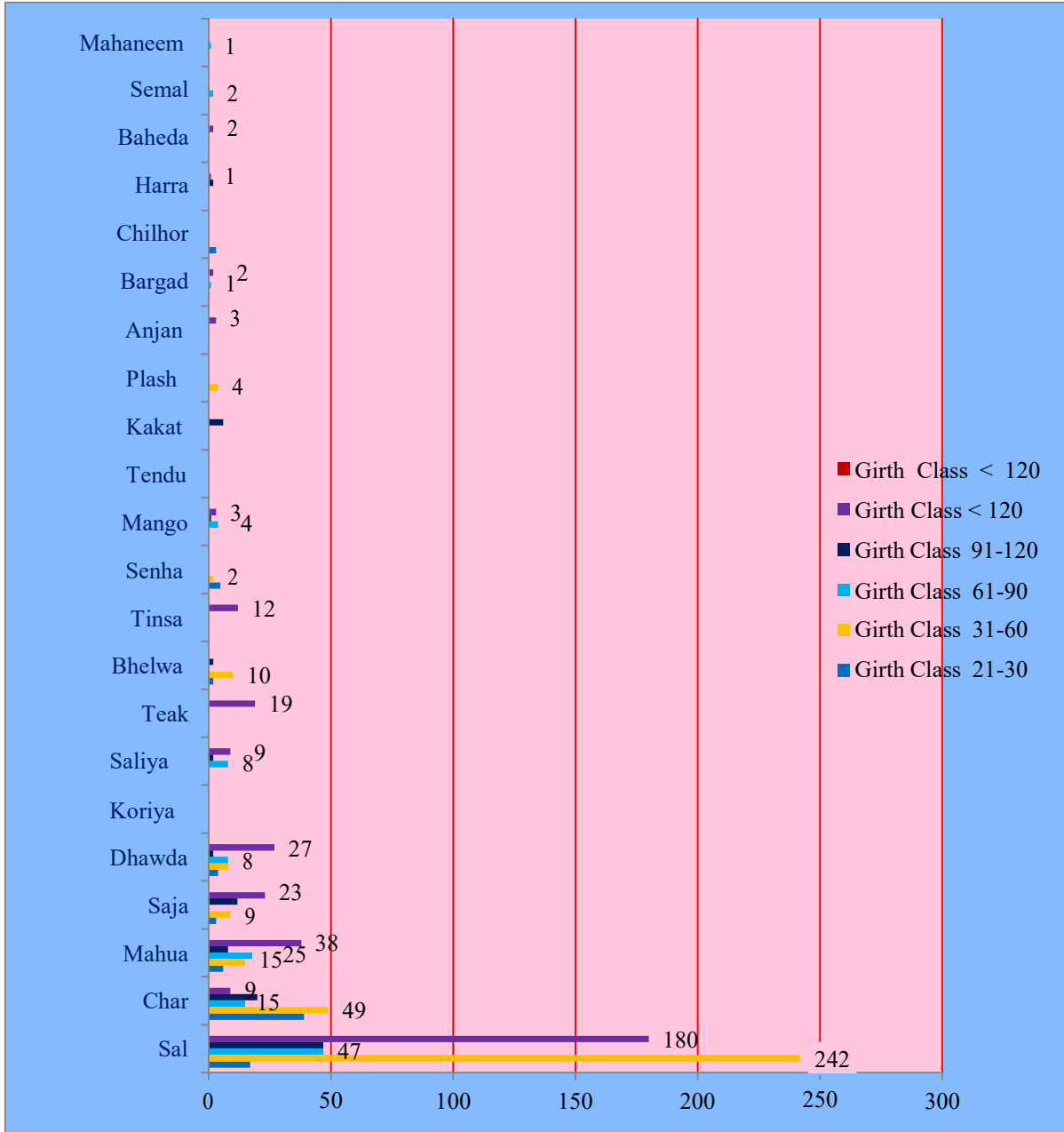
On the basis of the field survey, the data had been collected and analyzed. That the core and buffer zone vegetation of study area are mainly surrounded by dominated tree species i.e. Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Saja (*Terminalia tomentosa*), Dhawda (*Anogeissus latifolia*), Koriya (*Pinus koraiensi*), Teak (*Tectona grandis*), Bhelwa (*Semecarpus anacardium*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Tendu (*Diospyros melanoxylon*), Kekad (*Garuga pinnata*), Plash (*Butea monosperma*), Anjan (*Hardwickia binata*), Bargad (*Ficus bengalensis*), Harra (*Terminalia chebula*), Baheda (*Terminalia bellerica*), Semal (*Bombax ceiba*), Jamun (*Syzygium cumini*) and Mahaneem (*Ailanthus excelsa*) etc. Floral diversity data have been recorded and tabulated during the seasonal field surveys of core and buffer zone of proposed mining site given below in table no 4.5.

**Table No. 4.5: Floral diversity along with girth class in study site**

Summary of available tree species in 60 sample plot (Total area = 18,849.6 m square)								
S. no.	Tree Species	Girth class						Regeneration status
		21-30	31-60	61-90	91-120	< 120	Total	Up to 20 cm
1	Sal	17	242	47	47	180	533	17
2	Char	39	49	15	20	9	132	12
3	Mahua	06	15	25	08	38	92	0
4	Saja	03	09		16	23	51	0
5	Dhawda	04	08	08	02	27	49	0
6	Koriya	0	0	0	0	0	0	33
7	Saliya	0	0	08	02	09	19	0
8	Teak	0	0	0	0	19	19	0
9	Bhelwa	02	10	0	2		14	0
10	Tinsa	0	0	0	0	12	12	0
11	Senha	07	02	0	0	0	09	0
12	Mango	0	0	04	01	03	08	0
13	Tendu	0	0	0	0	0	0	08
14	Kakat	0	0	0	06	0	06	0
15	Plash	0	04	0	0	0	04	0
16	Anjan	0	0	0	0	03	03	0
17	Bargad	0	0	01	0	02	03	0
18	Chilhor	03	0	0	0	0	03	0

19	Harra	0	0	0	02	01	03	0
20	Baheda	0	0	0	0	02	02	0
21	Semal	0	0	02	0	0	02	0
22	Mahaneem	0	0	01	0	0	01	0

**Area details : Total number of transect = 12; Total number of plots = 12x5 = 60; Area of one sample plot = 314.16 m Square**

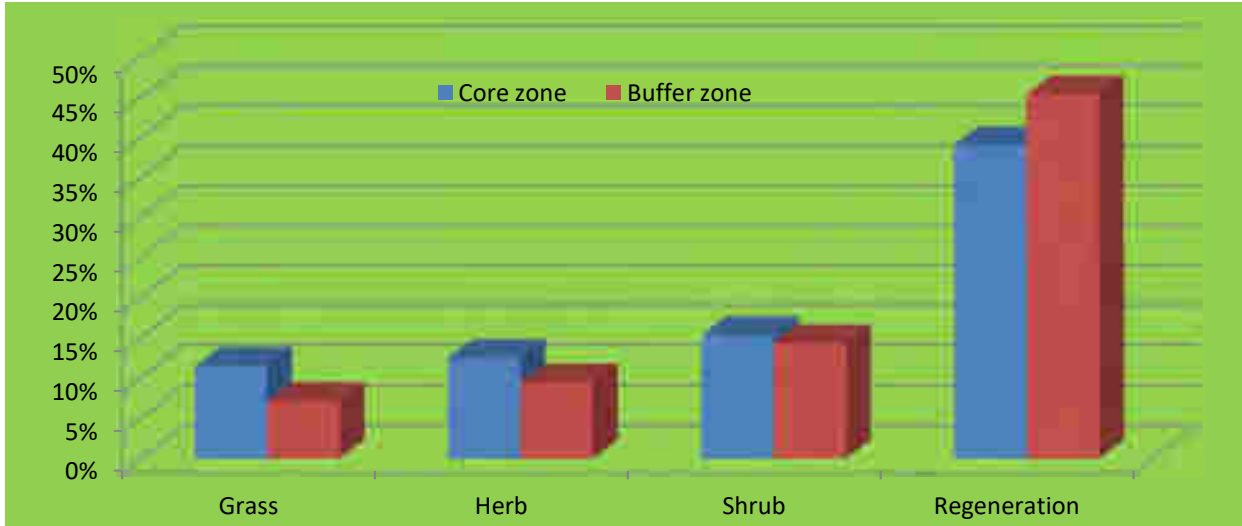


**Graph 4.4: Floral diversity along with girth class in study site**

**4.2.2 Overall vegetation cover –** The data of all 12 transect have been recorded which is given below in table no.4.6

**Table No. 4.6: Average vegetation percentage of core and buffer zone**

Vegetation	Core zone	Buffer zone
Grass	11.5%	7.16%
Herb	12.5%	9.5%
Shrub	15.33%	14.33%
Regeneration	39.16%	44.5%



**Graph 4.5: Overall vegetation comparisons of core and buffer zone**

According to vegetation survey, it has been analyzed that the diversity of tree species categorized under five girth classes i.e. 21-30 cm, 31-60 cm, 61-90 cm, 91-120 cm followed by above 120 cm which shows in the table no 4.5 and graph 4.4 whereas the overall vegetation comparison of floral diversity other than tree species are recorded in percent i.e. grassland 11.5:7.16 %, herbs 12.5:9.5 %, shrubs 15.33:14.33 % and the regeneration percentage is 39.16:44.5 % (Table no 4.6 and Graph 4.5).

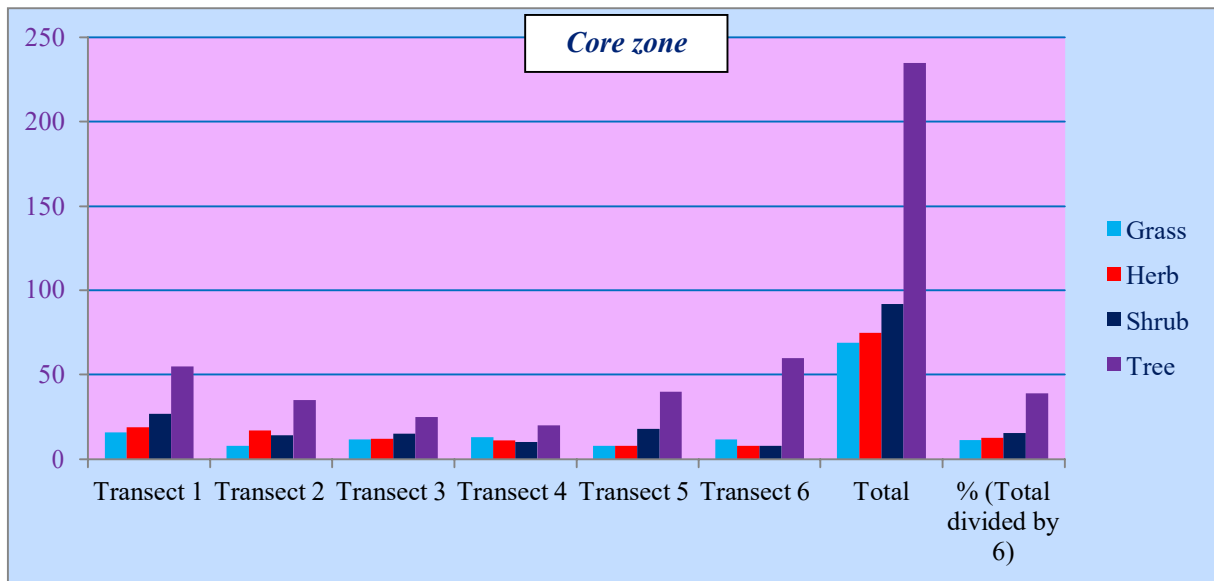
#### 4.2.3 Core zone

The core zone area comprises about 185.155 hectare. The winter seasonal field visits have been conducted in December 2018. The observation shows floral phenology of core zone in mining area is mostly dominated by Sal (*Shorea robusta*) species followed by Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Saja (*Terminalia tomentosa*), Dhawda (*Anogeissus latifolia*) etc.



**Table No. 4.7: Vegetation covers percentage of core mining area.**

S. No.	Grass	Herb	Shrub	Tree
1	16%	19%	27%	55%
2	8%	17%	14%	35%
3	12%	12%	15%	25%
4	13%	11%	10%	20%
5	8%	8%	18%	40%
6	12%	8%	8%	60%
<b>Average</b>	<b>69%</b>	<b>75%</b>	<b>92%</b>	<b>235%</b>
<b>% (Total average divided by 6)</b>	<b>11.5%</b>	<b>12.5%</b>	<b>15.33%</b>	<b>39.16%</b>



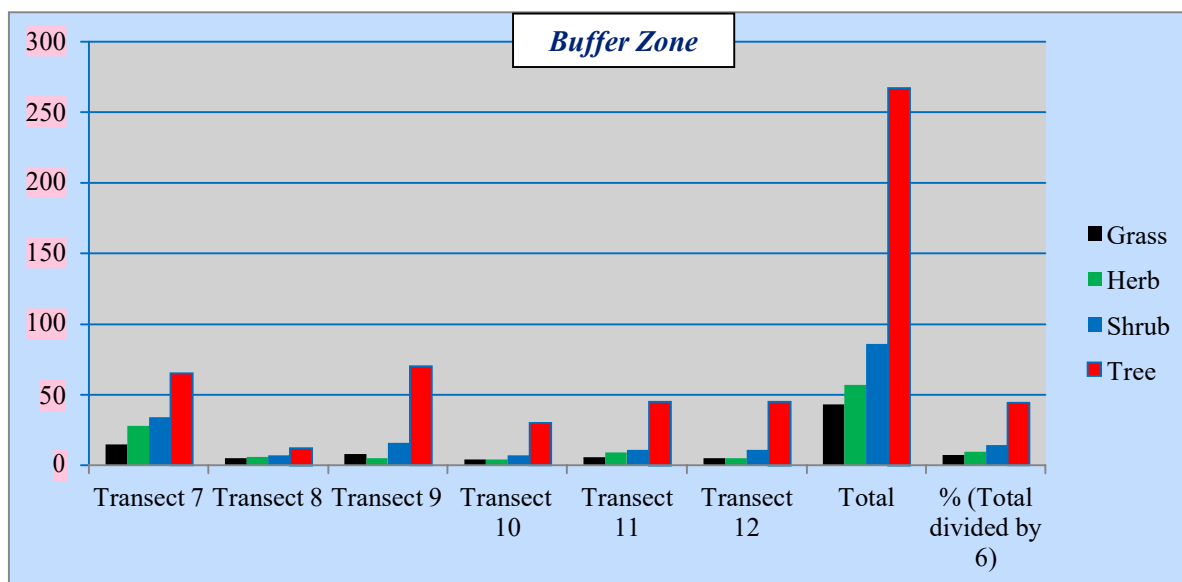
**Graph 4.6: Vegetation composition of core zone**

**4.2.4 Buffer zone:**

The buffer zone of mining area is situated at 5-10 km distance from the core mining boundary. The floral vegetation diversity of buffer zone is illustrated in graph 4.7 and tabulated in table no 4.8.

**Table No 4.8: Vegetation percentage of buffer zone.**

S. No.	Grass	Herb	Shrub	Tree
1	15	28	34	65
2	5	6	7	12
3	8	5	16	70
4	4	4	7	30
5	6	9	11	45
6	5	5	11	45
<b>Average</b>	<b>43</b>	<b>57</b>	<b>86</b>	<b>267</b>
<b>% (Total average divided by 6)</b>	<b>7.16</b>	<b>9.5</b>	<b>14.33</b>	<b>44.5</b>



Graph 4.7: Vegetation composition of buffer zone

#### 4.2.5 Avifauna diversity

According to seasonal survey, 776 individual belongs to 89 different species has been recorded. As per recorded data, the population of avifauna dominated by Indian Pond Heron, Black Drongo, Red Vented bulbul, Indian Roller and Common Myna. Mostly the birds found during the survey are endemic and resident. The avifaunal diversity of mining area are tabulated in table no 4.9 and graph 4.8.

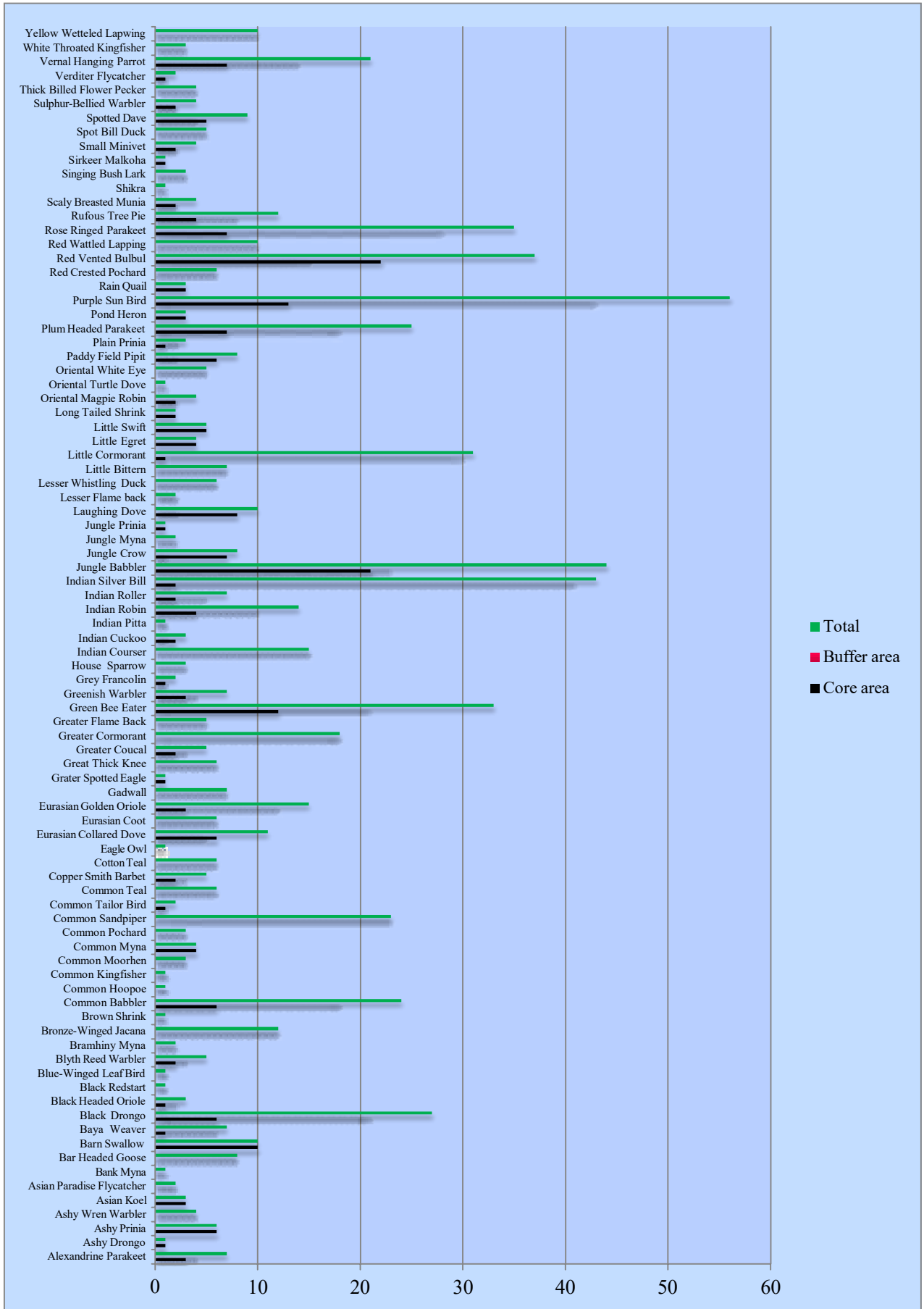
Table No 4.9: Checklist of avifauna recorded in the study site

S. No	Common Name	Local Name	Scientific Name	Family	IUCN Status	Core zone	Buffer zone	No of birds
1	Alexandrin eParakeet	Parrot, Tota	<i>Psittacula eupatria</i>	Psittacidae	NT	3	4	7
2	Ashy Drongo	-----	<i>Dicrurus leucophaeus</i>	Dicruridae	LC	1		1
3	Ashy Prinia	-----	<i>Prinia socialis</i>	Cisticolidae	LC	6		6
4	Ashy Wren Warbler	-----	<i>Prinia socialis</i>	Cisticolidae	LC		4	4
5	Asian Koel	Koel, Cuckoo	<i>Eudynamys</i>	Cuculidae	LC	3		3
6	Asian Paradise Flycatcher	-----	<i>Terpsiphone paradisi</i>	Monarchidae	LC		2	2
7	Bank Myna	Myna	<i>Acridotheres ginginianus</i>	Sturnidae	LC		1	1
8	Bar Headed Goose	-----	<i>Anser indicus</i>	Anatidae	LC		8	8
9	Barn Swallow	-----	<i>Hirundo rustica</i>	Hirundinidae	LC	10		10
10	Baya Weaver	Gauraiya	<i>Ploceus philippinus</i>	Ploceidae	LC	1	6	7
11	Black Drongo	Karrauna	<i>Dicrurus macrocercus</i>	Dicruridae	LC	6	21	27

12	Black Headed Oriole	-----	<i>Oriolus larvatus</i>	Oriolidae	LC	1	2	3
13	Black Redstart	-----	<i>Phoenicurus ochruros</i>	Muscicapidae	LC		1	1
14	Blue-Winged Leaf Bird	-----	<i>Chloropsis cochinchinensis</i>	Chloropseidae	NT		1	1
15	Blyth Reed Warbler	-----	<i>Acrocephalus dumetorum</i>	Acrocephalidae	LC	2	3	5
16	Bramhiny Myna	Maina	<i>Sturnia pagodarum</i>	Sturnidae	LC		2	2
17	Bronze-Winged Jacana	-----	<i>Metopidius indicus</i>	Jacanidae	LC		12	12
18	Brown Shrink	-----	<i>Lanius cristatus</i>	Laniidae	LC		1	1
19	Common Babbler	-----	<i>Turdoides caudate</i>	Lieoethrichidae	LC	6	18	24
20	Common Hoopoe	-----	<i>Upupa epops</i>	Upupidae	LC		1	1
21	Common Kingfisher	Kilkila	<i>Alcedo atthis</i>	Alcedinidae	LC		1	1
22	Common Moorhen	-----	<i>Gallinula chloropus</i>	Rallidae	LC		3	3
23	Common Myna	Salhai /desimyna	<i>Acridotheres tristis</i>	Sturnidae	LC	4		4
24	Common Pochard	-----	<i>Aythya ferina</i>	Anatidae	VU		3	3
25	Common Sandpiper	-----	<i>Actitis hypoleucos</i>	Scolopacidae	LC		23	23
26	Common Tailor Bird	-----	<i>Orthotomus sutorius</i>	Cisticolidae	LC	1	1	2
27	Common Teal	-----	<i>Anas crecca</i>	Anatidae	LC		6	6
28	Copper Smith Barbet	-----	<i>Psilopogon haemacephalus</i>	Megalaimidae	LC	2	3	5
29	Cotton Teal	-----	<i>Nettapus coromandelianus</i>	Anatidae	LC		6	6
30	Eagle Owl	Ullu	<i>Bubo bubo</i>	Strigidae	LC		1	1
31	Eurasian Collared Dove	Padki	<i>Streptopelia decaocto</i>	Columbidae	LC	6	5	11
32	Eurasian Coot	-----	<i>Fulica atra</i>	Rallidae	LC		6	6
33	Eurasian Golden Oriole	-----	<i>Oriolus oriolus</i>	Oriolidae	LC	3	12	15
35	Gadwall	-----	<i>Mareca strepera</i>	Anatidae	LC		7	7
36	Grater Spotted Eagle	-----	<i>Clanga clanga</i>	Accipitridae	VU	1		1
37	Great Thick Knee	-----	<i>Esacus recurvirostris</i>	Burhinidae	NT		6	6
38	Greater Coucal	Koyal	<i>Centropus sinensis</i>	Cuculidae	LC	2	3	5
39	Greater Cormorant	-----	<i>Phalacrocorax carbo</i>	Phalacrocoracidae	LC		18	18
40	Greater Flame Back	-----	<i>Chrysocolaptes guttacristatus</i>	Picidae	LC		5	5
41	Green Bee Eater	Patinga	<i>Merops orientalis</i>	Meropidae	LC	12	21	33
42	Greenish Warbler	-----	<i>Phylloscopus trochiloides</i>	Phylloscopidae	LC	3	4	7
43	Grey Francolin	-----	<i>Francolinus pondicerianus</i>	Phasianidae	LC	1	1	2
44	House Sparrow	Gouriaya	<i>Passer domesticus</i>	Passeridae	LC		3	3
45	Indian Courser	-----	<i>Cursorius coromandelicus</i>	Glareolidae	LC		15	15
46	Indian Cuckoo	-----	<i>Cuculus micropterus</i>	cuculidae	LC	2	1	3
47	Indian Pitta	-----	<i>Pitta brachyura</i>	Pittidae	LC		1	1

48	Indian Robin	Chirak	<i>Saxicoloides fulicatus</i>	Muscicapidae	LC	4	10	14
49	Indian Roller	Nilkanth/ teohra	<i>Coracias benghalensis</i>	Coraciidae	LC	2	5	7
50	Indian Silver Bill	-----	<i>Euodice malabarica</i>	Estrildidae	LC	2	41	43
51	Jungle Babbler	Satbhaiya	<i>Turdoides striata</i>	Leiothrichidae	LC	21	23	44
52	Jungle Crow	Koua	<i>Corvus culminatus</i>	Corvidae	LC	7	1	8
53	Jungle Myna	Maina	<i>Acridotheres fuscus</i>	Sturnidae	LC		2	2
54	Jungle Prinia	-----	<i>Prinia sylvatica</i>	Cisticolidae	LC	1		1
55	Laughing Dove	Padki	<i>Spilopelia senegalensis</i>	Columbidae	LC	8	2	10
56	Lesser Flame back	-----	<i>Dinopium benghalense</i>	Picidae	LC		2	2
57	Lesser Whistling Duck	-----	<i>Dendrocygna javanica</i>	Anatidae	LC		6	6
58	Little Bittern	-----	<i>Ixobrychus minutus</i>	Ardeidae	LC		7	7
59	Little Cormorant	-----	<i>Microcarbo niger</i>	Phalacrocoracidae	LC	1	30	31
60	Little Egret	Kokda	<i>Egretta garzetta</i>	Ardeidae	LC	4		4
61	Little Swift	-----	<i>Apus affinis</i>	Apodidae	LC	5		5
62	Long Tailed Shrike	-----	<i>Lanius schach</i>	Laniidae	LC	2		2
63	Oriental Magpie Robin	-----	<i>Copsychus saularis</i>	Muscicapidae	LC	2	2	4
64	Oriental Turtle Dove	-----	<i>Streptopelia orientalis</i>	Columbidae	LC		1	1
65	Oriental White Eye	-----	<i>Zosterops palpebrosus</i>	Zosteropidae	LC		5	5
66	Paddy Field Pipit	-----	<i>Anthus rufulus</i>	Motacillidae	LC	6	2	8
67	Plain Prinia	-----	<i>Prinia inornata</i>	Cisticolidae	LC	1	2	3
68	Plum Headed Parakeet	Tota/Sua	<i>Psittacula cyanocephala</i>	Psittacidae	LC	7	18	25
69	Pond Heron	Khokho bakli	<i>Ardeola grayii</i>	Ardeidae	LC	3		3
70	Purple Sun Bird	-----	<i>Nectarania asiatica asiatica</i>	Nectariniini	LC	13	43	56
71	Rain Quail	Quail	<i>Coturnix coromandelica</i>	Phasianidae	LC	3		3
72	Red Crested Pochard	-----	<i>Netta rufina</i>	Anatidae	LC		6	6
73	Red Vented Bulbul	Fikkadlow	<i>Pycnonotus cafer</i>	Pycnonotidae	LC	22	15	37
74	Red Wattled Lapping	-----	<i>Vanellus indicus</i>	Charadriidae			10	10
75	Rose Ringed Parakeet	Tota/Sua	<i>Psittacula krameri</i>	Psittaculidae	LC	7	28	35
76	Rufous Tree Pie	-----	<i>Dendrocitta vagabunda</i>	Corvini	LC	4	8	12
77	Scaly Breasted Munia	-----	<i>Lonchura punctulata</i>	Estrildidae	LC	2	2	4
78	Shikra	Cheel	<i>Accipiter badius</i>	Accipitridae	LC		1	1
79	Singing Bush Lark	-----	<i>Mirafra javanica</i>	Alaudidae	LC		3	3
80	Sirkeer Malkoha	-----	<i>Taccocua leschenaultii</i>	Cuculidae	LC	1		1

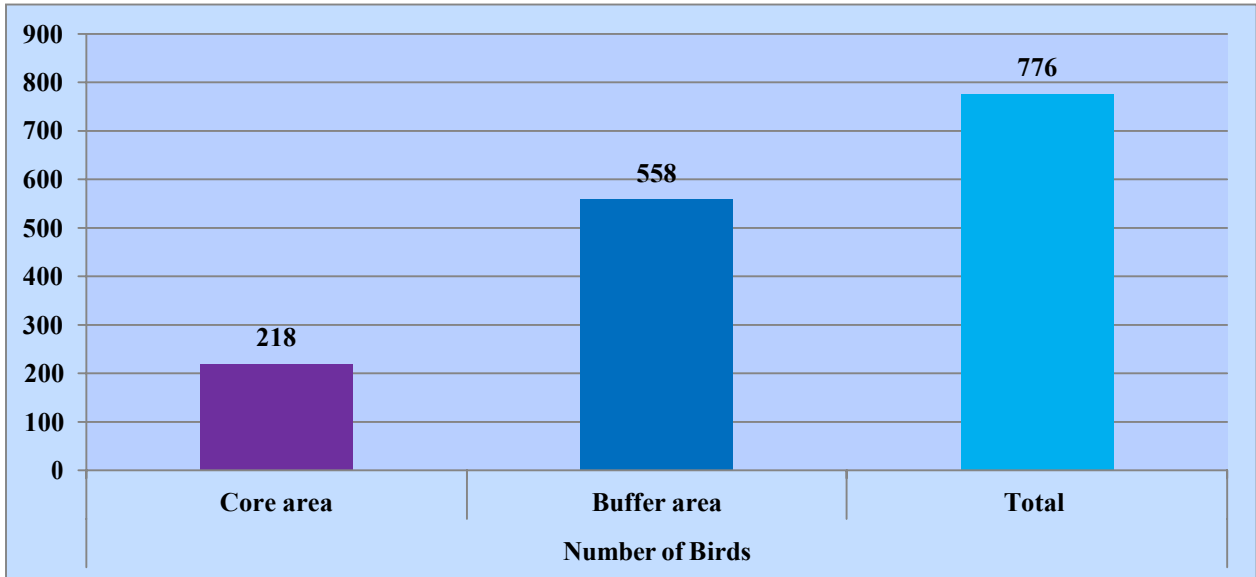
81	Small Minivet	-----	<i>Pericrocotus cinnamomeus</i>	Campephagidae	LC	2	2	4
82	Spot Bill Duck	-----	<i>Anas poecilorhyncha</i>	Anatidae	LC		5	5
83	Spotted Dove	-----	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC	5	4	9
84	Sulphur-Bellied Warbler	-----	<i>Phylloscopus griseolus</i>	Acrocephalidae	LC	2	2	4
85	Thick Billed Flower Pecker	-----	<i>Dicaeum agile</i>	Dicaeidae	LC		4	4
86	Verditer Flycatcher	-----	<i>Eumyias thalassinus</i>	Muscicapidae	LC	1	1	2
87	Vernal Hanging Parrot	-----	<i>Loriculus vernalis</i>	Psittaculidae	LC	7	14	21
88	White Throated Kingfisher	Kilkila	<i>Halcyon smyrnensis</i>	Alcedinidae	LC		3	3
89	Yellow Wetteled Lapwing		<i>Vanellus malabaricus</i>	Charadriidae	LC		10	10
<b>Total</b>						<b>218</b>	<b>558</b>	<b>776</b>



Graph 4.8: Overview of recorded avifauna (2<sup>nd</sup> seasonal survey)

**Table No.4.10 Birds population difference between core and buffer zone**

S.No.	Number of birds		
	Core zone	Buffer zone	Total
2.	218	558	776



**Graph No.4.9 Birds population difference between core and buffer zone**

### 4.3 AUTUMN SEASON SURVEY

#### 4.3.1 Floral diversity of study site

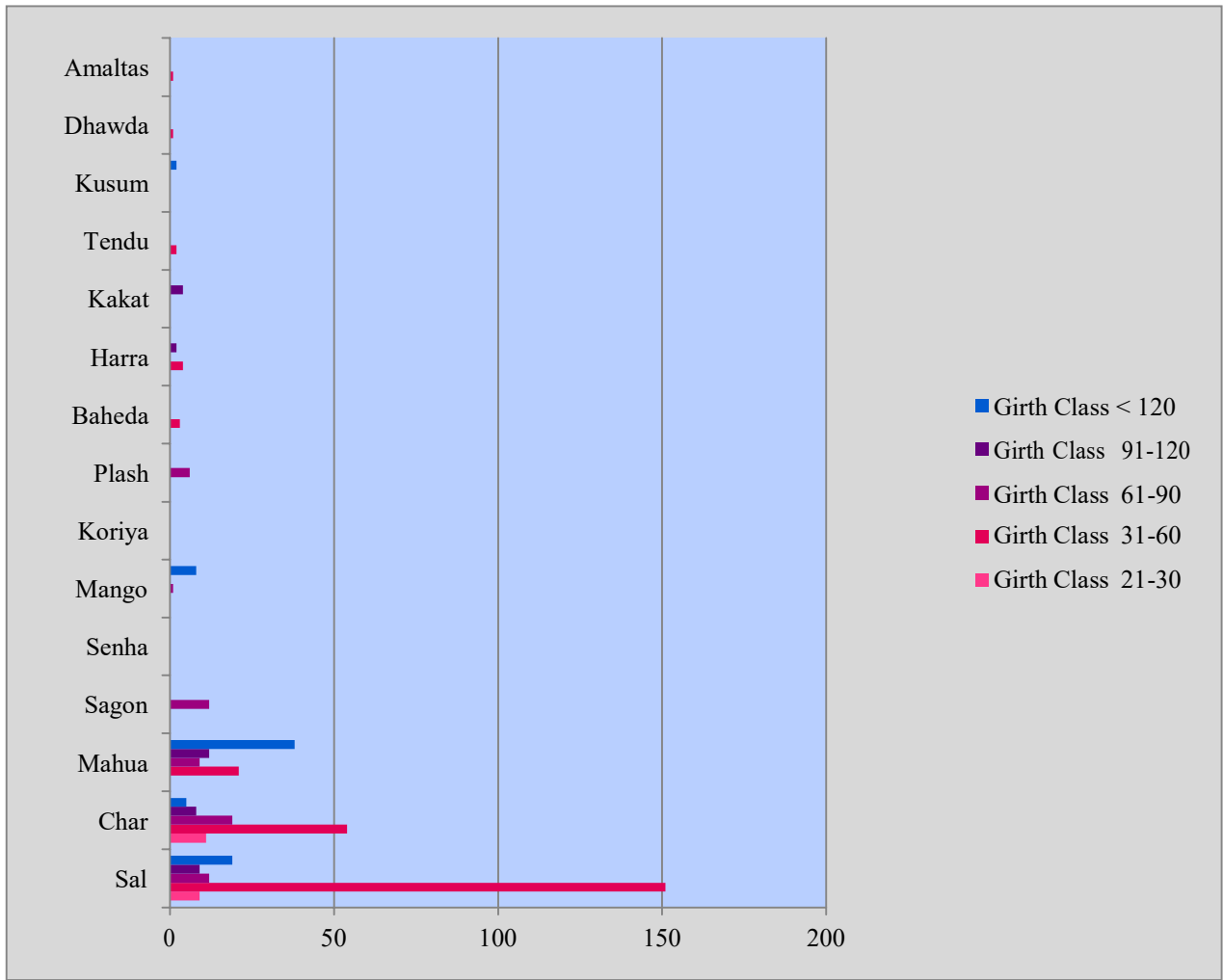
On the basis of the field survey, the data had been collected and analyzed. That the core and buffer zone vegetation of study site are mainly surrounded by dominated tree species i.e. Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Teak (*Tectona grandis*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Koriya (*Pinus koraiensi*), Plash (*Butea monosperma*), Baheda (*Terminalia bellerica*), Harra (*Terminalia chebula*), Kekad (*Garuga pinnata*), Tendu (*Diospyros melanoxylon*), Dhawda (*Anogeissus latifolia*) and Amaltas (*Cassia fistula*) etc. Floral diversity data have been recorded and tabulated during the seasonal field surveys of core and buffer zone of proposed mining site is given below in table no 4.11

**Table No. 4.11: Floral diversity along with girth class in study site**

Summary of available tree species in 35 sample plot (Total area = 10,995.6 m square)								
S. no.	Tree species	Girth class						Regeneration status
		21-30	31-60	61-90	91-120	< 120	Total	Up to 20 cm
1	Sal	9	151	12	9	19	200	0
2	Char	11	54	19	8	5	97	7
3	Mahua	0	21	9	12	38	80	2
4	Sagon	0	0	12	0	0	12	3
5	Senha	0	0	0	0	0	0	12
6	Mango	0	0	1	0	8	9	0
7	Koriya	0	0	0	0	0	0	8
8	Plash	0	0	6	0	0	6	0
9	Baheda	0	3	0	0	0	3	3
10	Harra	0	4	0	2	0	6	0
11	Kakat	0	0	0	4	0	4	0
12	Tendu	0	2	0	0	0	2	0
13	Kusum	0	0	0	0	2	2	0
14	Dhawda	0	1	0	0	0	1	0
15	Amaltas	0	1	0	0	0	1	0

Area details : Total number of transect = 7; Total number of plots = 7x5 = 35 ; Area of one sample plot = 314.16 m square



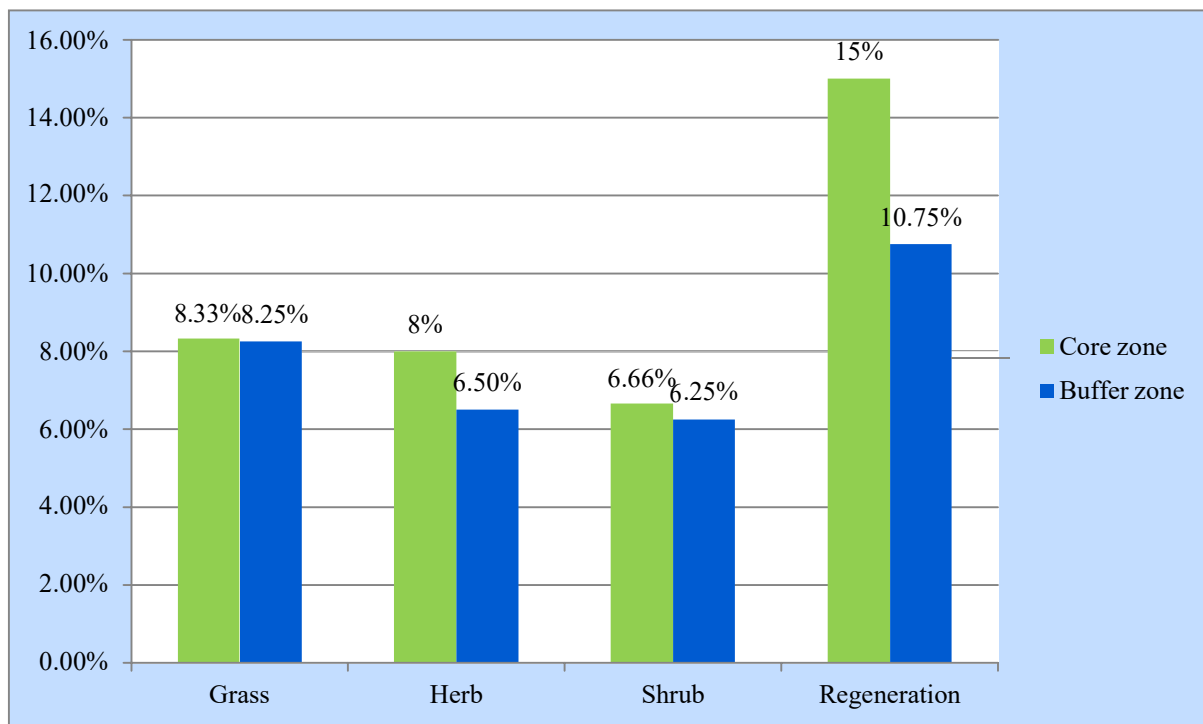


**Graph 4.10: Floral diversity along with girth class in study site**

**4.3.2 Overall vegetation cover** – The data of 7 transect have been recorded which is given below in table no 4.11

**Table No. 4.12: Vegetation percentage of core and buffer zone**

<b>Vegetation</b>	<b>Core zone</b>	<b>Buffer zone</b>
<b>Grass</b>	<b>8.33%</b>	<b>8.25%</b>
<b>Herb</b>	<b>8%</b>	<b>6.50%</b>
<b>Shrub</b>	<b>6.66%</b>	<b>6.25%</b>
<b>Regeneration</b>	<b>15%</b>	<b>10.75%</b>



**Graph 4.11: Vegetation comparisons of core and buffer zone**

According to vegetation survey, 7 transects with 5 intervals (7x5) in each sample plots have been drawn in the core and buffer zone respectively; in which the diversity of tree species categorized under five girth classes i.e. 21-30 cm, 31-60 cm, 61-90 cm, 91-120 cm followed by above 120 cm which shows in the table no 4.11 and graph 4.10 whereas the overall vegetation comparison of floral diversity other than tree species are recorded in percent i.e. grassland 8.33:8.25%, herbs 8:6.5%, shrubs 6.66:6.5% and the regeneration percentage is 15:10.75% (Table no 4.12 and Graph 4.11).

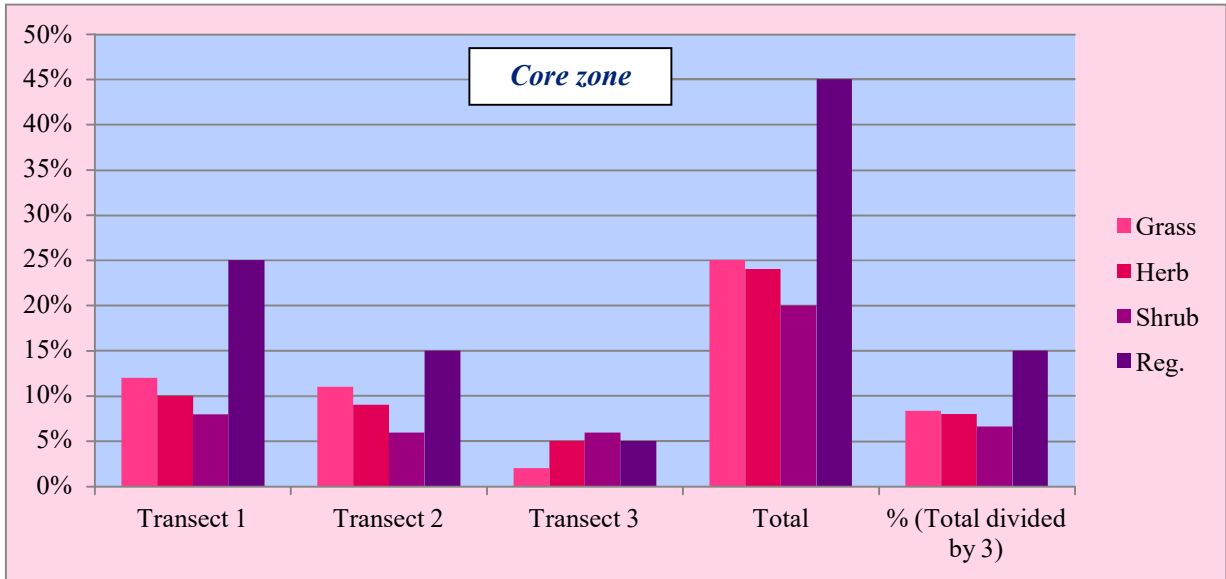
### 4.3.3 Core zone

The core zone comprises about 185.155 hectare. The third seasonal field visits were conducted in the month of March 2019. The observation shows the floral phenology of core zone in mining area is mostly dominated by Sal (*Shorea robusta*) species followed by Char (*Buchanania lanzan*)

**Table No. 4.13: Vegetation covers percentage of core mining area.**

Transect No.	Grass	Herb	Shrub	Reg.
1	12%	10%	8%	25%
2	11%	9%	6%	15%
3	2%	5%	6%	5%

<b>Average</b>	<b>25%</b>	<b>24%</b>	<b>20%</b>	<b>45%</b>
<b>% (Total average divided by 3)</b>	<b>8.33%</b>	<b>8%</b>	<b>6.66%</b>	<b>15%</b>



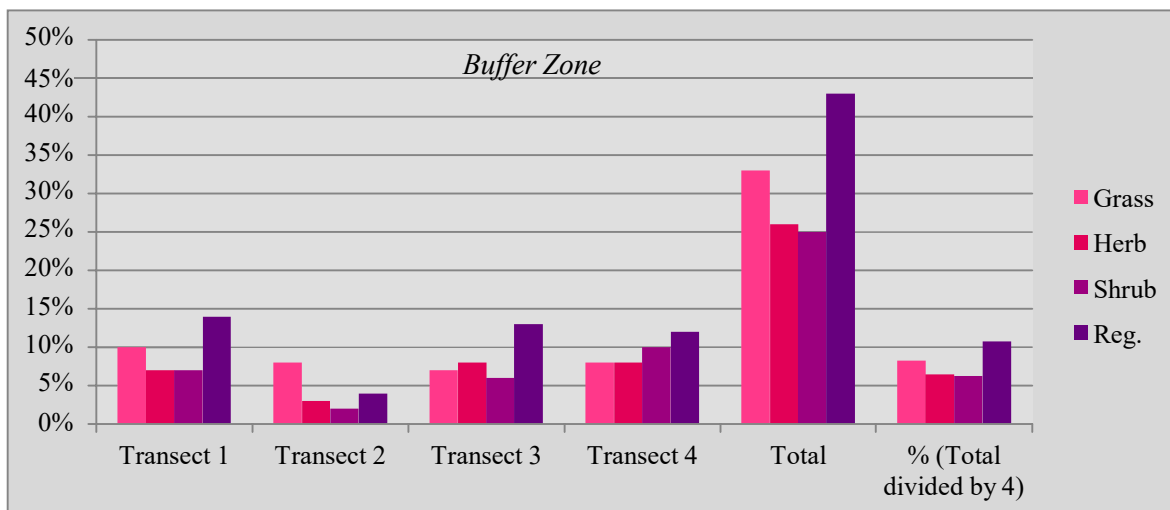
**Graph 4.12: Vegetation composition of core zone**

**4.3.4 Buffer zone:**

The buffer zone of mining area is situated in 5-10 km distance from the core mining boundary. The floral vegetation diversity of buffer zone is illustrated in graph 4.13 and tabulated in table no 4.14.

**Table No 4.14: Vegetation percentage of buffer zone.**

<b>Transect No.</b>	<b>Grass</b>	<b>Herb</b>	<b>Shrub</b>	<b>Reg.</b>
<b>1</b>	10%	7%	7%	14%
<b>2</b>	8%	3%	2%	4%
<b>3</b>	7%	8%	6%	13%
<b>4</b>	8%	8%	10%	12%
<b>Average</b>	<b>33%</b>	<b>26%</b>	<b>25%</b>	<b>43%</b>
<b>% (Total average divided by 7)</b>	<b>8.25%</b>	<b>6.50%</b>	<b>6.25%</b>	<b>10.75%</b>



**Graph 4.13: Vegetation composition of buffer zone**

### 4.3.5 Avifauna

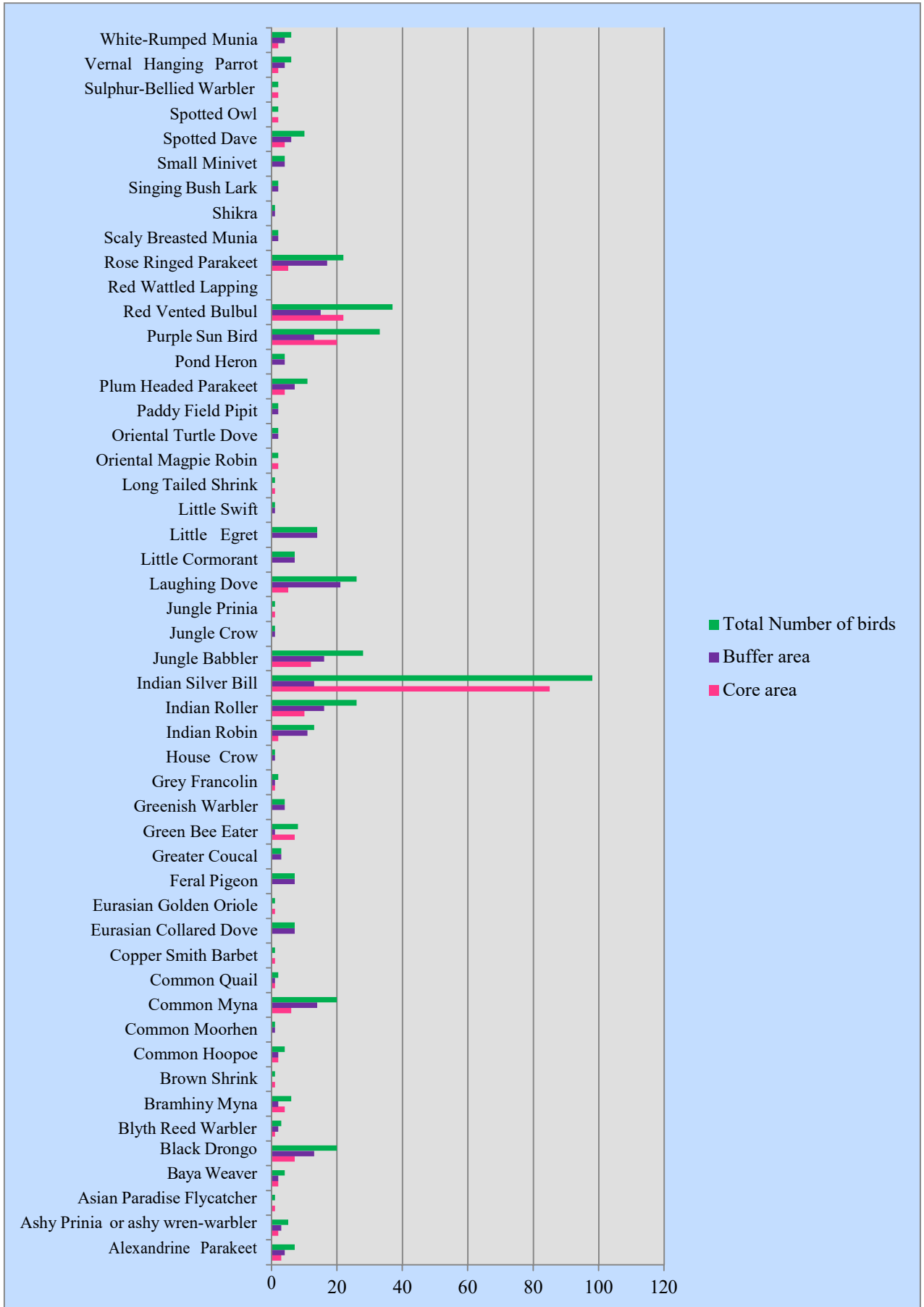
According to seasonal survey, 472 individual belongs to 50 different species has been recorded. As per recorded data, the population of avifauna dominated by Indian Pond Heron, Black Drongo, Red Vented Bulbul, Indian Roller and Common Myna etc. Mostly the birds found during the survey are endemic and resident. The avifaunal diversity of mining area are tabulated in table no 4.15 and graph 4.14.

**Table No 4.15: Checklist of avifauna recorded in the mining area**

S. No	Common Name	Local Name	Scientific Name	Family	IUCN Status	Core zone	Buffer zone	No of birds
1	Alexandrine Parakeet	Parrot, Tota	<i>Psittacula eupatria</i>	Psittacidae	NT	3	4	7
2	Ashy Prinia or ashy wren-warbler	-----	<i>Prinia socialis</i>	Cisticolidae	LC	2	3	5
3	Asian Paradise Flycatcher	-----	<i>Terpsiphone paradisi</i>	Monarchidae	LC	1		1
4	Baya Weaver	Gaurai ya	<i>Ploceus philippinus</i>	Ploceidae	LC	2	2	4
5	Black Drongo	Karrauna	<i>Dicrurus macrocercus</i>	Dicruridae	LC	7	13	20
6	Blyth Reed Warbler	-----	<i>Acrocephalus dumetorum</i>	Acrocephalidae	LC	1	2	3
7	Bramhiny Myna	Maina	<i>Sturnia pagodarum</i>	Sturnidae	LC	4	2	6
8	Brown Shrink	-----	<i>Lanius cristatus</i>	Laniidae	LC	1		1
9	Common Hoopoe	-----	<i>Upupa epops</i>	Upupidae	LC	2	2	4
10	Common Moorhen	-----	<i>Gallinula chloropus</i>	Rallidae	LC		1	1
11	Common Myna	Salhai /desimyna	<i>Acridotheres tristis</i>	Sturnidae	LC	6	14	20
12	Common Quail	Titar	<i>Coturnix coturnix</i>	Phasianidae	LC	1	1	2

13	Copper Smith Barbet	-----	<i>Psilopogon haemacephalus</i>	Megalaimidae	LC	1		1
14	Eurasian Collared Dove	Padki	<i>Streptopelia decaocto</i>	Columbidae	LC		7	7
15	Eurasian Golden Oriole	-----	<i>Oriolus oriolus</i>	Oriolidae	LC	1		1
16	Feral Pigeon	Kabutar	<i>Columba livia domestica</i>	Columbidae	LC		7	7
17	Greater Coucal	Koyal	<i>Centropus sinensis</i>	Cuculidae	LC		3	3
18	Green Bee Eater	Patinga	<i>Merops orientalis</i>	Meropidae	LC	7	1	8
19	Greenish Warbler	-----	<i>Phylloscopus trochiloides</i>	Phylloscopidae	LC		4	4
20	Grey Francolin	-----	<i>Francolinus pondicerianus</i>	Phasianidae	LC	1	1	2
21	House Crow	Kauaa	<i>Corvus splendens</i>	Corvidae	LC		1	1
22	Indian Robin	Chirak	<i>Saxicoloides fulicatus</i>	Muscicapidae	LC	2	11	13
23	Indian Roller	Nilkanth/teohara	<i>Coracias benghalensis</i>	Coraciidae	LC	10	16	26
24	Indian Silver Bill	-----	<i>Euodice malabarica</i>	Estrildidae	LC	85	13	98
25	Jungle Babbler	Satbhaya	<i>Turdoides striata</i>	Leiotherichidae	LC	12	16	28
26	Jungle Crow	Koua	<i>Corvus culminatus</i>	Corvidae	LC		1	1
27	Jungle Prinia	-----	<i>Prinia sylvatica</i>	Cistacolidae	LC	1		1
28	Laughing Dove	Padki	<i>Spilopelia senegalensis</i>	Columbidae	LC	5	21	26
29	Little Cormorant	-----	<i>Microcarbo niger</i>	Phalacrocoracidae	LC		7	7
30	Little Egret	Kokda	<i>Egretta garzetta</i>	Ardeidae	LC		14	14
31	Little Swift	-----	<i>Apus affinis</i>	Apodidae	LC		1	1
32	Long Tailed Shrike	-----	<i>Lanius schach</i>	Laniidae	LC	1		1
33	Oriental Magpie Robin	-----	<i>Copsychus saularis</i>	Muscicapidae	LC	2		2
34	Oriental Turtle Dove	-----	<i>Streptopelia orientalis</i>	Columbidae	LC		2	2
35	Paddy Field Pipit	-----	<i>Anthus rufulus</i>	Motacillidae	LC		2	2
36	Plum Headed Parakeet	Tota/Sua	<i>Psittacula cyanocephala</i>	Psittacidae	LC	4	7	11
37	Pond Heron	bagula	<i>Ardeola grayii</i>	Ardeidae	LC		4	4
38	Purple Sun Bird	-----	<i>Nectarania asiatica asiatica</i>	Nectariniini	LC	20	13	33
39	Red Vented Bulbul	Fikkadlow	<i>Pycnonotus cafer</i>	Pycnonotidae	LC	22	15	37
40	Red Wattled Lapping	-----	<i>Vanellus indicus</i>	Charadriidae				
41	Rose Ringed Parakeet	Tota/Sua	<i>Psittacula krameri</i>	Psittaculidae	LC	5	17	22
42	Scaly Breasted Munia	-----	<i>Lonchura punctulata</i>	Estrildidae	LC		2	2
43	Shikra	Cheel	<i>Accipiter badius</i>	Accipitridae	LC		1	1
44	Singing Bush Lark	-----	<i>Mirafra javanica</i>	Alaudidae	LC		2	2

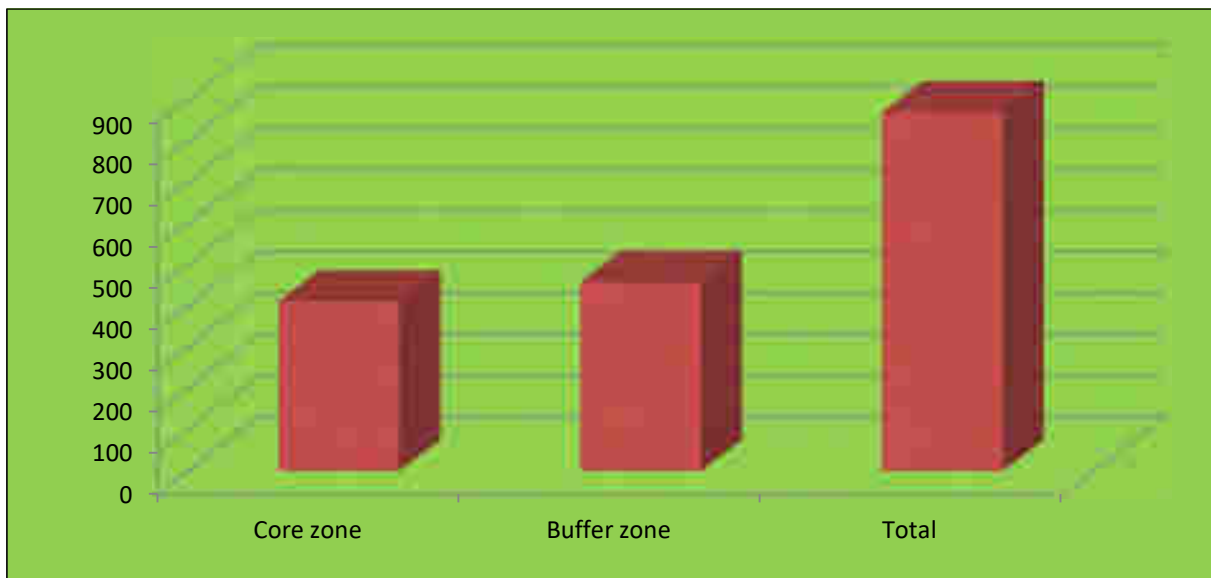
45	Small Minivet	-----	<i>Pericrocotus cinnamomeus</i>	Campephagidae	LC		4	4
46	Spotted Dove	Padki	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC	4	6	10
47	Spotted Owl	Ullu	<i>Strix occidentalis</i>	Strigidae	NT	2		2
48	Sulphur-Bellied Warbler	-----	<i>Phylloscopus griseolus</i>	Acrocephalidae	LC	2		2
49	Vernal Hanging Parrot	Tota	<i>Loriculus vernalis</i>	Psittaculidae	LC	2	4	6
50	White-Rumped Munia	-----	<i>Lonchura striata</i>	Estrildidae	LC	2	4	6
<b>Total</b>						<b>221</b>	<b>251</b>	<b>472</b>



Graph 4.14: Overview of recorded avifauna

**Table No.4.16 Birds population difference between core and buffer zone**

Number of birds		
Core zone	Buffer zone	Total
411	458	869



**Graph No.4.15 Birds population difference between core and buffer zone**

#### 4.4 Faunal Diversity of Study Site

Geomorphology of the region affects the occurrence of wild animals. Composition of species depends directly upon the plant and vegetative composition and climatic condition in habitats.

As per the reference available in working plans and field data collection, the faunal diversity status has been recorded as follows Elephant, Sloth bear, Cheetal, Barking dear, Rabbit, Monkey, Jungle Cat, Rat, Wild Bore, Mangoose, Indian Porcupin etc.

Study also focused on to identify the presence of animals belonging to IUCN red list categories. Study done based on secondary data and field visit & ground thruthing on interaction with local people. The faunal diversity data have been recorded during the field survey of core and buffer zone have been tebulated in table given bellow



**Availability of Fauna in Study Site.**

SN	Local Name	English Name	Scientific Name
1	Udan Gilhari	Greheaded Flying squirrel	<i>Petaurista elegans</i>
2	Khargosh	Common Rabbit	<i>Lepus ruficaudatus</i>
3	Siyar	Jackal	<i>Canis aurus</i>
4	Gilhari	The Threestripeed Palm squirrel	<i>Funambulus palmarum</i>
5	Chamgadar	Shortnosed Fruit Bat	<i>Cynopterus sphinx</i>
6	Chital	Spotted Deer	<i>Axis axis</i>
7	Choocha	Field Rat	<i>Bandicota bengalensis</i>
8	Jangli Kutta	Indian wild Dog	<i>Cuon alpines</i>
9	Jangli suar	Indian wildboar	<i>Sus scrofa</i>
10	Nevla	Common Mongoose	<i>Herpestes edwardsi</i>
11	Bandar	Rhesus Macaque	<i>Macaca Mulata</i>
12	Kotri	Barking Deer	<i>Muntiacus muntjak</i>
13	Bhalu	Sloth bear	<i>Melursus ursinus</i>
14	Lakad baggha	Striped hyaena	<i>Hyaena hyaena</i>
15	Lomdi	Indian Fox	<i>Vulpes bengalensis</i>
16	Langur	Common Langur	<i>Presbytis antellus</i>
17	Shahi	Indian Porcupine	<i>Hystrix indica</i>
18	Hathi	Indian Elephant	<i>Elephas Maximus indicus</i>

## CHAPTER 5

### RESULT AND DISCUSSION

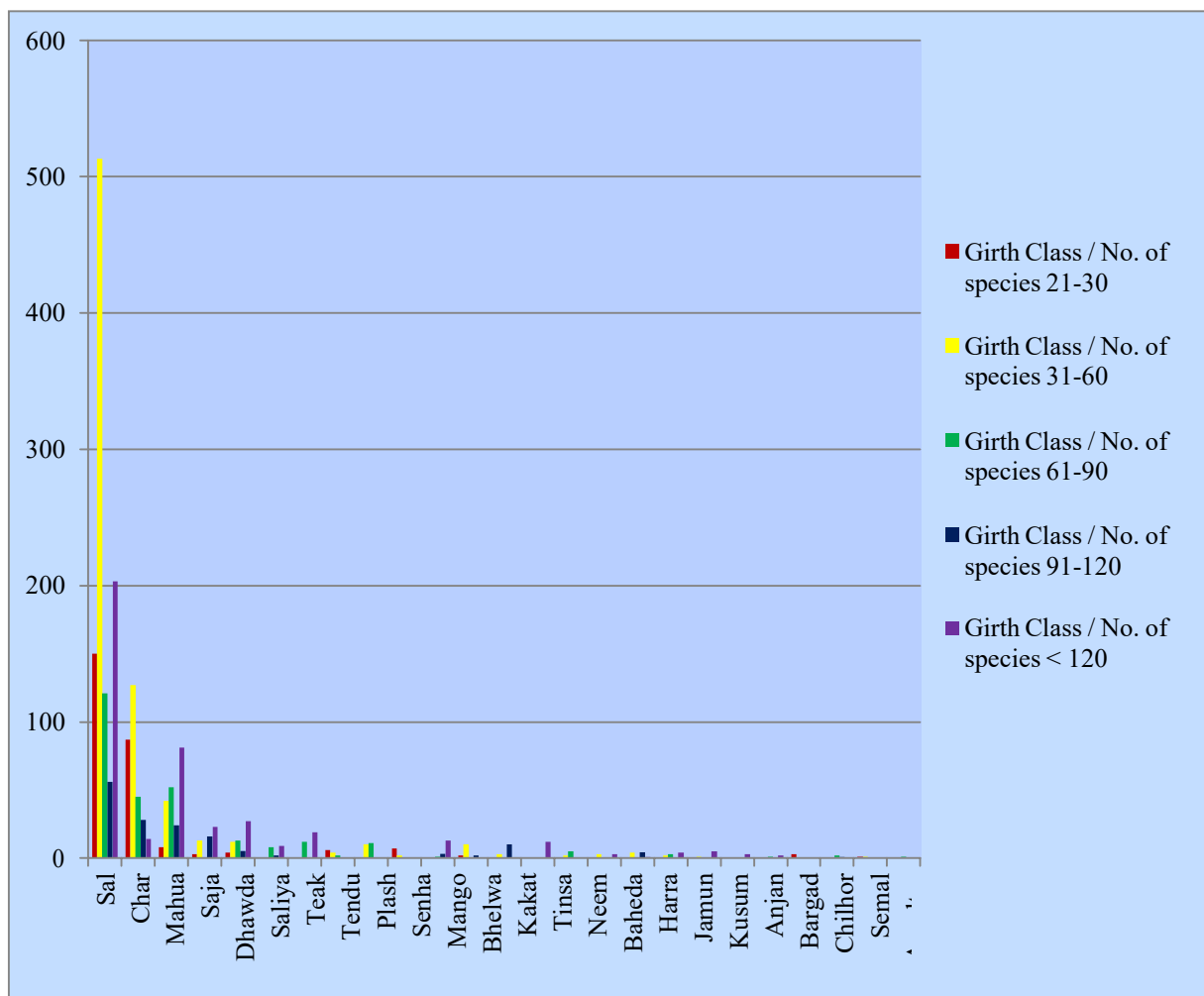
#### 5.1 Floral diversity of study site

On the basis of the field survey (as discussed above in chapter 4) the study have been revealed that the core and buffer zone vegetation of proposed area for excavation are mainly surrounded by dominated tree species i.e. Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Teak (*Tectona grandis*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Koriya (*Pinus koraiensi*), Plash (*Butea monosperma*), Baheda (*Terminalia bellerica*), Harra (*Terminalia chebula*), Kekad (*Garuga pinnata*), Tendu (*Diospyros melanoxylon*), Dhawda (*Anogeissus latifolia*) and Amaltas (*Cassia fistula*) etc. The floral diversity data have been recorded during the seasonal field survey of core and buffer zone have been tabulated in table no.5.1

**Table No 5.1. Floral diversity along with girth class in study site**

Summary of available tree species in 130 sample plot (Total area = 40480.8 m square)								
S. no.	Tree Species	Girth Class						Regeneration Status
		21-30	31-60	61-90	91-120	< 120	Total	Up to 20 cm
1	Sal	150	513	121	56	203	1043	27
2	Char	87	127	45	28	14	301	66
3	Mahua	8	42	52	24	81	207	4
4	Saja	3	13	0	16	23	55	0
5	Dhawda	4	12	13	5	27	61	8
6	Koriya	0	0	0	0	0	0	41
7	Saliya	0	0	8	2	9	19	0
8	Teak	0	0	12	0	19	31	3
9	Tendu	6	4	2	0	0	12	12
10	Plash	0	10	11	0	0	21	0
11	Senha	7	2	0	0	0	9	12
12	Mango	0	0	1	3	13	17	0
13	Bhelwa	2	10	0	2		14	0
14	Kakat	0	3	0	10	0	13	0
15	Tinsa	0	0	0	0	12	12	0
16	Neem	0	2	5	0	0	7	3
17	Baheda	0	3	0	0	3	6	3
18	Harra	0	4	0	4	1	9	0
19	Jamun	0	2	3	0	4	9	0
20	Kusum	0	1	0	0	5	6	0

21	Anjan	0	0	0	0	3	3	0
22	Bargad	0	0	1	0	2	3	0
23	Chilhor	3	0	0	0	0	3	0
24	Semal	0	0	2	1	0	3	0
25	Amaltas	1	1	0	0	0	2	0
26	Mahaneem	0	0	1	0	0	1	0
<b>Area details : Total number of transect = 26 ; Total number of plots = 26 x 5 = 130 ; Area of one sample plot = 314.16 m Square</b>								



**Graph No. 5.1 Floral diversity along with girth class of study site**

The table below shows the total numbers of 58 tree species which have been recorded through three seasonal surveys including Sal, Char, Mahua and Tendu which have been mostly found in the study area.

**Table No.5.2 Floral diversity of study site**

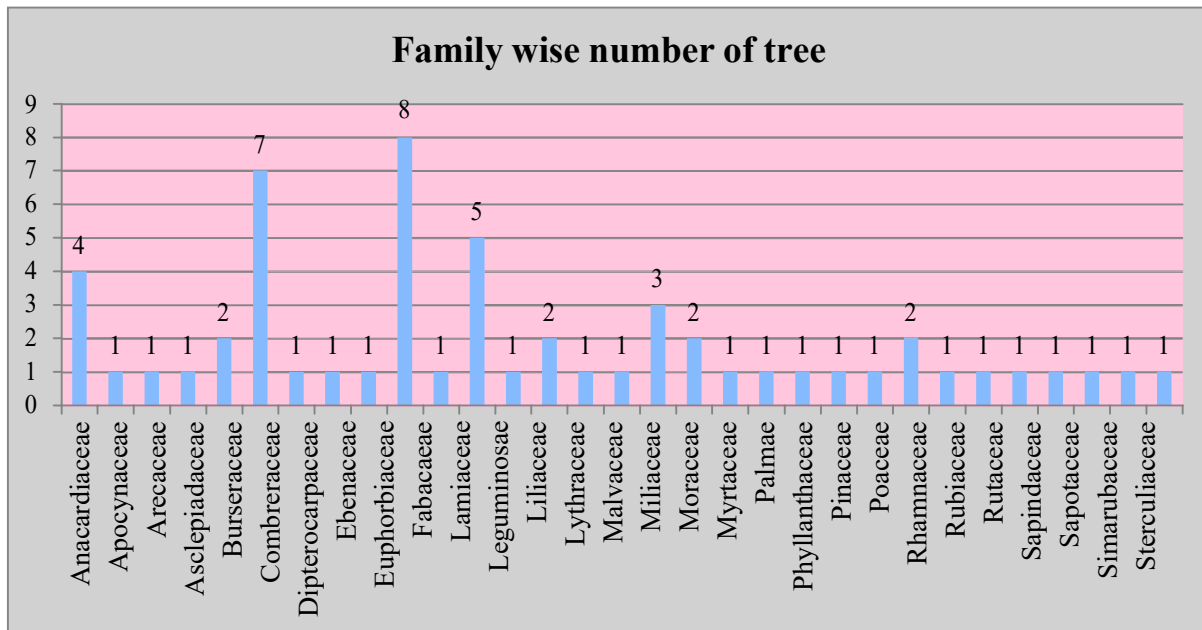
S. N	Local Name	Common Name	Botanical name	family
1.	Aam	Mango	<i>Mangifera indica</i>	Ancardiaceae
2.	Amaltash	amaltash	<i>Cassia fistula</i>	Fabaceae

3.	Amla	Aonla	<i>Phyllanthus emblica</i>	Phyllanthaceae
4.	Arkasiya	Arkasiya	<i>acacia mangium</i>	Fabaceae
5.	Ashan	Saja	<i>Terminalia tomentosa</i>	Combretaceae
6.	Bad	Bargad	<i>Ficus benghalensis</i>	Moraceae
7.	Bahera	Bahera	<i>Terminalia bellerica</i>	Combretaceae
8.	Bakli, Dhau	Dhawra	<i>Anogeissus latifolia</i>	Combretaceae
9.	Bamoor/Bamri	Babul	<i>Acacia arabica</i>	Leguminosae
10.	Bel	Beal	<i>Aegle marmelos, correa.</i>	Rutaceae
11.	Ber	Ber	<i>Zizyphus mauritiana</i>	Rhamnaceae
12.	Bhelwa	Bhelwa	<i>Semecarpus anacardiam</i>	Anacardiaceae
13.	Bhirra	Bhirra	<i>Chloroxylon swietenia</i>	Miliaceae
14.	Bija	Bija	<i>Pterocarpus marsipium</i>	Fabaceae
15.	Chhind	Khajur	<i>Phoenix dactylifera</i>	Arecaceae
16.	Chirol	Chirol	<i>Holoptelea integrifolia</i>	Ulmaceae
17.	Chironji	Char	<i>Buchanania lanzan</i>	Anacardiaceae
18.	Chui	Chind	<i>Phoinex acaulis</i>	Palmae
19.	Dhawai	Dhawai	<i>Woodfordia fruticosa</i>	Lythraceae
20.	Dhawda	Dhawra	<i>Anogeissus latifolia</i>	Combretaceae
21.	Dumar	Gular	<i>Ficus glomerata</i>	Moraceae
22.	Gamari	Khamar	<i>Gmelina arborea</i>	Verbenaceae
23.	Harra	Harra	<i>Terminalia chebula</i>	Combretaceae
24.	Imli	Imli	<i>Tamarindus indica</i>	Fabaceae
25.	Jamun	Jamun	<i>Syzygium cumini</i>	Myrtaceae
26.	Kachnar	Kachnar	<i>Bauhinia variegata</i>	Leguminosae
27.	Kaju	Kaju	<i>Anacardium occidentale</i>	Anacardiaceae
28.	Karam	Haldu	<i>Adina cordifolia</i>	Rubiaceae
29.	Karanj	Karanj	<i>Pongamia pinnata</i>	Fabaceae
30.	Kasai	Kashi	<i>Bridelia retusa</i>	Euphorbiaceae
31.	Kauha	Arjun	<i>Terminalia arjuna</i>	Combretaceae
32.	Kekad	Kekar	<i>Garuga pinnata</i>	Burseraceae
33.	Kem	Mundi	<i>Mitrangyna parviflora</i>	Rubiaceae
34.	Koriya	Koriya	<i>Pinus koraiensis</i>	Pinaceae
35.	Kossum	Kusum	<i>Schleichera oleosa</i>	Sapindaceae
36.	Kurru	kurru	<i>Sterculia urens</i>	Sterculiaceae
37.	Lathi Bans	Bamboo	<i>Dendrocalamus strictus</i>	Poaceae
38.	Madhar	Aak	<i>Calotropis gigantea</i>	Asclepiadaceae
39.	Mahaneem	Mahaneem	<i>Ailanthus excelsa</i>	Simarubaceae
40.	Mahua	Mahua	<i>Madhuca indica</i>	Sapotaceae
41.	Senha	Senha	<i>Lagerstoemia parviflora</i>	Lythraceae
42.	Neelgiri	Neelgiri	<i>Eucalyptus globulus</i>	Myrtaceae
43.	Neem	Neem	<i>Azadirachta indica</i>	Liliaceae
44.	Pakri	Pipal	<i>Ficus religiosa</i>	Moraceae
45.	Parsa	Palash	<i>Butea monosperma</i>	Fabaceae
46.	Pat koria, Kurchi	Koria	<i>Holarrhena antidysenterica</i>	Apocynaceae

47.	Safed Siris	Siris	<i>Albezia procera</i>	Fabaceae
48.	Kachnar	Kachnar	<i>Bauhinia variegata</i>	Fabaceae
49.	Sagaon	Teak	<i>Tectona grandis</i>	Lamiaceae
50.	Saja	Saja	<i>Terminallia tomentosa</i>	Combretaceae
51.	Salai	Salai	<i>Boswellia serrata</i>	Burseraceae
52.	Sarai	Sal	<i>Shorea robusta</i>	Dipterocarpaceae
53.	Semal	Semul	<i>Bombax ceiba</i>	Malvaceae
54.	Senha	Senha	<i>Lagerstoemia parviflora</i>	Lythraceae
55.	Shisham	Shisham	<i>Dalbergia latifolia</i>	Leguminosae
56.	Sissoo	Sissoo	<i>Dalbergia sissoo</i>	Leguminosae
57.	Tendu	Tendu	<i>Diospyros melanoxylon</i>	Ebenaceae
58.	Tilisa	Tilisa	<i>Ougeinia oojeinensis</i>	Leguminosae

Table No. 5.3 Family wise number of tree

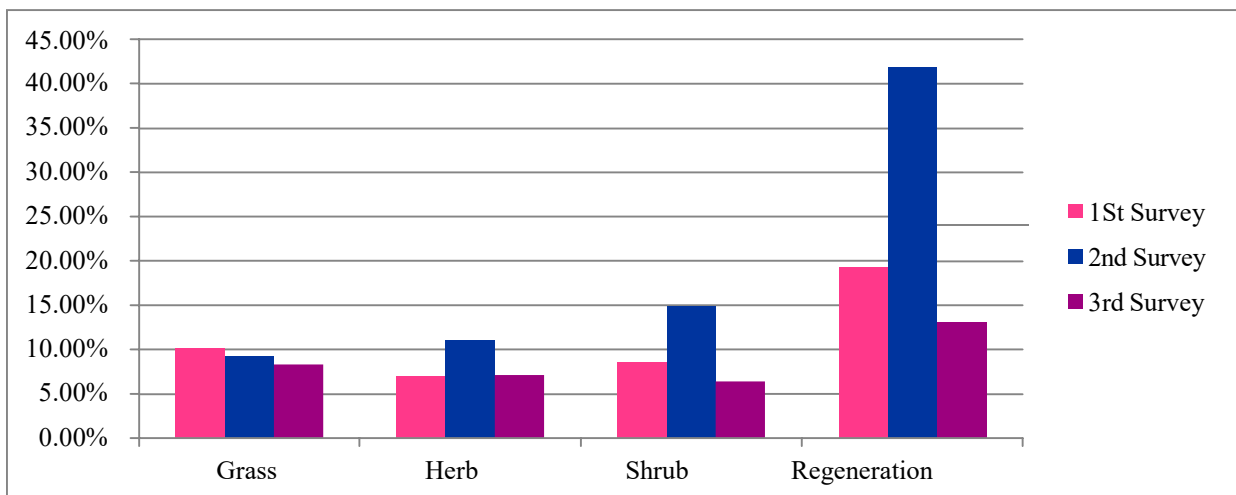
S. No.	Name of family	Number of tree species
1.	Anacardiaceae	4
2.	Apocynaceae	1
3.	Arecaceae	1
4.	Asclepiadaceae	1
5.	Burseraceae	2
6.	Combreraceae	7
7.	Dipterocarpaceae	1
8.	Ebenaceae	1
9.	Euphorbiaceae	1
10.	Fabaceae	8
11.	Lamiaceae	1
12.	Leguminosae	5
13.	Liliaceae	1
14.	Lythraceae	2
15.	Malvaceae	1
16.	Miliaceae	1
17.	Moraceae	3
18.	Myrtaceae	2
19.	Palmae	1
20.	Phyllanthaceae	1
21.	Pinaceae	1
22.	Poaceae	1
23.	Rhamnaceae	1
24.	Rubiaceae	2
25.	Rutaceae	1
26.	Sapindaceae	1
27.	Sapotaceae	1
28.	Simarubaceae	1
29.	Sterculiaceae	1
30.	Ulmaceae	1
31.	Verbenaceae	1



Graph No. 5.2 Family wise number of tree

Table no. 5.4 Seasonal vegetation covers at present in the study site

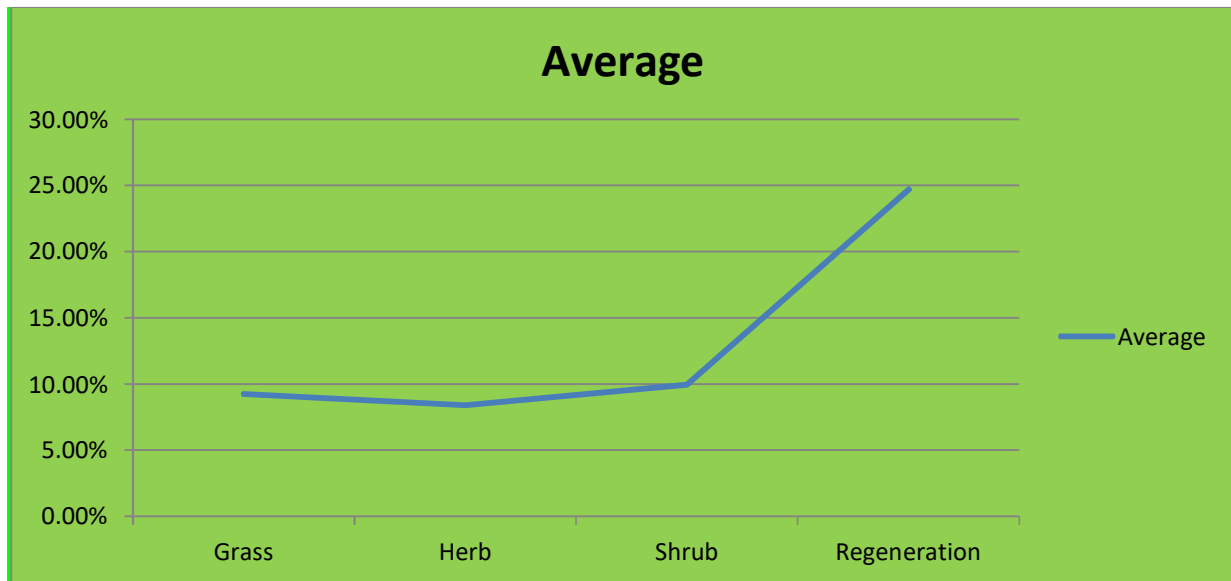
Vegetation	1st Survey	2nd Survey	3rd Survey
<b>Grass</b>	10.14%	9.33%	8.29%
<b>Herb</b>	7.00%	11.00%	7.20%
<b>Shrub</b>	8.57%	14.83%	6.45%
<b>Regeneration</b>	19.28%	41.83%	13.00%



Graph no. 5.3 Seasonal vegetation cover at present in the study site

Table no.5.5 Average vegetation at present in the study site

Vegetation	Average
<b>Grass</b>	<b>9.25%</b>
<b>Herb</b>	<b>8.40%</b>
<b>Shrub</b>	<b>9.95%</b>
<b>Regeneration</b>	<b>24.70%</b>



Graph No. 5.4 Average vegetation cover at present in the study site

## 5.2 Avifauna of OCP Chhal

According to three seasonal surveys, the avifauna populations have been recorded which are as, Summer season survey, total 405 individuals of 61 avifauna species, Winter season survey, total 776 individuals of 89 avifauna species and in Autumn season survey, 472 individuals of 50 avifauna species were recorded.

Overall from three seasonal surveys, total numbers of 1653 individual species of avifauna were recorded from 106 different species belongs to 32 families.

Table No.5.6 Checklist of availability of avifauna in the OCP Chhal

S. No.	Common Name	Local Name	Scientific Name	Family	IUCN Status
1.	Alexandrine Parakeet	Parrot, Tota	<i>Psittacula eupatria</i>	Psittacidae	NT
2.	Ashy Drongo	-----	<i>Dicrurus leucophaeus</i>	Dicruridae	LC
3.	Ashy Prinia or ashy wren-warbler	-	<i>Prinia socialis</i>	Cisticolidae	LC
4.	Asian Brown Flycatcher	--	<i>Muscicapa dauurica</i>	Muscicapidae	LC
5.	Asian Koel	Koel, Cuckoo	<i>Eudynamys scolopacea</i>	Cuculidae	LC
6.	Asian Paradise Flycatcher	-----	<i>Terpsiphone paradisi</i>	Monarchidae	LC
7.	Bank Myna	Myna	<i>Acridotheres ginginianus</i>	Sturnidae	LC
8.	Bar Headed Goose	-----	<i>Anser indicus</i>	Anatidae	LC

9.	Barn Swallow	-----	<i>Hirundo rustica</i>	Hirundinidae	LC
10.	Baya Weaver	Gauraiya	<i>Ploceus philippinus</i>	Ploceidae	LC
11.	Black Drongo	Karrauna	<i>Dicrurus macrocercus</i>	Dicruridae	LC
12.	Black Headed Oriole	-----	<i>Oriolus larvatus</i>	Oriolidae	LC
13.	Black Redstart	-----	<i>Phoenicurus ochruros</i>	Muscicapidae	LC
14.	Blue-Winged Leaf Bird	-----	<i>Chloropsis cochinchinensis</i>	Chloropseidae	NT
15.	Blyth Reed Warbler	-----	<i>Acrocephalus dumetorum</i>	Acrocephalidae	LC
16.	Bramhiny Myna	Maina	<i>Sturnia pagodarum</i>	Sturnidae	LC
17.	Bronze-Winged Jacana	-----	<i>Metopidius indicus</i>	Jacanidae	LC
18.	Brown Shrink	-----	<i>Lanius cristatus</i>	Laniidae	LC
19.	Cattle Egret	Gay Bagula	<i>Bubulcus ibis</i>	Ardeidae	LC
20.	Common Babbler	-----	<i>Turdoides caudate</i>	Lieothrichidae	LC
21.	Common Hawk Eagle	Cheel	<i>Hierococyx varius</i>	Cuculidae	LC
22.	Common Hoopoe	-----	<i>Upupa epops</i>	Upupidae	LC
23.	Common Kingfisher	Kilkila	<i>Alcedo atthis</i>	Alcedinidae	LC
24.	Common Moorhen	-----	<i>Gallinula chloropus</i>	Rallidae	LC
25.	Common Myna	Salhai/ desimyna	<i>Acridotheres tristis</i>	Sturnidae	LC
26.	Common Pochard	-----	<i>Aythya ferina</i>	Anatidae	VU
27.	Common quail	Titar	<i>Coturnix coturnix</i>	Phasianidae	LC
28.	Common Sandpiper	-----	<i>Actitis hypoleucos</i>	Scolopacidae	LC
29.	Common Tailor Bird	-----	<i>Orthotomus sutorius</i>	Cisticolidae	LC
30.	Common Teal	-----	<i>Anas crecca</i>	Anatidae	LC
31.	Copper Smith Barbet	-----	<i>Psilopogon haemacephalus</i>	Megalaimidae	LC
32.	Cotton Teal	-----	<i>Nettapus coromandelianus</i>	Anatidae	LC
33.	Crimson Backed sunbird or Small Sunbird	-	<i>Leptocoma minima</i>	Nectariniidae	LC
34.	Eagle Owl	Ullu	<i>Bubo bubo</i>	Strigidae	LC
35.	Eurasian Collared Dove	Padki	<i>Streptopelia decaocto</i>	Columbidae	LC
36.	Eurasian Coot	-----	<i>Fulica atra</i>	Rallidae	LC
37.	Eurasian Golden Oriole	-----	<i>Oriolus oriolus</i>	Oriolidae	LC
38.	European Turtle Dove	Padki	<i>Streptopelia turtur</i>	Columbidae	VU
39.	Feral Pigeon	Kabutar	<i>Columba livia domestica</i>	Columbidae	LC
40.	Gadwall	-----	<i>Mareca strepera</i>	Anatidae	LC
41.	Grater Spotted Eagle	-----	<i>Clanga clanga</i>	Accipitridae	VU
42.	Great Thick Knee	-----	<i>Esacus recurvirostris</i>	Burhinidae	NT
43.	Greater Coucal	Koyal	<i>Centropus sinensis</i>	Cuculidae	LC



44.	Greater Cormorant	-----	<i>Phalacrocorax carbo</i>	Phalacrocoracidae	LC
45.	Greater Flame Back Woodpecker	Katpodva	<i>Dryocopus martius</i>	Picidae	LC
46.	Green Bee Eater	Patinga	<i>Merops orientalis</i>	Meropidae	LC
47.	Greenish Warbler	-----	<i>Phylloscopus trochiloides</i>	Phylloscopidae	LC
48.	Grey Francolin	-----	<i>Francolinus pondicerianus</i>	Phasianidae	LC
49.	House Crow	Kauaa	<i>Corvus splendens</i>	Corvidae	LC
50.	House Sparrow	Gouriaya	<i>Passer domesticus</i>	Passeridae	LC
51.	Indian Barn Owl	-	<i>Tyto alba</i>	Tytonidae	LC
52.	Indian Courser	-----	<i>Cursorius coromandelicus</i>	Glareolidae	LC
53.	Indian Cuckoo	-----	<i>Cuculus micropterus</i>	cuculidae	LC
54.	Indian Nuthatch	-	<i>Sitta castanea</i>	Sittidae	LC
55.	Indian Pitta	-----	<i>Pitta brachyura</i>	Pittidae	LC
56.	Indian Pond Heron	Khokho bakli	<i>Ardeola grayii</i>	Ardeidae	LC
57.	Indian Pygmy Woodpecker	-	<i>Yungipicus nanus</i>	Picidae	LC
58.	Indian Robin	Chirak	<i>Saxicoloides fulicatus</i>	Muscicapidae	LC
59.	Indian Roller	Nilkanth/teohra	<i>Coracias benghalensis</i>	Coraciidae	LC
60.	Indian Silver Bill	-----	<i>Euodice malabarica</i>	Estrildidae	LC
61.	Indian Spotted Dove	Padki	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC
62.	Jungle Babbler	Satbhaiya	<i>Turdoides striata</i>	Leiotherichidae	LC
63.	Jungle Bush Quail	Titar	<i>Perdica asiatica</i>	Phasianidae	LC
64.	Jungle Crow	Koua	<i>Corvus culminatus</i>	Corvidae	LC
65.	Jungle Myna	Maina	<i>Acridotheres fuscus</i>	Sturnidae	LC
66.	Jungle Prinia	-----	<i>Prinia sylvatica</i>	Cisticolidae	LC
67.	Laughing Dove	Padki	<i>Spilopelia senegalensis</i>	Columbidae	LC
68.	Lesser Flame Back	-----	<i>Dinopium benghalense</i>	Picidae	LC
69.	Lesser Whistling Duck	-----	<i>Dendrocygna javanica</i>	Anatidae	LC
70.	Little Bittern	-----	<i>Ixobrychus minutus</i>	Ardeidae	LC
71.	Little Cormorant	-----	<i>Microcarbo niger</i>	Phalacrocoracidae	LC
72.	Little Egret	Kokda	<i>Egretta garzetta</i>	Ardeidae	LC
73.	Little Swift	-----	<i>Apus affinis</i>	Apodidae	LC
74.	Long tailed Minivet		<i>Pericrocotus ethologus</i>	Campephagidae	LC
75.	Long Tailed Shrike	-----	<i>Lanius schach</i>	Laniidae	LC
76.	Oriental Magpie Robin	-----	<i>Copsychus saularis</i>	Muscicapidae	LC
77.	Oriental Turtle Dove	-----	<i>Streptopelia orientalis</i>	Columbidae	LC
78.	Oriental White Eye	-----	<i>Zosterops palpebrosus</i>	Zosteropidae	LC
79.	Paddy Field Pipit	-----	<i>Anthus rufulus</i>	Motacillidae	LC
80.	Plain Prinia	-----	<i>Prinia inornata</i>	Cisticolidae	LC

81.	Plum Headed Parakeet	Tota/Sua	<i>Psittacula cyanocephala</i>	Psittacidae	LC
82.	Purple Sun Bird	-----	<i>Nectarania asiatica asiatica (Latham)</i>	Nectariniini	LC
83.	Rain Quail	Quail	<i>Coturnix coromandelica</i>	Phasianidae	LC
84.	Red Avadavat	-	<i>Amandava amandava</i>	Estrildidae	LC
85.	Red Crested Pochard	-----	<i>Netta rufina</i>	Anatidae	LC
86.	Red Vented Bulbul	Fikkadlow	<i>Pycnonotus cafer</i>	Pycnonotidae	LC
87.	Red Wattled Lapping	-----	<i>Vanellus indicus</i>	Charadriidae	
88.	Rose Ringed Parakeet	Tota/Sua	<i>Psittacula krameri</i>	Psittaculidae	LC
89.	Rufous Tree Pie	-----	<i>Dendrocitta vagabunda</i>	Corvini	LC
90.	Scaly Breasted Munia	-----	<i>Lonchura punctulata</i>	Estrildidae	LC
91.	Shikra	Cheel	<i>Accipiter badius</i>	Accipitridae	LC
92.	Singing Bush Lark	-----	<i>Mirafra javanica</i>	Alaudidae	LC
93.	Singing Bush Lark	-	<i>Mirafra javanica</i>	Alaudidae	LC
94.	Sirkeer Malkoha	-----	<i>Taccocua leschenaultii</i>	Cuculidae	LC
95.	Small Minivet	-----	<i>Pericrocotus cinnamomeus</i>	Campephagidae	LC
96.	Spot Bill Duck	-----	<i>Anas poecilorhyncha</i>	Anatidae	LC
97.	Spotted Dave	-----	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC
98.	Spotted Owl	Ullu	<i>Strix occidentalis</i>	Strigidae	NT
99.	Sulphur-Bellied Warbler	-----	<i>Phylloscopus griseolus</i>	Acrocephalidae	LC
100.	Thick Billed Flower Pecker	-----	<i>Dicaeum agile</i>	Dicaeidae	LC
101.	Verditer Flycatcher	-----	<i>Eumyias thalassinus</i>	Muscicapidae	LC
102.	Vernal Hanging Parrot	-----	<i>Loriculus vernalis</i>	Psittaculidae	LC
103.	White Throated Kingfisher	Kilkila	<i>Halcyon smyrnensis</i>	Alcedinidae	LC
104.	White-Rumped Munia	-----	<i>Lonchura striata</i>	Estrildidae	LC
105.	Yellow Wattled lapwing	-	<i>Vanellus malabaricus</i>	Charadriidae	LC
106.	Yellow-Footed Green Pigeon	Kabootar	<i>Treron phoenicoptera</i>	Columbidae	LC

**Extinct (EX)** – Beyond reasonable doubt that the species is no longer extant.

**Extinct in the wild (EW)** – Survives only in captivity, cultivation and/or outside native range, as presumed after exhaustive surveys.

**Critically endangered (CR)** – In a particularly and extremely critical state.

**Endangered (EN)** – Very high risk of extinction in the wild, meets any of criteria A to E for Endangered.

**Vulnerable (VU)** – Meets one of the 5 red list criteria and thus considered to be at high risk of unnatural (human-caused) extinction without further human intervention.

**Near threatened (NT)** – Close to being at high risk of extinction in the near future.

**Least concern (LC)** – Unlikely to become extinct in the near future.

**Data deficient (DD)**

**Not evaluated (NE)**

Biodiversity is under threat worldwide and birds are the prime victim of the declining trend of biodiversity. It was observed that many of the birds recorded in OCP Chhal are enlisted in the threatened categories of IUCN as well as in the schedules of wild life (Protection) Act, 1972.

The conservation status of birds according to IUCN, and the wildlife (Protection) Act, 1972, along with their local status is presented in the table.

During field visit, total 106 bird species have been found in which 99 bird species are Least Concerned (LC), 3 birds species are Vulnerable (VU) and 4 bird species are Near threatened as per IUCN list (Table no-5.6).

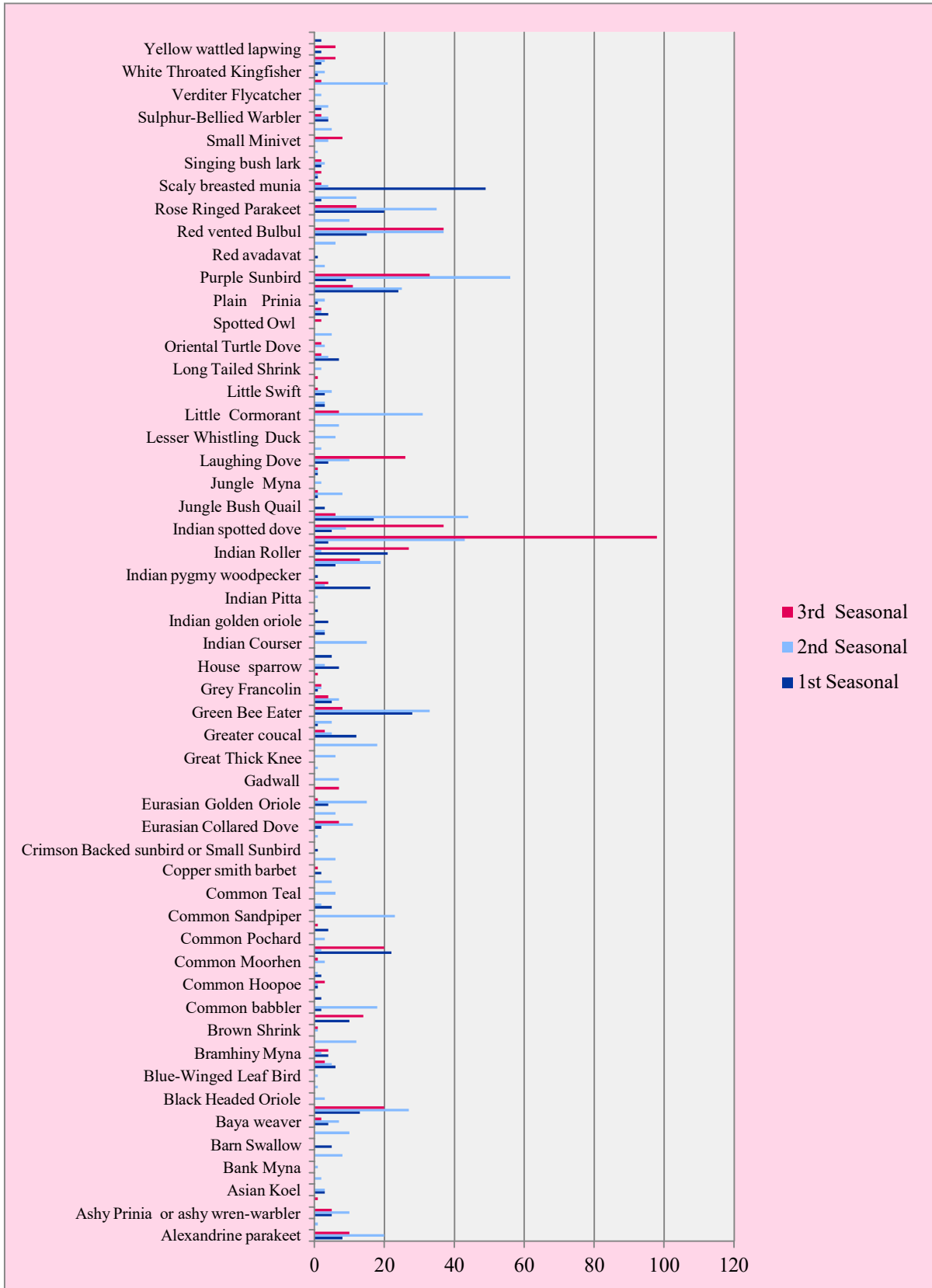
**Table No. 5.7 Checklist of total no. of birds species at present in OCP Chhal**

S.No.	Common Name	Number of birds			Total
		1 <sup>st</sup> Seasonal	2 <sup>nd</sup> Seasonal	3 <sup>rd</sup> Seasonal	
1	Alexandrine Parakeet	8	7	7	22
2	Ashy Drongo	-	1		1
3	Ashy Prinia or ashy wren-warbler	5	10	5	20
4	Asian Brown Flycatcher	-	-	1	1
5	Asian Koel	3	3	-	6
6	Asian Paradise Flycatcher	-	2	1	3
7	Bank Myna	-	1	-	1
8	Bar Headed Goose	-	8	-	8
9	Barn Swallow	5	-	-	5
10	Barn Swallow	-	10	-	10
11	Baya Weaver	4	7	4	15
12	Black Drongo	13	27	20	60

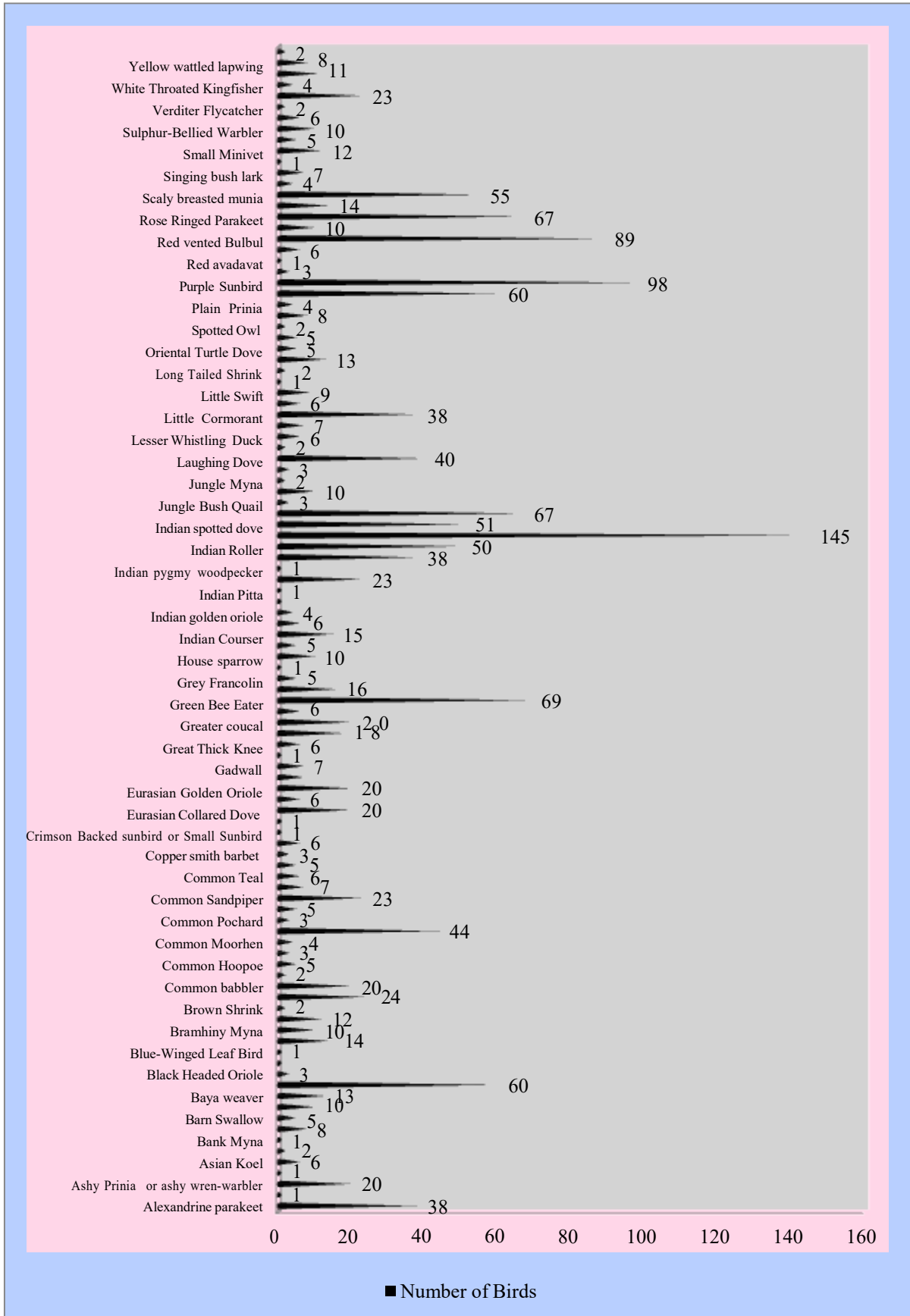
13	Black Headed Oriole	-	3	-	3
14	Black Redstart	-	1	-	1
15	Blue-Winged Leaf Bird	-	1	-	1
16	Blyth Reed Warbler	6	5	3	14
17	Bramhiny Myna	4	2	6	12
18	Bronze-Winged Jacana	-	12	-	12
19	Brown Shrink	-	1	1	2
20	Cattle Egret	10	-	0	10
21	Common Babbler	2	24	-	26
22	Common Hawk Eagle	2	-	-	2
23	Common Hoopoe	1	1	4	6
24	Common Kingfisher	2	1	-	3
25	Common Moorhen		3	1	4
26	Common Myna	22	4	20	46
27	Common Pochard	-	3	-	3
28	Common Quail	4	-	2	6
29	Common Sandpiper	-	23	-	23
30	Common Tailor Bird	5	2	-	7
31	Common Teal	-	6	-	6
32	Copper Smith Barbet	-	5		5
33	Copper Smith Barbet	2	-	1	3
34	Cotton Teal	-	6	-	6
35	Crimson Backed Sunbird or Small Sunbird	1	-	-	1
36	Eagle Owl	-	1	-	1
37	Eurasian Collared Dove	2	11	7	20
38	Eurasian Coot	-	6	-	6
39	Eurasian Golden Oriole	4	15	1	20
40	Feral Pigeon	-	-	7	7
41	Gadwall	-	7	-	7
42	Grater Spotted Eagle	-	1	-	1
43	Great Thick Knee	-	6	-	6
44	Greater Cormorant	-	18	-	18
45	Greater Coucal	12	5	3	20
46	Greater Flame Back Woodpecker	1	5	-	6
47	Green Bee Eater	28	33	8	69
48	Greenish Warbler	5	7	4	16
49	Grey Francolin	1	2	2	5
50	House Crow	-	-	1	1
51	House Sparrow	7	3	-	10
52	Indian Barn Owl	5	-	-	5
53	Indian Courser	-	15	-	15
54	Indian Cuckoo	3	3	-	6

55	Indian Golden Oriole	4	-	-	4
56	Indian Nuthatch	1	-	-	1
57	Indian Pitta	-	1	-	1
58	Indian Pond Heron	16	3	4	23
59	Indian Pygmy Woodpecker	1	-	-	1
60	Indian Robin	6	19	13	38
61	Indian Roller	21	2	26	49
62	Indian Silver Bill	4	43	98	145
63	Indian Spotted Dove	5	9	10	24
64	Jungle Babbler	17	44	28	89
65	Jungle Bush Quail	3	-	-	3
66	Jungle Crow	1	8	1	10
67	Jungle Myna	-	2	-	2
68	Jungle Prinia	1	1	1	3
69	Laughing Dove	4	10	26	40
70	Lesser Flame Back	-	2	-	2
71	Lesser Whistling Duck	-	6	-	6
72	Little Bittern	-	7	-	7
73	Little Cormorant	-	31	7	38
74	Little Egret	3	3	14	20
75	Little Swift	3	5	1	9
76	Long Tailed Minivet	-	-	1	1
77	Long Tailed Shrink	-	2	1	3
78	Oriental Magpie Robin	7	4	2	13
79	Oriental Turtle Dove	-	3	2	5
80	Oriental White Eye	-	5	-	5
81	Spotted Owl	-	-	2	2
82	Paddy Field Pipit	4	2	2	8
83	Plain Prinia	1	3	-	4
84	Plum Headed parakeet	24	25	11	60
85	Purple Sunbird	9	56	33	98
86	Rain Quail	-	3	-	3
87	Red avadavat	1	-	-	1
88	Red Crested Pochard	-	6	-	6
89	Red vented Bulbul	15	37	37	89
90	Red Wattled Lapping	-	10	-	10
91	Rose Ringed Parakeet	20	35	22	77
92	Rufous Tree Pie	2	12	-	14
93	Scaly Breasted Munia	49	4	2	55
94	Shikra	1	1	1	3
95	Singing Bush Lark	2	3	2	7
96	Sirkeer Malkoha	-	1	-	1
97	Small Minivet	-	4	4	8
	Spotted Owl			2	2

<b>98</b>	Spot Bill Duck	-	<b>5</b>	-	<b>5</b>
<b>99</b>	Sulphur-Bellied Warbler	<b>4</b>	<b>4</b>	<b>2</b>	<b>10</b>
<b>100</b>	Thick Billed Flower pecker	<b>2</b>	<b>4</b>	-	<b>6</b>
<b>101</b>	Verditer Flycatcher	-	<b>2</b>	-	<b>2</b>
<b>102</b>	Vernal Hanging Parrot	-	<b>21</b>	<b>2</b>	<b>23</b>
<b>103</b>	White Throated Kingfisher	<b>1</b>	<b>3</b>		<b>4</b>
<b>104</b>	White-Rumped Munia	<b>2</b>	<b>3</b>	<b>6</b>	<b>11</b>
<b>105</b>	Yellow Wattled Lapwing	<b>2</b>	-	<b>6</b>	<b>8</b>
<b>106</b>	Yellow-Footed Green Pigeon	<b>2</b>	-	-	<b>2</b>
<b>Total</b>		<b>405</b>	<b>776</b>	<b>472</b>	<b>1653</b>

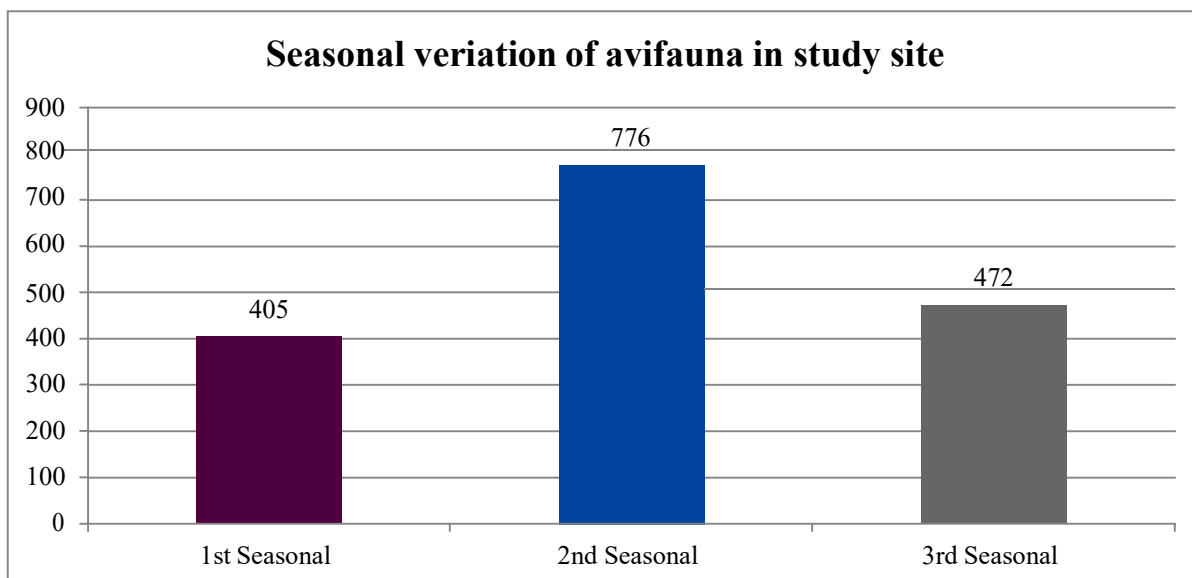


**Graph 5.5: Seasonal variation of individual birds species**



Graph: 5.6 Species variation of avifauna



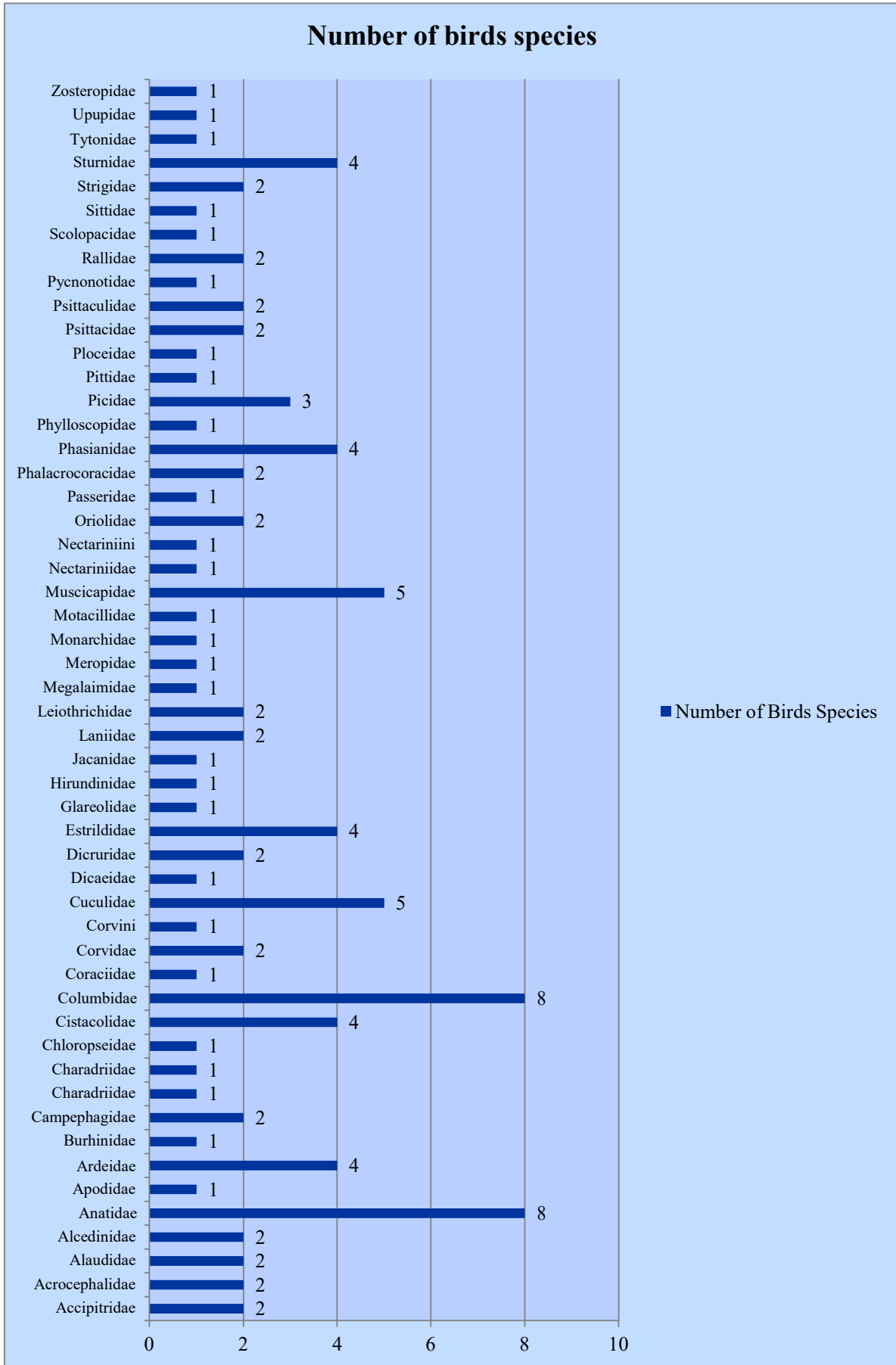


**Graph: 5.7 Seasonal variations of avifauna in study site**

**Table No. 5.8 Checklist of birds' species according to their family**

S.No.	Family name	Number of birds species
1	Accipitridae	2
2	Acrocephalidae	2
3	Alaudidae	2
4	Alcedinidae	2
5	Anatidae	8
6	Apodidae	1
7	Ardeidae	4
8	Burhinidae	1
9	Campephagidae	2
10	Charadriidae	1
11	Charadriidae	1
12	Chloropseidae	1
13	Cistacolidae	4
14	Columbidae	8
15	Coraciidae	1
16	Corvidae	2
17	Corvini	1
18	Cuculidae	5
19	Dicaeidae	1
20	Dicruridae	2
21	Estrildidae	4
22	Glareolidae	1
23	Hirundinidae	1
24	Jacaniidae	1
25	Laniidae	2
26	Leiothrichidae	2
27	Megalaimidae	1
28	Meropidae	1

29	Monarchidae	1
30	Motacillidae	1
31	Muscicapidae	5
32	Nectariniidae	1
33	Nectariniini	1
34	Oriolidae	2
35	Passeridae	1
36	Phalacrocoracidae	2
37	Phasianidae	4
38	Phylloscopidae	1
39	Picidae	3
40	Pittidae	1
41	Ploceidae	1
42	Psittacidae	2
43	Psittaculidae	2
44	Pycnonotidae	1
45	Rallidae	2
46	Scolopacidae	1
47	Sittidae	1
48	Strigidae	2
49	Sturnidae	4
50	Tytonidae	1
51	Upupidae	1
52	Zosteropidae	1



Graph: No. 5.8 Checklist of birds species according to their family

### 5.3 Faunal Diversity of OCP Chhal

Geomorphology of the region affects the occurrence of wild animals. Composition of species depends directly upon the plant and vegetative composition and climatic condition in habitats.

As per the reference available in working plans and field data collection, the faunal diversity status has been recorded as follows Elephant, Sloth bear, Cheetal, Barking deer, Rabbit, Monkey, Jungle Cat, Rat, Wild Bore, Mongoose, Indian Porcupin etc.

Study also focused on to identify the presence of animals belonging to IUCN red list categories. Study done based on secondary data and field visit & ground thruthing on interaction with local people. The faunal diversity data have been recorded during the field survey of core and buffer zone have been tebulated in table no. 5.9.

**Table no. 5.9 Avaibility of Fauna in OCP Chhal.**

SN	Local Name	English Name	Scientific Name
1	Udan Gilhari	Greheaded Flying squirrel	<i>Petaurista elegans</i>
2	Khargosh	Common Rabbit	<i>Lepus ruflicaudatus</i>
3	Siyar	Jackal	<i>Canis aurus</i>
4	Gilhari	The Threestripeed Palm squirrel	<i>Funambulus palmarum</i>
5	Chamgadar	Shortnosed Fruit Bat	<i>Cynopterus sphinx</i>
6	Chital	Spotted Deer	<i>Axis axis</i>
7	Choocha	Field Rat	<i>Bandicota bengalensis</i>
8	Jangli Kutta	Indian wild Dog	<i>Cuon alpines</i>
9	Jangli suar	Indian wildboar	<i>Sus scrofa</i>

Nevla	Common Mongoose	<i>Herpestes edwardsi</i>
Bandar	Rhesus Macaque	<i>Macaca Mulata</i>
Kotri	Barking Deer	<i>Muntiacus muntjak</i>
Bhalu	Sloth bear	<i>Melursus ursinus</i>
Lakad baggha	Striped hyaena	<i>Hyaena hyaena</i>
Lomdi	Indian Fox	<i>Vulpes bengalensis</i>
Langur	Common Langur	<i>Presbytis antellus</i>
Shahi	Indian Porcupine	<i>Hystrix indica</i>
Hathi	Indian Elephant	<i>Elephas Maximus indicus</i>

#### 5.4 Discussion

During field visit, the area of Compartment number 477 (core zone) and 478 (buffer zone) have been surveyed in which total 26 transects were made to study the existing avifauna of the area and their habitat including wildlife and existing flora.

As per survey and the referance available in working plans and field data collection total 19 mammals (table no 5.9) has been recorded. Based on Divisional records and data collections, the Elephant movements and presence of seen in maximum parts of the Chhal Forest area. The Elephants are noticed as area atjoining of the Forest area of Raigarh and Korba Divisions.

After three seasonal surveys, total 1653 individual species of avifauna were recorded from 106 different species belong to 32 families. (Table no.5.7 and graph 5.5).

According to three seasonal surveys, the avifauna populations have been recorded which are as; Summer season survey, total 405 individuals of 61 avifauna species; Winter season survey, total 776 individuals of 89 avifauna species; and in Autumn season survey, 472 individuals of 50 avifauna species were recorded.

It has been found that there are certain species of birds in the study area that have been classified under different threat categories by the IUCN status. Of these, *Clanga clanga*, *Streptopelia turtur* and *Aythya farina* was placed in the Vulnerable (VU) category, *Strix occidentalis*, *Esacus recurvirostris*, *Chloropsis cochinchinensis*, *Psittacula eupatria* were placed in the Near Threatened category and all the remaining species (n = 99) are placed in the Least concern category (Table no. 5.6)

Apart from the above survey technique, the study of working plan report of Raigarh - Dharamjaigarh Forest Division have been done in which total 86 tree species and 121 species of birds have been mentioned. Chhal Ranges under Dharamjaigarh Forest Division have been found dense forest with Sal dominated forest. During the field survey, most of the bird nests were found in Sal species followed by Char then Mahua and Saja. In each interval, observation of birds and its counting, vegetation study, dominating tree species, birds nest & its pattern were documented in this report.

The impact of noise, air and land disturbance on the study site, affecting the diversity of bird population can be understood as follows. It was observed the bird diversity of the core area is lesser than that of the buffer area. It was also observed that major disturbances produced by sound and noise pollution in the core area, which affect bird diversity, are caused due to blasting, vehicle movement and anthropogenic pressure. Other disturbances observed are caused due to air pollution by mining dust, and habitat degradation due to tree felling and ground digging. The above problems of noise and air pollution are directly related to mining activities and decreasing of forests, which destroy the habitat of avifauna. Buffer area is rich with agriculture land and forestland, which may provide suitable habitat for birds, and they may settle down there (*Vishwakarma, et. al 2018*).

It was also observed that vegetation cover and avifauna population were mainly occupying the buffer areas. This observation shows that the avifaunal population presence in thicker vegetative covered areas is more than the lesser ones. The direct impacts on the living organisms of the mining area include

death of plants and animals due to mining activity or contact with toxic wastes and mine drainages, disturbance of wildlife habitat due to blasting and heavy machines. Indirect impacts may include changes in nutrient cycling, disruption of food chain and instability of ecosystem (*Gayatri et al 2010*). Therefore, it is accepted that biodiversity of flora and fauna needs essential amount of fresh atmosphere which is necessary for life.

Although grassland and scrub-species birds benefit from the early successive habitat development from post mining reclamation, forest-dwelling birds are adversely affected by land use change from forest to grassland, regardless of the origin of the changes. Concern has been expressed related to habitat loss for cerulean warblers in the Appalachian Mountains associated with deforestation from coal mining. (*Buechler et al.2006, wood et al.2006, Bulluck 2007*),

Similar observations have been found in the study area, the diversity of birds, and in particular the native species, is positively correlated with increasing structural complexity of the vegetation. Also a seasonal change in species diversity of birds occurs in forests due to their foraging behaviour (*Robertson and Hack well 1995*).

Forests attract a large number of avifauna because they provide suitable habitat for most birds, especially those birds that are associated with vegetation, and for most, the existence of tree is a vital component of their life cycle. The bird's level of interest on various forests depends on the age of the stands. The composition of bird species is highly related to the vegetation structure of forests (*Robertson and Hack well 1995*).

Accordingly, the alternative habitat development is proposed in the buffer zone for the conservation of avifauna. For better conservation measures artificial nesting trail is proposed for avifauna as per their habit, habitat, and behaviour and nesting pattern. The artificial nesting pattern and their designs are explained in the chapter 7.

The current status of avifauna as per their nesting pattern are categorized in eight parts which are Scrape nesting birds, Burrow nesting birds, Cavity nesting birds, Cup shaped nesting birds, Saucer/Plate form nesting birds, Platform nesting birds, Pendent nesting birds, Sphere shaped nesting birds found in the core zone of OCP Chhal. The data shows that the rich avifaunal diversity of OCP Chhal is good and alternative habitat is needed.

It is also observed that the vast majority of this studies conducted on wild life response have focused on birds and wildlife in part because birds are easily monitored using various count based survey. The effects of mining on avian communities occur initially by the removal of vegetation in preparation for mining. If the site is forested, vegetation removal occurs through timber harvest or clearing. Although few studies have been done specifically evaluate the changes associated with mine sites from pre-mining to post-mining land uses. (*Sallabanks et al. 2000.*)

This study also signifies that the seasonal variations in bird population were mostly found in winter season comparison to summer season and autumn seasons. The bird diversity is impacted by climate condition (Temperature) (*Waterhouse and Trapani, 2002*) According to *parsesan (2005)*, Weather conditions determine bird diversity by the spatial temporal shift of the species from one habitat to the other, seeking favourable condition. The highest diversity is in the forest due to the availability of food, water, breeding sites, breeding material and cover from predators. (*Hobson et al.2003*).

Therefore, the above discussion part shows the problems occurred in bird diversity and their habitat which were directly or indirectly affected from air, noise and land disturbance from mining activities. The whole reasonable parts should be solved from proper conservational practices attempted regarding biodiversity conservation of flora and fauna.



## CHAPTER 6

### WILDLIFE CONSERVATION PLAN AND RECOMMENDATIONS

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The forest cover in India is 21.34% of the total geographical area of the country out of which 4.89% treated as "Protected Areas" where no. of National parks, sanctuaries, conservation reserves and community reserves are notified.

The forest cover in the Chhattisgarh State is 55674 q. Km which is 41.18% of the state's geographical area.

It is a hard fact that mining activity leads to destruction of environment. It adversely affects air, water and land. Increased air and water pollution affects humans and also affects wildlife by destroying its habitat. The adverse effect is very far reaching in its impact.

The habitat cannot be restored to its pre-mining status. At best by active management its adverse effect can be minimized. The mitigation measures should include on the one hand villages situated in the vicinity of the mine, and wildlife habitats on the other.

Hence, the main objective of this plan is to mitigate the adverse effects of mining in the project area.

#### 6.1 CONSERVATION PLAN

**The Conservation plan consists of the following components**

- a) Mitigation Measures in the 15 affected villages in the vicinity of the mine.
- b) Mitigation Measures to minimise the impact of mining on the habitat of Wildlife mainly Elephant and Bears, and Avifauna.

##### 6.1.1 Impact Area

In the vicinity of the mine 15 villages namely Bangarsuta, Kudekela, Banhar, Rilo, Chuhkimar, Lath, Bojiya, Gadainabhri, Lamikhar, Bandhapali, Cheetapali, Puslda, Nawapara, Khedapali, Chhal. Each village will be allocated funds for developmental activities.

S.N.	PF		RF		Revenue	Villages
	Comp. No.	Area (Ha.)	Comp. No.	Area (Ha.)	Area (Ha.)	
1	538	261.99	543	129.46	28703.4	Bangarsuta, Kudekela, Banhar, Rilo, Chuhkimar, Lath, Bojiya, Gadainabhri, Lamikhar, Bandhapali, Cheetapali, Puslda, Nawapara, Khedapali, and Chhal.
2	537	167.29	542	249.86		
3	536	185.8	541	263.96		
4	525	127.25	539	210.97		
5	523	18.7	534	255.39		
6	524	47.56	535	216.33		
7	522	51.62	533	217.05		
8	521	38.43	532	166.25		
9	491	214.08	519	309.74		
10	501	15.7	575	114.4		
11	500	22.83	520	204.59		
12	499	20.27	518	206.23		
13	498	33.62	517	292.57		
14	495	142.07	502	359.32		
15	490	12.5	497	148.8		
16	488	51.3	496	230.63		
17	489	13.52	493	160.73		
18	487	39.31	494	31.7		
19	495	142.07	479	96.6		
20	486	62.7	477	258.94		
21	485	36.3	482	153.2		
22	484	53.47	483	117.97		
23	481	49.8	516	238.11		
24	480	11.97	514	154.7		
25	503	14.3	513	213.8		
26	504	60.3	512	233.5		
27	505	141.65	511	205.89		
28	506	70.98	510	202.62		
29	507	112.9	508	31.56		
30	509	17.45				
<b>Total</b>		<b>2237.73</b>		<b>5674.87</b>	<b>28703.4</b>	

Total impact area of Dharamjaigarh Division = 36616 ha.

## 6.2 CONSERVATION PLAN FOR FAUNA

Several reasons for the decline of wildlife and methods for their conservation are practiced. However the best method for the conservation of wild life is related directly to the maintenance of ecosystems in their natural condition, allowing their natural development and degree of protection afforded to the wildlife and their habitat. Both these phenomena (ecosystem development and habitat protection) are related to anthropogenic factors. Some of the important anthropogenic factors are listed below:

- ❖ Habitat fragmentation and destruction
- ❖ Man-animal conflict
- ❖ Forest fire
- ❖ Poaching
- ❖ Stake holders dependence on forest resources
- ❖ Creating awareness amongst forest stake holders
- ❖ Water scarcity

The plan for wild life conservation, with respect to above situations, is detailed as under:

### 6.2.1 Habitat improvement

The areas of Dharamjaygarh Division is home to Wild Elephants. There are certain pockets in which the Elephants mainly reside. They Cris-Cross various pockets through Elephant corridors. Hence, it is important to focus our efforts for improvement of habitat in these pockets and corridors. Wildlife Institute of India Dehradun has conducted a study on Elephants in various divisions of Sarguja Circle. In this study it was recommended that habitat improvement work such as plantation of trees and creation of water holes should not be done in the areas which are contiguous to human habitations. Waterholes and ponds should be dug in sufficient numbers.

Hence habitat improvements works should be taken-up in the areas where Elephants normally reside most period of the year. Our effort should be to confine

Elephant population in the areas away from the human habitaion so that men-elephant conflicts are minimized.

Wildlife has four basic needs: food, cover, water and space. The quality of these components determines the carrying capacity of the land- the maximum number of animals that can be supported in good conditions throughout the year. Carrying capacity changes by season and by year as a direct result of changes in forest habitat.

Some of the common trees to be planted for habitat improvement will include: *Terminalia tomentosa*, *Anogeissus latifolia*, *Madhuca latifolia*, *Buchanania lanzan*. Together with these some fruit yielding species should also be planted e.g. Mango, Tendu and Gular etc. *Ficus benghalensis* is also encountered in the forests but with a very low frequency, but is a flagship species and should be planted with similar frequency. To this it is important to add the plantation of aonla, which has almost disappeared from the area. The area vegetated with the local species will provide natural environment, food and shelter to the wild life attracting them more to the area. Some hideouts, suitable to different wildlife species, should also be created at suitable places.

### **6.2.2 Elimination of Man-animal conflict**

Due to mining activities the habitat of the elephants and bears will be severely streassed, thus leading to more number of man-animal conflicts. Awareness campaign about the behaviour of the elephants and bears should be carried out in the villages. Hathi mitradal should be constituted to constantly monitor the movement of the elephants and keep the villagers informed about this. Compansations for loss of human life, cattle, crops and property should be expedited.

### 6.3 CONSERVATION PLAN FOR ELEPHANT

Elephants are major agents of change and are often indicated as those large herbivores possessing the ability of changing entire ecosystems in terms of vegetation structure and composition, thereby affecting a whole series of other ecosystem components as well. The exclusive role of elephants as agents of change could thus far not be completely isolated from the multitude of factors involved in ecosystem dynamics.

Globally, wild elephants are present in 50 countries, 13 of which are in Asia and 37 in Africa. At present the number of wild Asian elephants (*Elephas maximus*) is between 35,000 and 50,000 ([www.elephantcare.org](http://www.elephantcare.org)), while the number in captivity is around 16,000. The trend in almost all Asian range states has been a drastic decline in wild elephant numbers, due to a range of anthropogenic factors related to increasing human population, loss and degradation of forest habitat, fragmentation of breeding populations and increasing human-elephant conflict (HEC).

The Asian elephant is categorized as an ‘endangered’ species in the red list of the World Conservation Union ([www.iucnredlist.org](http://www.iucnredlist.org)) and is classified with the Convention for International Trade of Endangered Species ([www.cites.org](http://www.cites.org)). They have declined from over 5 million animals located throughout the continent 100 years ago, to the current number confined to fragmented habitats in sub-Saharan regions. Whereas poaching for ivory and meat was a major reason for the decline in the past, loss of habitat is the biggest threat to their continued survival at present. Paradoxically, though, elephant numbers are increasing in some countries and may need to be controlled in order to prevent degradation of their habitats.

India holds by far the largest number of wild Asian elephants, estimated at about 26,000 to 28,000 or nearly 60% of the population of the species (Bist 2002). *Elephas maximus* is placed in Schedule I and Part I of Indian Wildlife Protection Act (1972)

Conferring it the highest level of protection. Wild elephants are presently distributed over an area of about 109,500 km<sup>2</sup> (Santiapillai and Sukumar, 2006); this is approximately 3% of India's geographical area. Adjacent to some of these areas, a segment of the elephant population killed an average of 350 people annually over the last five years (2005-2006 to 2009-2010) (Project Elephant), and damaged an average of 330 km<sup>2</sup> of crops every year for the last three years (2007-2008 to 2009-2010) (Project Elephant).

Northern Chhattisgarh in Central India has been home of Asian elephants since historical times. However, in the early part of the 20th century they became locally extinct (Singh, 2002). In 1988 elephants migrated from the prime elephant habitat of Jharkhand into Chhattisgarh and caused extensive damage to life and property. Since then, HEC cases have been increasing due to straying of migratory elephants in the state (Singh, 2002). The number of wild elephants in the year 2007-08 in the state estimated to be 122 (Moe, 2008). Major reason for prolonged stay of elephants in the state could be better forest cover (44 %), heavy mining, habitat degradation and deforestation in the states of Jharkhand and Orissa (Singh, 2002; Earth Matters Foundation, 2008). Even the state of Chhattisgarh is primarily inhabited by tribal communities dependent largely on agriculture and minor forest produce. Increasing human pressure on forested areas is resulting in increased incidences of human- elephant conflicts. This necessitated a detailed assessment of habitat suitability and dispersal corridor for elephants in the area.

### **6.3.1 Records of the Elephant's movement in Raigarh District**

During 19th century and earlier elephants were, recorded only from the northern part (Raigarh district) of the state but for unknown reasons the species left the area in the beginning of the 20th century. During this time the species was recorded from Raigarh District. However, the species re-entered the area of Chhattisgarh state, in 1980s, around the year 1986. The elephants then entered the area of Raigarh district, from Orissa state. In the beginning their entry was occasional, coming and going in to and out of the area. However, in later years their entry as well as their residence time, within the area of the state, has increased.

**At present, the study area of Chhal Range under Dharamjaigarh Forest Division has been observed the elephant movement**

Based on divisional records and data collection, the elephant movements and presence are seen in many parts of the division forest area, thus many ranges are under stress because of their movement.

The elephant movements are noticed as area adjoining to the forest area of Raigarh, Korba and Jashpur divisions. Mand river is the border of Korba



and Dharamjaygarh which happens to be very good habitat for elephants. Adjoining to river, the forests are rich in vegetation which fulfill food requirement of elephants.

The forest area and adjoining villages of Dharamjaygarh, Boro, Chhal, Bakaruma, Lelunga and Kapu forest ranges are affected by elephants since very long.

The villages which are badly affected and gone through many conflicts with elephants in Dharamjaigarh division are Bartagar, Semipali, Pandaripani, Khapnar, Chhuipahad, Sirki, Bagdandi, Newar, Jabga, Dahidaand, Karigadai, Chherchuchi, Chalha, Ganeshpur, Bijapatra, Ogn, Damas, Premnagar, Tendumundi, Jamjhor, Balpeda, Fatehpur, Bansajhar, Behramar, Banhar, Tendumundi, Chhal, Barbaspur, Krontha, Bojiya, Kudekela, Sherban, Amapali, Sithra, Haati, Bartapali, Khadgaon, Kamosindand, Auranala, Purunga, Mendharmar, Mendharmar, Dumarnara, Tejpur, Rerumakhurd, Barukhol, Nagdarha, Chidodih, Bansajhar, Gersa, Naraitikra, Amritpur, Baheramar, Potiya, Chhal, Kudukel, Munund Baheramar, Jalgaritikra, Munund, Chhapradand, Marghatipatra, Bonki, Pandopara, Chulhakhhol, Ogn, Tendumudi, Sagarpur, Dhaskamuda, Paremer, Jogda, Gerupani, Khadgaon, Kansabhar, Thakurpodi, Khajumohar, Purunga, Barbaspur, Koylar, Pandaripani, Samharsingha,

Nagdahra, Pusaudera, Dhodagaon, Bansajhar, Kudmura, Champa, Bayasi, Marghatipatra, Ginabahripara, Kukrikhoro, Chheramada, Khadgaon, Kharnitikra, Chuhkimar Kutera nala, Kansabhar, Suarlot, Kanchira, Tendumudi, Surpara, Ruaphool, Koylar, Lamikhar, Devrasdand, Khamhar Dhumaghat. Bojiyanawadih,



Patthalgaon, Patkura, Sagra dondmuda, Khalbora, Tendumudi, Jampali, Jamargidih, Bamhanpali, Tedhasemar, Narkalo, Dandkera, Parpatiya, Balepada. These villages have conquered by elephant movements and adjoining forest areas have gone through many human-conflicts. (Sorce-record of Dharamjaygarh division). Elephant movement data of last 22 year in Dharamjaigarh division is given below:-

SN	Period (year)	No. Elephants
1	2000	8 to 10
2	2001-2005	15 to 20
3	2006-2010	15 to 20
4	2011-2015	15 to 25
5	2016-2020	25 to 35
6	2021-2023	30 to 40



### Human - Elephant Conflict Incidences in Dharamjaigarh Division:

There are many incidences reported of Human- Elephant conflicts in Dharamjaygarh, Korba, Raigarh forest areas. In study area, which fall in Elephant corridors of Dharamjaygarh, Forest Divisions, many conflicts have been reported and recorded from time to time.

**Table No. 6. Loss of Lives in Attack of Elephants - Dharamjaygarh Forest Divisions**

SN	Year	Loss of Lives	Place of incidence/ Affected area	Forest Range
1	2001	3	Bartagar	Lelunga
2	2002	12	Semipali, Pandripani, Chhuipahad, Sirki, Bagdandi, Newar, Jabga, Dahidaand	Dharamjaigarh, Boro, Kapu
3	2003	2	Ganeshpur	Bakaruma
4	2004	3	Karigadai, Chherchuchi, Chalha	Dharamjaigarh, Boro
5	2005	3	Bijapatra, Oгна, Damas	Dharamjaigarh
6	2006	3	Sithara, Premnagar, Tendumundi	Dharamjaigarh, Chhal
7	2007	9	Jamjhor, Balpeda, Fatehpur, Bansajhar, Behramar, Banhar, Tendumundi, Chhal	Dharamjaigarh, Boro, Chhal
8	2008	3	Barbaspur, Krongha	Dharamjaigarh, Chhal
9	2009	1	Amaoali	Dharamjaigarh,
10	2010	4	Bojiya, Kudekela, Sherban	Dharamjaigarh, Chhal
11	2011	8	Sithra, Krongha, Haati, Kadgaon, Kamosi, ndand, Purunga	Dharamjaigarh, Chhal
12	2012	7	Mendharmar, Dumamara, Tejpur, Rerumakhud, Barukhol nagdarha, Chidodih, Bansajhar	Dharamjaigarh, Chhal, Boro, Bakaruma
13	2013	2	Gersa, Naraitira	Dharamjaigarh
14	2014	5	Sithra, Krongha, Bagdandi, Amritpur, Baheramar	Dharamjaigarh, Chhal
15	2015	8	Dharamjaygarh, Potiya, Chhal, Kudukela Dharamjaygarh, PF538, Krongha PF 566, Munund PF540, Baheramar PF548, Jalgaritikra	Dharamjaigarh, Chhal, Kapu

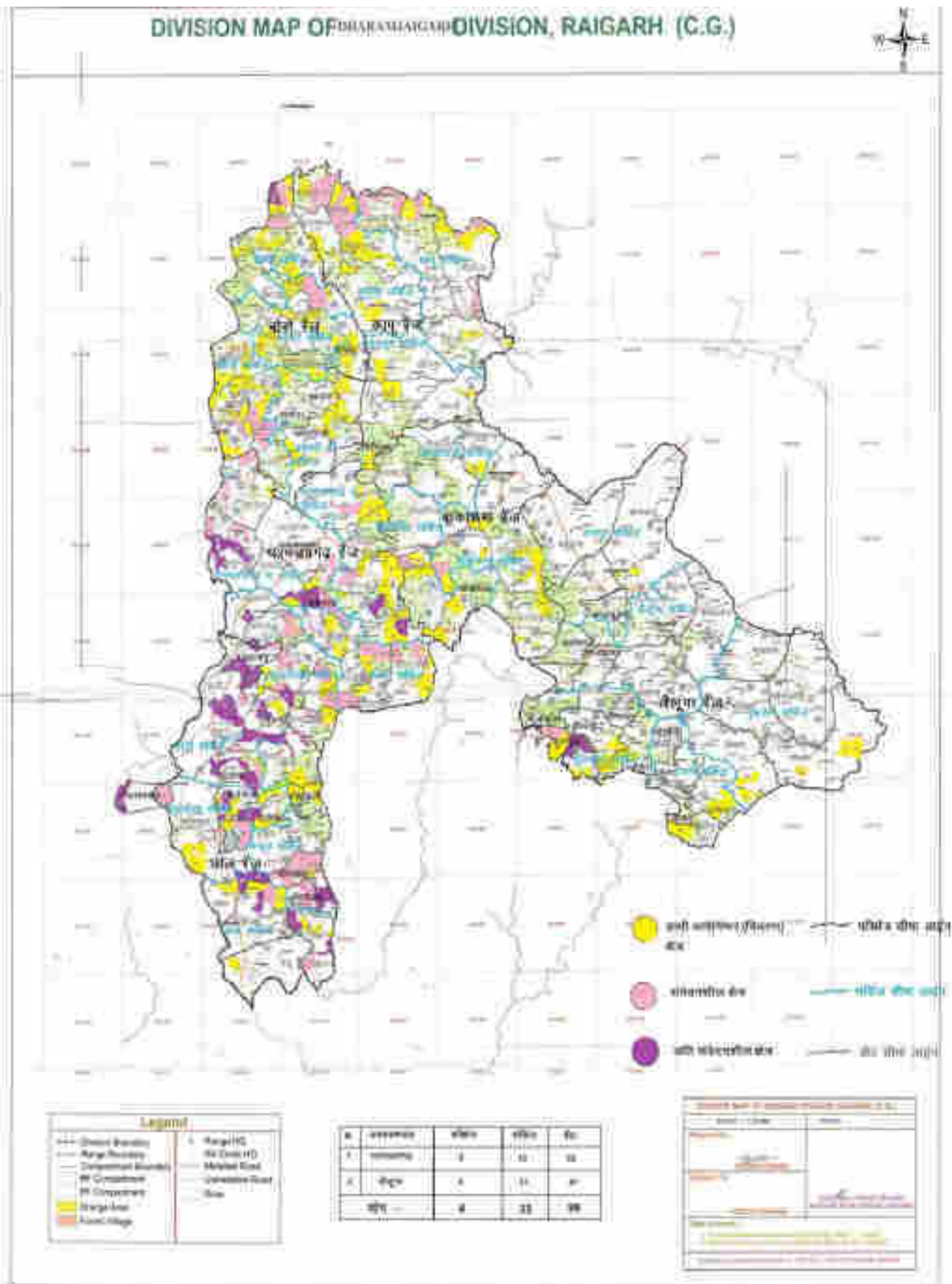
16	2016	8	Munund PF539, Chhapradand PF2, Marghatipatra PF548, Kapu, Bonki,Pandopara RF 176, Chulhakhhol, Bakaruma, Dharamjaygarh RF387, Ogna	Dharamjaigarh, Chhal, Kapu, Bakaruna, Lelunga
17	2017	14	Tendumudi near Haati PF561, Sagarpur,Baheramar, Dhaskamuda PF545, Paremer, Kapu RF 19, OA Jogda, Gerupani, Khadgaon PF590, Kansabhar PF506, Thakurpodi	Dharamjaigarh,Chhal, Kapu
18	2018	16	Khajumohar PF630, Purunga PF 560, Barbaspur, Koylar PF476, Pandaripani Samharsingha PF433, Nagdahra PF 413,Dahidand Pusaudera RF13, Dhodagaon Bansajhar OA,Baheramar PF546,Kudmura PF 554, Champa PF545, Bayasi Marghatipatra, Ginabahripa	Dharamjaigarh, Chhal, Kapu, Boro
19	2019	18	Baheramar RF57, Kukrikhoro, SemipaliChheramada PF594, Khadgaon Kharnitikra PF591, Chuhkimar Kutera nala PF519, Kansabhar Sukhanara PF513, Suarlot PF 543, Kanchira RF 705, Tendumudi, Surpara, Ruaphool, Koylar, Krontha PF454, Lamikhar Devrasdand, Bihar PF 516, Khamhar Dhumaghat PF630.	Dharamjaigarh, Chhal, Kapu, Boro
20	2020	10	Bojiyanawadih PF496, Patthalgaon sarsobadi RF26, Patkura RF17, Semipali, Chainpur RF433, Sagra dondmuda,Khalbora, Tendumudi RF562, Jampali Baheramar PF 550,Koylar, Jamargidih Hurkitoli.	Dharamjaigarh, Chhal, Kapu, Boro
21	2021	11	Bamhanpali RF293, Tedhasemar RF22,Baheramar PF549, Krontha PF454, Narkalo, Dandkera, Parpatiya,	Dharamjaigarh, Chhal, Kapu, Boro,Lelunga

			Balepada, Ogna	
22	2022	4	Chapkachhar, Medharmar, Chikhalapani, Chhatasari, Uparsalkheta	Dharamjaigarh, Kapu, Boro
<b>Total</b>		<b>154</b>		

**Table No. 6.2 Death of Wild Elephant in Dharamjaigarh Forest Division**

SN	Year	Elephant Death (No.)	Place of Death	Cause of Death	Forest Range
1	2005	1	Krontha	Due to Pneumonia	Dharamjaigarh
2	2006	1	RF1114	Due to Hepatitis	Chhal
3	2007	1	Chuhkimar	Electric current	Chhal
4	2008	0			
5	2009	1	PF287 Karmi pathra	Due to Hepatitis	Dharamjaigarh
6	2010	4	RF510, RF482, Salihari PF, Rajajungle	Electric current	Dharamjaigarh, Chhal
7	2011	4	Semipali, Munundpara and Bansajhar villages and forest area of Chhal Auranala	Electric current and illness, Sky lighting	Chhal
8	2012	8	Bakaruma, Ghoghranala, Bijapatra, Barbhauna, Kharra	Electric current and illness,	Dharamjaigarh, Chhal
9	2013	2	Sagarpur, Makkabari	Electric current	Dharamjaigarh,
10	2014	5	Khadgaon, Dholuama, Behramar, Khurru	Electric current, Natural Death	Dharamjaigarh, Chhal
11	2015	3	Jhumarmahua, Chuhkimar, Baheramar	Illness, Natural Death	Dharamjaigarh, Lelunga
12	2016	3	Ghoghratikra, Jhumarmahua, Dheknara	Electric current, Natural Death	Chhal, Kapu
13	2017	5	Ogna	Electric current,	Dharamjaigarh, Chhal
14	2018	5	Dahranala, Pandripani, Puroong,	Electric current, Natural Death	Dharamjaigarh, Chhal,

			Kronkha		Bakaruma
<b>15</b>	2019	<b>0</b>			
<b>16</b>	2020	<b>3</b>	Sarakhar, Beheramar,Mendhar mar	Electric current	Dharamjaigarh, Chhal,
<b>17</b>	2021	<b>4</b>	Sangapani, Hinjhar, Dharranala	Electric current, Natural Death	Dharamjaigarh, Chhal,
<b>18</b>	2022	<b>5</b>	Bhalumuda, Singhigadai, Jamabira,Haa ti,Jamghat	Natural Death	Lelunga,Chhal, Bakaruma, Dharamjaigarh
<b>19</b>	2023	<b>3</b>	Baiginjhariya,Gersa, Chuhkimar	Illness, Natural Death	Chhal, Dharamjaigarh
<b>Total</b>		<b>58</b>			



### 6.3.2 Important points in the conservation of elephants:

Following are some key points in the conservation of elephants:

- ❖ Require 150-250 kg of plant food every day, with preference for grasses.
- ❖ Evolved to a large size, with black color. The black color absorbs more heat.
- ❖ Lack sweat gland to dissipate the body heat, hence, require a shade in sunny days, or require frequent cooling through wallowing or spreading water over the body.
- ❖ Have very poor visibility particularly during night. Their eyes do not shine in the night, because of reduced number of cones, unlike the canines like tiger, leopard and even bovid like the cow.
- ❖ A good source of water is required also for drinking.
- ❖ Frequent dusting of the body or mud cover over the body is required to protect the body from the biting insects.
- ❖ Change in cropping pattern by introducing crops disliked by elephant or the plant which act as elephant repellent (e.g. Patchouli, (Pachouli) *Helianthus annuus* (Sunflower) *Capsicum annum* (Chilli) *Sesamum indicum* (Til) and Citrus should be promoted.

### 6.3.3 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<sup>2</sup>.

Dharamjaigarh Forest Division has elephant corridors. At any given time 40 to 50 elephants are resident in the forest of the divisions. It also has significance of bears and elephants.

Habitat Development for Elephant such as pasture development, digging of ponds etc. should be done in the areas which are far off from the villages. It should be done keeping in view the findings of the study conducted by Wildlife Institute of India, Dehradun.

### 6.3.4 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.

### 6.3.5 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.

### 6.3.6 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.

SN	Botanical Name	Local Name
1.	<i>Acacia catechu</i>	Khair
2.	<i>Acacia nilotica</i>	Babool
3.	<i>Aegle marmelos</i>	Bel
4.	<i>Albizzia lebbek</i>	Kala siris
5.	<i>Bambusa arundinacea</i>	Bans
6.	<i>Albizzia procera</i>	Safed siris
7.	<i>Bauhinia variegata</i>	Kachnar
8.	<i>Bauhinia vahlii</i>	Mahul
9.	<i>Bauhinia malabarica</i>	Khatua
10.	<i>Bombax ceiba</i>	Semal
11.	<i>Brachiaria sp.</i>	Ghas
12.	<i>Bridelia retusa</i>	Kasai
13.	<i>Careya arborea</i>	Kumhi
14.	<i>Cordia myxa</i>	Lassora
15.	<i>Cymbopogon flexuosus</i>	Ghas

16.	<i>Cynodon dactylon</i> Doob	Grass
17.	<i>Dalbergia sissoo</i>	Shisham
18.	<i>Dendrocalamus strictus</i>	Bans/ Bamboo
19.	<i>Desmostachya bipinnata</i>	Urai/Khus
20.	<i>Eleusine sp.</i>	Ghas
21.	<i>Emblica officinalis</i>	Amla
22.	<i>Eucalyptus spp</i>	Nilgiri
23.	<i>Eulaliopsis binata</i>	Bagai Ghas
24.	<i>Feronia elephantum</i>	Kaith
25.	<i>Ficus bengalensis</i>	Bargad/Bar
26.	<i>Ficus glomerata</i>	Dumar/Gular
27.	<i>Ficus religiosa</i>	Pipal
28.	<i>Ficus rumphii</i>	Duranga-hesa
29.	<i>Ficus infectoria</i>	Pakar
30.	<i>Flacourtia indica</i>	Kandai
31.	<i>Garuga pinnata</i>	Kekad
32.	<i>Grewia elastica</i>	Dhaman
33.	<i>Helicteres isora</i>	Ainthe
34.	<i>Holarrhena antidyenterica</i>	Korea
35.	<i>Ipomoea spp.</i>	Karmata
36.	<i>Imperata arundinacea</i>	Ulu
37.	<i>Kydia calycina</i>	Baranga/Pula
38.	<i>Lagerstroemia parviflora</i>	Senha/Sidha
39.	<i>Limonia acidissima</i>	Kaith
40.	<i>Mallotus philippinensis</i>	Sinduri/Rohini
41.	<i>Mimosa pudica</i>	Lajwanti
42.	<i>Mitragyna parvifolia</i>	Mudhi
43.	<i>Musa paradisiaca</i>	Banana
44.	<i>Neyraudia arundinacea</i>	Bichhloo
45.	<i>Oryza sativa</i>	Dhan
46.	<i>Ougeinia oojeinensis</i>	Tinsa
47.	<i>Phoenix humilis</i>	Buta Chhind
48.	<i>Pithecellobium dulce</i>	Jangal Jalebi
49.	<i>Randia dumetorium</i>	Mainphal
50.	<i>Saccharum munja</i>	Kandi-khar
51.	<i>Saccharum officinarum</i>	Ganna
52.	<i>Saccharum spontaneum</i>	Kans
53.	<i>Sansevieria sp.</i>	Sisal
54.	<i>Schleichera oleosa</i>	Kosam/Kusum
55.	<i>Shorea robusta</i>	Sarai/Sal
56.	<i>Syzygium cumini</i>	Jamun
57.	<i>Tamarindus indica</i>	Amla / Imli
58.	<i>Terminalia tomentosa</i>	Saja
59.	<i>Tectona grandis</i>	Sagaun / Teak
60.	<i>Tinospora cordifolia</i>	Giloe / Gurch
61.	<i>Thysanolaena agrostis</i>	Hathi ghas / Pirlu
62.	<i>Zizyphus mauritiana</i>	Bhander
63.	<i>Zizyphus xylopyra</i>	Ghont



The most commonly consumed species belong to family *Poaceae* and *Fabaceae* (17.65%) followed by *Moraceae* (14.71%). Elephants extensively feed on *Artocarpus heterophyllus*, *Syzygium cumini*, *Acacia nilotica*, *A. catechu*, *Dalbergia sissoo*, *Zizyphus mauritiana*, *Aegle marmelos* and *Ficus* species, besides various grasses and shrubs (Bhagat et al, 2017). *Saccharum spontaneum*, *Thysanolaena maxima* and fruit parts of *Dillenia indica*, are some of the other species recorded to be preferred by elephants. Some other food plants have been reported by the villagers of elephant moving areas of Chhattisgarh state. The list includes:

<i>Musa paradisiaca</i>	Kela	All the parts are edible.
<i>Oryza sativa</i>	rice	Eat very cleverly the fruiting part, only, in the barn yard they dismantle the heap of gathered rice.
<i>Saccharum officinarum</i>	Ganna	One of the most preferred food item.
<i>Dendrocalamus strictus</i>	Bamboo	All the parts are edible.
<i>Ficus benghalensis</i>	Bargad	Leaves and barks were eaten mostly.
<i>Ficus religiosa</i>	peepal	Leaves and barks were eaten mostly.
<i>Artocarpus heterophyllus</i>	Kathal	Fruits, leaves and barks were eaten mostly.
<i>Miliusa velutina</i>	Bhilwa	Leaves and barks were eaten mostly.
<i>Pterocarpus marsupium</i>	Bija	Barks were eaten mostly.
<i>Zea mays</i>	Makka	Whole plant's parts are eaten.
<i>Phoenix sylvestris</i>	Chhind	Rhizomes are edible.
<i>Phoenix acaulis</i>	Buta chhind	Rhizomes are edible.
<i>Buchanania lanzan</i>	Char	The saplings are up-rooted; the root is thrashed clean of soil and is then eaten.
<i>Goruga pinnata</i>	Kekad	Barks were eaten mostly.
<i>Carica papaya</i>	Papita	Whole plant's parts are eaten.

Some of the elephants develop fascination for country made alcoholic drinks called "Handia".

### 6.3.7 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.

### 6.3.8 Solution

Habitat destruction by man has threatened the survival of the Asian Elephant. Therefore; maintenance of the habitat is the first requirement in the conservation of the elephants. If proper habitat is absent or is below the desirable standard, then it may be developed. Elephants require, simultaneously, two types of habitats:

**a. Dense forest with tall trees and**

**b. Scrub jungle and grasslands dense forest is required as refuge and protection from intense sun rays**

Scrub and grasslands are required as a better feeding area. Tall trees are not a good source of food because their foliage and tender twigs are beyond the reach of elephant's trunk. It is only the fallen fruit and bark of such trees which can be eaten. It is generally difficult to peel off the bark from trees. In a scrub or grassland, it is easy to feed. The food item may be foliage, tender shoot, entire plant or even the root; all are within their easy reach. With respect to the area, there are two options for the conservation of the elephants:

- **Restrict the elephants in a defined area**
- **Develop a corridor for long, may be interstate, migration route.**

Development of a corridor far beyond the OCP Chhal Dhramjaigah mining lease area will be the best choice for the conservation of the species. The corridor, to be developed, must have both the dense forest with tall trees as well as shrubby areas. Now it depends upon the condition of the area to decide that the shrubby areas should be forming outer fringe to the tall tree area or should be in the middle or should be in patches in between the tall trees. The corridor belt should be of sufficient width and should be planned either away from the village settlements or the isolated houses near to their path should be shifted. Elephants require 150-200kg of food per head, per day. Habitat planning should include provisions to yield sufficient food. It is important now to decide about the plant species. The food plants should be of more liking type to the elephants. To keep the food plants within easy reach of the elephants, regular planting of new plants or pruning to stimulate coppicing, should be made. Some of the food plant species suggested to be planted in the area are:

*Dendrocalamus strictus*, (Bans) *D. Rhedhii* (Bans), *Bambusa arundinacea* (Bans), *Ficus benghalensis* (Bargad), *F. religiosa* (peepal), *F. glomerata* (Gular), *F. rumphii* (Jangali Bargad), *F. infectoria* (Pakar), *Artocarpus heterophyllus* (Kathal), *Milium velutina* (Bhilwa), *Pterocarpus marsupium* (Bija), *Phoenix sylvestris* (Chhind), *Phoenix acaulis* (Buta chhind), *Buchanania lanzan* (Char), *Feronia elephantum* (Kaith), *Goruga pinnata* (Kekad), *Thysanolaena agrostis* (Hathi ghas), *Cymbopogon flexuosus* (ghas), *Themeda quadrivalvis* (Ghas), *Iseilema laxum* (Ghas), *Bothriochloa pertusa* (Ghas), *Apluda mutica* (Ghas) etc. Bamboos (*Dendrocalamus strictus*, *Bambusa arundinacea*) are one group of fast growing plants which can form a good proportion of diet to the elephants. Another bamboo species *Dendrocalamus rhedii* will be an exotic species to the area but is common in Western Ghats. It has a thin stem. Elephants have special liking for the bamboo plant and it is easy to grow the plant in sufficient quantity in short time. However, it is not a species which can create any problem. The villagers in OCP Chhal area have informed that the elephants have special liking for *Buchanania lanzan*. The saplings of the plant are uprooted and the root thrashed clean and eaten. With the vegetation it is essential to develop perennial sources of water with some salt ponds, within the conservation area.

### 6.3.9 ELEPHANT CORRIDOR

There is a need to establish an elephant corridor, combining the Tamor-Pingla and Semarsot wildlife sanctuaries in Sarguja district and Badalkhol wildlife sanctuary in Jashpur district. Corridor will be developed to join these three wildlife sanctuaries. However, still no notification has been issued so far.

### 6.3.10 SOME SUGGESTIONS TO ESCAPE ELEPHANT DAMAGE

Methods adopted to escape elephant damage may be categorized as

#### ❖ Active and passive methods

##### Active methods

- Noise-making like shouting, drum beating, bursting fire crackers, firing gun shots into the air (by forest officials only),
- Using elephant torch light
- Pelting stones and lighted fuel-woods.

- Loudspeaker broadcasting of tiger roaring sound However, the major drawback of using all these methods is that these may provoke the raiding elephants increasing the possibility of more damage to the crops and other properties as well as higher risk to the farmer's life. Further, if the active methods fail to be effective, singly, then combined effort should be made.

### **Passive methods**

- Change in cropping pattern by introducing some elephant repellent alternative cash crops (e.g. Patchouli, *Helianthus annuus*, *Capsicum annum* and Citrus).
- Digging trenches around village area.
- Planting sisal (*Agave americana*) around village boundary.
- Solar fencing.
- Improvement of water sources.
- Raise/improve fodder resources.
- Fencing houses with GI wires.

Elephants avoid shining objects. GI wires are cheapest, shining objects to distract the elephants. Barbed wire fencing is gradually proving ineffective in preventing the movement of elephants. In the buffer zone of the presently applied mining lease area also the elephant have broken barbed wire fencing and entered a nursery. Crops of elephant liking should be avoided, as far as possible. Some of the crops, listed above, should be used to replace the more traditional crops like the sugarcane and rice. In Karnataka elephant proof trenches are being dig around the village area, but I have observed in Raigarh district in Chhattisgarh state that the elephants can move down and up in trenches of good depth. Sisal has been found to be good to prevent the elephants to cross the sisal planted area. The plant yields a good quality fiber. Electric fencing has also been suggested as one of the methods but in Assam it has been found to be a failure as the elephant have discovered techniques to break such fences, safely. In areas like Kamakshyanagar in Dhenkanal division in Orissa improvement of fodder resources in the forest has shown promising result of restricting the elephants more in the forest area. Passive methods are always better to avoid man-elephant conflicts. More important are the selection of plants as alternative

crop as well as plants to check the entry of elephants in to the settlement areas. A good amount of researches and suggestions on the conservation and reducing its conflicts with human being is going on, resulting in suggestions coming frequently on these aspects. With the above, some more, methods are being suggested for affected region:

- **Two doors in a house:** Most of the houses in villages have only one door or exit. In case the elephant enters the house through the door, the occupants can escape through another door.
- **Timely information:** Timely information to the helping person about the approach of elephants can reduce the conflicts as well as loss of human life. For this a network should be formed with the villages and the forest officers.
- **Elephant torch:** The elephant torch should be provided to each of the vulnerable villages. Presently the torch is only with the forest officer, one torch for several villages.

**Some more suggestions to avoid conflicts:**

- Do not make crowd near elephant.
- Maintain at least 300 meter distance from the elephant.
- Do not wear red, white or colorful clothes.
- Day time is their resting time; do not disturb them during day time.
- Do not injure them neither they become more violent.
- Do not allow children, ladies and aged persons to go near the elephants.
- Do not prepare liquor or “handia” (country liquor) in the elephant movement area, because elephants like it and can smell it from distance. Do not go near the elephant after taking alcoholic drink.
- Elephants have good smelling power so keep in mind the direction of the wind.
- Elephant can run at a speed of 30-40km per hour, so do not run straight instead make zig-zag running.
- While running throw towel, handkerchief, cap or any other cloth so that they will get attracted to that and will get engaged with that.

- In a hilly terrain run towards the slope.
- While running away from an elephant do not hide behind a tree nor climb up a tree in the evening.
- To prevent the entry of elephants in a village burn wood and “Masal”. Collect in a group and make noise by beating drum, tin etc. Try to drive them towards non in habituated area.
- Make the payment for compensation of elephant loss, early.
- Inform loss of human life or property, within 24 hours to the Patwari or the nearest forest employee.
- Steps taken in Africa, to escape elephant damage
- Elephant area is fenced with ropes. Fencing ropes are smeared with a mixture of chilli + tobacco powder in engine oil. Disagreeable smell of the mixture helps to some extent, to ward off the elephants
- Honey bee combs are promoted on the elephant corridor boundary. Honey bees ward off the elephants.
- Electronic tracking devices are attached to the elephants to track their movements. This helps in timely information to the villagers.

## 6.4 CONSERVATION PLAN FOR SLOTH BEAR:

Based on Divisional records and data collection the Bear movement and presence are seen in many parts of Dharamjaigarh Forest area, thus many ranges are under stress because of their movement.

### 6.4.1 Habit:

Bears are nocturnal in habit; their sense of smell is well developed than their sight and hearing. During accidental encounter with human being they cause severe damage to the human or even death. When

they have cubs, they move with them, otherwise they are solitary or are in pair with opposite sex. They have a specific breeding season. Mating takes place in June to July and they give birth to



cubs in caves during December and January. Litter varies between 1 and 3 cubs. Parental care lies with mother only. Their average life span is around 40 years.

### 6.4.2 Habitat:

They are in good number in drier and secondary forests and are also found in dense forests. They are omnivorous in nature. They feed on tubers, roots, grubs, various fruits, various insects, honey, termites, flowers (Mahua, Simul, etc.). It also damage sugar cane crop, maize etc. Their home range is limited and restricted. In quest of food they may travel several kilometers. It is believed that their gall bladder and bile have medicinal properties and hence they are exposed to poaching.

### Loss and Compensation Paid in attack by Bear in Dharamjaigarh Division

S N	Year	Loss of lifes		Injuries to Human	
		No.	Compsation (Rs.)	No.	Compsation (Rs.)
1	2015	2	600000/-	11	221565/-
2	2016	0	0	19	350549/-
3	2017	0	0	8	129148/-

4	2018	1	300000/-	2	8455/-
5	2019	3	1400000/-	10	215878/-
6	2020	0	0	7	101735/-
7	2021	0	0	1	59100/-

#### 6.4.3 Threats:

- Prominent threats are
- Loss of habitat, destruction of termite and ant nests due to development activities and
- Biotic interference and illegal poaching.
- Cubs are snatched and use them as show piece by Madaris in rural and urban exhibitions.
- During conflict with human, bear are killed in self-defense.

#### 6.4.4 Conservation measures:

- People residing or having Agri field around the habitats should be educated and trained to protect sloth bear.
- Periodical training campaign in nearby villages shall help in save the life of bear. Effective network and bonding should be developed among all the stakeholders in
- Order to reduce human bear conflicts.
- Proper water availability should be ensured in habitat.
- Food resources enhancement for sloth bear.

#### Sloth Bear plant Species Recommended for Habitat Improvement and food resource enhancement

SN	Local Name	Scientific Name	Life form
1	Bel	<i>Aegle marmelos</i>	Tree
2	Amaltas	<i>Cassia fistula</i>	Tree
3	Dahiman	<i>Cordia macleodii</i>	Tree
4	Bahuwar	<i>Cordia myxa</i>	Tree
5	Tendu	<i>Diospyros melanoxylon</i>	Tree
6	Aonla	<i>Emblica officinalis</i>	Tree



7	Bargad	<i>Ficus benghalensis</i>	Tree
8	Gular	<i>Ficus glomerata</i>	Tree
9	Anjeer	<i>Ficus infectoria</i>	Tree
10	Pipal	<i>Ficus religiosa</i>	Tree
11	Mahua	<i>Madhuca indica</i>	Tree
12	Aam	<i>Mangifera indica</i>	Tree
13	Jamun	<i>Syzygiumcumini</i>	Tree
14	Ber	<i>Zizyphus mauritiana</i>	Tree

## 6.5 CONSERVATION PLAN FOR AVIFAUNA

India is rich in Biodiversity with two global Hotspots. The avifauna of India includes around 1301 species, (Clements & James, 2000). Birds are the indicators of the health of an ecosystem as they indicate its needs and diversity. However, detailed study, exclusively on birds of Raigarh district has been carried out. According to working plan, Raigarh forest Division shows diversity of habitat like barren, woodland, shrub land, agricultural and grassland etc. This diversity of topography and habitat offers suitable environment and opportunities for the bird population for breeding, feeding, resting and nesting. Beside this, some of natural habitats of avifauna were disturbed by mining of coal production expansion. From growth of mining, the natural habitat of birds are getting affected which results decreased population of avifauna in other manner. To conserve affected avifauna, it is most important to conserve the species of birds and their habitat.

The avifauna conservation plan should be planned in such a manner that habitat, water and food availability were naturally surrounded in newest location. The conservation plan for avifauna is detailed as below:

### 6.5.1 MAJOR STRUCTURES FOR ALTERNATE HABITAT DEVELOPMENT

Species diversity has often been the prime attribute in conservation strategies. Sites have been evaluated merely by the number of species they contain (Ranjit.R.J, Daniels; A landscape approach to conservation of birds). The major structures for alternate habitat development of avifauna conservation should be focused on food, water and shelter availability. The conservation plan consist the food, water and shelter availability considered with scientific recommendations. The avifauna conservation plan is based majorly on availability of following points:

- (i) Food availability**
- (ii) Water availability**
- (iii) Shelter availability**

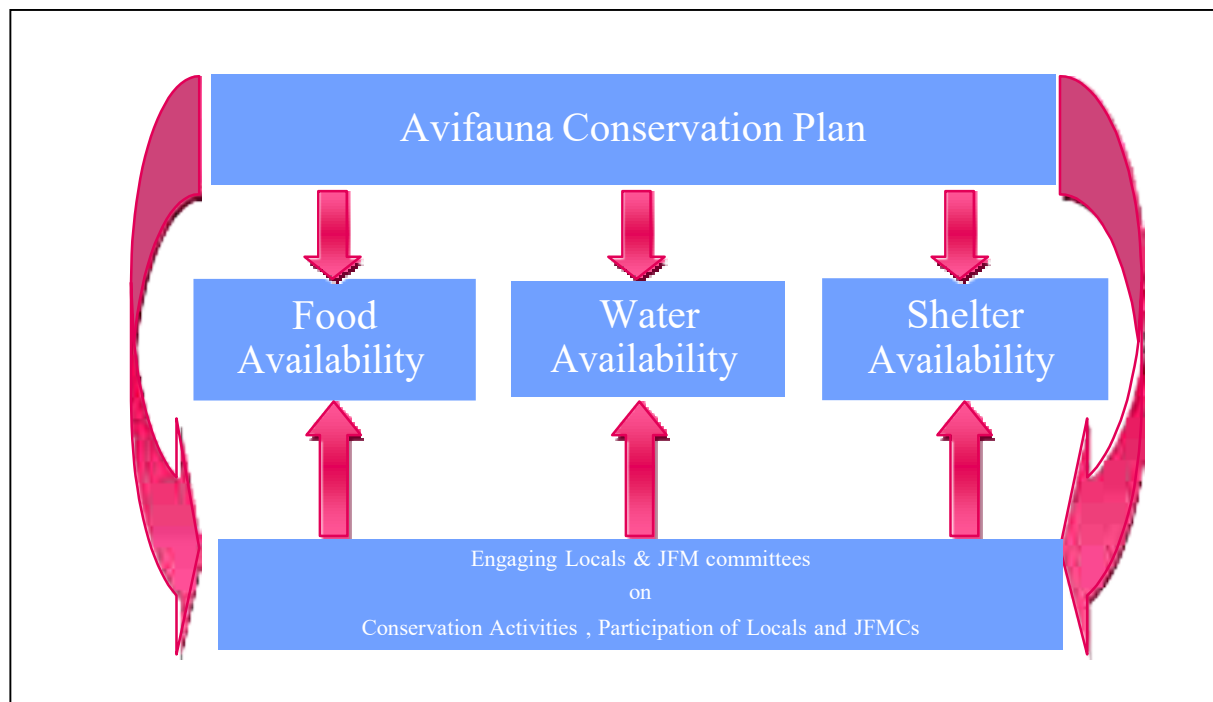


Figure 6.1: Conceptual model for improving Avifauna Conservation Plan.

### (I) Food availability

For every living creature, food is important need to survive and to live. In line with previous studies in pied flycatchers (Verhulst 1994; Siikamäki 1998), our food supplementation was successful at increasing nestling survival until fledging. In supplemented nests, the effect of breeding density on adult body mass and fledging probability was cancelled out. The decrease in provisioning rate with increasing density in control nests, independently of dispersal status, also disappeared in supplemented nests, mainly because of an increase in provisioning rate in high-density habitats. Food availability thus played a role in mediating the density-dependence of these traits and in particular the differences between dispersing and philopatric individuals in patterns of density-dependence on adult body mass and fledging probability, although the last result remains to be confirmed with more statistical power.

**(a) Bird feeder:** Bird feeders are artificial structures for feeding birds in proper medium. The structure is made such a manner that a hollow container for foods, seeds etc and consist of holes through which grains or seeds were feed by birds. Bird feeders are available in different models such as crop feeders, seed feeders etc. These feeders can also be constructed by wood logs or bamboos. This structure can be made by local peoples by proper instructions and demonstration.

**(b) Plantation of fruit tree species:** To promote people for planting fruit yielding tree species such as jamun, ficus spp, anjeer etc.

**(c) Encouraging locals for cereal crop cultivation:** Promoting locals for cultivation of crops like bajra, kodo, kutki, tilhan etc. They are also encouraged for growing green vegetables like bitter ground (kheera), green vegetables etc.

## **(II) Water availability**

**(a) Selecting habitat in water available location:** The Annual Rainfall in Raigarh district is about 1300 mm and is sufficient to be categorized as a wet area. However, selection of alternate habitat in buffer zone for nest placement will be chosen nearby the natural water bodies like naala, ponds or rivers. Due to lack of proper storage, severe water scarcity develops during the summer months.

**(b) Construction of water structures:** Secondly, to make the water available throughout the year it is essential to create water storage facility. Multiple water storage places will be created in the Buffer zone through improving the existing ponds, constructing stop dams in the water channels and through creating water holes. Moreover, permanent water sources are important to foster bird diversity (Tilghman 1987; Jokimäki 1992).

**(c) Mud pot or ‘Sapote’ made by locals:** The next structure is ‘mud pot’ or ‘sakore’ which is also effective model for conservation of avifauna for the purpose of water and food storage. The plate like mud pots can be easily made by ‘potter’ and can be constructed by local villagers. Involving local villagers or local potter will be helpful for this purpose and for rise of their participation awareness. These mud pots can be easily placed in anywhere and also in branches of trees.

## **(III) Shelter availability**

Birds are generally one of the first types of wildlife to visit a mine site following reclamation due to their mobility and active search for suitable habitat (Brändle et al. 2003). The availability of different kinds of nest-boxes may increase the colonization of urban parks by a great variety of cavity-nesting birds (Jokimäki 1999). Many bird species are not restricted to a single vegetation type, but rather depend on some combination of early successional habitat, open areas, and young and mature forests to find food and shelter and raise young (Hunter et al.

2001). For providing the shelter to avifauna will be based on nesting patterns of bird species found in raigarh district. Internationally recommended artificial nests will be constructed by the help of local communities / Joint forest management. Detailed nest designs are mentioned below.

**6.5.2 Artificial nesting:** Before the artificial nesting trail we had surveyed the avifauna species of mining site and categorized them according to their habit, habitat and nesting pattern through which artificial nesting is being proposed.

Artificial nesting structures can be used to increase avifauna reproductive success in buffer zones where natural nest site are unavailable or unsuitable. While artificial nesting structure cannot replace natural nesting habitats, they can increase the number of nesting site available in an area. Many types of avifauna use artificial nesting structures including song birds, woodpecker, waterfowl, and raptors. While structures are generally designed to meet the nesting requirements of certain species, they may also be used by none target animals and provide roosting and winter cover for variety of birds. Nest boxes, nesting platform or shelves, and nesting baskets, culverts, and cylinders are some of the common types of artificial nesting structures. The most effective artificial nesting structures are those installed enclose proximity to brood- rearing habitat, adequate escape/concealment cover, a reliable source of food and water and other element of the habitat of target species. Predators, competitors and Territory sizes for individual species also influence the usefulness of nesting structures. Nest monitoring and maintenance actions can be taken to limit competing or undesirable species access reproduction success, and provide an opportunity for landowners and managers to observe avifauna. Cavity nesting birds which mainly nests in tree cavities are likely to use nest box. Primary cavity nesting species, such as members of the woodpecker family, excavate nesting cavity in live / standing dead tree (snags); Secondary cavity nesters (e.g. some passerine or perching birds, owls, and waterfowl) use cavities abandoned by primary excavators and those formed by fungus, knots, and tree subject to decay. The presence of snags in forested areas is directly related to the quality and quantity of nesting habitat for many cavities nesting species.

**6.5.3 Construction material:** structures made of wood are relatively inexpensive and easy to build. Wood seems to be the most weather resistant, insulating material, and most avifauna species prefer wood to metal or plastic structures. For most nest boxes,

$\frac{3}{4}$  inch rough-cut borders are best used for construction. Since cavity nesting waterfowl do not carry nesting material to the nest, 3-4 inches of coarse sawdust or woodchips should be placed inside the nest box. Nest boxes intended for use by woodpeckers can be tightly packed with sawdust to resemble decaying woody material. Old nesting material should be removed at the start of each nesting season and replaced with fresh material. While many artificial nesting structures are designed for cavity nesters, some provide nesting sites for other avifauna. Nesting platforms, baskets and cylinders are used by waterfowl, raptors and other species. If wire mesh is used as nest support material, the weave must be tight enough to prevent eggs and young from falling.

Designs range from simple platforms to complex, multi-compartment structures some of these design are more successful than others, and most can be built or acquired from a variety of suppliers. Basic nest box designs can be modified to accommodate various species by altering dimensions or entrance hole sizes. The size of the entrance hole also influences the internal temperature of the box, predator accessibility, and use by competing non-target species.

#### **6.5.4 Basic nest box characteristic**

1. Should be made of wood; Sal (*Shorea robusta*), Sisoo (*Dalbergia sisoo*), Babool (*Acacia nilotica*) etc (preferred, most weather resistant).
2. Box should open from the side or top for maintenance and cleaning.
3. Sides of nest box should enclose the floorboard (recessed  $\frac{1}{4}$  inch) to prevent rain seepage.
4. Nails, woodscrews, and hinges should be rust proof.
5. Entrance hole dimensions should accommodate the desired bird species; hole should not be large enough to allow competitors and predators access.
6. A double thick entrance and extended roof to deter predators like squirrels and raccoons.

7. Ventilation holes or slits at the top of both sides, just beneath the roof of the box.
8. Drainage holes (four or five) drilled into the bottom of the nest box to allow for drainage.
9. Song bird nest box should not have a perch, which increase predator access; nativesong birds do not use perches.
10. Nest box should not be treated with green preservative, it is poisonous to birds.
11. Nest box should not be painted on the inside or painted bright, unnatural colour on the outside (may attract predators or exotic species) (Avifauna survey 2013).

### Artificial nest designs

#### Design I

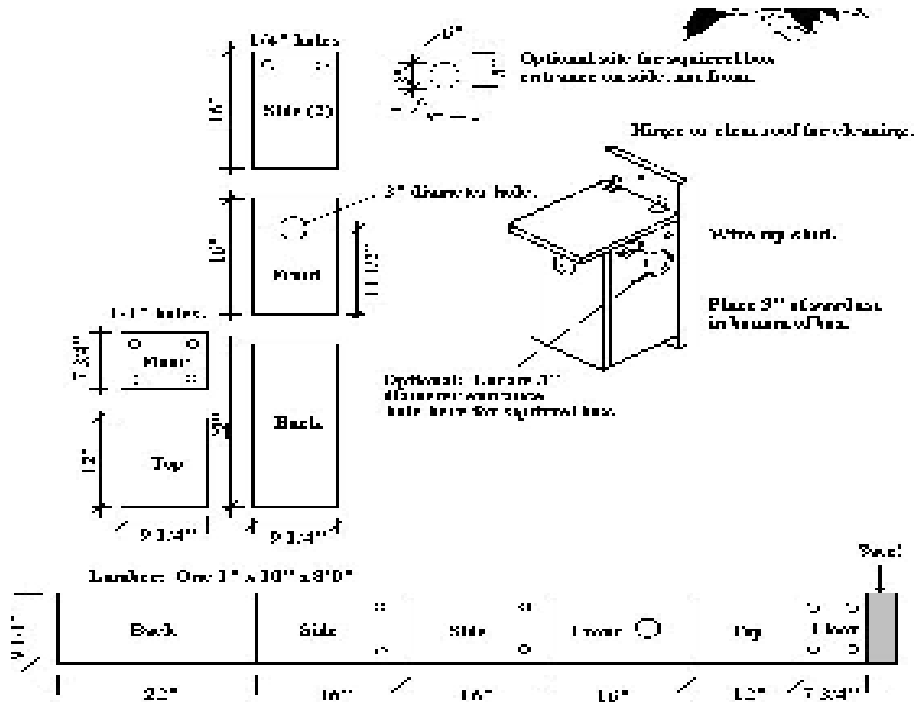


Fig 6.2: Ideal nest design for Doves, Parakeets, and Orioles

#### Design II

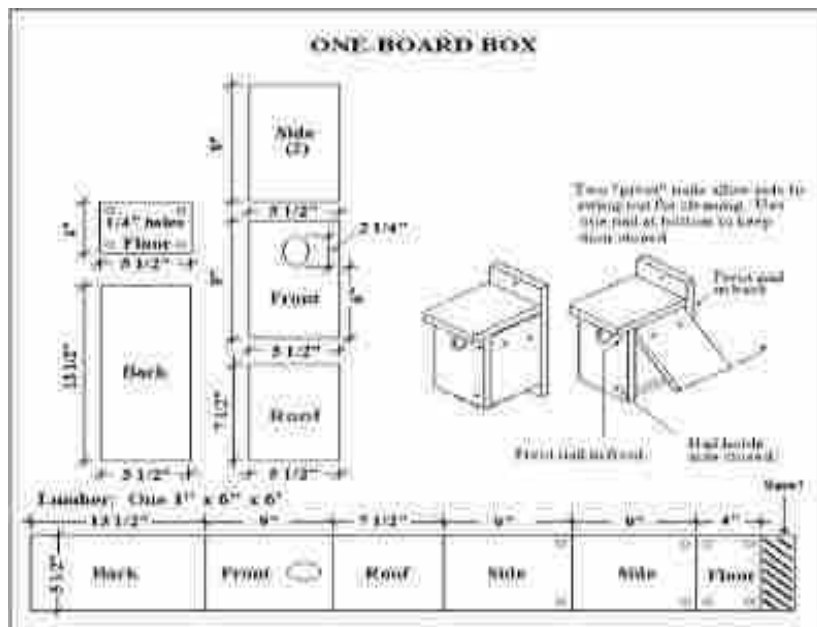


Fig 6.3: Ideal nest design for Yellow Throated Sparrow, Mynas, Parakeets, and Indian Rollers etc.



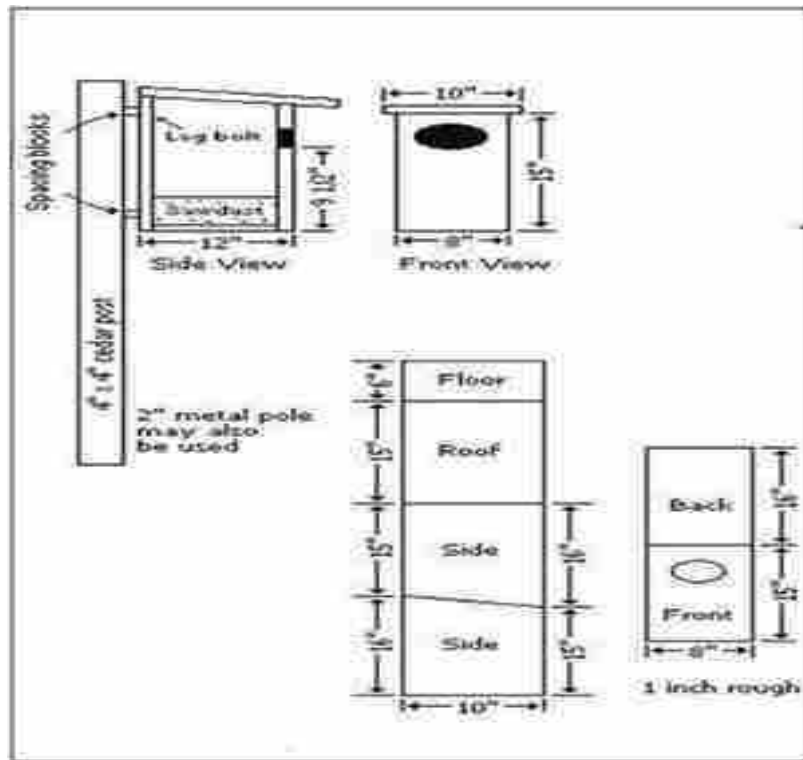


Fig 6.4: Ideal nest design for Shrikes, Indian Robin, Magpie Robin, etc.

Design IV

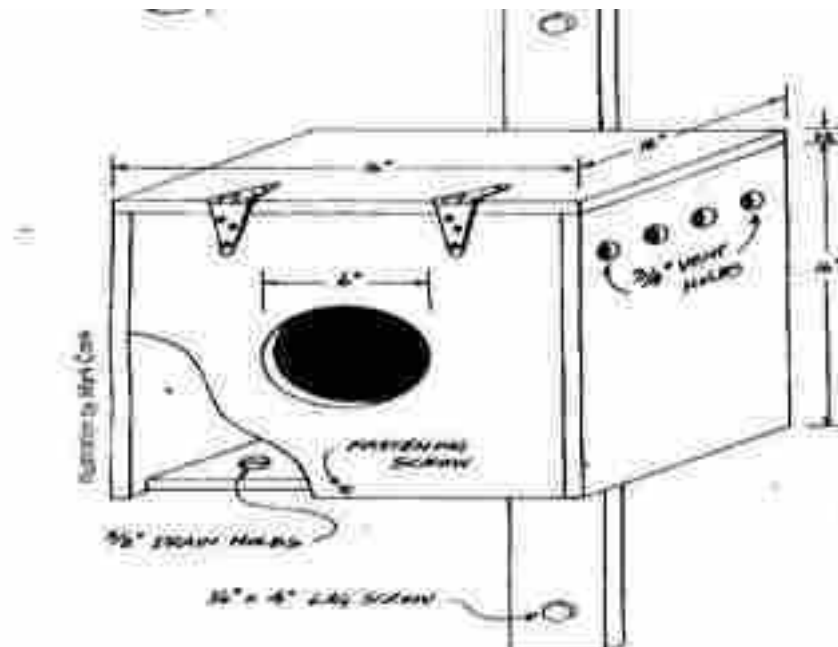


Fig 6.5: Ideal nest design for Owl and Owlets.

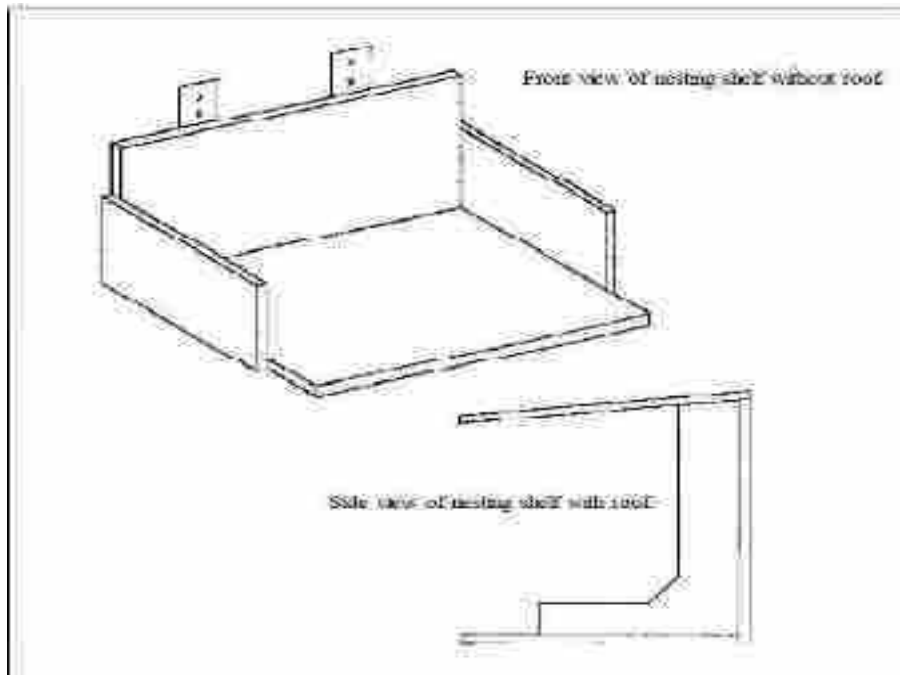


Fig-6.6: Ideal nest design for Platform and Twig nesting birds.

Design VI

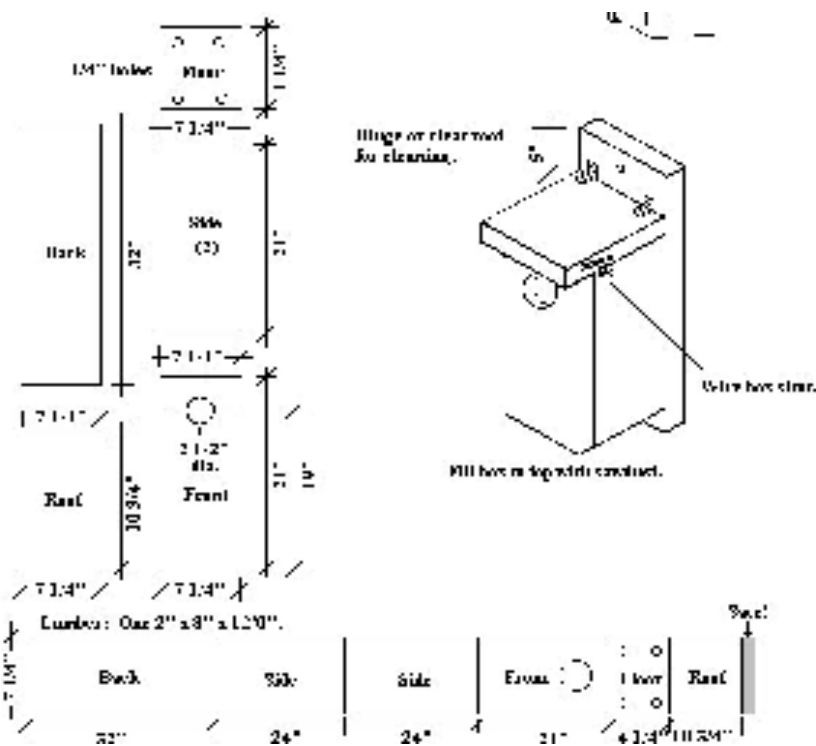


Fig 6.7: Ideal Nest design for excavators having yellow tail and red patch on the back of head and neck

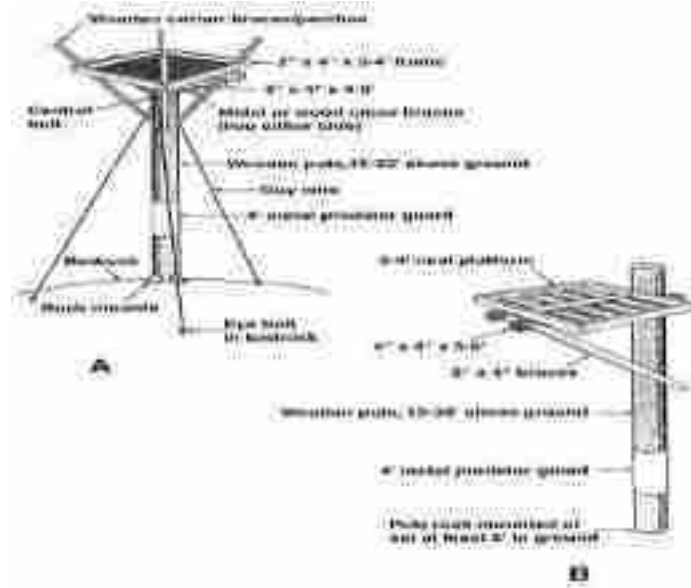


Fig 6.8: Ideal nest design for Raptors.

Design VIII

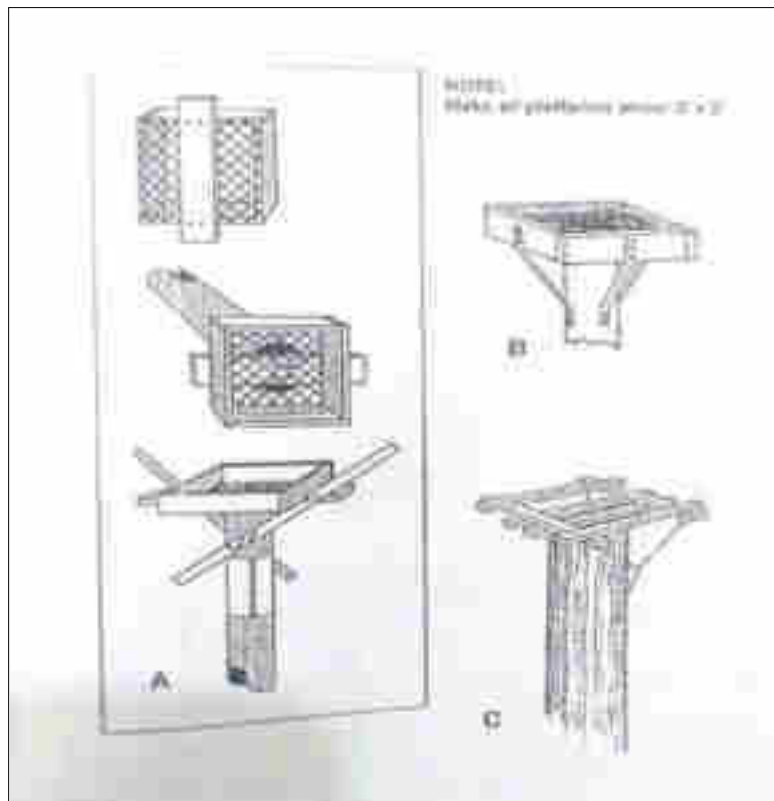
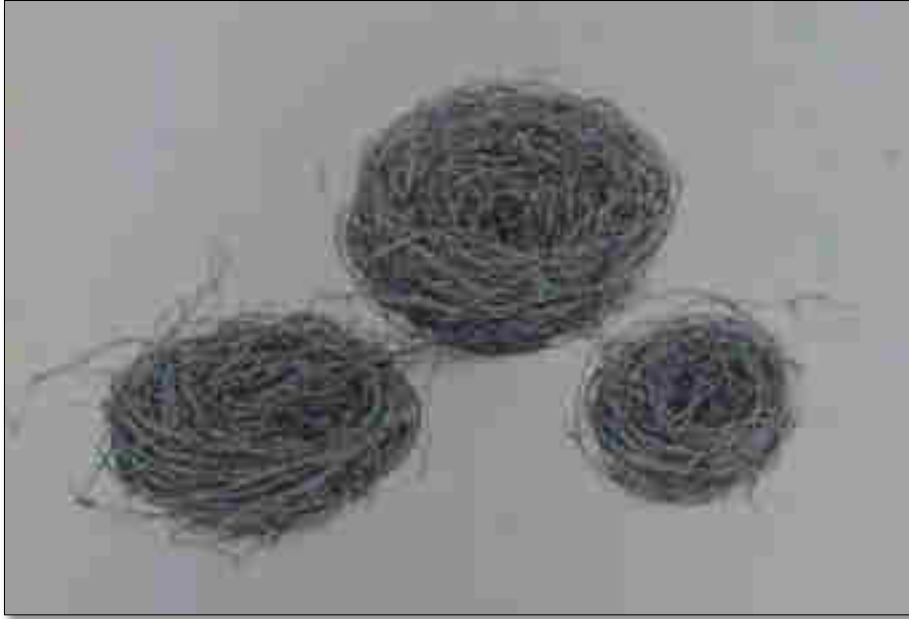


Fig 6.9: Ideal nest design for Raptors.

## Design IX



**Fig 6.10: Ideal nest design for grassland birds and Cup nesting birds.**

As per the above cited figures for all the birds found in the mining area of OCP Chhal. The artificial nesting design proposed for all birds characterized on their habit, habitat and nesting patterns (Fig 6.1- 6.8).

## 6.6 RECOMMENDATIONS

Keeping in view of various impacts, a wildlife Conservation and management plan have been proposed for impact area of OCP Chhal in Dharamjaigarh Forest Division in the state of Chhattisgarh. The recommendation of this management plan is summarized as below:-

1. Maintenance of ecological balance through preservation and restoration of wherever it has been disturbed due to project development activities.
2. The wastage coal dust particles in the dumping site of coal mine's should be managed properly to reduce air pollution and loss of avifaunal diversity & habitats.
3. Biological reclamation should be done to transform the degraded land and waste dump into a self - sustaining ecologically stable land form. Re-vegetation of waste dump is recommended to the slope stability, enhances the infiltration of rain water to increases the soil fertility.
4. Habitat enhancement in project impact zone by taking of forestation and soil conservation measures.
5. Top soil management is needed to maintain the top soil stockpile to retain fertility. Excavated top soil can be dumped for future use such as meadow development and plantation purpose in order to further mitigation for habitat conservation of wildlife and avifauna.
6. Fruit bearing and feeder tree species that are preferred by the birds available in the area, to be needed to plant in the buffer zone for plantation of avifauna conservation. Some of the tree species to be planted are: Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Pipal (*Ficus religiosa*), Bargad (*Ficus benghalensis*), Bhelwa (*Semecarpus anacardium*), Gular (*Ficus glomerata*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Baheda (*Terminalia bellerica*), Harra (*Terminalia chebula*), Tendu (*Diospyros melanoxylon*), Dhawda (*Anogeissus latifolia*) and Amaltas (*Cassia fistula*) etc.
7. Multiple water storage facilities are to be developed in the buffer boundaries to assure the water availability throughout the year. The existing ponds, river, dam and canals water resources recharge should be maintained.

8. The mining in the buffer zone along the river bank of Mand River must be avoided to insure of the river changing the path.
9. The social awareness program should be conducted among the local communities and villagers to provide information & awareness about birds and wild life their contribution in ecosystem and environment.
10. Artificial nest made up of local, light and fine wood materials. Nests will be prepared with the help of active JFM Committee and local forest staff and placed in the buffer area for the affected avifauna of core zone.
11. Assisted natural regeneration (ANR) should be done for the regeneration and reclamation, protection and preservation of natural tree seedlings in forest areas.
12. Best practices from forest department should be implemented for the prevention of forest fire.
13. Plantation and conservation efforts should be monitor regularly during various growth stages of site.
14. Establishment of artificial avifauna habitat “*Pakshi Vihar*” on dumping site.

## CHAPTER 7

### ENVIRONMENTAL MITIGATION MEASURES

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#### Environmental mitigation measures

##### 7.1 Mitigation measures of air pollution

- Dust cannot be avoided completely due to the nature of the activities during mining operation. However it can be managed by regularly water spraying (particularly during the dry season) on haul roads, transfer points of conveyors and crushers.
- A fleet of sprinkler vehicles with adequate water spray systems will be made available and would be operational at all times.
- The novel enclosures method for control of fugitive particulate emission involves the application of porous wind fences (also referred to as wind screens).
- OB dumps areas will be isolated and re-vegetated.
- Plantation along coal transportation roads, infrastructures etc.
- Stabilization of unpaved surfaces.
- Tarpaulin covers shall be used over the beds of the trucks employed for transportation of overburden and coal, which are prone to fugitive dust emission.
- Idling of delivery trucks/equipment should not be permitted.

##### 7.2 Mitigation measures of water pollution

The impact on water quality will be due to mine discharge. There will not be any impact on nearby water body as there isn't any surface water body in the vicinity of the mines. The change in the ground and surface water quality will be more pronounced mainly due to population increase by setting of new townships and influx of population from other areas.

- The surface water from the mining area will be regulated to cause minimum contamination and alteration to the natural drainage system.

- The storm water will be diverted from the mining areas through a series of diversion banks intercept drains to either the natural drainage channels or to water storage reservoirs.
- All drain channels will provide with small stone/rock barriers across drain to water current and to arrest solid particles. This will also be cleaned periodically.
- Sewage treatment plan is proposed for sewage from office and colony.
- The mine water will be collected in setting tanks after sedimentation clear water will be discharged in natural stream.
- A network of drains, sedimentation control dams and sumps will be provided in the in-pit drainage so that maximum quantity of water will be reused to store in the water reservoirs.

### **7.3 Mitigation measures of noise pollution**

- Acoustic treatment of rotating equipments.
- Compulsory use of personnel protective equipment (PPE) such as ear plugs for water workers.
- All machine mountings will have in their foundations anti vibration pads / sheets for reducing the vibration and nearby noise.
- Installation of noise generating machinery, strictly in-compliance with the recommendation of the manufactures. This would ensure an installation free from vibration and exhaust leaks which are also measure contributors to increased noise levels.
- Use of dumping materials such as thin rubber sheet for wrapping the worn places of compressors, generators etc.
- Shock absorbing techniques to reduce impact.
- Use of physical barriers and green belt development around the mine to restrict the noise from going outside the proposed mine boundary during operation.



#### **7.4 Mitigation measures of land use**

- Design the mining and associated activities for the minimum possible forest land requirement.
- Design the mining activities in such a manner that the changes in the surface drainage pattern are minimum.
- In case of opencast mines plan the mine with decommissioning, closure, reclamation and rehabilitation so that the land after mining can be brought in economic uses.

#### **7.5 Mitigation measures for soil profile**

- Provisions should be made in opencast mining for separate removal and handling of top and sub-soils so that these can be re-laid at the time of reclamation for developing the land uses of the reclaimed surface.
- River bank and their stability plan for soil conservation.

#### **7.6 Mitigation measures for vegetation**

- The vegetation cover will be improved by scientific green belt developments as per MoEF guidelines 2006.
- The plantation should be made 4 times the number of existing plants before the mine is started.
- The plantation will be done as per the approved mining plan and Environmental Management Plan.
- Using advanced technologies such as remote sensing and Geographic Information Systems for planning, monitoring and evaluating forest cover.

#### **7.7 Mitigation measures for wildlife**

- Development of alternate habitat for affected avifauna of core zone to buffer zone.
- Artificial nesting placement, trails and their regular monitoring by coordination with the forest department.
- Development of migratory corridors for wild animals.
- Check the natural streams to restore the water banks.

## CHAPTER 8

### FINANCIAL OUTLAY OF WILDLIFE CONSERVATION PLAN

Keeping in view of various impacts, a wildlife Conservation and management plan have been proposed for impact area of OCP Chhal in Dharamjaigarh Forest Division in the state of Chhattisgarh. The salient feature of this Conservation plan is summarized as below:-

- i. Maintenance of ecological balance through preservation and restoration of wherever it has been disturbed due to project developmental activities,
- ii. Conservation, preservation and betterment of natural habitats in Impact zone.
- iii. Rehabilitation of critical species (endemic and threatened species of this region), if any with provisions for in-situ or ex-situ conservation of critical/ important plant/ animal species,
- iv. Mitigation and control of project induced biotic and/or abiotic pressures/ influences that may affect the natural habitats,
- v. Habitat enhancement in project Impact zone by taking up forestation and soil conservation measures.
- vi. Creating all round awareness regarding conservation and ensuring people's participation in the conservation effort its and minimizing human - animal conflict.

Broadly the plan has main components like

- a) Soil and Water conservation and development of water sources
- b) Habitat enhancement for Wild animals specially Schedule 1 species.
- c) Plantation on species which are suitable to wild animals of the area.
- d) Fire Protection
- e) Provision for the enhancement of habitat of wild animals Elephant, Sloth bear and Avifauna

- f) Rescue arrangements.
- g) Organizing various committees for conservation of flora and fauna.
- h) Monitoring of the programs.
- i) Equipment purchases for Elephant conservation and arrangement of vehicle to avoid Human-wild animal conflicts.
- j) Trainings of people for protection of Flora and fauna.

The financial requirement of various interventions suggested in the plan as per current labor wage rate of the districts and norms of various forestry related activities 10% escalation is proposed in the financial outlay for future rate of inflation. The plan period of 6 year is proposed which shall be valid and applicable from the date of approval.

#### **Important Provisions for Divisional Forest Officer Dharamjaigarh**

1. All the activities given in the financial outlay of plan will be implemented by State Forest Department through Divisional Forest Officer of Dharamjaigarh Forest Division with Budgetary provision from user agency South East Coal Limited (SECL).
2. Area for development as suggested in conservation plan shall be finalized by the Divisional Forest Officer Dharamjaigarh Forest Division after through field visit, verification of suitability.
3. Any changes in proposed plan shall be allowed to Divisional Forest Officers as per the suggestion of committee described in point 2 and after getting due approval from concerned Chief Conservator of Forest.

**FINENICIAL PROPOSAL FOR WILDLIFE CONSERVATION PLAN INCLUDING  
ALTERNATIVE HABITAT DEVELOPMENT FOR AVIFAUNA, ELEPHANTS AND OTHER  
WILD ANIMALS OF IMPACT AREA OF OCP CHHAL**

SN	Description of Item of Work	Unit (No/ha)	Yearwise Estimated Requirement of Budget (Rs. In Lakh)						Total
			1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	
<b>1</b>	<b>Habitat Improvement Activities</b>								
1.1	Food resource enhancement for Elephant, sloth bear and birds and other species with 4 year of maintainance. Species which are to be chosen for silvi pasture can be referred from chapter no 5.(Para 5.3.6)	As per norms and sanctioned project by competent officer	200.00	40.00	30.00	30.00	-	-	300.00
1.2	Improvement of water availability by digging of ponds/ water holes and maintainance of existing water holes for elephants, sloth bear and other animal.	LS	50.00	100.00	50.00	-	-	-	200.00
<b>2</b>	<b>Human Elephant conflict Mitigation Activities</b>								
2.1	Insulation of electricity lines in elephants passage/corridore.	LS	100.00	150.00	150.00	-	-	-	400.00
<b>3</b>	<b>Eco Development In Villages</b>								
3.1	Eco development works in 15 villages.	LS	20.00	20.00	20.00	20.00	20.00	-	100.00
<b>4</b>	<b>Training &amp; workshops / Awareness Program</b>								
4.1	Hathi Mitra Dal, public awareness,training etc. And miscellaneous work/ activities that may be developed subsequently to reduce human wildlife conflicts.	LS	8.00	8.00	8.00	8.00	6.00	5.00	43.00
4.2	Arrangement of utility vehicle " Gajraj Vahan" for the field to transport of man, materials used in Human-Wildlife conflicts situation	LS	8.00	8.00	8.00	8.00	8.00	8.00	48.00
4.3	Purchase of Elephant Rescue vehicle	LS	-	60.00	-	-	-	-	60.00
<b>5</b>	<b>Purchase of Equipments</b>								
5.1	Purchase of protective equipment like Flare gun, night vision camera, binoculars, traking equipments and essential rescue equipments/	LS	5.00	5.00	-	-	-	-	10.00
<b>6</b>	<b>Monitoring and evaluation of works</b>								
6.1	Monitoring and evaluation of works	LS				3.00	3.00	3.00	9.00
6.2	Consultant for Elephant Habitat/ Human Elephant conflicts management.	LS	12.00	12.00	12.00	12.00	12.00	-	60.00
<b>Grand Total</b>			<b>403.00</b>	<b>403.00</b>	<b>278.00</b>	<b>81.00</b>	<b>49.00</b>	<b>16.00</b>	<b>1230.00</b>

Rupees in word- Twelve Crore Thirty Lakh only

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**PHOTO PLATES**



*Cup Shaped Nest*

*Cup Shaped Nest*



*Platform Nest*

*Platform Nest*



*Sphere Shaped Nest*

*Pendent Nest*

**Glimpses of birds nest found in study area during the transect line**



*Sphere Shaped Nest*



*Sphere Shaped Nest*



*Cup shaped nest*



*Platform Nest*



*Saucer Plate Nest*



*Platform Nest*

**Glimpses of birds nest found in study area during the transect line**



*Platform Nest*



*Platform Nest*



*Cup Shape Nest*



*Platform Nest*



*Sphere Shaped nest*



*Pendent Nest*

### Glimpses of birds nest found in study area during the transect lines



*Cavity Shaped Nest*



*Cavity Shaped Nest*



*Cup Shaped Nest*



*Pendulum Shaped Nest*



*Cup Shaped Nest*



*Platform Shaped Nest*



**Glimpses of avifauna species found in study area during the transect line**



*Indian Pond Heron*



*Cattle egret*



*Indian Roller*



*House Sparrow*



*Black Drongo*



*Yellow Wattled Lapwing*



*Pond Heron*



*Rose Ringed Parakeet*



*Scaly Brested Munia*



*Eurasian Collared Dove & Plum Headed Parakeet*



*Baya Weaver*



*Spotted Dove*



*Greater Coucal*



*Red Vented Bulbul*



*Jungle Prinia*



*Indian Robin*



*Common Myna*



*Pond Heron*



*House Sparrow*



*Green Bee Eater*



*Purple Sun Bird*



*Purple Sun Bird female*



*Asian Koel*



*Indian Pond Heron*



*Common Pigeon*



*Jungle Bush Quail*



*Indian Roller*



*Cattle Egret*

## ARTIFICIAL NEST IMAGES



*Design for Sparrow, Myna etc*



*Design for Indian Robin, Roller etc*



*Design for Doves, Parakeets etc*



*Design for Cavity Nesters*



*Design for Owls & Owlets*



*Design for Platform Nesters*

## BIRD FEEDER



*Construction of bamboo based bird feeder in SFRTI*

## CHAPTER 9

### REFERENCES

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- ❖ *Ammer, F. K. (2003). Population level dynamics of grasshopper sparrow populations breeding on reclaimed mountaintop mines in West Virginia. Ph.D. dissertation, West Virginia University, Morgantown.*
- ❖ *Anders, A. D. and Marshall, M. R. (2005). Increasing the accuracy of productivity and survival estimates in assessing landbird population status. Conservation Biology 19:66-74.*
- ❖ *Angel, P., V. Davis, J. Burger, D. Graves, and C. Zipper. (2005). The Appalachian Regional Reforestation Initiative (ARRI). Forest Reclamation Advisory, 1, 1-2.*
- ❖ *Arcos, F., and Salvadores, R. (2005). Habitat selection by territorial males of Little Bustard *Tetrax tetrax* in a NW Iberian population. Ardeola 52:151–157.*
- ❖ *Avifauna survey report for Power Grid Corporation, 765 KV D/C Jharsuguda-Dharamjaigarh (Korba), Transmission line, prepared by Conservation core Society and Bilaspur State University, 2013.*
- ❖ *Bajema, R. A., Devault T.L., Scott P.E., and Lima S.L. (2001). Large reclaimed coal mine grasslands and their significance for Henslow's Sparrows in the American Midwest. Auk 118:422–431.*
- ❖ *Balbontin, J. (2005). Identifying suitable habitat for dispersal in Bonelli's eagle: An important issue in halting its decline in Europe. Biological Conservation 126:74–83.*
- ❖ *Bard, A. M., Smith, H.T., Egensteiner, E. D., Mulholland, R., Harber, T. V., Heath, G. W., Miller, W. J. B. and Weske, J. S. (2002). A simple structural method to reduce road-kills of royal terns at bridge sites. Wildlife Society Bulletin 30:603–605.*
- ❖ *Best Management Practices Manual, Ministry of Environment and Forests, Government of India, February (2003).*
- ❖ *Beachy, T. A. (2008). Cerulean warbler (*Dendroica cerulea*) breeding ecology and habitat selection, initial response to forest management, and association with anthropogenic disturbances in the Cumberland Mountains of Tennessee. M.S. thesis, University of Tennessee, Knoxville.*



- ❖ *Beckerle, L. T. (2004). Techniques for encouraging native plants and creating bobwhite quail habitat on drastically disturbed land. Proceedings of the National Meeting of the American Society of Mining and Reclamation 21:127.*
- ❖ *Bhushan, Chandra Rich Lands, Poor People: The Socio-Environmental Challenges of Mining in India. Rich, Lands, Poor People: The Socio-Environmental Challenges of Mining in India.*
- ❖ *Boaz A.A. et al, Birds of Chhattisgarh (2012), First edition published by Ela Foundation and Forest Department Chhattisgarh.*
- ❖ *Bolger, D.T., A.C. Alberts, and M.E. Soule. (1991). Occurrence patterns of bird species in habitat fragments: Sampling, extinction, and nested species subsets. The American Naturalist, 137, 155-166.*
- ❖ *Bollinger, E. K., and Gavin, T. A. (2004). Responses of nesting bobolinks *Dolichonyx oryzivorus* to habitat edges. Auk 121:767–776.*
- ❖ *Boves, T. A. (2011). Multiple responses by Cerulean Warblers to experimental forest disturbance in the Appalachian Mountains. Ph. D. dissertation, University of Tennessee, Knoxville.*
- ❖ *Brändle, M., Durka, W., Krug, H. and Brandl, R. (2003). The assembly of local flora and fauna: Plants and birds in non-reclaimed mining sites. Ecography 26:652-60.*
- ❖ *Brenner, F. J., and Kelly, J. (1981). Characteristics of bird communities on surface mined lands in Pennsylvania. Environmental Management 5:441-49.*
- ❖ *Brown, K.S. jr. (1991). Conservation of Neotropical environments: insects as indicators. In: Collins, N.M., Thomas, J.A. (Eds.), The conservation of insects and their habitats. Academic Press, London, pp. 449–504.*
- ❖ *Buehler, D. A., Welton, M. J. and Beachy, T. A. (2006). Predicting cerulean warbler habitat use in the Cumberland Mountains of Tennessee. Journal of Wildlife Management 70:1763-1769.*
- ❖ *Buehler, D. A., Roth, A. M., Vallender, R., Will, T. C., Confer, J. L., Canterbury, R. A., Swarthout, S. B., Rosenberg, K. V. and Bulluck, L. P. (2007). Status and conservation priorities of Golden-Winged Warbler (*Vermivora chrysoptera*) in North America. The Auk 124:1439-1445.*
- ❖ *Bulluck, L. P. and Buehler, D. A. (2008). Factors influencing golden-winged warbler (*Vermivora chrysoptera*) nest-site selection and nest survival in the Cumberland Mountains of Tennessee. Auk 125:551-559.*

- ❖ Burger, J.A. (2011). *Sustainable mine land reclamation in the eastern U.S. coalfields: A case for an ecosystem reclamation approach. Paper presented at the 2011 National Meeting of the American Society of mining and Reclamation, Bismarck, ND.*
- ❖ Camenzind, F. J. (1984). *Wildlife and coal development: An overview. Minerals and the Environment 6:94-100.*
- ❖ Canterbury, G.E., T.E. Martin, D.R. Petit, L.J. Petit and D.F. Bradford (2000). *Bird communities and habitat as ecological indicators of forest condition in regional monitoring. Conservation Biology, 14, 544–558.*
- ❖ Carrascal, L. M., Seoane, J., Palomino, D. and Alonso, C. L. (2006). *Habitat preferences, population size and demographic trends of Houbara Bustard Chlamydotis undulata in Lanzarote and La Graciosa (Canary Islands). Ardeola 53:251–269.*
- ❖ Catlin, D. H., and Rosenberg, D.K. (2006). *Nest destruction associated with mortality and dispersal of burrowing owls in the Imperial Valley, California. Southwestern Naturalist 51:406–409.*
- ❖ Clevenger, A. P., Chruszcz, B. and Gunson, K. E. (2003). *Spatial patterns and factors influencing small vertebrate fauna road-kill aggregations. Biological Conservation 109:15–26.*
- ❖ Devault, T. L., Scott, P.E., Bajema R.A., and Lima, S.L. (2002). *Breeding bird communities of reclaimed coal-mine grasslands in the American Midwest. Journal of Field Ornithology 73:268–275.*
- ❖ Dutta, P., Mahatha, S. and De, P. (2004). *Opencast mining impact. A methodology for cumulative impact assessment of opencast mining projects with special reference to air quality assessment. Impact Assessment and Project Appraisal, volume 22, number 3, September 2004, pages 235–250, Beech Tree Publishing, 10 Watford Close, Guildford, Surrey GUI 2EP, UK.*
- ❖ *EIA Guidance Manual - Ministry of Minerals, Ministry of Environment and Forest, Government of India, New Delhi, February 2010.*
- ❖ Erritzoe, J., Mazgajski, T. D. and Rejt, L. (2003). *Bird casualties on European roads—a review. Acta Ornithologica 38:77–93.*
- ❖ Ferrer, M., and Harte, M. (1997). *Habitat selection by immature Spanish Imperial Eagles during the dispersal period. Journal of Applied Ecology 34:1359–1364.*

- ❖ Forman, R. T. T., and Alexander, L. E. (1998). Roads and their major ecological effects. *Annual Review of Ecological Systems* 29:207–231.
- ❖ Frey, S. N., and Conover, M. R. (2006). Habitat use by meso-predators in a corridor environment. *Journal of Wildlife Management* 70:1111–1118.
- ❖ Gavashelishvili, A., and McGrady, M. J. (2006). Breeding site selection by Bearded Vulture *Gypaetus barbatus* and Eurasian Griffon *Gyps fulvus* in the Caucasus. *Animal Conservation* 9:159–170.
- ❖ Galligan, E.W., T.L. DeVault, and S. Lima. (2006). Nesting success of grassland and savanna birds on reclaimed surface coal mines of the Midwestern United States. *The Wilson Journal of Ornithology*, 118, 537-546.
- ❖ Glista, D. J., DeVault, T. L. and DeWoody, J. A. (2008). Vertebrate road mortality predominantly impacts amphibians. *Herpetological Conservation and Biology* 3(1):77–87.
- ❖ Gorog, A. J., Pamungkas, B. and Lee, R.J. (2005). Nesting ground abandonment by the Maleo *Macrocephalon maleo* in North Sulawesi: identifying conservation priorities for Indonesia's endemic megapode. *Biological Conservation* 126:548–555.
- ❖ Gregg, I. D. (1997). American Woodcock use of reclaimed surface mines in West Virginia. M. S. thesis, West Virginia University, Morgantown.
- ❖ Gutzwiller, K. J., and Barrow, W.C. (2003). Influences of roads and development on bird communities in protected Chihuahuan Desert landscapes. *Biological Conservation* 113:225–237.
- ❖ Hardt, R.A. and R.T.T Forman. (1989). Boundary form effects on woody colonization of reclaimed surface mines. *Ecology*, 70, 1252-1260.
- ❖ Herzog, F., A. Lausch, E. Muller, H. Thulke, U. Steinhardt, and S. Lehmann. (2001). Landscape Metrics for Assessment of Landscape destruction and Rehabilitation. *Environmental Management* 27, 91-107.
- ❖ Hunter, W. C., D. A. Buehler, R. A. Canterbury, J. L. Confer, and P. B. Hamel. (2001). Conservation of disturbance-dependent birds in eastern North America. *The Wildlife Society Bulletin* 29:440-55.
- ❖ Ingold, D. J. (2002). Use of reclaimed stripmine by grassland nesting birds in east-central Ohio. *Ohio Journal of Science* 102:56–62.
- ❖ Jacobson, S. L. (2005). Mitigation measures for highway-caused impacts to birds. In C. J. Ralph and T. D. Rich (eds.). *USDA Forest Service General*

- Technical Report PSWGTR- 191, Volume I and II, 1043–1050. Forest Service, U.S. Department of Agriculture. 1294pp.*
- ❖ *James, F.C. and N.O. Wamer. (1982). Relationships between temperate forest bird communities and vegetation structure. Ecology, 63, 159-171.*
  - ❖ *Jones, S. L., Dieni, J. S., Green, M. T. and Gouse, P. J. (2007). Annual return rates of breeding grassland songbirds. Wilson Journal of Ornithology 119:89-94.*
  - ❖ *Kadekodi, Gopal K. (2010). The Health of Mining and Wealth of Miners July 24, Economic & Political Weekly XIV (30): 14-15.*
  - ❖ *Kimmel, R. O. and Samuel, D. E. (1984). Ruffed grouse brood habitat on reclaimed surface mines in West Virginia. Environmental Geochemistry and Health 6:150-153.*
  - ❖ *Loss, S.R., M.O. Ruiz, and J.D. Brawn. (2009). Relationships between avian diversity, neighborhood age, income, and environmental characteristics of an urban landscape. Biological Conservation, 142, 2578-2585.*
  - ❖ *Mattice, J. A., Brauning, D. W. and Diefenbach, D. R. (2005). Abundance of grassland sparrows on reclaimed surface mines in western Pennsylvania. Pages Pages 504-510 in C. J. Ralph and T. D. Rich, editors. Bird conservation implementation and integration in the Americas: Proceedings of the Third International Partners in Flight Conference, USDA Forest Service General Technical Report PSW-GTR-191.*
  - ❖ *Ministry of Mines (2008). National Mineral Policy (For non - fuel and non - coal minerals), Government of India*
  - ❖ *Ministry of Mines (2011). Mining Policy and Legislation, Annual Report 2010-2011*
  - ❖ *Monroe, M. S. and Ritchison, G. (2005). Breeding biology of Henslow's Sparrows on reclaimed coal mine grasslands in Kentucky Journal of Field Ornithology 76:143-149.*
  - ❖ *Mumme, R. L., Schoech, S. J., Woolfenden, G. E. and Fitzpatrick, J. W. (2000). Life and death in the fast lane: demographic consequences of road mortality in the Florida Scrub-Jay. Conservation Biology 14:501–512.*
  - ❖ *Palmer, W. E., Terhune, T. M. and McKenzie, D. F. (2011). The National Bobwhite Conservation Initiative: A range-wide plan for recovering bobwhites. National Bobwhite Technical Committee Technical Publication, ver. 2.0.*

- ❖ *Parmenter, R. R., and J. A. MacMahon. (1992). faunal community development on disturbed lands: An indicator of reclamation succession. In Evaluating Reclamation Success: The Ecological Consideration— Proceedings of a Symposium, ed. J. C. Chambers and G. L. Wade, 73-89. (Contains selected papers from the 1990 Mining and Reclamation Conference and Exhibition of the American Society for Surface Mining and Reclamation, held April 23-26, 1990, in Charleston, W.Va.) U.S. Department of Agriculture. U.S. Forest Service. Northeast Forest Experiment Station General Technical Report NE-164. Radnor, Pa.: Northeastern Forest Experiment Station.*
- ❖ *Parrish, T. L., Hubert, W. A., Anderson, S. H., Purcherelli, M. J. and Mangus, W. (2001). Distributions of roosting Sandhill Cranes as identified by aerial thermography. Prairie Naturalist 33:93–100.*
- ❖ *Perlut, N. G., A. M. Strong, T. M. Donovan, and N. J. Buckley. (2008). Grassland songbird survival and recruitment in agricultural landscapes: implications for source-sink demography. Ecology 89:1941-1952.*
- ❖ *Pinto, M., Rocha, P. and Moreira, F. (2005). Long-term trends in Great Bustard *Otis tarda* populations in Portugal suggest concentration in single high quality area. Biological Conservation 124:415–423.*
- ❖ *Ramp, D., Wilson, V. K., and Croft, D. B. (2006). Assessing the impacts of roads in peri-urban reserves: road-based fatalities and road usage by wildlife in the Royal National Park, New South Wales, Australia. Biological Conservation 129:348–359.*
- ❖ *Ramsden, D. J. (2003). Barn owls and major roads: results and recommendations from a 15-year research project. Barn Owl Trust, Ashburton, Devon, UK.*
- ❖ *Reijnen, R., and Foppen, R. (1994). The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for Willow Warblers *Phylloscopus trochilus* breeding close to a highway. Journal of Applied Ecology 31:85–94.*
- ❖ *Reijnen R., and Foppen, R. (2006). Chapter 12: Impact of road traffic on breeding bird populations. In Davenport, J. and J. L. Davenport (eds.). The ecology of transportation: managing mobility for the environment, 255–274. Springer, the Netherlands.*

- ❖ Rice, F. H. (1986). *Response of wild turkeys to surface coal mining in north central Pennsylvania*. M. S. thesis, Pennsylvania State University, University Park, Pennsylvania.
- ❖ Rohrbaugh, R. W., Jr. and Yahner, R. H. (1996). *Reclaimed surface mines: an important nesting habitat for northern harriers in Pennsylvania*. Pages 307-314 in D. Bird, D. Varland, and J. Negro, editors. *Raptors in human landscapes. Adaptations to built and cultivated environments*. Academic Press.
- ❖ Sara, M., and Di Vittori, M. (2003). *Factors influencing the distribution, abundance and nest-site selection of an endangered Egyptian vulture *Neophron percnopterus* population in Sicily*. *Animal Conservation* 6:317–328.
- ❖ Scott, M. D., and G. M. Zimmerman. (1984). *Wildlife management at surface coal mines in the Northwest*. *Wildlife Society Bulletin* 12:364-70.
- ❖ Scott, P. E., Devault, T.L., Bajema, R. A., and Lima, S. L. (2002). *Grassland vegetation and bird abundances on reclaimed midwestern coal mines*. *Wildlife Society Bulletin* 30:1006–1014.
- ❖ *Standard terms of reference [TOR] for EIA / EMP report for Projects / activities requiring Environment clearance under EIA Notification, 2006, Ministry of Environment, Forest and Climate Change, April 2015.*
- ❖ Singh, Dr. Gurdeep, (2008). *Mitigating environmental and social impacts of Coal mining in India*. 1st International Conference on “Managing the Social & Environmental Consequences of Coal Mining in India’ during November 19-21, 2007 at New Delhi, *Mining Engineer Journal*,
- ❖ Singh, Gurdeep, (2005). *Regional Environmental and Social Challenges facing the Coal Industry*. The Coal Summit Organised the India Energy Forum, Indian Coal Forum and MGMI, 19-20 October.
- ❖ Singh, Gurdeep and Gupta, R. K. (2005). *Water Pollution from Coal Washeries and its Impact on Damodar River*. *The Indian Mining & Engg. J.* 44 (3)
- ❖ Singh, A. N., Raghubanshi, A. S. and Singh, J. S. (2002). *Plantations as a tool for mine spoil restoration*, *Current Science*, 82:12.
- ❖ Singh, Gurdeep and Puri, S. K, (2004). *Air quality assessment in Korba Coalfield* *Indian Journal of Air Pollution Control*, IV (2) 31-41.
- ❖ Singh, Gurdeep, (1999). *Water pollution issues and control strategies in mining areas*, *Minetech*, 20:1 pp45-53.

- ❖ Singh, Gurdeep, (2005). *Water sustainability through Augmentation of Underground Pumped out Water for Potable Purpose from Coal Mines of Eastern India. Environmental Geochemistry, Vol8, No. 1 & 2, pp.89-94.*
- ❖ Singh, Arun P. (2010). *Butterfly diversity in tropical moist deciduous sal forests of Ankua Reserve Forest, Koina Range, Saranda Division, West Singhbhum District, Jharkhand, India. Journal of Threatened Taxa 2(9): 1130-1139.*
- ❖ Singh, R. K. (2000). *Impact of Iron ore mining on the elephant habitat of Singhbhum forests, Bihar. Thesis presented to the Saurashtra University, Rajkot, India for the degree of Doctor of Philosophy in Wildlife Science.*
- ❖ Stauffer, G. E. (2008). *Nesting ecology and site fidelity of grassland sparrows on reclaimed surface mines in Pennsylvania. M. S. thesis, Pennsylvania State University, University Park.*
- ❖ Stauffer, G. E., Diefenbach, D. R., Marshall, M. R. and Brauning, D. W. (2011). *Nest success of grassland sparrows on reclaimed surface mines. Journal of Wildlife Management 75:548-557.*
- ❖ Tripathy, D. P., Panigrahi, D. C. and Singh, Gurdeep (1997). *Environmental Impacts of Mine Fires - A Case Study of a Part of Jharia Coalfield, 2nd WOMEC, Katowice, Poland.*
- ❖ Whelan, C.J., C.H. Sekercioglu and D.G. Wenny (2015). *Why bird matter from economic ornithology to ecosystem services. J. Ornithol., 156, 227-238.*
- ❖ Whelan, C.J., D.G. Wenny and R.J. Marquis (2008). *Ecosystem services provided by birds. Annals of the New York Academy of Sci., 1134, 25-60.*
- ❖ Wickham, J.D., K. Riitters K., Wade, T.G., Coan, M., and Homer, C. (2007). *The effect of Appalachian mountaintop mining on interior forest. Landscape Ecology, 22, 179-187.*
- ❖ Winter, M., Johnson, D.J., and Faaborg, J. (2000). *Evidence for edge effects on multiple levels in tallgrass prairie. The Condor, 102, 256-266.*
- ❖ Wood, P. B., Bosworth, S. B. and Dettmers, R. (2006). *Cerulean warbler abundance and occurrence relative to large-scale edge and habitat characteristics. Condor 108:154-165.*
- ❖ [https://en.wikipedia.org/wiki/Waste\\_management](https://en.wikipedia.org/wiki/Waste_management)
- ❖ <https://en.wikipedia.org/wiki/Ecology>

## ANNEXURE I (SUMMAR SEASON)

### Datasheet for Bird status survey

Cell-ID T1 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal and Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
0 M	22 <sup>0</sup> 05' 38.24"	83 <sup>0</sup> 06' 49.07"	Common Myna	03	-	-	-	By Flying
			Greater Coucal	01	-	-	-	Noted Through Chirping
			Indian Robin	01	-	-	-	Noted Through Chirping
300 M	22 <sup>0</sup> 05' 28.83"	83 <sup>0</sup> 06' 47.56"	Plum Headed Parakeet	02	-	-	-	Noted Through Chirping
			Common Myna	04	-	-	-	Noted Through Chirping
600 M	22 <sup>0</sup> 05' 18.80"	83 <sup>0</sup> 06' 49.30"	Common Myna	02	-	-	-	Noted Through Chirping
			Plum Headed Parakeet	01	-	-	-	By flying
			Indian Robin	01	-	-	-	By flying
			Red Vented Bulbul	01	13.71m	31 <sup>0</sup>	340 <sup>0</sup>	Perching
900 M	22 <sup>0</sup> 05' 09.17"	83 <sup>0</sup> 06' 51.36"	Common Hawk Eagle	02	-	-	-	By flying
			Rose Ringed Parakeet	01	-	-	-	Noted Through Chirping
			Indian Roller	01	29.26m	340 <sup>0</sup>	340 <sup>0</sup>	Perching
1200 M	22 <sup>0</sup> 04' 59.19"	83 <sup>0</sup> 06' 50.07"	Red Vented Bulbul	01	18.28m	90 <sup>0</sup>	20 <sup>0</sup>	Perching
			Common Myna	02	-	-	-	Noted Through Chirping
			Indian Roller	02	-	-	-	By flying

### Datasheet for Bird status survey

Cell-ID: T2 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
0 M	22 05 18.92	83 07 36.25	Indian Roller	01	-	-	-	Noted Through Chirping
			Greenish Warbler	01	7.31m	145	90	Perching
			Blyth's Reed Warbler	01	-	-	-	Noted Through Chirping
300 M	22 05 16.54	83 07 25.64	Little Swift	01	-	-	-	Noted Through Chirping
			Indian Pygmy Woodpecker	01	-	-	-	Noted Through Chirping



			Indian Pond Heron	01	-	-	-	By flying		
			Indian Roller	01	5.48m	170	90	Perching		
			Purple Sun Bird	01	9.14m	170	90	Perching		
<b>600 M</b>	22°05' 17.94"	83°07' 16.54"	Spotted Dove	01	10.05m	60 <sup>0</sup>	90 <sup>0</sup>	Perching		
			Plum Headed	06	10.05m	125 <sup>0</sup>	90 <sup>0</sup>	Perching		
			Greater Coucal	02	-	-	-	Noted Through Chirping		
			Eurasian collared	02	10.05m	125 <sup>0</sup>	90 <sup>0</sup>	Perching		
			Yellow Footed	02	10.05m	125 <sup>0</sup>	90 <sup>0</sup>	Perching		
			Jungle Babbler	05	53.94m	350 <sup>0</sup>	90 <sup>0</sup>	Perching		
			Baya Weaver	01	8.22m	160 <sup>0</sup>	90 <sup>0</sup>	Perching		
			Rufous Tree Pie	01	-	-	-	By flying		
<b>900 M</b>	22°05' 19.20"	83°07' 07.46"	Rose Ringed	06	-	-	-	By flying		
			Green Bee Eater	05	-	-	-	By flying		
			Jungle Babbler	01	-	-	-	Noted Through Chirping		
			Indian Roller	02	-	-	-	Noted Through Chirping		
<b>1200 M</b>	22°05' 20.01"	83°06' 59.10"	Red Vented Bulbul	01	-	-	-	Noted Through Chirping		
			Southern Coucal	06	-	-	-	By flying		
			Greater Coucal	05	-	-	-	Noted Through Chirping		
			Oriental Magpie Robin	04	-	-	-	Noted Through Chirping		
			Purple Sun Bird	01	-	-	-	Noted Through Chirping		
			Baya Weaver	01	-	-	-	Noted Through Chirping		

### Datasheet for Bird status survey

Cell-ID: T3 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
<b>0 M</b>	22°05' 05.16"	83°07' 08.53"	Blyth's Reed Warbler	01	21.94	200 <sup>0</sup>	270 <sup>0</sup>	Perching
			Indian Roller	02	38.40	200 <sup>0</sup>	270 <sup>0</sup>	Perching
			Common Myna	02	-	-	-	By flying
			Purple Sun Bird	01	-	-	-	By flying
			Black Drongo	02	-	-	-	By flying
<b>300 M</b>	22°05' 04.57"	83°07' 11.89"	Green Bee Eater	01	-	-	-	By flying
			Indian Pond Heron	07	-	-	-	By flying
			Red Vented Bulbul	01	7.31m	301	240	Perching
			Aisy Prinia	01	-	-	-	By flying
			Laughing Dove	01	-	-	-	By flying
<b>600</b>	22°05' 08.17"	83°07' 22.21"	Indian Roller	01	-	-	-	By flying

<b>M</b>			Common Myna	01	-	-	-	Noted Through Chirping
			Aisy Prinia	01	-	-	-	By flying
			Green Bee Eater	01	-	-	-	Noted Through Chirping
			Laughing Dove	01	-	-	-	By flying
			Plum Headed Parakeet	02	-	-	-	By flying
			Indian Robin	01	-	-	-	By flying
			Greenish Warbler	01	-	-	-	Perching
			Oriental Magpie Robin	01	-	-	-	By flying
			Red Avadavat	01	-	-	-	By flying
			Indian Silverbill	01	20.11	210 <sup>0</sup>	270 <sup>0</sup>	Perching
<b>900 M</b>	22 <sup>0</sup> 05' 11.84"	83 <sup>0</sup> 07' 28.60"	Rufuos Tree Pie	01	-	-	-	By flying
			Green Bee Eater	01	-	-	-	By flying
			Black Drongo	01	-	-	-	By flying
			Cattle Egret	04	-	-	-	By flying
			Rose Ringed Parakeet	02	-	-	-	By flying
			Indian Roller	01	-	-	-	By flying
<b>1100 M</b>	22 <sup>0</sup> 05' 12.80"	83 <sup>0</sup> 07' 39.29"	Common Myna	01	-	-	-	By flying

### Datasheet for Bird status survey

Cell-ID: T4 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
<b>0 M</b>	22 <sup>0</sup> 05' 00.42"	83 <sup>0</sup> 07' 10.85"	Red Vented Bulbul	01	-	-	-	By Flying
			Ashy Prinia	01	-	-	-	By Flying
			Scaly Breasted Prinia	01	-	-	-	By Flying
			Indian Roller	01	-	-	-	Noted Through Chirping
			Indian Cuckoo	01	-	-	-	Noted Through Chirping
			Black Drongo	01	-	-	-	By flying
			Asian Koel	01	-	-	-	Noted Through Chirping
<b>300 M</b>	22 <sup>0</sup> 05' 00.29"	83 <sup>0</sup> 07' 00.28"	Red Vented Bulbul	01	-	-	-	Noted Through Chirping
			Plain Prinia	01	-	-	-	By flying
			Indian Cuckoo	01	-	-	-	Noted Through Chirping
			Black Drongo	01	-	-	-	Noted Through Chirping
			White Rumped Munia	01	20.12m	330	370	Perching
<b>600 M</b>	22 04 56.87	83 04 49.85	Rose Ringed Parakeet	02	-	-	-	By flying
			Indian Pond Heron	03	-	-	-	By flying

			Indian Roller	01	-	-	-	By flying			
			Common Kingfisher	01	-	-	-	By flying			
			Greater Coucal	02	-	-	-	By flying			
<b>900 M</b>	22°04'55.99"	83°06'42.75"	Cattle Egret	02	-	-	-	By flying			
			Indian Roller	01	-	-	-	Noted Through Chirping			
			Purple Sun Bird	01	22.86m	340 <sup>0</sup>	340 <sup>0</sup>	Perching			
			Red Vented Bulbul	01	22.86m	340 <sup>0</sup>	340 <sup>0</sup>	Perching			
			Plum Headed Parakeet	02	-	-	-	By flying			
			Scaly Brested Munia	03	-	-	-	By flying			
			<b>1200 M</b>	22°04'53.75"	83°06'34.19"	Scaly Brested Munia	04	18.28m	90 <sup>0</sup>	75 <sup>0</sup>	Perching
						Red Vented Bulbul	02	-	-	-	By flying
Indian Roller	01	-				-	-	By calling			
Jungle Bush Quail	01	9.14m				345 <sup>0</sup>	75 <sup>0</sup>	Perching			
Yellow Wattled	01	10.97m				310 <sup>0</sup>	75 <sup>0</sup>	Perching			
Jungle Crow	01	-				-	-	By flying			
Green Bee Eater	01	19.20m				210 <sup>0</sup>	75 <sup>0</sup>	Perching			
Black Drongo	02	15.54m				222 <sup>0</sup>	75 <sup>0</sup>	Perching			
Paddy Field Pipit	02	10.97m				140 <sup>0</sup>	75 <sup>0</sup>	Perching			
Singing Bush Lark	02	12.80m				145 <sup>0</sup>	75 <sup>0</sup>	Perching			
Thick Bellied Flower	01	-				-	-	By flying			
Common Tailor Bird	05	20.11m				163 <sup>0</sup>	75 <sup>0</sup>	Perching			

### Datasheet for Bird status survey

Cell-ID: T5 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
<b>0 M</b>	22°05'38.90"	83°07'41.06"	Red Vented	02	13.71m	80 <sup>0</sup>	150 <sup>0</sup>	Perching
			Indian Robin	02	19.20m	110 <sup>0</sup>	150 <sup>0</sup>	Perching
			Green Bee	03	-	-	-	By flying
			Indian Cuckoo	01	-	-	-	By flying
			Black Drongo	01	-	-	-	Noted Through Chirping
			Indian hawk	01	20.11m	115 <sup>0</sup>	150 <sup>0</sup>	Perching
			Shikara	01	20.11m	115 <sup>0</sup>	150 <sup>0</sup>	Perching
			Blyth reed	01	-	-	-	Noted Through Chirping
<b>300 M</b>	22°05'40.52"	83°07'30.65"	Oriental	01	13.72m	80	80	Perching
			Black drongo	01	9.14m	190	80	Perching
			Common quail	01	-	-	-	Noted Through Chirping
			Bramhiny	02	-	-	-	By flying
			Bayar weaver	02	32.01m	35	80	Perching
			Indian silver	01	19.20m	72	80	Perching
			Thick bellied	01	-	-	-	By flying
<b>600 M</b>	22°05'34.53"	83°07'20.50"	Indian nuthatch	01	14.63m	310	50	Perching
			sulphur-bellied	02	15.54m	215	50	Perching

			Blyth reed	01	15.54m	170 <sup>0</sup>	50 <sup>0</sup>	Perching
			Red Vented	01	-	-	-	By flying
			Alexandrine	04	31.09m	237 <sup>0</sup>	50 <sup>0</sup>	Perching
			Plum headed	03	31.09m	237 <sup>0</sup>	50 <sup>0</sup>	Perching
			Jungle prinia	01	-	-	-	By flying
			Jungle babbler	01	28.35m	256 <sup>0</sup>	50 <sup>0</sup>	Perching
			Common	02	28.35m	256 <sup>0</sup>	50 <sup>0</sup>	Perching
900 M	22 <sup>0</sup> 05' 26.03"	83 <sup>0</sup> 07' 12.54"	Red Vented	01	24.68m	310 <sup>0</sup>	60 <sup>0</sup>	Perching
			Common myna	04	-	-	-	By flying
			Bramhiny	02	-	-	-	By flying
			Cattle egret	06	15.54m	117 <sup>0</sup>	60 <sup>0</sup>	Perching
			Indian pond	02	13.71m	215 <sup>0</sup>	60 <sup>0</sup>	Perching
			Ashy Prinia	01	20.11m	220 <sup>0</sup>	60 <sup>0</sup>	Perching
			Paddy Field	02	6.40m	290 <sup>0</sup>	60 <sup>0</sup>	Perching
			Shikra	01	24.68m	275 <sup>0</sup>	60 <sup>0</sup>	Perching
1200 M	22 <sup>0</sup> 05' 26.54"	83 <sup>0</sup> 06' 00.64"	Indian Roller	01	-	-	-	Noted Through Chirping
			Indian robin	01	-	-	-	Noted Through Chirping
			Purple sun bird	02	10.97m	215 <sup>0</sup>	90 <sup>0</sup>	Perching
			Greater flame back	01	-	-	-	Noted Through Chirping
			Common	01	9.14m	210 <sup>0</sup>	90 <sup>0</sup>	Perching
			Alexandrine	03	15.54m	310 <sup>0</sup>	90 <sup>0</sup>	Perching

### Datasheet for Bird status survey

Cell-ID: T6 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
0 M	22 <sup>0</sup> 05' 48.12"	83 <sup>0</sup> 07' 29.38"	Jungle babbler	02	19.20m	135 <sup>0</sup>	190 <sup>0</sup>	Perching
			Sulphur-bellied warbler	01	22.86m	264 <sup>0</sup>	190 <sup>0</sup>	Perching
			Crimson backed sun bird	01	22.86m	264 <sup>0</sup>	190 <sup>0</sup>	Perching
			Asian koel	02	-	-	-	By flying
			Spotted dove	02	15.54m	111 <sup>0</sup>	190 <sup>0</sup>	Perching
			Green bee eater	04	-	-	-	By flying
			Red vented bulbul	01	-	-	-	Noted Through Chirping
300 M	22 05 57.00	83 07 37.40	Ashy prinia	01	19.21m	112	195	Perching
			Indian silverbill	01	16.45m	136	195	Perching
			Blyth reed warbler	02	16.45m	136	195	Perching
			Green bee eater	08	-	-	-	By flying
			White rumped munia	01	10.05m	290	195	Perching
			Cattle egret	04	-	-	-	By flying
600 M	22 06 06.30	83 07 36.63	Black drongo	01	65.83m	270	195	Perching
			Green bee eater	04	-	-	-	By flying
			Spotted dove	02	55.77m	97	195	Perching

			Loughing dove	01	55.77m	97 <sup>0</sup>	195 <sup>0</sup>	Perching
			Greater coucal	01	20.11m	111 <sup>0</sup>	195 <sup>0</sup>	Perching
			Purple sun bird	01	20.11m	111 <sup>0</sup>	195 <sup>0</sup>	Perching
			Indian pond heron	01	-	-	-	By flying
			Rose ringed parakeet	04	11.88m	250 <sup>0</sup>	195 <sup>0</sup>	Perching
<b>900 M</b>	22 <sup>0</sup> 06' 11.93"	83 <sup>0</sup> 07' 34.57"	Indian silverbill	01	10.97m	134 <sup>0</sup>	170 <sup>0</sup>	Perching
			Black drongo	01	-	-	-	Noted Through Chirping
			Jangle babbler	01	-	-	-	By flying
			Rose ringed parakeet	02	19.20m	117 <sup>0</sup>	170 <sup>0</sup>	Perching
			Jungle Bush Quail	02	23.77m	210 <sup>0</sup>	170 <sup>0</sup>	Perching
			Green bee eater	01	-	-	-	By flying
			Indian roller	01	-	-	-	Noted Through Chirping
			Indian pond heron	01	-	-	-	By flying
<b>1200 M</b>	22 <sup>0</sup> 06' 26.83"	83 <sup>0</sup> 07' 31.12"	Plum headed parakeet	02	-	-	-	Noted Through Chirping
			Golden oriole	01	-	-	-	Noted Through Chirping
			Cattle egret	01	-	-	-	By flying
			Scaly Bressted Munia	01	9.14m	95 <sup>0</sup>	160 <sup>0</sup>	Perching
			Common quail	01	32.91m	217 <sup>0</sup>	160 <sup>0</sup>	Perching
			Purple sun bird	01	-	-	-	By flying
			Green bee eater	25	-	-	-	By flying
			Indian robin	01	-	-	-	By flying
			Oriental magpie robin	01	10.97m	123 <sup>0</sup>	160 <sup>0</sup>	Perching
			Alexandrian parakeet	01	24.68m	136 <sup>0</sup>	160 <sup>0</sup>	Perching
			Laughing dove	01	6.40m	90 <sup>0</sup>	160 <sup>0</sup>	Perching

### Datasheet for Bird status survey

Cell-ID: T7 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Num ber	Perp. Dist.	Bearing		Observation
						A	T	
<b>0 M</b>	22 <sup>0</sup> 04' 44.28"	83 <sup>0</sup> 07' 37.23"	Common myna	03	13.76m	10 <sup>0</sup>	277 <sup>0</sup>	Perching
			Rose ringed parakeet	02	12.80m	0 <sup>0</sup>	277 <sup>0</sup>	Perching
			Indian roller	01	-	-	-	Noted Through Chirping
			White throated kingfisher	01	10.05m	180	277	Perching
			Sulphur bellied warbler	01	-	-	-	By flying
			Red vented bulbul	01	6.40m	0	277	Perching
			Little swift	01	-	-	-	By flying
			Indian pond heron	01	-	-	-	By flying
			Scaly breasted munia	>45	10.97m	315	277	Perching
<b>300 M</b>	22 04 45.09	83 07 47.78	Red vented bulbul	01	-	-	-	By flying
			Purple sunbird	01	-	-	-	Noted Through

								Chirping
			Green bee eater	01	-	-	-	By flying
			Indian roller	01	15.54m	351 <sup>0</sup>	268 <sup>0</sup>	Perching
			Greater coucal	01	-	-	-	Noted Through Chirping
			Plum headed parakeet	02	29.26m	295 <sup>0</sup>	268 <sup>0</sup>	Perching
<b>600 M</b>	22 <sup>0</sup> 04'44.50"	83 <sup>0</sup> 07'57.25"	Eurasian golden oriole	03	9.14m	170 <sup>0</sup>	250 <sup>0</sup>	Perching
			Greenish warbler	02	9.14m	170 <sup>0</sup>	250 <sup>0</sup>	Perching
			Indian roller	01	11.88m	340 <sup>0</sup>	250 <sup>0</sup>	Perching
			Plum headed parakeet	04	15.54m	348 <sup>0</sup>	250 <sup>0</sup>	Perching
			Black drongo	01	-	-	-	By flying
			Jungle babbler	03	-	-	-	By flying
<b>900 M</b>	22 <sup>0</sup> 04'40.40"	83 <sup>0</sup> 08'08.70"	Barn swallow	05	9.14m	165 <sup>0</sup>	262 <sup>0</sup>	Perching
			Little swift	01	-	-	-	By flying
			Rose ringed parakeet	01	-	-	-	Noted Through Chirping
			Alexandrine parakeet	02	10.97m	365 <sup>0</sup>	262 <sup>0</sup>	Perching
			Ashy prinia	01	10.97m	365 <sup>0</sup>	262 <sup>0</sup>	Perching
			Jungle babbler	>12	-	-	-	By flying
<b>1200 M</b>	22 <sup>0</sup> 04'48.24"	83 <sup>0</sup> 08'18.80"	Green bee eater	02	-	-	-	By flying
			Indian roller	01	-	-	-	By flying
			Greenish warbler	01	-	-	-	Noted Through Chirping
			Gray Francolin	01	21.94m	190 <sup>0</sup>	260 <sup>0</sup>	Perching
			Common kingfisher	01	12.80m	201 <sup>0</sup>	260 <sup>0</sup>	Perching
			Blyth's reed warbler	01	4.57m	330 <sup>0</sup>	260 <sup>0</sup>	Perching

### ANNEXURE I (WINTER SEASON)

#### Datasheet for Bird status survey

Cell-ID: T1 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 6:00 AM

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
<b>0 M</b>	22 <sup>0</sup> 05'35.19"	83 <sup>0</sup> 06'45.69"	6:32 AM	Ashy Wren Warbler	02	-	-	-	By Flying
<b>300 M</b>	22 <sup>0</sup> 05'27.50"	83 <sup>0</sup> 06'53.18"	6:40 AM	Indian Silverbil	01	-	-	-	Noted Through chirping
				Purple Sun Bird	01	-	-	-	Noted Through chirping
				Green Bee Eater	05	12M	230	231	Perching
				Ashy Prinia	02	-	-	-	By Flying
				Greenish Warbler	01				By Flying
<b>600 M</b>	22 05 22.51	83 07 00.80	6:55 AM	Small Parakeet	01	-	-	-	Noted Through chirping
				Purple Sun Bird	01	-	-	-	Noted Through chirping
				Sulphur-Bellied	01	-	-	-	By flying

				Warbler					
				Rose Ringed Parakeet	02	-	-	-	Noted Through chirping
				Ashy Drongo	01	-	-	-	By flying
<b>900 M</b>	22°05' 19.45"	83°07' 05.06"	7:05 AM	Jungle Prinia	01	-	-	-	By flying
				Common Myna	01	-	-	-	Noted Through chirping
				Jungle Babbler	01	-	-	-	Noted Through chirping
				White-Rumped Munia	01	-	-	-	By flying
				Indian Robin	01	-	-	-	By flying
<b>1200 M</b>	22°05' 14.34"	83°07' 11.52"	7:13 AM	Alexandrine Parakeet	01	-	-	-	By flying
				Asian Koel	01	-	-	-	Noted Through chirping
				Jungle Babbler	03	-	-	-	Noted Through chirping
				Purple Sun Bird	02	-	-	-	By flying
				Rufous Tree Pie	02	-	-	-	By flying
				Black Drongo	01	-	-	-	By flying
				Green Bee Eater	01	-	-	-	Noted Through chirping
				Eurasian Golden Oriole	01	-	-	-	By flying

### Datasheet for Bird status survey

Cell-ID: T2 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.0 (Km). Season: winter. Time: 7:30 AM

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
<b>0 M</b>	22°05' 15.17"	83°07' 21.33"	7:35 AM	Laughing Dove	02	-	-	-	Noted Through chirping
				Jungle Crow	07	-	-	-	By Flying
				Purple Sun Bird	01	-	-	-	By Flying
				Red Vented Bulbul	01	-	-	-	Noted Through chirping
<b>300 M</b>	22 05 24.71	83 07 20.42	7:47 AM	Rose Ringed Parakeet	01	-	-	-	Noted Through chirping
				Purple Sun Bird	01	-	-	-	Noted Through chirping
				Indian Robin	01	-	-	-	Preaching
				Indian Roller	01	-	-	-	By Flying

				Black Drongo	01	-	-	-	By Flying
				Asian Koel	01	-	-	-	By Flying
				Eurasian Collared Dove	01	-	-	-	By Flying
				Red Vented Bulbul	01	-	-	-	Noted Through chirping
<b>600 M</b>	22 <sup>0</sup> 05' 32.45 <sup>''</sup>	83 <sup>0</sup> 07' 22.60 <sup>''</sup>	8:00 AM	Plum Headed Parakeet	03	-	-	-	By Flying
				Small Parakeet	03	-	-	-	By Flying
				Purple Sun Bird	01	-	-	-	Noted Through chirping
				Green Bee Eater	01	-	-	-	Noted Through chirping
				Red Vented Bulbul	01	-	-	-	Noted Through chirping
				Eurasian Collared Dove	02	-	-	-	By Flying
				Grater Spotted Eagle	01	-	-	-	By Flying
<b>900 M</b>	22 <sup>0</sup> 05' 40.75 <sup>''</sup>	83 <sup>0</sup> 07' 26.24 <sup>''</sup>	8:10 AM	Black Drongo	01	-	-	-	By flying
				Rufous Tree Pie	01	15 M	170 <sup>0</sup>	200 <sup>0</sup>	Preaching
				Eurasian Collared Dove	01	17 M	170 <sup>0</sup>	200 <sup>0</sup>	Preaching
				Red Vented Bulbul	01	15 M	160 <sup>0</sup>	200 <sup>0</sup>	Noted Through chirping
				Alexandrine Parakeet	01	-	-	-	Noted Through chirping
				Spotted Dove	02	12 M	160 <sup>0</sup>	200 <sup>0</sup>	Preaching

### Datasheet for Bird status survey

Cell-ID: T3 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 9:00 AM

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
<b>0 M</b>	22 <sup>0</sup> 05' 17.18 <sup>''</sup>	83 <sup>0</sup> 07' 34.30 <sup>''</sup>	9:00 AM	Indian Silverbil	01	-	-	-	Noted Through chirping
				Purple Sunbird	01	-	-	-	Noted Through chirping
				Red Vented Bulbul	01	-	-	-	By Flying
<b>300 M</b>	22 05 13.21	83 07 25.26	9:15 AM	Green Bee Eater	01	-	-	-	By Flying
				Rufous Tree Pie	01	-	-	-	By Flying
				Plum Headed Parakeet	02	20 M	70	70	Perching
				Red Vented Bulbul	05	13 M	140	70	Perching
				Indian Robin	01	-	-	-	By Flying



600 M	22 <sup>0</sup> 05' 09.38"	83 <sup>0</sup> 07' 16.70"	9:22 AM	Green Bee Eater	01	-	-	-	By Flying
				Black Drongo	01	-	-	-	By Flying
				Laughing Dove	02	-	-	-	Noted Through chirping
				Indian Cuckoo	01	-	-	-	Noted Through chirping
				Capper Smith Babbler	01	-	-	-	By flying
				Spotted Dave	01	-	-	-	Noted Through chirping
900 M	22 <sup>0</sup> 05' 04.08"	83 <sup>0</sup> 07' 08.54"	9:33 AM	Red Vented Bulbul	01	-	-	-	Noted Through chirping
				Purple Sunbird	01	-	-	-	Noted Through chirping
				Ashy Prinia	01	-	-	-	By flying
				Scaly Breasted Munia	01	-	-	-	Noted Through chirping
				White Rumped Munia	01	-	-	-	By flying
				Common Tailorbird	01	11 M	330 <sup>0</sup>	50 <sup>0</sup>	Perching
1200 M	22 <sup>0</sup> 05' 00.12"	83 <sup>0</sup> 07' 01.95"	9:45 AM	Rose Ringed Parakeet	02	-	-	-	By flying
				Small Parakeet	01	-	-	-	By flying
				Eurasian Collared Dove	02	15 M	130 <sup>0</sup>	70 <sup>0</sup>	Perching
				Red Vented Bulbul	01	-	-	-	By flying
				Sirkeer Malkoha	01	17 M	150 <sup>0</sup>	70 <sup>0</sup>	Perching
				Green Bee Eater	01	-	-	-	By flying
				Black Drongo	01	-	-	-	By flying
				Scaly Breasted Munia	01	19 M	1350 <sup>0</sup>	70 <sup>0</sup>	Perching
				Little Swift	01	-	-	-	By flying

**Datasheet for Bird status survey**

Cell-ID: T4 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 10:05 AM

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
0 M	22 <sup>0</sup> 05' 03.40"	83 <sup>0</sup> 06' 54.64"	10:05AM	Jungle Babbler	07	10 M	180 <sup>0</sup>	90 <sup>0</sup>	Perching
				Greenish Warbler	02	-	-	-	By Flying
				Asian Koel	01	-	-	-	By Flying
				Laughing Dove	01	-	-	-	Noted Through chirping
				Indian Roller	01	-	-	-	By Flying
300 M	22 <sup>0</sup> 05' 58.77"	83 <sup>0</sup> 07' 45.39"	10:20AM	Red Vented Bulbul	01	-	-	-	By Flying
				Sulphur-	01	-	-	-	By Flying

				Bellied Warbler					
				Laughing Dove	01	-	-	-	Noted Through chirping
				Indian Roller	01	-	-	-	Noted Through chirping
				Purple Sunbird	01	-	-	-	Noted Through chirping
				Oriental Magpie Robin	01	17 M	135 <sup>0</sup>	90 <sup>0</sup>	Perching
<b>600 M</b>	22 <sup>0</sup> 05'01.01"	83 <sup>0</sup> 06'33.82"	10:30AM	Barn Swallow	09	27 M	40 <sup>0</sup>	120 <sup>0</sup>	Perching
				Golden Oriole	01	12 M	70 <sup>0</sup>	120 <sup>0</sup>	Perching
				Laughing Dove	01	-	-	-	By flying
				Little Swift	01	-	-	-	By flying
				Small Parakeet	01	-	-	-	By flying
				Greater Coucal	01	18 M	90 <sup>0</sup>	120 <sup>0</sup>	Perching
<b>900 M</b>	22 <sup>0</sup> 05'06.29"	83 <sup>0</sup> 06'28.92"	10:40AM	Laughing Dove	01	-	-	-	Noted Through chirping
				Purple Sunbird	01	-	-	-	Noted Through chirping
				Indian Robin	01	-	-	-	By flying
				Green Bee Eater	02	11 M	330 <sup>0</sup>	50 <sup>0</sup>	Perching
				Plum Headed Parakeet	01	-	-	-	By flying
				Plum Headed Parakeet	01	-	-	-	By flying
				Black Drongo	01	11 M	330 <sup>0</sup>	50 <sup>0</sup>	Perching
				Copper Smith Barbet	01	-	-	-	By flying
				Little Swift	01	-	-	-	By flying
				Red Vented Bulbul	01	-	-	-	Noted Through chirping
Little Cormorant	01	-	-	-	By flying				
<b>1200 M</b>	22 05 09.56"	83 06 24.12	10:55AM	Purple Sunbird	01	-	-	-	Noted Through chirping
				Indian Robin	02	-	-	-	Noted Through chirping
				Little Egret	03	-	-	-	By flying
				Little Swift	01	-	-	-	By flying
				Barn Swallow	01	-	-	-	By flying
				Pond Heron	03	15 M	130	70	Perching

### Datasheet for Bird status survey

Cell-ID: T5 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 0.9 (Km). Season: winter. Time: 3:25PM

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
0 M	22°05'48.32"	83°07'28.90"	3:25PM	Red Vented Bulbul	01	-	-	-	By Flying
				Jungle Babbler	04	-	-	-	By Flying
				Indian Roller	01	-	-	-	By Flying
				Indian Silver Bill	01	10 M	180 <sup>0</sup>	180 <sup>0</sup>	Perching
300 M	22°05'57.68"	83°07'31.08"	3:37PM	Laughing Dove	01	35 M	290 <sup>0</sup>	200 <sup>0</sup>	Perching
				Red Vented Bulbul	01	-	-	-	By Flying
				Ashy Prinia	01	-	-	-	By Flying
				Plain Prinia	01	-	-	-	By Flying
				Sulphur-Bellied Warbler	01	-	-	-	By Flying
				Blyth Reed Warbler	01	-	-	-	By Flying
600 M	22°06'05.21"	83°07'34.13"	3:45PM	Greater Coucal	01	-	-	-	By Flying
				Grey Francolin	01	-	-	-	By Flying
				Raqin Quail	03	-	-	-	By flying
				Purple Sunbird	01	-	-	-	Noted Through chirping
				Red Vented Bulbul	02	-	-	-	By flying
				Spotted Dave	01	35 M	190 <sup>0</sup>	190 <sup>0</sup>	Perching
900 M	22°06'13.27"	83°07'38.04"	3:55PM	European Turtle Dove	01	35 M	190 <sup>0</sup>	190 <sup>0</sup>	Perching

### Datasheet for Bird status survey

Cell-ID: T6 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 0.9 (Km). Season: winter. Time: 4:25 PM

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
0 M	22 05 33.17	83 08 13.63	4:25 PM	Spotted Dave	01	20 M	0	320	Perching
				Long Tailed Shrink	01	17M	120	320	Perching
				Rose Ringed Parakeet	01	-	-	-	By Flying
				Little Swift	01	-	-	-	By Flying
				Common	01	-	-	-	By Flying

300 M	22°05'26.51"	83°08'18.95"	4:33PM	Myna					
				Baya Weaver	01	-	-	-	By Flying
				Red Vented Bulbul	03	-	-	-	Noted Through chirping
				Blyth Reed Warbler	01	-	-	-	By Flying
				Oriental Magpie Robin	01	-	-	-	By Flying
				Golden Oriole	01	-	-	-	Noted Through chirping
600 M	22°05'18.32"	83°08'22.65"	4:42PM	Black Leaded Oriole	01	22 M	180°	320°	Perching
				Alexandrine Parakeet	04				
				Euopium Turtle Dove	01	15 M	30°	320°	Perching
				Red Vented Bulbul	01	-	-	-	By flying
				Long Tailed Shrink	01	-	-	-	By flying
				Indian Cuckoo	02	25 M	40°	320°	Perching
				Jungle Babbler	07	-	-	-	By flying
900 M	22°05'11.03"	83°08'26.36"	4:52PM	Jungle Babbler	01	-	-	-	Noted Through chirping
				Small Parakeet	01	-	-	-	Noted Through chirping
				Verditer Flycatcher	01	5 M	210°	320°	Perching

### Datasheet for Bird status survey

Cell-ID: T7 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 6:53 AM

GPS at every 300 m			Sighting information						
S. N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
0 M	22°05'42.72"	83°08'26.85"	6:53 AM	Indian Roller	01	-	-	-	Noted Through chirping
				Common Moorhen	03	-	-	-	By Flying
				Lesser Whistling Duck	01	-	-	-	By Flying
				Shikra	01	30M	140°	250°	Perching
				Indian Robin	01	15M	140°	250°	Perching
300 M	22°05'43.35"	83°08'36.54"	7:05 AM	Greenish Warbler	01	-	-	-	By Flying
				Indian Silver Bill	02	-	-	-	By Flying
				Scaly Breasted Munia	02	12M	290	260	Perching
				Asian Paradise Flycatcher	02	17M	320	260	Perching
				Baya Weaver	01	12M	290	260	Perching
600 M	22°05'42.84"	83°08'46.12"	7:15 AM	Grey Francolin	01	13M	180	280	Perching
				Plum Headed Parakeet	01	-	-	-	By flying

				Red Vented Bulbul	02	-	-	-	Noted Through chirping
				Green Bee Eater	16	-	-	-	By flying
				Oriental Turtle Dove	01	-	-	-	By flying
				Blyth Reed Warbler	02	27M	160 <sup>0</sup>	280 <sup>0</sup>	Perching
				Jungle Babbler	06	-	-	-	By flying
900 M	22 <sup>0</sup> 05'42.58"	83 <sup>0</sup> 08'55.34"	7:27 AM	Jungle Crow	01	-	-	-	By flying
				Sulphur-Bellied Warbler	01	-	-	-	By flying
				Spotted Dave	02	-	-	-	Noted Through chirping
				Red Vented Bulbul	01	-	-	-	Noted Through chirping
				Paddy Field Pipit	02	-	-	-	By flying
				Black Drongo	01	-	-	-	By flying
1200 M	22 <sup>0</sup> 05'42.33"	83 <sup>0</sup> 09'03.88"	7:41 AM	Red Vented Bulbul	02	-	-	-	By flying
				Laughing Dove	01	-	-	-	Noted Through chirping
				Indian Roller	01	-	-	-	Noted Through chirping
				Indian Silver Bill	02	-	-	-	By flying
				Purple Sunbird	01	24 M	0 <sup>0</sup>	280 <sup>0</sup>	Perching
				Common Babbler	04	12 M	190 <sup>0</sup>	280 <sup>0</sup>	Perching
				Verditer Flycatcher	01	32 M	190 <sup>0</sup>	280 <sup>0</sup>	Perching

### Datasheet for Bird status survey

Cell-ID: T8 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:02 AM

GPS at every 300 M			Sighting Information						
S. N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
00 M	22 <sup>0</sup> 05'58.62"	83 <sup>0</sup> 09'13.18"	8:02 AM	Indian Roller	01	-	-	-	Noted Through Chirping
				Golden Oriole	01	25M	150 <sup>0</sup>	100 <sup>0</sup>	Perching
				Purple Sunbird	01	-	-	-	By Flying
				Indian Robin	01	-	-	-	By Flying
				Indian Silver Bill	02	-	-	-	By Flying
300 M	22 <sup>0</sup> 06'00.55"	83 <sup>0</sup> 09'03.81"	8:12 AM	Purple Sunbird	01	-	-	-	By Flying
				Red Vented Bulbul	02	-	-	-	Noted Through Chirping
				Spotted Dave	02	-	-	-	Noted Through Chirping
600 M	22 06 00.19"	83 08 55.28"	8:20 AM	Common Tailor Bird	01	7 M	30	80	Perching
				Common Babbler	01	-	-	-	By Flying
				Purple Sunbird	02	-	-	-	Noted Through Chirping
				Indian Silver Bill	16	-	-	-	By Flying
				Greenish Warbler	01	-	-	-	By Flying
				Green Bee Eater	02	12 M	40	80	Perching

90 0 M	22 <sup>0</sup> 06 01. 42"	83 <sup>0</sup> 08 45. 36"	8:32 AM	Alexandrine Parakeet	01	-	-	-	By Flying
				Eurasian Collared Dove	01	-	-	-	Noted Through Chirping
				Indian Silver Bill	01	-	-	-	By Flying
				Plum Headed Parakeet	01	-	-	-	By Flying
				Blue-Winged Leaf Bird	01	12 M	20 <sup>0</sup>	90 <sup>0</sup>	Perching
				Black Redstart	01	25 M	180 <sup>0</sup>	90 <sup>0</sup>	Perching
12 00 M	22 <sup>0</sup> 05 42. 33"	83 <sup>0</sup> 09 03. 88"	8:40 AM	Eagle Owl	01	-	-	-	By Flying
				Indian Roller	01	-	-	-	By Flying
				Black Drongo	06	25 M	200 <sup>0</sup>	90 <sup>0</sup>	Perching
				Little Cormorant	30	35 M	90 <sup>0</sup>	90 <sup>0</sup>	Perching
				Eurasian Collared Dove	02	12 M	210 <sup>0</sup>	90 <sup>0</sup>	Perching
				Common Kingfisher	01	24 M	80 <sup>0</sup>	90 <sup>0</sup>	Perching
				White Throated Kingfisher	02	24 M	70 <sup>0</sup>	90 <sup>0</sup>	Perching
				Bronze-Winged Jacana	12	45 M	130 <sup>0</sup>	90 <sup>0</sup>	Perching
				Indian Courser	15	14 M	130 <sup>0</sup>	90 <sup>0</sup>	Perching
				Great Thick Knee	06	32M	110 <sup>0</sup>	90 <sup>0</sup>	Perching
				Gadwall	07	30 M	40 <sup>0</sup>	90 <sup>0</sup>	Perching
				Spot Bill Duck	05	15 M	90 <sup>0</sup>	90 <sup>0</sup>	Perching
				Cotton Teal	06	20 M	80 <sup>0</sup>	90 <sup>0</sup>	Perching
				Common Teal	06	24 M	80 <sup>0</sup>	90 <sup>0</sup>	Perching
				Red Wattled Lapping	10	30M	60 <sup>0</sup>	90 <sup>0</sup>	Perching
				Common Sandpiper	23	24 M	70 <sup>0</sup>	90 <sup>0</sup>	Perching
				Singing Bush Lark	3	13 M	100 <sup>0</sup>	90 <sup>0</sup>	Perching
				Greater Cormorant	18	18 M	120 <sup>0</sup>	90 <sup>0</sup>	Perching
				Lesser Whistling Duck	05	20 M	190 <sup>0</sup>	90 <sup>0</sup>	Perching
				Little Bittern	07	19 M	130 <sup>0</sup>	90 <sup>0</sup>	Perching
Eurasian Coot	06	11 M	160 <sup>0</sup>	90 <sup>0</sup>	Perching				
Red Crested Pochard	06	21 M	90 <sup>0</sup>	90 <sup>0</sup>	Perching				
Common Pochard	03	22 M	140 <sup>0</sup>	90 <sup>0</sup>	Perching				
Bar Headed Goose	08	32 M	90	90	Perching				

### Datasheet for Bird status survey

Cell-ID: T9 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:00 AM

GPS at every 300 M			Sighting Information						
S. N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
0	22 09 44.	83 10 02	8:00	Jungle Babbler	02	-	-	-	By Flying

M	00"	.25"	AM	Rufous tree pie	01	25M	0 <sup>o</sup>	290 <sup>o</sup>	Perching
				Plum headed parakeet	01	-	-	-	By Flying
				Indian Silver Bill	01	-	-	-	By Flying
				Small Parakeet	02	-	-	-	By Flying
30 0 M	22 <sup>o</sup> 09 44. 02"	83 <sup>o</sup> 10 08 .74"	8:25 AM	Indian Pitta	01	21 M	200 <sup>o</sup>	290 <sup>o</sup>	Perching
				Brown Shrink	01	18 M	200 <sup>o</sup>	290 <sup>o</sup>	Perching
				Small Parakeet	01	-	-	-	By Flying
				Indian Silver Bill	01	-	-	-	By Flying
				Black Drongo	01	-	-	-	Noted Through Chirping
				Lesser Flame Back	01	-	-	-	Noted Through Chirping
60 0 M	22 <sup>o</sup> 09 44. 56"	83 <sup>o</sup> 10 17 .23"	8:35 AM	Indian Silver Bill	01	-	-	-	By Flying
				Purple Sunbird	01	-	-	-	Noted Through Chirping
				Red vented Bulbul	01	-	-	-	Noted Through Chirping
				Rose ringed Parakeet	04	-	-	-	By Flying
90 0 M	22 <sup>o</sup> 09 44. 86"	83 <sup>o</sup> 10 25 .67"	8:45 AM	Rose ringed Parakeet	01	-	-	-	Noted Through Chirping
				Eurasian Collared Dove	01	-	-	-	Noted Through Chirping
				Purple Sunbird	01	-	-	-	Noted Through Chirping
				Common Babbler	03	-	-	-	By Flying
12 00 M	22 <sup>o</sup> 09 46. 54"	83 <sup>o</sup> 10 35 .42"	9:00 AM	Alexandrine Parakeet	01	-	-	-	By Flying
				Indian Robin	01	-	-	-	By Flying
				Rufous tree pie	06	-	-	-	Noted Through Chirping
				Purple Sunbird	30	-	-	-	Noted Through Chirping
				Eurasian Collared Dove	01	-	-	-	By Flying
				House Sparrow	03	-	-	-	By Flying
				Small Parakeet	01	-	-	-	Noted Through Chirping
				Eurasian golden oriole	04	-	-	-	By Flying
				Rose ringed Parakeet	02	-	-	-	By Flying

### Datasheet for Bird status survey

Cell-ID: T10 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 9:27 AM

GPS at every 300 M			Sighting Information						
S. N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
0 M	22 09 59. 09"	83 10 35 .11"	9:27 AM	Plum headed parakeet	06	-	-	-	By Flying

				Rose ringed Parakeet	03	-	-	-	By Flying
				Alexandrine Parakeet	03	-	-	-	By Flying
				Black Drongo	02	-	-	-	By Flying
				Greater Flame Back	02	-	-	-	Noted Through Chirping
300 M	22°09'58.18"	83°10'24.76"	9:35 AM	Rose ringed Parakeet	01	22 M	160 <sup>0</sup>	80 <sup>0</sup>	Perching
				Black Drongo	02	-	-	-	Noted Through Chirping
				Black Headed Oriole	01	-	-	-	By Flying
				Green Bee Eater	01	-	-	-	By Flying
				Greater Coucal	01	-	-	-	By Flying
600 M	22°09'57.36"	83°10'15.20"	9:45 AM	Jungle Babbler	03	-	-	-	By Flying
				Ashy Prinia	02	-	-	-	By Flying
				Black Drongo	02	-	-	-	By Flying
				Blyth Reed Warbler	01	-	-	-	By Flying
				Rose ringed Parakeet	02	-	-	-	By Flying
				Small Parakeet	02	12 M	20 <sup>0</sup>	80 <sup>0</sup>	Perching
				Common Hoopoe	01	20 M	120 <sup>0</sup>	80 <sup>0</sup>	Perching
				Indian Roller	01	-	-	-	By Flying
900 M	22°09'57.62"	83°10'05.26"	9:50 AM	Indian Silver Bill	01	-	-	-	By Flying
				Plain Prinia	02	-	-	-	By Flying
				Common Babbler	04	-	-	-	By Flying
				Rose ringed Parakeet	02	-	-	-	By Flying
				Purple Sunbird	01	-	-	-	By Flying
				White-throated kingfisher	01	20 M	120 <sup>0</sup>	80 <sup>0</sup>	Perching
				Greater Coucal	01	-	-	-	By Flying

### Datasheet for Bird status survey

Cell-ID: T11 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 9:27 AM

GPS At Every 300 M			Sighting Information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
0m	22°09'57.59	83°10'47.98	Greater Flameback	01	-	-	-	Noted Through Chirping
			Jungle Myna	02	-	-	-	Flying
			Black Drongo	01	-	-	-	Flying
			Indian Roller	01	-	-	-	Noted Through Chirping
300 m	22°09'54.40	83°10'39.14	Alexandrine Parakeet	03	-	-	-	Flying
			Rose Ringed Parakeet	05	12	340°	50°	Perching



			Plum Headed Parakeet	04	-	-	-	Noted Through Chirping
			Small Parakeet	06	-	-	-	Flying
			Golden Oriole	02	-	-	-	Noted Through Chirping
			Jungle Babbler	08	17	120°	50°	Perching
600 m	22°09'51.67	83°10'30.07	Rose Ringed Parakeet	05	-	-	-	Flying
			Copper Smith Barbet	03	10	350°	50°	Perching
			Rufus Tree Pie	01	14	110°	50°	Perching
			Black Drongo	02	-	-	-	Flying
900 m	22°09'47.40	83°10'21.18	Indian Silverbil	05	22	130°	50°	Perching
			Black Myna	01	-	-	-	Flying
			Golden Oriole	01	-	-	-	Noted Through Chirping
1200 m	22°09'44.08	83°10'13.70	Alexandrine Parakeet	02	-	-	-	Flying
			Plumheaded Parakeet	02	-	-	-	Flying
			Purple Sunbird	01	-	-	-	Noted Through Chirping
			Black Hooded Oriole	01	17	140°	70°	Perching

**Datasheet for Bird status survey**

Cell-ID: T12 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 9:27 AM

GPS At Every 300 M			Sighting Information					
S.N.	Latitude	Longitude	Species	Number	Per P. Dist.	Bearing		Observation
						A	T	
0m	22°09'12.70	83°10'37.34	Greater Flameback	2	-	-	-	Flying
			Greater Cauca	1	-	-	-	Flying
			Rose Ringed Parakeet	3	-	-	-	Flying
			Indian Silverbil	2	-	-	-	Noted Through Chirping
300 m	22°09'12.70	83°10'26.53	Thick Blid Flower Peacker	2	35	170°	90°	Perching
			White Rumped Munia	1	30	40°	90°	Perching
			Alexandrine Parakeet	4	-	-	-	Flying
			Black Drongo	2	-	-	-	Flying
600 m	22°09'12.45	83°10'16.57	Oriental White Eye	2	32	10°	90°	Perching
			Indian Silverbil	4	-	-	-	Flying
			Green Bee Eater	12	-	-	-	Flying
			Ashy Prinia	2	29	160°	90°	Perching
			Purple Sunbird	2	-	-	-	
900 m	22°09'12.54	83°10'07.44	Red Vented Bulbul	5	25	20°	90°	Perching
			Baya Weaver	2	35	150°	90°	Perching
			Golden Oriole	2	-	-	-	Noted Through

								Chirping
			Lesser Flamback	1	-	-	-	Noted Through Chirping
			Common Babbler	6	-	-	-	Flying
			Greenish Warbler	2	-	-	-	Flying
			Oriental Magpie Robin	2	35	120°	90°	Perching
			Small Minivet	2	40	40°	90°	Perching
1200 m	22°09'12. 59	83°10'01 .34	Small Minivet	2	32	130°	90°	Perching
			Plum Headed Parakeet	3	-	-	-	Flying
			Jungle Babbler	6	-	-	-	Flying
			Purple Sunbird	1	-	-	-	Noted Through Chirping
			Small Parakeet	2	-	-	-	Noted Through Chirping
			Thick Billed Flower Pecker	2	12	107°	90°	Perching
			Golden Oriole	2	17	30°	90°	Perching
			Oriental White Eye	3	28	50°	90°	Perching
			Black Drongo	2	-	-	-	Noted Through Chirping
			Red Vented Bulbul	2	-	-	-	Noted Through Chirping
			Indian Silverbil	3	-	-	-	Flying
			Baya Weaver	3	-	-	-	Flying

**ANNEXURE II (SUMMER SEASON)**

**Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T1 Team:** Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)		
				B / A / G / W / S	Tree species	Parameters	Observation	1 / 2 / 3 / 4 / 5	Grass	Herb		Shrub	Regeneration
0 M	22°05'38.24"	83°06'49.07"	W/S	Sal	G 0.20 m	4	2%	1%	5 %	30 %	Nil		
				Char	G 0.18 m								
300 M	22°05'28.83"	83°06'47.56"	W/S	Sal	G 0.35m	1,4	1%	2%	3%	25%	Nil		
				Char	G 0.15m								
				Mahua	G 0.19m								
600 M	22°05'18.80"	83°06'49.30"	W/S	Jamun	G 0.10m	1,4	2%	3%	4%	35%	Nil		
				Sal	G 0.22m								
				Char	G 0.20m								
900 M	22°05'09.17"	83°06'51.36"	W/S	Sal	G 0.35m	1,4	3%	1%	5%	20%	Nil		
				Char	G 0.20m								
1200 M	22°04'59.19"	83°06'50.07"	W/A	Mango	G 0.95m	1,4	1%	2 %	5 %	15%	Nil		
				Amaltash	G 0.20 m								
				Mahua	G 0.65m								

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T2 Team:** Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)		
				B / A / G / W / S	Tree species	Parameters	Observation	1 / 2 / 3 / 4 / 5	Grass	Herb		Shrub	Regeneration

**REVISED PROJECT REPORT ON WILDLIFE AND AVIFAUNA CONSERVATION PLAN FOR THE OCP CHAAL, DHARAMJAIGARH AREA**

<b>0 M</b>	22°05'18.92"	83°07'36.25"	W	Sal	G 0.65 m	1,4	1%	1%	1 %	15 %	R/E/S
				Char	G 0.15 m						
				Mahua	G 0.90m						
<b>300 M</b>	22°05'16.54"	83°07'25.64"	W	Sal	G 0.35m	1,4	1%	1%	2%	30%	Nil
				Char	G 0.22m						
				Mahua	G 0.18m						
<b>600 M</b>	22°05'17.94"	83°07'16.54"	W	Neem	G 0.20m	1,4	1%	2%	5%	35%	Nil
				Sal	G 0.50m						
				Char	G 0.20m						
<b>900 M</b>	22°05'19.20"	83°07'07.46"	W	Sal	G 0.35m	1,4	2%	3%	5%	40%	Nil
				Char	G 0.18m						
				Mahua	G 0.36m						
<b>1200 M</b>	22°05'20.01"	83°06'59.10"	W	Sal	G 0.30m	1,4	2%	1 %	5 %	35%	Nil
				Char	G 0.20 m						
				Dhawda	G 0.15m						

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T3 Team:** Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)	
					B / A / G / W / S	Tree species	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub		Regeneration
<b>0 M</b>	22°05'05.16"	83°07'08.53"		W/A	Kusum (01)	G 3.00 m	1,4	1%	2%	7%	30 %	E/S/P	
					Jamun (02)	G 0.50m							
					Char (02)	G 0.60 m							
<b>300 M</b>	22°05'04.57"	83°07'11.89"		W	Sal (35)	G 0.22m	1,4	1%	2%	5%	50%	Nil	
					Char (06)	G 0.40m							
					Kekat (01)	G 0.40m							
<b>600 M</b>	22°05'08.17"	83°07'22.21"		W	Senha (02)	G 0.16m	1,4	1%	1%	5%	50%	Nil	
					Sal (10)	G 0.80m							

**REVISED PROJECT REPORT ON WILDLIFE AND AVIFAUNA CONSERVATION PLAN FOR THE OCP CHAAL, DHARAMJAIGARH AREA**

					Char (5)	G 0.15m						
<b>900 M</b>	22°05' 11.84"	83°07' 28.60"	W	Sal (15)	G 0.50m	1,4	2%	3%	3%	40%	Nil	
				Char (03)	G 0.20m							
				Dhawda (03)	G 0.35m							
<b>1100 M</b>	22°05' 12.80"	83°07' 39.29"	W	Sal (15)	G 0.50m	1,4	1%	2 %	2%	20%	E/S/R/W	
				Char (12)	G 0.17m							
				Senha (3)	G 0.15m							

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datasheet for habitat characterization at every 300 m along transect route**

Cell-ID: T4 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)
				B / A / G / W / S	Tree species	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub	
			<b>0 M</b>	22°05' 00.42"	83°07' 10.85"	W/A	Mahua (01)	G 0.60m	1,4	1%	1%
			Char (02)	G 0.55m							
<b>300 M</b>	22°05' 00.29"	83°07' 00.28"	W/S	Mahua (02)	G 0.75m	1,4	1%	1%	1%	2%	S/W
				Char(04)	G 0.75m						
				Mango (02)	G 0.60m						
<b>600 M</b>	22°04' 56.87"	83°04' 49.85"	A/S	Jamun(02)	G 1.30m	1,4	0%	1%	1%	2%	E
				Mango(02)	G 2.10m						
				Palash (02)	G 2.30m						
<b>900 M</b>	22°04' 55.99"	83°06' 42.75"	A/S	Jamun(02)	G 2.30m	1,4	3%	1%	1%	5%	Nil
				Mango(03)	G 2.10m						
				Bahera (01)	G 1.20m						
<b>1200 M</b>	22°04' 53.75"	83°06' 34.19"	A/W/S	Palash (05)	G 0.67m	1,4	1%	1%	2%	6%	E/P
				Jamun (03)	G 0.74 m						
				Mahua (04)	G 0.55m						

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datasheet for habitat characterization at every 300 m along transect route**

Cell-ID: T5 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)
				B / A / G / W / S	Tree species	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub	
			S/H/R/E/W/P								
0 M	22°05'38.90"	83°07'41.06"	W/S	Sal (02)	G 0.80 m	1,4	2%	3%	5 %	20 %	Nil
				Mahua (02)	G 0.60m						
				Char (03)	G 0.35 m						
300 M	22°05'40.52"	83°07'30.65"	W/S	Tendu(02)	G 0.50m	1,4	1%	2%	3%	25%	Nil
				Saja (02)	G 0.60m						
				Dhawda (3)	G 0.65m						
600 M	22°05'34.53"	83°07'20.50"	W	Mahua (03)	G 0.65m	1,4	2%	3%	5%	30%	Nil
				Sal (05)	G 0.45m						
				Char(05)	G 0.40m						
900 M	22°05'26.03"	83°07'12.54"	W/A	Tendu (02)	G 0.90m	1,4	1%	2%	3%	40%	Nil
				Sal(03)	G 0.90m						
				Char (05)	G 0.50m						
1200 M	22°05'26.54"	83°06'00.64"	W/A	Char (03)	G 0.55m	1,4	1%	3%	2%	20%	Nil
				Sal (02)	G 0.75 m						
				Mahua (02)	G 0.95m						

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datasheet for habitat characterization at every 300 m along transect route**

Cell-ID: T6 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)
				B / A / G / W / S	Tree species	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub	
			S/H/R/E/W/P								

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<b>0 M</b>	22°05'48.12"	83°07'29.38"	W/S	Sal (25)	G 0.55 m	1,4	1%	1%	2 %	20 %	R/E
				Char (02)	G 0.12 m						
<b>300 M</b>	22°05'57.00"	83°07'37.40"	W/S	Tendu(06)	G 0.25m	1,4	>1%	>1%	1 %	20 %	R/E
				Sal (35)	G 0.26m						
				Dhawda (4)	G 0.10m						
<b>600 M</b>	22°06'06.30"	83°07'36.63"	S/G	Tendu (04)	G >0.10m	1,4	10%	1%	1%	35%	Nil
				Sal (10)	G >0.10m						
				Neem(01)	G 0.60m						
<b>900 M</b>	22°06'11.93"	83°07'34.57"	B/A	Nil	Nil	-	20%	0%	0%	0%	Nil
<b>1200 M</b>	22°06'26.83"	83°07'31.12"	W	Palash(06)	G 0.40m	1,4	5%	1%	1%	20%	E/P/S
				Neem (05)	G 0.70 m						
				Mahua (02)	G 1.20m						

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datsheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T7 Team:** Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)	
				B / A / G / W / S	Tree species	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub		Regeneration
<b>0 M</b>	22°04'44.28"	83°07'37.23"	A	Mahua (02)	G 1.55 m	1,4	2%	1%	2 %	25 %	Nil	
				Char (02)	G 0.75 m							
				Semul (01)	G 1.19 m							
<b>300 M</b>	22°04'45.09"	83°07'47.78"	W/A	Char(04)	G 0.80m	1,4	1%	2%	3 %	15 %	Nil	
				Sal (7)	G 0.80m							
				Neem (1)	G 0.55m							
<b>600 M</b>	22°04'44.50"	83°07'57.25"	W/S	dhawda (02)	G 0.90m	1,4	2%	2%	3%	20%	Nil	
				Kusum(01)	G 0.60m							
				kekat(02)	G 0.45m							

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<b>900 M</b>	22°04'40.40"	83°08'08.70"	W/S	Dhawda (3)	G 1.20m	1,4	1%	3%	5%	35%	Nil
				Sal (04)	G 1.30m						
				Saja (02)	G 0.60m						
<b>1200 M</b>	22°04'48.24"	83°08'18.80"	W/A	kusum(02)	G 2.10m	1,4	2%	3%	6%	5%	Nil
				Char (01)	G 0.80 m						
				Mahua (07)	G 1.80m						

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**ANNEXURE II (WINTER SEASON)**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T1 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 6:00 AM**

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb		Shrub	Regeneration
								H	G						
<b>0 M</b>	22°05'35.19"	83°06'45.69"	6:32 AM	S/G	Mahua	06	7m	0.33m	4	5%	5%	10 %	10 %	E,W,H	
					Char	04	3m	0.25m							
					Mango	01	12m	1.12m							
<b>300 M</b>	22°05'27.50"	83°06'53.18"	6:40 AM	W/S	Sal	07	11m	0.47m	4,5	5%	3%	5%	10%	Nil	
					Senha	03	5m	0.28m							
					Char	03	7m	0.45m							
<b>600 M</b>	22°05'22.51"	83°07'00.80"	6:55 AM	W/S	Char	05	11m	0.32m	4,5	2%	4%	5%	20%	Nil	
					Sal	04	6m	0.27m							
					Dhaoda	23	8m	0.45m							
<b>900 M</b>	22°05'19.45"	83°07'05.06"	7:05 AM	W	Char	09	7m	0.25m	4,5	2%	5%	5%	10%	Nil	
					Mahua	02	9m	0.45m							
					Sal	15	10m	0.35m							
<b>1200 M</b>	22°05'14.34"	83°07'11.52"	7:13 AM	W/A	Mango	02	12m	3.00m	4	2%	2%	2%	5%	Nil	
					Mahua	04	3m	0.35m							
					Koria	09	3m	0.42m							



Abbreviation: Land cover – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

Human structure – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

Cell-ID: T2 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.0 (Km). Season: winter. Time: 7:35 AM

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb		Shrub	Regeneration
								H	G						
0 M	22°05'15.17"	83°07'21.33"	7:35 AM	W	Sal	06	10m	0.90m	4	2%	5%	5%	10 %	E,W,H	
					Baheda	05	3m	0.35m							
					Koriya	06	4m	0.28m							
300 M	22°05'24.71"	83°07'20.42"	7:47 AM	G/S	Sal	06	10m	0.45m	4	2%	2%	2%	10%	Nil	
					Mahua	06	5m	0.26m							
					Chironji	03	3m	0.28m							
600 M	22°05'32.45"	83°07'22.60"	8:00 AM	W	Sal	17	7m	0.42m	4	2%	5%	2%	20%	Nil	
					Char	04	5m	0.35m							
					Dhaoda	04	3m	0.35m							
900 M	22°05'40.75"	83°07'26.24"	8:10 AM	W	Sal	17	3m	0.25m	4	2%	5%	5%	5%	Nil	
					Senha	04	3m	0.25m							
					Dhaoda	02	5m	0.35m							

Abbreviation: Land cover – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

Human structure – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**ANNEXURE II (WINTER SEASON)**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

Cell-ID: T3 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 9:00 AM

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition	Human structure (500m radius)
					B / A / G /	Tree	Number	Parameters		

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				W / S	species	of Tree	H	G	n 1/2/3/4/5	Grass	Herb	Shrub	Regeneration	S/H/R/E/W/P
0 M	22°05'17.18"	83°07'34.30"	9:00 AM	W	Sal	17	10m	0.95m	4	2%	2%	3%	10 %	R,H,E
					Saja	06	6m	0.35m						
					Dhaoda	03	5m	0.40m						
300 M	22°05'13.21"	83°07'25.26"	9:15 AM	W	Sal	05	8m	0.65m	4	2%	3%	5%	10%	Nil
					Baheda	03	5m	0.45m						
					Char	03	4m	0.42m						
600 M	22°05'09.38"	83°07'16.70"	9:22 AM	W	Sal	07	10m	0.60m	1,4	3%	2%	5%	20%	Nil
					Mahua	03	10m	1.50m						
					Char	05	8m	0.35m						
900 M	22°05'04.08"	83°07'08.54"	9:33 AM	W, S	Mahua	02	5m	0.25m	1,4	2%	2%	5%	10%	Nil
					Char	05	5m	0.35m						
					Sal	06	7m	0.45m						
22°05'00.12"	83°07'01.95"	22°05'00.12"	9:45 AM	W/G	Mahua	01	8m	1.20m	1,4	3%	3%	2%	5%	Nil
					Char	01	6m	0.42m						
					Baheda	02	12m	1.00m						

**Abbreviation: Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T4 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 10:05 AM**

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb		Shrub	Regeneration
								H	G						
0 M	22°05'03.40"	83°06'54.64"	10:05 AM	W	Mahua	02	10m	2.60m	1,4	2%	2%	2%	3 %	S,E	
					Mango	03	11m	0.75m							
					Char	01	7m	0.45m							
300	22°05'58.77"	83°07'45.39"	10:20	W	Mahua	05	12m	1.25m	1,4	3%	2%	2%	5%	E	

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M			AM		Palash	04	7m	0.40m						
					Char	02	3m	0.20m						
600 M	22°05'01.01"	83°06'33.82"	10:30 AM	W	Char	02	10m	0.95m	1,4	2%	3%	2%	5%	E
					Mango	03	10m	2.20m						
					Mahua	01	8m	1.65m						
900 M	22°05'06.29"	83°06'28.92"	10:40 AM	W/S	Mahua	04	10m	1.25m	1,4	2%	2%	2%	5%	S,E
					Baheda	01	9m	1.70m						
					Chhar	04	7m	0.35m						
1200 M	22°05'09.56"	83°06'24.12"	10:55 AM	W/G	Mahua	05	12m	0.55m	1,4	2%	2%	2%	2%	P,S,E
					Baheda	01	10m	0.42m						
					Semal	02	16m	0.75m						

**Abbreviation: Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

Cell-ID: T5 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.0 (Km). Season: winter. Time: 3:25 PM

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)					Vegetation composition				Human structure (500m radius)	
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb	Shrub		Regeneration
								H	G						
0 M	22°05'48.32"	83°07'28.90"	3:25PM	S	Sal	15	9m	1.20m	1,4	0%	1%	2%	3 %	S,R,E	
					Chilho	02	3m	0.25m							
					Char	06	3m	0.30m							
300 M	22°05'57.68"	83°07'31.08"	3:37PM	S,W	Sal	17	3m	0.20m	4	5%	2%	10%	25%	E	
					Koria	20	7m	0.40m							
					Tendu	08	6m	0.60m							
600 M	22°06'05.21"	83°07'34.13"	3:45PM	S,G	Baheda	01	11m	0.35m	2,4	2%	4%	5%	10%	E	
					Mahaneem	02	4m	0.35m							
					Sal	01	15m	0.95m							

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<b>900 M</b>	22°06'13.27"	83°07'38.04"	3:55PM	B	Mango	02	8m	0.65m	4	1%	1%	1%	2%	R,E,S
					Mahaneem	01	10m	1.70m						
					Mahua	03	10m	0.98m						

**Abbreviation: Land cover – B** (barren) / **A** (Agriculture) / **G** (Grassland) / **W** (Woodland) / **S** (Scrubland)

**Human structure – S** (Settlement) / **R** (Metal road) / **E** (Electricity) / **P** (Pond) / **W** (Well / tube well)

**Observation – 1.** Illicit felling **2.** Girdling **3.** Dead tree **4.** Living / Healthy **5.** Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T6 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.0 (Km). Season: winter. Time: 10:05 AM**

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb		Shrub	Regeneration
								H	G						
<b>0 M</b>	22°05'33.17"	83°08'13.63"	4:25 PM	W	Bargad	01	5m	0.75m	4	2%	1%	2%	20 %	R,E	
					Sal	25	5m	0.35m							
					Char	06	3m	0.30m							
<b>300 M</b>	22°05'26.51"	83°08'18.95"	4:33PM	S,W	Sal	26	6m	0.50m	1,2,4	5%	3%	2%	20 %	Nil	
					Saja	03	4m	0.45m							
					Char	04	4m	0.35m							
<b>600 M</b>	22°05'18.32"	83°08'22.65"	4:42PM	W	Sal	35	6m	0.40m	1,2,4	3%	2%	2%	10%	Nil	
					Char	08	5m	0.55m							
					Baheda	02	4m	0.25m							
<b>900 M</b>	22°05'11.03"	83°08'26.36"	4:52PM	W	Sal	11	5m	0.80m	1,4	2%	2%	2%	10%	Nil	
					Char	05	4m	0.45m							
					Mahua	03	5m	0.75m							

**Abbreviation: Land cover – B** (barren) / **A** (Agriculture) / **G** (Grassland) / **W** (Woodland) / **S** (Scrubland)

**Human structure – S** (Settlement) / **R** (Metal road) / **E** (Electricity) / **P** (Pond) / **W** (Well / tube well)

**Observation – 1.** Illicit felling **2.** Girdling **3.** Dead tree **4.** Living / Healthy **5.** Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T7 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 6:53 AM**

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S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb		Shrub	Regeneration
								H	G						
0 M	22°05'42.72"	83°08'26.85"	6:53AM	W	Sal	16	7m	0.45m	1,4	5%	2%	10%	15%	P,S,R,E	
					Char	06	5m	0.55m							
					Mahua	03	4m	0.35m							
300 M	22°05'43.35"	83°08'36.54"	7:05AM	W,S	Sal	21	5m	0.60m	1,2,4	2%	5%	5%	5%	P	
					Mahua	03	3m	0.35m							
					Char	04	3m	0.25m							
600 M	22°05'42.84"	83°08'46.12"	7:15AM	W,S	Sal	08	5m	0.40m	1,2,4	5%	10%	15%	25%	Nil	
					Char	10	4m	0.25m							
					Baheda	03	5m	0.45m							
900 M	22°05'42.58"	83°08'55.34"	7:27AM	A,W	Chhar	05	5m	0.50m	2,4	2%	10%	2%	10%	Nil	
					Mahua	07	7m	0.70m							
1200 M	22°05'42.33"	83°09'03.88"	7:41AM	A,W	Mango	01	8m	0.90m	1,4	1%	1%	2%	5%	Nil	
					Sal	06	6m	0.95m							
					Mahua	01	5m	0.70m							

**Abbreviation: Land cover – B** (barren) / **A** (Agriculture) / **G** (Grassland) / **W** (Woodland) / **S** (Scrubland)

**Human structure – S** (Settlement) / **R** (Metal road) / **E** (Electricity) / **P** (Pond) / **W** (Well / tube well)

**Observation – 1.** Illicit felling **2.** Girdling **3.** Dead tree **4.** Living / Healthy **5.** Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T8 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:02 AM**

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb		Shrub	Regeneration
								H	G						
0 M	22°05'58.62"	83°09'13.18"	8:02AM	A,W	Mahua	08	7m	0.85m	1,4	1%	2%	2%	5%	Nil	
					Char	07	6m	0.65m							

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<b>300 M</b>	22°06'00.55"	83°09'03.81"	8:12AM	W	Sal	15	6m	0.55m	1,4	1%	1%	2%	3%	Nil
					Sal	35	7m	0.55m						
					Saja	03	3m	0.30m						
					Senha	02	4m	0.35m						
<b>600 M</b>	22°06'00.19"	83°08'55.28"	8:20AM	W	Mahua	06	8m	0.75m	4	1%	1%	1%	2%	Nil
					Sal	07	9m	0.80m						
					Chhar	05	4m	0.55m						
<b>900 M</b>	22°06'01.42"	83°08'45.36"	8:32AM	W	Harra	01	9m	1.20m	4	1%	1%	1%	1%	P
					Mahua	03	12m	1.45m						
					Chhar	04	4m	0.45m						
<b>1200 M</b>	22°05'42.33"	83°09'03.88"	8:40AM	B,P	Harra	01	8m	1.20m	4	1%	1%	1%	1%	Wetland
					Mahua	02	15m	1.55m						
					Bargad	01	10m	1.35m						

**Abbreviation: Land cover – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)**

**Human structure – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)**

**Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased**

### ANNEXURE II

#### Appendix 2: Datasheet for habitat characterization at every 300 m along transect route

**Cell-ID: T9 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:00 AM**

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb		Shrub	Regeneration
								H	G						
<b>0 M</b>	22°09'44.00"	83°10'02.25"	8:00AM	W	Sal	18	30m	1.55m	4	1%	2%	2%	10%	H,S	
					Char	03	12m	1.35m							
					Saja	01	22m	1.44m							
<b>300 M</b>	22°09'44.02"	83°10'08.74"	8:25AM	W	Sal	13	30m	130m	4	1%	1%	2%	10%	Nil	
					Char	04	25m	110m							
					Saliya	06	30m	130m							
<b>600 M</b>	22°09'44.56"	83°10'17.23"	8:35AM	W	Sal	29	32m	1.65m	4	2%	1%	5%	75%	Nil	
					Dhawda	05	25m	1.40m							
					Saja	03	22m	0.95m							

**REVISED PROJECT REPORT ON WILDLIFE AND AVIFAUNA CONSERVATION PLAN FOR THE OCP CHAAL, DHARAMJAIGARH AREA**

<b>900 M</b>	22°09'44.86"	83°10'25.67"	8:45AM	W	Sal	08	33m	1.20m	4	2%	1%	2%	70%	Nil
					Dhawda	04	35m	1.10m						
					Chhar	02	30m	1.09m						
<b>1200 M</b>	22°09'46.54"	83°10'35.42"	9:00AM	W	Sal	19	35m	1.45m	4	2%	1%	5%	25%	Nil
					Saliya	08	25m	0.80m						
					Saja	05	28m	1.20m						

**Abbreviation: Land cover – B** (barren) / **A** (Agriculture) / **G** (Grassland) / **W** (Woodland) / **S** (Scrubland)

**Human structure – S** (Settlement) / **R** (Metal road) / **E** (Electricity) / **P** (Pond) / **W** (Well / tube well)

**Observation – 1.** Illicit felling **2.** Girdling **3.** Dead tree **4.** Living / Healthy **5.** Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T10 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.0 (Km). Season: winter. Time: 8:00 AM**

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)					Vegetation composition				Human structure (500m radius)	
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb	Shrub		Regeneration
								H	G						
<b>0 M</b>	22°09'59.09"	83°10'35.11"	9:27AM	W	Sal	15	30m	1.55m	4	1%	2%	2%	10%	H,S	
					Saja	04	12m	1.35m							
					Tilisa	02	22m	1.44m							
<b>300 M</b>	22°09'58.18"	83°10'24.76"	9:35AM	W	Sal	16	30m	1.30m	4	1%	1%	2%	10%	Nil	
					Dhawda	02	25m	1.10m							
					Anjan	03	30m	1.30m							
<b>600 M</b>	22°09'57.36"	83°10'15.20"	9:45AM	W	Sal	08	32m	1.65m	4	2%	1%	5%	75%	Nil	
					Dhawda	06	25m	1.40m							
					Saja	03	22m	0.95m							
<b>900 M</b>	22°09'57.62"	83°10'05.26"	9:50AM	W	Teak	19	33m	1.20m	4	2%	1%	2%	70%	Nil	
					Harra	01	35m	1.10m							
					Mahua	07	30m	1.09m							

**Abbreviation: Land cover – B** (barren) / **A** (Agriculture) / **G** (Grassland) / **W** (Woodland) / **S** (Scrubland)

**Human structure – S** (Settlement) / **R** (Metal road) / **E** (Electricity) / **P** (Pond) / **W** (Well / tube well)

Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

ANNEXURE II

Appendix 2: Datasheet for habitat characterization at every 300 m along transect route

Cell-ID: T11 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:45 AM

S.N.	GPS Location		Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
	Lat.	Long.			B / A / G / W / S	Tree spp.	Number of tree	Parameters		Observation 1 / 2 / 3 / 4 / 5	Grass (%)	Herb (%)		Shrub (%)	Regeneration (%)
								H	G						
0m	22°09'57.59	83°10'47.98	11:35 am	W	Sal	08	25m	1.40m	4	1%	2%	2%	5%	E	
					Mahua	05	30m	1.70m							
					Char	02	35m	1.65m							
300m	22°09'54.40	83°10'39.14	11:55 am	W	Sal	12	17m	0.95m	4,5	1%	1%	3%	5%	E	
					Char	04	40m	1.55m							
					Saja	04	30m	1.35m							
600m	22°09'51.67	83°10'30.07	12:03 am	W	Sal	08	17m	0.70m	4,5	1%	2%	2%	15%	E	
					Char	08	17m	0.75m							
					Mahua	03	30m	1.35m							
900m	22°09'47.40	83°10'21.18	12:16 am	W	Sal	08	28m	1.25m	3,4,5	2%	3%	2%	10%	E	
					Saja	04	26m	1.10m							
					Saliha	02	26m	1.15m							
1200m	22°09'44.08	83°10'13.70	12:27 am	W	Sal	08	35m	1.65m	4	1%	1%	2%	10%	E	
					Saliha	03	28m	1.40m							
					char	06	25m	1.10m							

Abbreviation: Land cover – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

Human structure – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased



ANNEXURE II

Appendix 2: Datasheet for habitat characterization at every 300 m along transect route

Cell-ID: T12 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:00 AM

S.N.	GPS Location		Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)					Vegetation composition				Human structure (500m radius)		
	Lat.	Long.			B / A / G / W / S	Tree spp.	Number of tree	Parameters		Observation 1 / 2 / 3 / 4 / 5	Grass (%)	Herb (%)	Shrub (%)		Regeneration (%)	S/H/R/E/W/P
								H	G							
0m	22 <sup>0</sup> 09'12.70	83 <sup>0</sup> 10'37.34	7:45am	W	Dhawda	08	35m	0.85m	4	1%	1%	2%	5%	R		
					Sal	11	35m	1.55m								
					Saja	07	25m	1.10m								
300m	22 <sup>0</sup> 09'12.70	83 <sup>0</sup> 10'26.53	7:50 am	W	Dhawda	06	40m	1.40m	1,4	1%	1%	3%	5%	R		
					Sal	12	40m	1.20m								
					Tinsa	04	30m	1.25m								
600m	22 <sup>0</sup> 09'12.45	83 <sup>0</sup> 10'16.57	8:02 am	W	Sal	10	40m	1.55m	1,4	1%	1%	2%	15%	R		
					Tinsa	05	35m	1.35m								
					dhawda	06	32m	1.25m								
900m	22 <sup>0</sup> 09'12.54	83 <sup>0</sup> 10'07.44	8:17 am	W	sal	08	45m	1.65m	1,4	1%	1%	2%	10%	R		
					Kekat	02	15m	0.95m								
					Saja	04	28m	1.20m								
1200m	22 <sup>0</sup> 09'12.59	83 <sup>0</sup> 10'01.34	8:25 am	W	Sal	11	50m	2.10m	1,4	1%	1%	2%	10%	R		
					Saja	04	32m	1.20m								
					Kekat	04	25m	1.10m								

Abbreviation: Land cover – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

Human structure – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

## ANNEXURE 3

## Avifauna checklist of seasonal survey 2018 of OCP Chhal by SFRTI

S. No.	Common Name	Local Name	Scientific Name	Family	IUCN Status
1.	Alexandrine Parakeet	Parrot, Tota	<i>Psittacula eupatria</i>	Psittacidae	NT
2.	Ashy Drongo	-----	<i>Dicrurus leucophaeus</i>	Dicruridae	LC
3.	Ashy Prinia or ashy wren-warbler	-	<i>Prinia socialis</i>	Cisticolidae	LC
4.	Asian Brown Flycatcher	--	<i>Muscicapa dauurica</i>	Muscicapidae	LC
5.	Asian Koel	Koel, Cuckoo	<i>Eudynamis scolopacea</i>	Cuculidae	LC
6.	Asian Paradise Flycatcher	-----	<i>Terpsiphone paradisi</i>	Monarchidae	LC
7.	Bank Myna	Myna	<i>Acridotheres ginginianus</i>	Sturnidae	LC
8.	Bar Headed Goose	-----	<i>Anser indicus</i>	Anatidae	LC
9.	Barn Swallow	-----	<i>Hirundo rustica</i>	Hirundinidae	LC
10.	Baya Weaver	Gauraiya	<i>Ploceus philippinus</i>	Ploceidae	LC
11.	Black Drongo	Karrauna	<i>Dicrurus macrocercus</i>	Dicruridae	LC
12.	Black Headed Oriole	-----	<i>Oriolus larvatus</i>	Oriolidae	LC
13.	Black Redstart	-----	<i>Phoenicurus ochruros</i>	Muscicapidae	LC
14.	Blue-Winged Leaf Bird	-----	<i>Chloropsis cochinchinensis</i>	Chloropseidae	NT
15.	Blyth Reed Warbler	-----	<i>Acrocephalus dumetorum</i>	Acrocephalidae	LC
16.	Bramhiny Myna	Maina	<i>Sturnia pagodarum</i>	Sturnidae	LC
17.	Bronze-Winged Jacana	-----	<i>Metopidius indicus</i>	Jacanidae	LC
18.	Brown Shrink	-----	<i>Lanius cristatus</i>	Laniidae	LC
19.	Cattle Egret	Gay Bagula	<i>Bubulcus ibis</i>	Ardeidae	LC
20.	Common Babbler	-----	<i>Turdoides caudate</i>	Lieothrichidae	LC
21.	Common Hawk Eagle	Cheel	<i>Hierococyx varius</i>	Cuculidae	LC
22.	Common Hoopoe	-----	<i>Upupa epops</i>	Upupidae	LC
23.	Common Kingfisher	Kilkila	<i>Alcedo atthis</i>	Alcedinidae	LC
24.	Common Moorhen	-----	<i>Gallinula chloropus</i>	Rallidae	LC
25.	Common Myna	Salhai/ desimyna	<i>Acridotheres tristis</i>	Sturnidae	LC
26.	Common Pochard	-----	<i>Aythya ferina</i>	Anatidae	VU
27.	Common quail	Titar	<i>Coturnix coturnix</i>	Phasianidae	LC
28.	Common	-----	<i>Actitis hypoleucos</i>	Scolopacidae	LC

	Sandpiper				
29.	Common Tailor Bird	-----	<i>Orthotomus sutorius</i>	Cisticolidae	LC
30.	Common Teal	-----	<i>Anas crecca</i>	Anatidae	LC
31.	Copper Smith Barbet	-----	<i>Psilopogon haemacephalus</i>	Megalaimidae	LC
32.	Cotton Teal	-----	<i>Nettapus coromandelianus</i>	Anatidae	LC
33.	Crimson Backed sunbird or Small Sunbird	-	<i>Leptocoma minima</i>	Nectariniidae	LC
34.	Eagle Owl	Ullu	<i>Bubo bubo</i>	Strigidae	LC
35.	Eurasian Collared Dove	Padki	<i>Streptopelia decaocto</i>	Columbidae	LC
36.	Eurasian Coot	-----	<i>Fulica atra</i>	Rallidae	LC
37.	Eurasian Golden Oriole	-----	<i>Oriolus oriolus</i>	Oriolidae	LC
38.	European Turtle Dove	Padki	<i>Streptopelia turtur</i>	Columbidae	VU
39.	Feral Pigeon	Kabutar	<i>Columba livia domestica</i>	Columbidae	LC
40.	Gadwall	-----	<i>Mareca strepera</i>	Anatidae	LC
41.	Grater Spotted Eagle	-----	<i>Clanga clanga</i>	Accipitridae	VU
42.	Great Thick Knee	-----	<i>Esacus recurvirostris</i>	Burhinidae	NT
43.	Greater Coucal	Koyal	<i>Centropus sinensis</i>	Cuculidae	LC
44.	Greater Cormorant	-----	<i>Phalacrocorax carbo</i>	Phalacrocoracidae	LC
45.	Greater flame back Woodpecker	Katpodva	<i>Dryocopus martius</i>	Picidae	LC
46.	Green Bee Eater	Patinga	<i>Merops orientalis</i>	Meropidae	LC
47.	Greenish Warbler	-----	<i>Phylloscopus trochiloides</i>	Phylloscopidae	LC
48.	Grey Francolin	-----	<i>Francolinus pondicerianus</i>	Phasianidae	LC
49.	House Crow	Kauaa	<i>Corvus splendens</i>	Corvidae	LC
50.	House Sparrow	Gouriaya	<i>Passer domesticus</i>	Passeridae	LC
51.	Indian barn owl	-	<i>Tyto alba</i>	Tytonidae	LC
52.	Indian Courser	-----	<i>Cursorius coromandelicus</i>	Glareolidae	LC
53.	Indian Cuckoo	-----	<i>Cuculus micropterus</i>	cuculidae	LC
54.	Indian nuthatch	-	<i>Sitta castanea</i>	Sittidae	LC
55.	Indian Pitta	-----	<i>Pitta brachyura</i>	Pittidae	LC
56.	Indian pond heron	Khokho bakli	<i>Ardeola grayii</i>	Ardeidae	LC
57.	Indian pygmy woodpecker	-	<i>Yungipicus nanus</i>	Picidae	LC
58.	Indian Robin	Chirak	<i>Saxicoloides fulicatus</i>	Muscicapidae	LC
59.	Indian Roller	Nilkanth/teohra	<i>Coracias benghalensis</i>	Coraciidae	LC

60.	Indian Silver Bill	-----	<i>Euodice malabarica</i>	Estrildidae	LC
61.	Indian spotted dove	Padki	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC
62.	Jungle Babbler	Satbhaiya	<i>Turdoides striata</i>	Leiothrichidae	LC
63.	Jungle Bush Quail	Titar	<i>Perdica asiatica</i>	Phasianidae	LC
64.	Jungle Crow	Koua	<i>Corvus culminatus</i>	Corvidae	LC
65.	Jungle Myna	Maina	<i>Acridotheres fuscus</i>	Sturnidae	LC
66.	Jungle Prinia	-----	<i>Prinia sylvatica</i>	Cisticolidae	LC
67.	Laughing Dove	Padki	<i>Spilopelia senegalensis</i>	Columbidae	LC
68.	Lesser Flame back	-----	<i>Dinopium benghalense</i>	Picidae	LC
69.	Lesser Whistling Duck	-----	<i>Dendrocygna javanica</i>	Anatidae	LC
70.	Little Bittern	-----	<i>Ixobrychus minutus</i>	Ardeidae	LC
71.	Little Cormorant	-----	<i>Microcarbo niger</i>	Phalacrocoracidae	LC
72.	Little Egret	Kokda	<i>Egretta garzetta</i>	Ardeidae	LC
73.	Little Swift	-----	<i>Apus affinis</i>	Apodidae	LC
74.	Long tailed Minivet		<i>Pericrocotus ethologus</i>	Campephagidae	LC
75.	Long Tailed Shrike	-----	<i>Lanius schach</i>	Laniidae	LC
76.	Oriental Magpie Robin	-----	<i>Copsychus saularis</i>	Muscicapidae	LC
77.	Oriental Turtle Dove	-----	<i>Streptopelia orientalis</i>	Columbidae	LC
78.	Oriental White Eye	-----	<i>Zosterops palpebrosus</i>	Zosteropidae	LC
79.	Paddy Field Pipit	-----	<i>Anthus rufulus</i>	Motacillidae	LC
80.	Plain Prinia	-----	<i>Prinia inornata</i>	Cisticolidae	LC
81.	Plum Headed Parakeet	Tota/Sua	<i>Psittacula cyanocephala</i>	Psittacidae	LC
82.	Purple Sun Bird	-----	<i>Nectarania asiatica asiatica (Latham)</i>	Nectariniini	LC
83.	Rain Quail	Quail	<i>Coturnix coromandelica</i>	Phasianidae	LC
84.	Red avadavat	-	<i>Amandava amandava</i>	Estrildidae	LC
85.	Red Crested Pochard	-----	<i>Netta rufina</i>	Anatidae	LC
86.	Red Vented Bulbul	Fikkadlow	<i>Pycnonotus cafer</i>	Pycnonotidae	LC
87.	Red Wattled Lapping	-----	<i>Vanellus indicus</i>	Charadriidae	
88.	Rose Ringed Parakeet	Tota/Sua	<i>Psittacula krameri</i>	Psittaculidae	LC
89.	Rufous Tree Pie	-----	<i>Dendrocitta vagabunda</i>	Corvini	LC
90.	Scaly Breasted Munia	-----	<i>Lonchura punctulata</i>	Estrildidae	LC
91.	Shikra	Cheel	<i>Accipiter badius</i>	Accipitridae	LC

92.	Singing Bush Lark	-----	<i>Mirafra javanica</i>	Alaudidae	LC
93.	Singing bush lark	-	<i>Mirafra javanica</i>	Alaudidae	LC
94.	Sirkeer Malkoha	-----	<i>Taccocua leschenaultii</i>	Cuculidae	LC
95.	Small Minivet	-----	<i>Pericrocotus cinnamomeus</i>	Campephagidae	LC
96.	Spot Bill Duck	-----	<i>Anas poecilorhyncha</i>	Anatidae	LC
97.	Spotted Dave	-----	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC
98.	Spotted Owl	Ullu	<i>Strix occidentalis</i>	Strigidae	NT
99.	Sulphur-Bellied Warbler	-----	<i>Phylloscopus griseolus</i>	Acrocephalidae	LC
100.	Thick Billed Flower Pecker	-----	<i>Dicaeum agile</i>	Dicaeidae	LC
101.	Verditer Flycatcher	-----	<i>Eumyias thalassinus</i>	Muscicapidae	LC
102.	Vernal Hanging Parrot	-----	<i>Loriculus vernalis</i>	Psittaculidae	LC
103.	White Throated Kingfisher	Kilkila	<i>Halcyon smyrnensis</i>	Alcedinidae	LC
104.	White-Rumped Munia	-----	<i>Lonchura striata</i>	Estrildidae	LC
105.	Yellow wattled lapwing	-	<i>Vanellus malabaricus</i>	Charadriidae	LC
106.	Yellow-footed Green Pigeon	Kabootar	<i>Treron phoenicoptera</i>	Columbidae	LC

### Characterization of bird species according to their nesting pattern

1. **Scrape nesting birds:** - The simplest nest construction is the Scrape, which merely a shallow depression in soil or vegetation.

#### **Bird species found in OCP Chhal area:**

- a) Common Quail
  - b) Rain Quail
  - c) Jungle Bush Quail
  - d) Gray Francolin
  - e) Yellow Wattled Lapwing
2. **Burrow nesting birds:** - Soil plays a different role in the burrow nest: the eggs and young in most cases the incubating parent birds are sheltered under the earth.

#### **Bird species found in OCP Chhal area:**

- a) Little Swift
- b) Barn Swallow

- c) Green Bee Eater
- d) White Throated Kingfisher

3. **Cavity nesting birds:** - The cavity nest is a chamber, typically in living or dead wood, but sometimes in the trunks of tree ferns or large cacti, including saguaro. In tropical areas, cavities are sometimes excavated in arboreal insect nests.

**Bird species found in OCP Chhal area:**

- a) Common Myna (Secondary cavity nester)
- b) Copper Smith Barbet (Primary cavity nester)
- c) House Sparrow (Secondary cavity nester)
- d) Bramhiny Myna (Secondary cavity nester)
- e) Indian Robin (Secondary cavity nester)
- f) Indian Roller (Secondary cavity nester)
- g) Oriental Magpie Robin (Secondary cavity nester)
- h) Rose Ringed Parakeet (Secondary cavity nester)
- i) Indian Nuthatch Barbet (Primary cavity nester)
- j) Plum Headed Parakeet (Secondary cavity nester)
- k) Alexandrine Parakeet (Secondary cavity nester)
- l) Indian Barn Owl (Secondary cavity nester)
- m) Lesser Golden Backed Woodpecker (Primary cavity nester)

4. **Cup shaped nesting birds:** - The cup nest is smoothly hemispherical inside, with a deep depression to house the eggs. Most are made of pliable materials including grasses though a small number are made of mud or saliva.

**Bird species found in OCP Chhal area:**

- a) Sulphur Bellied Warbler
- b) Indian Spotted Dove
- c) Black Drongo
- d) Common Hawk Cuckoo
- e) Common Tailor Bird
- f) White Rumped Munia
- g) Ashy Prinia or Ashy Wren Warbler
- h) Blyth Reed Warbler
- i) Greenish Warbler
- j) Jungle Babbler

- k) Laughing Dove
  - l) Indian Cuckoo (Mostly use a nest of crows and drongos House Crow)
  - m) Eurasian Collared Dove
  - n) Asian Koel (Brood parasite lays egg on different birds nest)
  - o) Eurasian Golden oriole
  - p) Paddy Field Pipit
  - q) Singing Bush lark
5. **Saucer or plate form nest:** - The saucer or plate nest, though superficially similar to a cup nest, has at most only a shallow depression to house the eggs.
- Bird species found in OCP Chhal area:**
- a) Greater Coucal
6. **Platform nesting birds:** - The platform nest is a large structure, often many times the size of the (typically large) bird which has built it. Depending on the species, these nests can be on the ground or elevated.
- Bird species found in OCP Chhal area:**
- a) Indian Pond Heron
  - b) Cattle Egret
  - c) Little Egret
  - d) Rufous Tree pie
  - e) Shikra
  - f) Yellow Footed Green Pigeon
  - g) Jungle Crow
  - h) Little Cormorant
  - i) Buzzard
  - j) Great Egret
7. **Pendant nesting birds:** - The pendant nest is an elongated sac woven of pliable materials such as grasses and plant fibers and suspended from a branch.
- Bird species found in OCP Chhal area:**
- a) Common Kingfisher
  - b) Purple Sunbird
  - c) Indian Golden Oriole
  - d) Crimson Backed Sunbird
  - e) Thick Billed Flower-pecker
  - f) Baya Weaver

g) Indian Silverbill

8. **Sphere shaped nesting birds:** - The Sphere nest is roundish structure; it is completely enclosed, except for a small opening which allows access.

**Bird species found in OCP Chhal area:**

- a) Red Vented Bulbul
- b) Scaly Breasted Munia
- c) Jungle Prinia
- d) Plain Prinia
- e) Red Avadavat

**Detailed description of birds including habit habitat and nesting pattern**

**1. Scrape nesting bird species found in OCP Chhal area:**

**a) Common Name: Common Quail**

**Zoological Name:** *Coturnix coturnix coturnix (Linnaeus)*

**Family:** Phasianidae

**Conservation Status:** Least Concern

**Voice Call:** The only indication of its presence is the distinctive "wet-my-lips" repetitive song of the male. The call is uttered mostly in the mornings, evenings and sometimes at night.

**Habitat:** Grassland, cropped fields, and scrubs

**Feeding:** The rain quail feeds on seeds of grasses and other plants, insect Larvae and small invertebrates.

**Breeding Season:** Breeding takes place between March and October.

**Nesting Pattern:** 6-12 eggs in a ground nest.

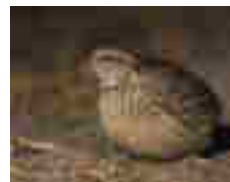
**Economic Importance:** Common Quail and their eggs provide food for humans. They are also common, well-liked birds of aviaries.



Nesting of Common Quail



Male Bird



Female Bird

**b) Common Name: Jungle Bush Quail**

**Zoological Name:** *Perdicula asiatica*

**Family:** Phasianidae

**Conservation Status:** Least Concern



**Voice Call:** Advertising call is a rhythmic, harsh, slightly grating “chee- chee-chuck, chee-chee-chuck

**Habitat:** Dry scrub and brush habitats, often stony, ranging from thin grass to fairly dense deciduous.

**Feeding:** The diet of the jungle bush quail consists mainly of seeds. Particularly of grasses, although it also takes insects.

**Breeding Season:** Breeding takes place after the rains and lasts until the onset of colder weather.

**Nesting Pattern:** their housing is, they need to be provided with plenty of green branches to provide sheltered and a place for the hens to lay.

**Economic Importance:** Sometimes, these quail are kept in aviaries. They have a pet trade.



Nesting of Rain Quail



Male Bird



Female Bird

### c) Common Name: Gray Francolin

**Zoological Name:** *Francolinus pondicerianus*

**Family:** Phasianidae

**Conservation Status:** Least Concern

**Voice Call:** loud and repeated *Ka-tee-tar... tee-tar*. The female call is *a tee... tee... tee* repeated and sometimes *kila.. kila.. kila* and the challenge call *kateela.. kateela.. kateela* is a duet.

**Habitat:** They are found in open cultivated lands as well as scrub forest and their local name of teetar.

**Feeding:** Food includes seeds, grains as well as insects, particularly termites and Beetles.

**Breeding Season:** April to September

**Nesting Pattern:** The nest is a hidden scrape on the ground.

**Economic Status:** They are hunted illegally in much of their range using low nets and easily caught using calling decoy birds.



Male Bird



Female Bird

**D) Common Name: Yellow-wattled Lapwing**

**Zoological Name:** *Vanellus malabaricus*

**Family:** Charadriidae

**Conservation Status:** Least Concern

**Voice Call:** The call is a sharp tchee-it call

**Habitat:** This species is common in much of India, being seen in a variety of open lowland habitats. It tends to be seen in drier habitats than the red-wattled lapwing, *Vanellus indicus*.

**Feeding:** The food of the yellow-wattled lapwing is beetles, termites and other invertebrates, which are picked from the ground

**Breeding Season:** These lapwings breed in the dry season with peak breeding in March to May ahead of the monsoons.

**Nesting Pattern:** A nest in a clump of grass has been noted as exceptional.



Nesting of Yellow-wattled Lapwing



Male female birds is alike

**E) Common Name: Rain Quail**

**Zoological Name:** *Coturnix coromandelica* (Gmelin)

**Family:** Phasianidae

**Conservation Status:** Least Concern

**Voice Call:** The call is a metallic chrink-chrink, constantly repeated mornings and evenings, and in the breeding season also during the night.

**Habitat:** Grassland, cropped fields, and scrubs

**Feeding:** The rain quail feeds on seeds of grasses and other plants, insect Larvae and small invertebrates.

**Breeding Season:** Breeding occurs during the wet season and depends on local rainfall patterns. Generally, rain quail breed from March to October. Their nests are constructed in standing crops or thin grasses in the ground and are sometimes hidden in scrub, low bush or grass.

**Nesting Pattern:** The quail nest usually on the ground contains six to eight eggs and the female incubate the eggs.

**Economic Importance:** Sometimes, these quail are kept in aviaries. They have a pet trade.



Nesting of Rain Quail



Male Bird



Female Bird

**F) Common Name:** Common Teal

**Zoological Name:** *Anas crecca*

**Family:** Anatidae

**Conservation Status:** Least Concern

**Voice Call:** The female has a feeble *keh* or *neeh*

**Habitat:** Common inhabitant of sheltered freshwater wetlands with some tall vegetation, such as taiga bogs or small lakes and ponds with extensive reed beds.

**Feeding:** Feeding on seeds of aquatic plants and grasses, including sedges and grains.

**Breeding Season:** Starts Mar/May

**Nesting Pattern:** The nest is a scrape or a natural depression on the ground.



Nesting of Common Teal



Male female birds a like

**G) Common Name: Red-wattled Lapwing**

**Zoological Name:** *Vanellus indicus*

**Family:** Charadriidae

**Conservation Status:** Least Concern

**Voice Call:** The call is a sharp “did he do it or pity to do it”

**Habitat:** It usually keeps in pairs or trios in well-watered open country, ploughed fields, grazing land, and margins and dry beds of tanks and puddles. They occasionally form large flocks, ranging from 26 to 200 birds. It is also found in forest clearings around rain-filled depressions. It runs about in short spurts and dips forward obliquely (with unflexed legs) to pick up food in a typical plover manner.

**Feeding:** The diet of the lapwing includes a range of insects, snails and other invertebrates, mostly picked from the ground. They may also feed on some grains. They feed mainly during the day but they may also feed at night. They may sometimes make use of the legs to disturb insect prey from soft soil.

**Breeding Season:** The breeding season is mainly March to August.

**Nesting Pattern:** Nests are difficult to find since the eggs are cryptically coloured and usually matches the ground pattern.



Nesting of Red- wattled lapwing



Male female birds is alike

**2. Burrow nesting bird species found in OCP Chhal area:**

**a) Common Name: Little Swift**

**Zoological Name:** *Apus affinis*

**Family:** Apodidae

**Conservation Status:** Least Concern

**Voice Call:** Tirr-Tirr

**Habitat:** Occurs over a wide range of habitats and latitudes, though less frequently in truly arid regions. Little swifts spend most of their lives in the air, living on the insects they catch in their beaks.

**Feeding:** Flies, termites, ants, beetles, grasshoppers and a dragonfly. They drink on the wing, but roost on vertical cliffs or walls.

**Breeding Season:** Winter

**Nesting Pattern:** Little swifts build their nests in hole in buildings or sometimes on cliffs, laying 1-4 eggs

**Predators:** Common buzzards (*Buteo buteo*)



Nesting of Little Swift



Male Female bird is alike

#### b) Common Name: Barn Swallow

**Zoological Name:** *Hirundo rustica*

**Family:** Hirundinidae

**Conservation Status:** Least Concern

**Voice Call:** The song of the barn swallow is a cheerful warble, often ending with su-seer with the second note higher than the first but falling in pitch. Calls include witt or witt-witt and a loud splee-plink when excited.

**Habitat:** Low vegetation, such as pasture, meadows and farmland, preferably with nearby water. The presence of accessible open structures such as barns, stables, or culverts to provide nesting sites, and exposed locations such as wires, roof ridges or bare branches for perching, are also important in the bird's selection of its breeding range.

**Feeding:** The barn swallow typically feeds 7–8 m (23–26 ft) above shallow water or the ground, often following animals, humans or farm machinery to catch disturbed insects, but it will occasionally pick prey items from the water surface, walls and plants.

**Breeding Season:** November- February

**Nesting Pattern:** It builds a cup nest from mud pellets in barns or similar structures and feeds on insects caught in flight.

**Predators:** Hawks, owls, Rats, Squirrels, Racoons, Domestic Cats, Snakes etc are predators of Barn Swallow. Barn swallows usually give alarm calls when predators come near. Most predators of barn swallows attack the nestlings, but hawks, falcons, and owls tend to hunt adults.



**Nesting of Barn Swallow**



**Male Bird**



**Female Bird**

**c) Common Name: Green Bee Eater**

**Zoological Name:** *Merops orientalis*

**Family:** Meropidae

**Conservation Status:** Least Concern

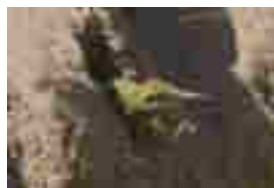
**Voice Call:** The calls are a nasal trill tree-tree-tree-tree, usually given in flight. Commonest call is a rolling or burry “trrrr....trrrr...” or a similar “trip..trip..trrrrr...trrrrr.”

**Habitat:** They are mainly insect eaters and they are found in grassland, thin scrub and forest often quite far from water.

**Feeding:** bee-eaters pre-dominantly eat insects, especially bees, wasps and ants, which are caught in the air by sorties from an open perch

**Breeding Season:** The breeding season is from March to June.

**Nesting Pattern:** These are often solitary nesters, making a tunnel in a sandy bank. They nest in hollows in vertical mud banks.



**Nesting of Green Bee Eater**



**Male female bird is alike**

**d) Common Name: White Throated Kingfisher**

**Zoological Name:** *Halcyon smyrnensis*

**Family:** Alcedinidae

**Conservation Status:** Least Concern

**Voice Call:** chake-ake-ake-ake-ake

**Habitat:** White-throated kingfisher is a common species of a variety of habitats, mostly in the trees, wires or other perches.

**Feeding:** This species mainly hunts large crustaceans, insects, earth-worms, rodents, snakes, fish and frogs. Predation of small birds such as the Oriental white-eye, chick of a Red-wattled Lapwing, sparrows and Munias have been reported.

**Breeding Season:** Monsoon

**Nesting Pattern:** The nest is a tunnel (50 cm long, but a nest with a 3-foot tunnel has been noted) in an earth bank.

**Predators:** With a powerful bill and rapid flight, these kingfishers have few predators when healthy and rare cases of predation by a black kite and a jungle crow may be of sick or injured birds.

**Economic Importance:** White-throated kingfishers eat domestic and agricultural pests, including both mammalian and insect pests. Like many generalists, these birds help to control the populations of small vertebrates and invertebrates that might otherwise do costly damage to human works and food supplies. (Ali and Ripley, 1983)



Nesting of White Throated Kingfisher



Male female bird is alike

### 3. Cavity nesting bird species found in OCP Chhal area:

#### a) Common Name: Common Myna

**Zoological Name:** *Acridotheres tristis*

**Family:** Sturnidae

**Conservation Status:** Least Concern

**Voice Call:** The calls includes croaks, squawks, chirps, clicks, whistles and 'growls', and the bird often fluffs its feathers and bobs its head in singing.

**Habitat:** Common Myna nests in commercial, Residential and bushland habitats.

**Feeding:** Like most starlings, the common myna is omnivorous. It feeds on insects, crustaceans, reptiles, small mammals, seeds, grain and fruits and discarded waste from human habitation.

**Breeding Season:** Depending on geographical location, common mynas have been reported to breed anywhere from 1-3 times yearly. In their native range, common mynas begin nesting in March and breeding lasts through September.

**Nesting Pattern:** Nest in a hole in a tree or wall

**Predators:** Common nest predators of common mynas are house crows (*Corvus splendens*) and house cats (*Felis silvestris*). Javan mongooses (*Herpestes javanicus*) raid nests to take nestlings and eggs. Common mynas roost together for predator defense and often mob predators in flocks.

**Economic Importance:** Common mynas may be helpful in reducing insect populations in agricultural areas. Common mynas also pollinate and disperse the seeds of economically important trees. Common mynas are often sold as pets for their intelligence and ability to mimic human speech.



Nesting of Common Myna

Male female birds is alike

#### b) Common Name: Copper Smith Barbet

**Zoological Name:** *Psilopogon haemacephalus*

**Family:** Megalaimidae

**Conservation Status:** Least Concern

**Voice Call:** tuk...tuk...tuk

**Habitat:** Throughout their wide range they are found in gardens, groves and sparse woodland. Habitats with trees having dead wood suitable for excavation is said to be important.

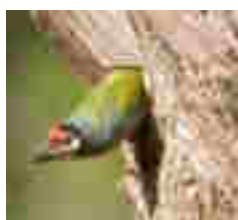
**Feeding:** Prefers Banyan, Peepal, and etc and the occasional insect, caught in aerial sallies. Flower petals may also be included in their diet.

**Breeding Season:** The breeding season is mainly February to April in India.

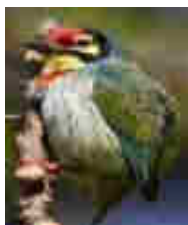
**Nesting Pattern:** Birds nest and roost in cavities.



**Mortality Factor:** Adult birds are sometimes taken by predatory species. In urban areas, there are records of collisions with structures including white walls. Pesticide poisoning has also been noted.



Nesting of Copper Smith Barbet



Male Bird



Female Bird

**c) Common Name: House Sparrow**

**Zoological Name:** *Passer domesticus*

**Family:** Passeridae

**Conservation Status:** Least Concern

**Voice Call:** chirr up, tschilp, or Philip, "chur-chur-r-r-it-it-it-it", House sparrows give a nasal alarm call, the basic sound of which is transcribed as quer, and a shrill chree call in great distress.

**Habitat:** The house sparrow is closely associated with human habitation and cultivation. Primarily associated with man, living around buildings from isolated farms to urban centres.

**Feeding:** As an adult, the house sparrow mostly feeds on the seeds of grains and weeds, but it is opportunistic and adaptable, and eats whatever foods are available.

**Breeding Season:** Feb–Sept, varying with latitude, but can be interrupted by high temperature and monsoon rains; up to three broods.

**Nesting Pattern:** Holes in cliffs and banks, or tree hollows, are also used. A sparrow sometimes excavates its own nests in sandy banks or rotten branches, but more frequently uses the nests of other birds such as those of swallows in banks and cliffs, and old tree cavity nests.

**Predators:** Many hawks and owls hunt and feed on house sparrows. Known predators of nesting young or eggs include cats, domestic dogs, raccoons, and many snakes. House sparrows avoid predation by foraging in small flocks so that there are many eyes watching out for potential predators.

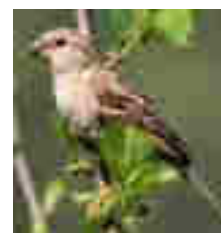
**Parasite and Disease:** The commonly recorded bacterial pathogens of the house sparrow are often those common in humans, and include Salmonella and Escherichia coli.



Nesting of House Sparrow



Male bird



Female bird

**d) Common Name: Bramhiny Starling**

**Zoological Name:** *Sturnia pagodarum*

**Family:** Sturnidae

**Conservation Status:** Least Concern

**Voice Call:** They have musical call notes that are long made up of a series of slurred notes that ends abruptly.

**Habitat:** found in dry forest, scrub jungle and cultivation and is often found close to human habitations. The especially favour areas with waterlogged or marshy lands.

**Feeding:** The brahminy starling is omnivorous, eating fruit and insects.

**Breeding Season:** March to September

**Nesting Pattern:** It builds its nest in tree holes or artificial cavities. The nest is lined with grass, feathers and rags.



Nesting of Bramhiny Myna



Male bird



Female bird

**e) Common Name: Indian Robin**

**Zoological Name:** *Saxicoloides fulicatus*

**Family:** Muscicapidae

**Conservation Status:** Least Concern

**Voice Call:** Song a very short, high-pitched, creaky squeaky jumble of 4–5 notes in minor key.

**Habitat:** This bird is found in open stony, grassy and scrub forest habitats. They are mainly found in dry habitats and are mostly absent from the thicker forest regions and high rainfall areas. The species is often found close to human habitation and will frequently perch on rooftops.

**Feeding:** They feed mostly on insects but are known to take frogs and lizards especially when feeding young at the nest. Individuals may forage late in the evening to capture insects attracted to lights.

**Breeding Season:** December to September

**Nesting Pattern:** Nests are built between rocks, in holes in walls or in a tree hollow. Nests are lined with animal hair and it has been noted that many nests have pieces of snake sloughs.

**Predators:** Nestlings may be preyed on by the Rufous treepie.



Nesting of Indian Robin



Male Bird



Female Bird

**f) Common Name: Indian Roller**

**Zoological Name:** *Coracias benghalensis*

**Family:** Coraciidae

**Conservation Status:** Least Concern

**Voice Call:** The call of the Indian roller is a harsh crow-like chack sound. It also makes a variety of other sounds, including metallic boink calls.

**Habitat:** They are very commonly seen perched along roadside trees and wires and are commonly seen in open grassland and scrub forest

**Feeding:** They descend to the ground to capture their prey which may include insects, arachnids, small reptiles (including *Calotes versicolor* (changeable lizard) ) and small snakes and amphibians.

**Breeding Season:** March to June

**Nesting Pattern:** Holes created by woodpeckers or wood boring insects in trees such as Sal favored for nesting. Nest cavities may also be made by tearing open rotten tree trunks or in cavities in building.



Nesting of Indian Roller



Male bird



Female bird

**g) Common Name: Oriental Magpie Robin**

**Zoological Name:** *Copsychus saularis*

**Family:** Muscicapidae

**Conservation Status:** Least Concern

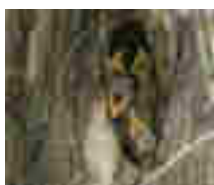
**Voice Call:** Harsh hissing krshhh

**Habitat:** They are common birds in urban gardens as well as forests. The oriental magpie-robin is found in open woodland and cultivated areas often close to human habitations.

**Feeding:** The diet of magpie robins includes mainly insects and other invertebrates. Although mainly insectivorous, they are known to occasionally take flower nectar, leeches, centipedes and even fish.

**Breeding Season:** March to July

**Nesting Pattern:** They nest in tree hollows or niches in walls or building, often adopting nest boxes.



Nesting of Oriental Magpie Robin



Male bird



Female bird

**h) Common Name: Rose Ringed Parakeet**

**Zoological Name:** *Psittacula krameri*

**Family:** Psittaculidae

**Conservation Status:** Least Concern

**Voice Call:** “kii-a” or “kii-ak”

**Habitat:** Rose-ringed Parakeet is common in cultivated areas, urban parks and gardens, dry and open forests.

**Feeding:** In the wild, rose-ringed parakeets usually feed on buds, fruits, vegetables, nuts, berries, and seeds.

**Breeding Season:** September to December

**Nesting Pattern:** They built nest in the hollow of trees.

**Aviculture:** Rose-ringed parakeets are popular as pets and they had a long History in aviculture.

**Economic Status:** Populations of these birds are decreasing due to trapping for the pet trade. Despite some people's attempts to revive their population by freeing these birds from local markets, the rose-ringed parakeet's population has dropped drastically in many areas of the Indian subcontinent.



Nesting of Rose Ringed Parakeet



Male bird



Female bird

**i) Common Name: Indian Nuthatch**

**Zoological Name:** *Sitta castanea*

**Family:** Sittace

**Conservation Status:** Least Concern

**Voice Call:** Nuthatch calls and sounds and behavior around a forest suet feeding location consist of aggressive displays of flared wings sometimes with a rattle-snake like rattle or Brrrr.... and a lot of calls that might be called "quank" or "yank" or "hit" calls that a pair of Nuthatches might use to keep in contact or let their other forest mates - mostly Chickadees and Titmice know that they are coming or in the area and maybe get out of the way.

**Habitat:** Indian nuthatch (*Sitta castanea*) is a species of bird in the Sittidae family. It is found in Bangladesh, India and Nepal. Its natural habitats are subtropical or tropical dry forests, subtropical or tropical moist lowland forests, and subtropical or tropical moist montane forests

**Feeding:** Nuthatches forage along tree trunks and branches and are members of the same feeding guild as woodpeckers

**Breeding Season:** Late Feb to May.

**Nesting Pattern:** Tree holes.



Nesting pattern



Female birds



Male birds

**J) Common Name: Plum Headed Parakeet**

**Zoological Name:** *Psittacula cyanocephala*

**Family:** Psittacidae

**Conservation Status:** Least Concern

**Voice Call:** The usual flight and contact call is tink

**Habitat:** The plum-headed parakeet is a bird of forest and open woodland, even in city gardens

**Feeding:** They feed on grains, fruits, the fleshy petals of flowers (*Salmalia, Butea*) and sometimes raid agricultural fields and orchards.

**Breeding Season:** The breeding season in India is mainly from December to April and July to August in Sri Lanka.

**Nesting Pattern:** Nests in tree holes.



Nesting of Plum Headed Parakeet

Male female birds is alike

**K) Common Name: Alexandrine Parakeet**

**Zoological Name:** *Psittacula eupatria*

**Family:** Psittacidae

**Conservation Status:** Near Threatened

**Voice Call:** The usual flight and contact call is tink.

**Habitat:** The Alexandrine Parakeet lives in forests, woodlands, agricultural lands and mangrove forests at elevations of up to 900 m (3000 ft).

**Feeding:** It eats a variety of wild and cultivated seeds, buds, flowers, fruits and nuts.

**Breeding Season:** November to April.

**Nesting Pattern:** They usually nest in tree hollows.



Nesting of Alexandrine Parakeet

Male female birds is alike

**L) Common Name: Indian Barn Owl**

**Zoological Name:** *Tyto alba*

**Family:** Tytonidae

**Conservation Status:** Least Concern

**Voice Call:** Their calls include screeches, wheeze, purrs and snoring sounds.

**Habitat:** The barn owl is a bird of open country such as farmland or grassland with some interspersed woodland, this owl prefers to hunt along the edges of woods or in rough grass strips adjoining pasture.

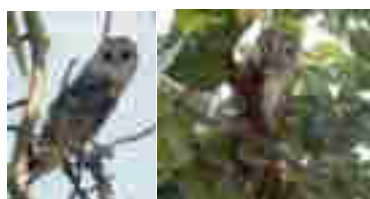
**Feeding:** The common barn owl ecosystem includes tropical and temperate deciduous or evergreen forests, taiga, arid and semi arid deserts and grasslands. They inhabit riparian woodlands, swamp forests, deciduous jungles, light secondary forest, thick scrub jungle urban areas of cities savanna and prairies.

**Breeding Season:** Barn owls living in tropical regions can breed at any time of year, but some seasonality in nesting is still evident. Where there are distinct wet and dry seasons, egg-laying usually takes place during the dry season, with increased rodent prey becoming available to the birds as the vegetation dies off.

**Nesting Pattern:** Barn Owls put their nests in holes in trees, cliff ledges and crevices, caves, burrows in river banks, and in many kinds of human structures, including barn lofts, church steeples, houses, nest boxes, haystacks, and even drive-in movie screens.



Nesting of Indian Barn Owl



Male female birds is alike

**j) Common Name: Lesser Golden Backed Woodpecker**

**Zoological Name:** *Dinopium benghalense* (Linnaeus)

**Family:** Picidae

**Conservation Status:** Least Concern

**Voice Call:** Klikir-r-r-r

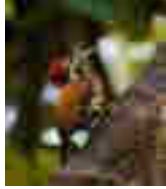
**Habitat:** 1. it is associated with open forest and cultivation lands.  
2. They are often seen in urban areas with wooded avenues.  
3. It is somewhat rare in the Kutch and desert region of Rajasthan

**Feeding:** They feed on insects mainly beetle larvae from under the bark, Visit Termite mounds and sometimes feed on nectar.

**Breeding Season:** February and July

**Nesting Pattern:** The nest hole is usually excavated by the birds and has a horizontal entrance and descends into a cavity. Nests have also been noted in

mud embankments. They adapt well in human-modified habitats making use of artificial constructions.



Nesting of Lesser Golden Back



Male Bbird



Female bird

- k) **Common Name:** Jungle Myna  
**Zoological Name:** *Acridotheres fuscus*

**Family:** Sturnidae

**Conservation Status:** Least Concern

**Voice Call:** Song a loud, hoarse "screow" repeated in short series.

**Habitat:** This common passerine is typically found in forest and cultivation and often close to open water. They may disperse outside their range particularly after the breeding season.

**Feeding:** Diet includes insects, fruit, seeds and nectar. Insect food comprises grasshoppers, mole-crickets and crickets (Orthoptera), termites Etc.

**Breeding Season:** Season Jan–Jul; in India.

**Nesting Pattern:** The Jungle Myna, one nest was in a tree hole.



Nesting of Jungle Myna



Male Female Birds are alike

- l) **Common Name:** Bank Myna  
**Zoological Name:** *Acridotheres ginginianus*

**Family:** Sturnidae

**Conservation Status:** Least Concern

**Voice Call:** Song of male includes low croaks, high-pitched whistles and warbles, also some mimicry.



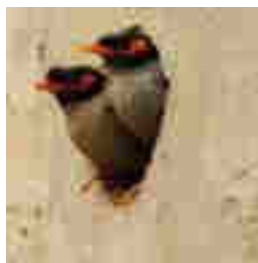
**Distribution:** The distribution was formerly noted to be restricted north roughly of a line between Bombay and Balasore in Orissa, but the species may be expanding its range.

**Habitat:** They are found mainly in the vicinity of open water and their usual habitat is cultivated farmland and open country but flocks will often live within cities, in markets and railway stations.

**Feeding:** Diet includes insects, fruit, seeds and nectar. Insect food comprises grasshoppers, mole-crickets and crickets (Orthoptera), termites Etc.

**Breeding Season:** Season Mar–Aug, primarily Apr–Jun.

**Nesting Pattern:** the Jungle Myna, one nest was in a tree hole.



Nesting of Bank Myna



Male female birds is alike

**M) Common Name: Common Hoopoe**

**Zoological Name:** *Upupa epops*

**Family:** Upupidae

**Conservation Status:** Least Concern

**Voice Call:** pleasant, mellow hoo...po... po..., sometimes only first two notes; calls have a slightly ventriloquistic quality; calls frequently when breeding.

**Habitat:** These requirements can be provided in a wide range of ecosystems, and as a consequence the hoopoe inhabits a wide range of habitats such as heath land, wooded steppes, savannas and grasslands, as well as forest glades.

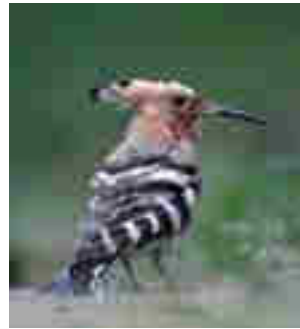
**Feeding:** The diet of the hoopoe is mostly composed of insects, although small reptiles, frogs and plant matter such as seeds and berries are sometimes taken as well.

**Breeding Season:** The breeding season in India is spread from March to September.

**Nesting Pattern:** Vertical surfaces with cavities (such as trees, cliffs or even walls, nest boxes, haystacks, and abandoned burrows) in which to nest.



Nest and adult



Male female alike

#### 4. Cup shaped nesting bird species found in OCP Chhal area:

##### a) Common Name: Sulphur Bellied Warbler

**Zoological Name:** *Phylloscopus griseolus*

**Family:** Phylloscopidae

**Conservation Status:** Least Concern

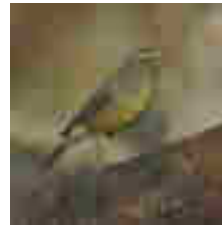
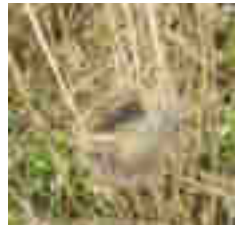
**Voice Call:** They have a single note cheep call.

**Habitat:** They are found on rocky hill and scrub forest habitats.

**Feeding:** Like other leaf-warblers it gleans insects from small branches and leaves.

**Breeding Season:** End-April to early August

**Nesting Pattern:** Nest, built entirely by female over 4–10 days, a ball of dry grasses.



Nesting of Sulphur Bellied Warbler Male female birds is alike

##### b) Common Name: Indian Spotted Dove

**Zoological Name:** *Streptopelia chinensis suratensis*

**Family:** Columbidae

**Conservation Status:** Least Concern

**Voice Call:** Krookruk-krukroo... kroo kroo kroo

**Habitat:** Woodland, scrub, farmland and ground.

**Feeding:** They forage on the ground for grass seeds, grains, fallen fruits and seeds of other plants.

**Breeding Season:** Summer

**Nesting Pattern:** They nest mainly in low vegetation, building a flimsy cup of twigs in which two whitish eggs are laid. Nests are sometimes placed on the ground or on buildings and other structures.



Nesting of Indian Spotted Dove



Male bird



Female bird

**c) Common Name: Black Drongo**

**Zoological Name:** *Dicrurus macrocercus*

**Family:** Dicruridae

**Conservation Status:** Least Concern

**Voice Call:** It is said that they imitate the call of the Shikra so as to put mynas to flight and then to steal prey. False alarm calls has also been noted.

**Habitat:** The black drongo is found predominantly in open forests and usually perches and hunts close to the ground. They are mostly aerial predators of insects but also glean from the ground or off vegetation. The black drongo can be found in savannas, fields, and urban habitats.

**Feeding:** They feed mainly on insects such as grasshoppers, cicadas, termites, wasps, bees, ants, moths, beetles and dragonflies.

**Breeding Season:** Black drongos breed mainly in February and March in southern India and until August in other parts of the country.

**Nesting Pattern:** The nest is a cup made with a thin layer of sticks placed in the fork of branch, and is built in a week by both the male and female. The usual clutch is three or rarely four eggs laid in a cup nest placed in the fork of an outer branch of tree. Large leafy tree such as the jackfruit are preferred.

**Predators:** Some predators such as the Javan hawk-eagle but the black eagle, a nest predator are mobbed with equal intensity in all seasons.

**Mobbing:** Their habit of driving away predators from near their nests is believed to encourage other birds such as orioles, doves, pigeons, babblers, and especially bulbuls, to nest in the vicinity.



Nesting of Black Drongo



Male female birds is alike

**d) Common Name: Common Hawk Cuckoo**

**Zoological Name:** *Hierococcyx varius*

**Family:** Cuculidae

**Conservation Status:** Least Concern

**Voice Call:** The call "Pee kahan" or "Papeeha" When moving with a flock of babblers the chick makes a grating kee-kee call to beg for food

**Habitat:** Wooded country, in deciduous and semi-evergreen forests, gardens, groves of cultivated trees.

**Feeding:** Common hawk-cuckoos feed mainly on insects and are specialized feeders that can handle hairy caterpillars.

**Breeding Season:** Breeds Mar–Jul in India, Jan–Apr in Sri Lanka.

**Nesting Pattern:** Nesting at top of tree using grass and sticks to make cup shaped nest.



Nesting of Common Hawk Cuckoo



Male female birds is alike

**e) Common Name: Common Tailor Bird**

**Zoological Name:** *Orthotomus sutorius*

**Family:** Cisticolidae

**Conservation Status:** Least Concern

**Voice Call:** The song is a loud cheep-cheep-cheep with variations across the populations.

**Habitat:** Favours bushy cover by villages, gardens, parks and also in forest areas.

**Feeding:** They forage for insects and have been known to feed on a range of beetles and bugs. They are attracted to insects at flowers and are known to favour the in florescences of mango.

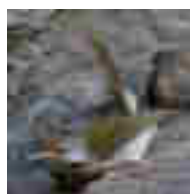
**Breeding Season:** March to December peaking from June to August in India

**Nesting Pattern:** The nest is a deep cup, lined with soft materials and placed in thick foliage and the leaves holding the nest have the upper surfaces outwards making it difficult to spot.

**Predators:** Mortality of eggs and chicks is high due to predation by rodents, cats, crow-pheasants, lizards and other predators.



Nesting of Common Tailor Bird



Male bird



Female bird

**f) Common Name: White Rumped Munia**

**Zoological Name:** *Lonchura striata*

**Family:** Estrildidae

**Conservation Status:** Least Concern

**Voice Call:** Loud call or distance call of male a single "peep!", female gives double or churring.

**Habitat:** It frequents open woodland, grassland and scrub, and is well able to adapt to agricultural land use

**Feeding:** It is a gregarious bird which feeds mainly on seeds

**Breeding Season:** Summer to pre monsoon

**Nesting Pattern:** The nest is a large domed grass structure in a tree, bush or grass into which three to eight white eggs are laid.



Nesting of White Rumped Munia Male female birds is alike



**g) Common Name: Ashy Prinia**

**Zoological Name:** *Prinia socialis*

**Family:** Cisticolidae

**Conservation Status:** Least Concern

**Voice Call:** The song is a repetitive tchup, tchup, tchup or zeet-zeet-zeet. Another call is a nasal tee-tee-tee. It also makes a sound like "electric sparks" during the fluttery flight which is thought to be produced by the wings.

**Habitat:** Found in dry open grassland, open woodland, scrub and in home gardens in the cities.

**Feeding:** The ashy prinia is insectivorous.

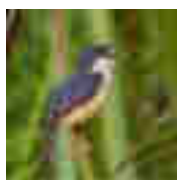
**Breeding Season:** The breeding season varies with locality and has been recorded Breeding around the year but mostly after the monsoons.

**Nesting Pattern:** The ashy prinia builds its nest close to the ground in a shrub or tall grass and lays 3–5 eggs. Several types of nests have been described including a flimsy cup made by sewing several large leaves; an oblong purse like structure with grass stems in the structure; and a flimsy ball of grass.

**Predators:** When the nest is threatened by predators such as cats, adults have been observed feigning injury.



Nesting of Ashy prinia



Male bird



Female bird

#### h) Common Name: Blyth Reed Warbler

**Zoological Name:** *Acrocephalus dumetorum*

**Family:** Acrocephalidae

**Conservation Status:** Least Concern

**Voice Call:** Song, given chiefly at night, characteristic, very varied mix of notes, some harsh tchar, some clear.

**Habitat:** Adapted to varied habitats, not necessarily close to water. This small passerine bird is a species found in scrub or clearings, often near water, but it is not found in marshes.

**Feeding:** Blyth's reed warbler is insectivorous, but will take other small food items, including berries.

**Breeding Season:** Season end of May to Jul; one brood per season. Monogamous, with facultative polygyny; pair formation takes place on breeding grounds.

**Nesting Pattern:** 4-6 eggs are laid in a nest in a bush.



Nesting of Blyth Reed Warbler



Male female bird is alike

**i) Common Name: Greenish Warbler**

**Zoological Name:** *Phylloscopus trochiloides*

**Family:** Phylloscopidae

**Conservation Status:** Least Concern

**Voice Call:** Call of nominate, given throughout year, a sharp, shrill and penetrating disyllabic “chee-wee.

**Habitat:** It breeds in lowland deciduous or mixed forest; non-breeding birds in the warmer parts of its range may move to mountain habitat in summer.

**Feeding:** This small passerine is insectivorous.

**Breeding Season:** May to mid-Aug

**Nesting Pattern:** The nest is on the ground in low shrub.



**Nesting of Greenish Warbler      Male female bird is alike**

**j) Common Name: Jungle Babbler**

**Zoological Name:** *Turdoides striata*

**Family:** Leiothrichidae

**Conservation Status:** Least Concern

**Voice Call:** The jungle babbler has harsh nasal calls. Harsh mewing calls, continual chattering, squeaking and chirping produced by its members.

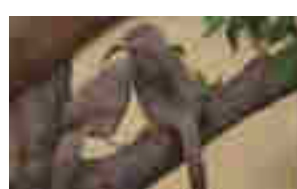
**Habitat:** The jungle babbler's habitat is forest and cultivation.

**Feeding:** They feed mainly on insects, but also eat grains, nectar and berries.

**Breeding Season:** They breed throughout the year; peak breeding in northern India has been noted between March–April and July–September.

**Nesting Pattern:** The nest is built halfway in a tree, concealed in dense masses of foliage.

**Predator:** They are known to gather and mob potential predators such as snakes.



**Nesting of Jungle Babbler      Male female bird is alike**

**k) Common Name: Laughing Dove**

**Zoological Name:** *Spilopelia senegalensis*

**Family:** Columbidae

**Conservation Status:** Least Concern

**Voice Call:** The chuckling call is a low rolling croo-doo-doo-doo-doo with rising and falling amplitude.

**Habitat:** It is a common and widespread species in scrub, dry farmland and habitation over a good deal of its range, often becoming very tame.

**Feeding:** Laughing doves eat the fallen seeds, mainly of grasses, other vegetable matter and small ground insects such as termites and beetles.

**Breeding Season:** The breeding season varies by location.

**Nesting Pattern:** The nest is a very flimsy platform of twigs built in a low bush and sometimes in crevices or under the eaves of houses.

**Predators:** Southern grey Shrike have been observed preying on an adult laughing dove in northwestern India while the lizard buzzard is a predator of the species in Africa.



Nesting of Laughing Dove



Male bird



Female bird

**l) Common Name: Indian cuckoo**

**Zoological Name:** *Cuculus micropterus*

**Family:** Cuculidae

**Conservation Status:** Least Concern

**Voice Call:** Indian Cuckoos have a loud call which mainly consists of four notes described as a 'bo-ko-ta-ko'. The male's song, goo-ko, is usually given from an open perch

**Habitat:** The preferred habitat is deciduous and evergreen forests but also occur in garden lands and thick scrub.

**Feeding:** Indian Cuckoos feed up on hairy caterpillars and other insects. They will also sometimes eat fruit. Indian Cuckoos tend to feed in the upper canopy of forests where they air-feed on flying termites.



**Breeding Season:** The breeding season varies from May to July in northern China, March to August in India, January to June in Burma and January to August in the Malay Peninsula.

**Nesting Pattern:** The male diverts the attention of hosts from their nest giving time for the female to lay her egg. It lays its single egg mostly in the nests of drongos and crows.



Nesting of Indian cuckoo



female



Male

**m) Common Name: Eurasian Collared Dove**

**Zoological Name:** *Streptopelia decaocto*

**Family:** Columbidae

**Conservation Status:** Least Concern

**Voice Call:** The song is a coo-coo-coo, sound is a hah-hah.

**Habitat:** In its original range in India, Sri Lanka and other parts of Asia inhabits semi-desert and arid.

**Feeding:** Takes seed, cereal grain, fruits of herbs and grasses and some green parts of plants.

**Breeding Season:** Season prolonged but mainly Mar–Oct in cooler parts of range.

**Nesting Pattern:** Collared doves typically breed close to human habitation wherever food resources are abundant and there are trees for nesting; almost all nests are within 1 km (0.62 mi) of inhabited buildings. The female lays two white eggs in a stick nest, which she incubates during the night and which the male incubates during the day



Nesting of Eurasian Collared Dove



Male female birds is alike

**n) Common Name: Asian Koel**

**Zoological Name:** *Eudynamys scolopacea*

**Family:** Cuculidae

**Conservation Status:** Least Concern

**Voice Call:** The familiar song of the male is a repeated koo-Ooo. The female makes a shrill kik-kik-kik... call. Calls vary across populations.

**Habitat:** The Asian koel is a bird of light woodland and cultivation land.

**Feeding:** It is insectivorous, but will also take berries and other soft fruit.

**Breeding Season:** March to August

**Nesting Pattern:** Brood parasite lays its single egg in the nests of a variety of birds, including the jungle crow.



**Male bird**



**Female bird**

**O) Common Name: Eurasian Golden Oriole**

**Zoological Name:** *Oriolus oriolus*

**Family:** Oriolidae

**Conservation Status:** Least Concern

**Voice Call:** The song is a beautiful fluting weela-wee-ooo or or-iii-ole, unmistakable once heard.

**Habitat:** The Eurasian golden oriole inhabits a range of habitats. In Western Europe they prefer open broadleaf forests and plantations, copses, riverine forest, orchards, large gardens; in Eastern Europe they may inhabit more continuous forest as well as mixed or coniferous forests. They generally avoid treeless habitats but may forage there. In their wintering habitat they are found in semi-arid to humid woodland, tall forests, riverine forest, woodland/savanna mosaic and savanna

**Feeding:** They feed on insects and fruit, using their bills to pick insects out of crevices.

**Breeding Season:** Eurasian golden orioles may delay breeding until they are 2 or 3 years of age. Males usually arrive at breeding area several days before the

females. The fidelity to a territory or even to a specific nest site suggests that the pair-bond may continue from one breeding season to the next

**Nesting Pattern:** The nest is placed high in a tree towards the edge of the crown. The deep cup-shaped nest is suspended below a horizontal fork of thin branches.



Nesting of Eurasian Golden Oriole Male female birds is alike

**P) Common Name: Paddy Field Pipit**

**Zoological Name:** *Anthus rufulus*

**Family:** Motacillidae

**Conservation Status:** Least Concern

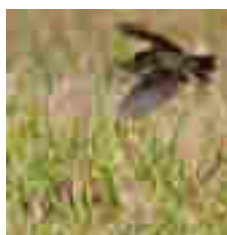
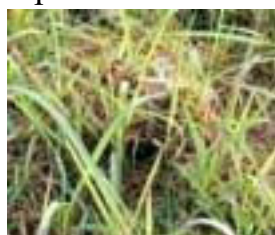
**Voice Call:** The birds flutter nearby with weak tsip-tsip-tsip calls.

**Habitat:** A wide spread species found in open habitats, especially short grassland and cultivation with open bare ground.

**Feeding:** It feeds principally on small insects but consumes larger beetles, tiny snails; worms etc. while walking on the ground, and may pursue insects like mosquitoes or termites in the air.

**Breeding Season:** The paddy field pipit breeds throughout the year but mainly in the dry season

**Nesting Pattern:** The nests are woven out of grass and leaves and are normally cup shaped.



Nesting of Paddy Field Pipit

Female

**Q) Common Name: Singing bush lark**

**Zoological Name:** *Mirafra javanica*

**Family:** Alaudidae

**Conservation Status:** Least Concern

**Voice Call:** Song, either from perch (usually not high) or in towering song flight.

**Habitat:** The Horsfield's Bushlark occurs in tropical and temperate grasslands, open woodlands, cereal crops and sparse sugar cane fields.

**Feeding:** The Horsfield's Bushlark feeds on grasses, seeds and insects. It often forages alone, but sometimes is found in small parties, foraging on the ground.

**Breeding Season:** The Horsfield's Bushlark will breed following significant rainfall in arid areas.

**Nesting Pattern:** It builds a deep, cup-shaped nest in a natural depression or a hollow scrape in the ground.



Nesting of Singing Bush Lark



Male female birds is alike

**R) Common Name: Common Sandpiper**

**Zoological Name:** *Actitis hypoleucos*

**Family:** Scolopacidae

**Conservation Status:** Least Concern

**Voice Call:** This species is usually called *tiritavoi*.

**Habitat:** The common sandpiper forages by sight on the ground or in shallow water.

**Feeding:** Adult and larval insects (e.g. beetles, Diptera), spiders, molluscs, crustaceans and annelids, sometimes frogs, tadpoles or small fish etc.

**Breeding Season:** Mainly May–Jun,

**Nesting Pattern:** The nests can vary from an open shallow nest to a complex nest filled with leaves and grass and is often hidden in thick vegetation.



Nesting of Common Sandpiper



Male female birds is alike

**P) Saucer or Plate form nesting bird species found in OCP Chhal area:**

- **Common Name: Greater coucal or crow pheasant**

**Zoological Name:** *Centropus sinensis* (Stephens)

**Family:** Cuculidae

**Conservation Status:** Least Concern

**Voice Call:** The calls are a booming low **coop-coop-coops** repeated and with variations and some duets between individuals. Other calls include a rapid rattling "**lotok, lotok ...**" and a harsh scolding "**skeeaaw**" and a hissing threat call.

**Habitat:** Found in wide range of habitats from jungle to cultivation and urban gardens.

**Feeding:** The greater coucal is a large bird which takes a wide range of insects, caterpillars and small vertebrates such as the Saw-scaled vipers. They are also known to eat bird eggs, nestlings, fruits and seeds.

**Breeding Season:** June to September

**Nesting Pattern:** The nest is a deep cup with a dome in dense vegetation inside tangles of creepers, bamboo clump or Pandanus crowns.

**Interesting Fact:** It is highly destructive to the eggs and young of other birds.



Nesting of Greater Coucal



Male bird



Female bird

- **Common Name: Indian Pond Heron**

**Zoological Name:** *Ardeola grayii* (Skyles)

**Family:** Ardeidae

**Conservation Status:** Least Concern

**Voice Call:** They are usually silent but may give a harsh croak when flushed or near their nests.

**Habitat:** The water body needs to be either shallow enough, or have a shelving margin in which it can wade. Although most common in the lowlands it also occurs in mountain tarns, lakes, reservoirs, large and small rivers, marshes, ponds, ditches, flooded areas, coastal lagoons, estuaries and the sea shore.

**Feeding:** The Indian pond heron's feeding habitat is marshy wetlands. They usually feed at the edge of ponds but make extensive use of floating vegetation such as water hyacinth to access deeper water.

**Breeding Season:** The breeding season begins with the onset of the monsoons.

**Nesting Pattern:** They nest in small colonies, often with other wading birds, usually on platforms of sticks in trees or shrubs. Most nests are built at a height of about 9 to 10 m in large leafy trees.



Nesting of Indian Pond Heron



Male bird



Female bird

- **Common Name: Cattle Egret**

**Zoological Name:** *Bubulcus ibis*

**Family:** Ardeidae

**Conservation Status:** Least Concern

**Voice Call:** This species gives a quiet, throaty rick-rack call at the breeding colony, but is otherwise largely silent.

**Habitat:** Cattle Egret sometimes feeds in shallow water, unlike most herons it is typically found in fields and dry grassy habitats, reflecting its greater dietary reliance on terrestrial insects rather than aquatic prey.

**Feeding:** The cattle egret feeds on a wide range of prey, particularly insects, especially grasshoppers, crickets, flies (adults and maggots), and moths, as well as spiders, frogs, and earthworms. In a rare instance they have been observed foraging along the branches of a banyan tree for ripe figs.

**Breeding Season:** Onset of monsoons in May.

**Nesting Pattern:** The cattle egret nests in colonies, which are often, but not always, found around bodies of water.



Nesting of Cattle Egret



Male female bird is alike

- **Common Name: Little Egret**

**Zoological Name:** *Egretta garzetta*

**Family:** Ardeidae

**Conservation Status:** Least Concern

**Voice Call:** Rather vocal: gives “kre, kre, kre” or “kark, kark, kark” in aggression and flight, with an “aaah”

**Habitat:** The little egret's habitat varies widely, and includes the shores of lakes, rivers, canals, ponds, lagoons, marshes and flooded land, the bird preferring open locations to dense cover.

**Feeding:** Their diet is mainly fish, but amphibian, small reptiles, mammals and birds are also eaten as well as crustaceans, molluscs, insects, spiders and worms.

**Breeding Season:** Monsoon

**Nesting Pattern:** Little egrets nest in colonies on trees, often with other wading birds.



Nesting of Little Egret



Male female birds is alike

- **Common Name: Rufous Treepie**

**Zoological Name:** *Dendrocitta vagabunda*

**Family:** Corvini

**Conservation Status:** Least Concern

**Voice Call:** bob-o-link or ko-tree

**Habitat:** Open forest consisting of scrub, plantations and gardens.

**Feeding:** Like other curved it is very adaptable, omnivorous and opportunistic in feeding.

**Breeding Season:** April to June

**Nesting Pattern:** The nest is built in trees and bushes and is usually a shallow platform.



Nesting of Rufous Treepie



Male female birds is alike

- **Common Name: Shikra**

**Zoological Name:** *Accipiter badius*

**Family:** Accipitridae

**Conservation Status:** Least Concern

**Voice Call:** Pee-wee and kik-ki ... kik-ki

**Habitat:** The shikra is found in a range of habitats including forests, farmland and urban areas.

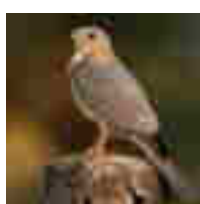
**Feeding:** They feed on rodents, squirrels, small birds, small reptiles (mainly lizards but sometimes small snakes) and insects.

**Breeding Season:** March to June

**Nesting Pattern:** The nest is a platform similar to that of crows lined with grass.



Nesting of Shikra



Male bird



Female bird

- **Common Name: Yellow-footed Green Pigeon**

**Zoological Name:** *Treron phoenicoptera*

**Family:** Columbidae

**Conservation Status:** Least Concern

**Voice Call:** They have pleasant, soft and mellow whistling calls which usually give the first indication of their presence in a locality.

**Habitat:** Forest, scrubland, parks and gardens in lowlands and foothills; avoids high mountains.

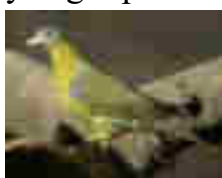
**Feeding:** The birds deftly climb about the twigs of fruit-bearing trees, often clinging upside down to get at some fig or berry, they keep in flocks of from 10 to 50 birds, and sometimes collect in enormous numbers on banyan or Peepal trees to gorge themselves on the ripe figs, in association with Mynas, Hornbills, Bulbuls and other frugivorous species.

**Breeding Season:** March to April

**Nesting Pattern:** Nest is a relatively slight platform of twigs in a tree or shrub.



Nesting of Yellow-footed Green Pigeon



Male bird



Female bird

- **Common Name: Jungle Crow**

**Zoological Name:** *Corvus macrorhynchos*

**Family:** Corvidae

**Conservation Status:** Least Concern



**Voice Call:** The voice is a harsh kaaw-kaaw.

**Habitat:** In the New World, a small population of house crows is established in the area around it is associated with human settlements throughout its range, from small villages to large cities.

**Feeding:** House crows feed largely on refuse around human habitations, small reptiles and mammals, and other animals such as insects and other small invertebrates, eggs, nestlings, grain and fruits.

**Breeding Season:** The breeding season is mainly March–April in northern India and earlier in south India.

**Nesting Pattern:** The nest is a platform of twigs placed in a large tree and very rarely on buildings.



Nesting of Jungle Crow



Male



Female

- **Common Name: Little Cormorant**

**Zoological Name:** *Microcarbo niger*

**Family:** Phalacrocoracidae

**Conservation Status:** Least Concern

**Voice Call:** They also produce grunts and groans, a low pitched ah-ah-ah and kok-kok-kok calls.

**Habitat:** It inhabits wetlands, ranging from small village ponds to large lakes, and sometimes tidal estuaries.

**Feeding:** Little cormorants tend to forage mainly in small loose groups and are often seen foraging alone. They swim underwater to capture their prey, mainly fish.

**Breeding Season:** November to February

**Nesting Pattern:** They may nest beside Indian pond herons and little egrets in Colonies. The nest is built in about two weeks. The whitish eggs turn muddy with age and incubation begins when the first egg is laid.

**Predator:** predators on eggs and hatchlings include gulls and crows, fledging taken by bald eagles and white tailed eagles. The presence of humans or large predators will cause adults to leave nests, leaving them vulnerable to predation. (Hatch, et al., 2000)



Nesting of Little Cormorant



Male female birds is alike

- **Common Name: Common Buzzard**

**Zoological Name:** *Buteo buteo*

**Family:** Accipitridae

**Conservation Status:** Least Concern

**Voice Call:** The call is a plaintive pee-a-y, similar to a cat's meow.

**Habitat:** Buzzards do not normally form flocks, but several may be seen together on migration or in good habitat. The Victorian writer on Dartmoor, William Crossing, noted he had on occasions seen flocks of 15 or more at some places.

**Feeding:** The common buzzard breeds in woodlands, usually on the fringes, but favours hunting over open land. It eats mainly small mammals, and will come to carrion.

**Breeding Season:** March to July

**Nesting Pattern:** The nest, built by both birds, is usually in a tree, rocky crag or cliff. It is a substantial structure of branches, twigs, heather and other available material. The average size of a newly built nest is 1 m in diameter and 60cm deep. Re-used nests can be 1.5 m across. The shallow cup in the nest is lined with green material immediately prior to egg laying, with further material added gradually until the young fledge.



Common Buzzard

- **Common Name: Great Egret**

**Zoological Name:** *Ardea alba*

**Family:** Ardeidae

**Conservation Status:** Least Concern

**Voice Call:** Rather vocal: gives “kre, kre, kre” or “kark, kark, kark” in aggression and flight, with an “aaah”

**Habitat:** The little egret's habitat varies widely, and includes the shores of lakes, rivers, canals, ponds, lagoons, marshes and flooded land, the bird preferring open locations to dense cover.

**Feeding:** Their diet is mainly fish, but amphibian, small reptiles, mammals and birds are also eaten as well as crustaceans, molluscs, insects, spiders and worms.

**Breeding Season:** Monsoon

**Nesting Pattern:** Little egrets nest in colonies on trees, often with other wading birds.



Great Egret



Nesting of Great Egret

**a) Common Name: Little Bittern**

**Zoological Name:** *Ixobrychus minutus minutus* (Linnaeus)

**Family:** Ardeidae

**Conservation Status:** Least Concern

**Voice Call:** It is variously rendered as “kohr, kohr, kohr, kohr,” “hork, hork, hork,” “Cor, orr, orr, orr,” or “gogh, gogh, gogh, gogh” and also “hogh”, “rru” and “woof.” The “Kwer” call is a flight call. It is rendered as “kuk-kuk, kuk-kak,” cuck, cuck, cuck cuck,” Cra, a, a, a, k,” “quer” or “ker-ack.”

**Habitat:** Most typically it uses freshwater wetlands having thick herbaceous vegetation with trees or bushes interspersed nearby. These habitats include peat bogs, reed swamps, edges of lakes, pools, reservoirs, oases, swamps, wooded and marshy edges of streams and rivers, wet grasslands, mangroves, salt marshes, lagoons.

**Feeding:** The diet is varied, fish, frogs and tadpoles, reptiles, eggs and youngbirds, shrimp, crayfish, worms, insects such as crickets, grasshoppers, caterpillars, water bugs, beetles, beetle larvae, dragonflies, spiders.

**Breeding Season:** Winter

**Nesting Pattern:** It nests on platforms of reeds in shrubs; and four to eight eggs are laid.



Nesting of Little Bittern



Male Bird



Female Bird

**Q) Pendant Nesting Bird species found in OCP Chhal area:**

**a) Common Name: Common Kingfisher**

**Zoological Name:** *Alcedo atthisp*

**Family:** Alcedinidae

**Conservation Status:** Least Concern

**Voice Call:** Uttering a sharp chi-chcc, chi-chec, shrit-it-it and nestlings call for food with a churring noise.

**Habitat:** Common kingfishers are found on the shores of lakes, ponds, streams, and in wetlands.

**Feeding:** Its diet consists of small fish, tadpoles, water beetles and their larva, and other aquatic insects.

**Breeding Season:** Common Kingfisher have 2-3 clutches yearly one in April, another by July and sometimes a final clutch in early October.

**Nesting Pattern:** Scrubs and bushes with overhanging branches close to shallow open water.

**Predators:** Common kingfishers have few natural predators as adults. Nestlings may be preyed on by snakes and other ground-dwelling predators, but kingfishers are aggressive birds and do defend their young against predators.



Nesting of Common Kingfisher



Male Bird



Female Bird

**b) Common Name: Purple Sunbird**

**Zoological Name:** *Cinnyris asiaticus*

**Family:** Nectariniidae

**Conservation Status:** Least Concern

**Voice Call:** The song is rapid rattle followed by ringing, metallic notes. "chwit" or "chwing!"

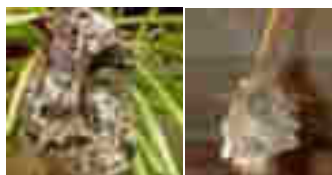
**Habitat:** Thin forest and garden land, including those in dense urban areas.

**Feeding:** They rarely hover at flowers and usually perch to forage for nectar. They are important pollinators of some plant species such as *Butea monosperma*, *Acacia* spp.

**Breeding Season:** The primary breeding season is before the Monsoons, April to June in northern India and January to June in Sri Lanka.

**Nesting Pattern:** The nest is a pouch made of cobwebs, thin strips of vegetation, lichens and bark. The entrance hole on the side is often shaded by an overhanging projection.

**Predators:** Owls are main predators.



Nesting of Purple Sunbird



Male bird



Female bird

### c) Common Name: Indian Golden Oriole

**Zoological Name:** *Oriolus kundoo*

**Family:** Oriolidae

**Conservation Status:** Least Concern

**Voice Call:** Song a fluty melodious "pee-lo" or "pee-lo-lo", "who-he-heer" or "weela whee-oh".

**Habitat:** Habitats including open deciduous forests, semi-evergreen forests, woodland, forest edge, mangroves, open country with scattered trees, parks, gardens orchards and plantations.

**Feeding:** Orioles feed on fruits, nectar and insects. They are capable of dispersing the seeds of many berry-bearing plants including the invasive *Lantana camara*.

**Breeding Season:** April to August

**Nesting Pattern:** The nest being a small cup placed in a fork near the end of a branch. Nests are often built in the vicinity of the nest of a black drongo.

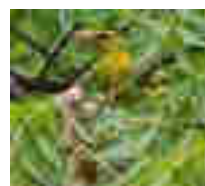
**Predators:** Shikras and Crows.



Nesting of Golden Oriole



Male bird



Female bird

**d) Common Name: Crimson Backed Sunbird**

**Zoological Name:** *Leptocoma minima*

**Family:** Nectariniidae

**Conservation Status:** Least Concern

**Voice Call:** The calls include short chik calls and longer chee-chee-which-chee. Squeaky song “see-see-whi-see-see-siwee...” lasting 5–10 seconds, frequently repeated.

**Habitat:** They are tiny birds that are resident and are found in forests but are particularly attracted to gardens at the edge of the forest where people grow suitable flower-bearing plants. They usually perch while taking nectar.

**Feeding:** Insects, spiders (Araneae) and nectar. Forages singly, in pairs or in small groups.

**Breeding Season:** December to March.

**Nesting Pattern:** Two eggs are laid in a suspended nest on a thin drooping branch of low tree, fern frond or shrub.

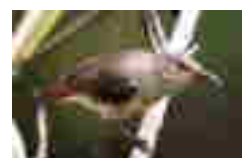
**Predators:** Being small birds they may be preyed on by a number of predators including praying mantises and arachnids.



Nesting of Crimson Backed Sunbird



Male bird



Female bird

**e) Common Name: Thick Billed Flower Pecker**

**Zoological Name:** *Dicaeum agile*

**Family:** Dicaeidae

**Conservation Status:** Least Concern

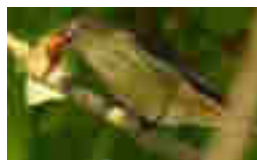
**Voice Call:** Loud “chik-chik-chik-chik”, rattling “tititiitili”, and very high-pitched.

**Habitat:** They feed predominantly on fruits and are active birds that are mainly seen in the tops of trees in forests.

**Feeding:** They feed mainly on berries, nectar but sometimes take insects, Feeds on fruits, including those of mistletoes, lantana (*Lantana* spp), figs (*Ficus* spp).

**Breeding Season:** December to March.

**Nesting Pattern:** The nest has been described as appearing camouflaged like a dry leaf. It is a pendant purse like structure made of cobwebs or fine plant fibers and is located from 3 to 15 meters high suspended from a thin horizontal branch.



Nesting of Thick Billed Flower Pecker      Male female birds is alike

**f) Common Name: Baya Weaver**

**Zoological Name:** *Ploceus philippinus*

**Family:** Ploceidae

**Conservation Status:** Least Concern

**Voice Call:** Their calls are a continuous chit-chit-... sometimes ending in a wheezy cheee-eee-ee that is produced by males in a chorus.

**Habitat:** Grassland, scrub with scattered trees, mangroves and cultivated areas.

**Feeding:** They forage in flocks for seeds, both on the plants and on the ground.

**Breeding Season:** The breeding season of the baya weavers is during the monsoons.

**Nesting Pattern:** These pendulous nests are retort-shaped, with a central nesting chamber and a long vertical tube that leads to a side entrance to the chamber.

**Predators:** They also feed on insects (including butterflies), sometimes taking small frogs, geckos and mollusks, especially to feed their young.



Nesting of Baya Weaver      Male female birds is alike

**g) Common Name: Indian Silver bill**

**Zoological Name:** *Euodice malabarica*

**Family:** Estrildidae

**Conservation Status:** Least Concern

**Voice Call:** The call of the Indian silverbill is a swift trill, and other vocalizations include a high-pitched ‘chirrup’ flight call and a harsh ‘tch wit’ alarm call.

**Habitat:** Indian silver bill inhabits dry, open, cultivated as well as sparse scrub-and-bush country, and avoids humid forest.

**Feeding:** They feed on the ground or on low shrubs and grass stalks.

**Breeding Season:** Breeds throughout year, varying locally, generally beginning with onset of rains; mainly in winter months in Indian Subcontinent;

**Nesting Pattern:** Nests have been found in a variety of locations, such as in low thorny bushes, up to 3-4 meters from the ground in trees, and even among the lower sticks of eagle nests.



Nest Material



Male



Female

#### h) Common Name: Indian Golden Oriole

**Zoological Name:** *Oriolus kundoo*

**Family:** Oriolidae

**Conservation Status:** Least Concern

**Voice Call:** Song a fluty melodious "pee-lo" or "pee-lo-lo", "who-he-heer" or "weela whee-oh".

**Habitat:** Habitats including open deciduous forests, semi-evergreen forests, woodland, forest edge, mangroves, open country with scattered trees, parks, gardens orchards and plantations.

**Feeding:** Orioles feed on fruits, nectar and insects. They are capable of dispersing the seeds of many berry-bearing plants including the invasive Lantana camara.

**Breeding Season:** April to August

**Nesting Pattern:** The nest being a small cup placed in a fork near the end of a branch. Nests are often built in the vicinity of the nest of a black drongo.

**Predators:** Shikras and Crows.





Nesting of Golden Oriole



Male bird



Female bird

**i) Common Name: Black Hooded Oriole**

**Zoological Name:** *Oriolus xanthornus*

**Family:** Oriolidae

**Conservation Status:** Least Concern

**Voice Call:** Song of liquid fluty whistles, very varied and differing among races, “tu-u-u-liu”

**Habitat:** It is a bird of open woodland and cultivation. The black hooded oriole lives in common contact with humans in rural and urban India.

**Feeding:** Its food is insects and fruit, especially figs, found in the tree canopies where they spend much of their time.

**Breeding Season:** Breeding throughout year, with local variations; two or more broods per season.

**Nesting Pattern:** The nest is built in a tree, and contains two eggs.

**Predators:** Shikras and Crows.



Nesting of Black Hooded Oriole



Male bird



Female bird

**R) Sphere Shaped nesting bird species found in OCP Chhal area:**

**S) Common Name: Red Vented Bulbul**

**Zoological Name:** *Pycnonotus cafer*

**Family:** Pycnonotidae

**Conservation Status:** Least Concern

**Voice Call:** The typical call has been transcribed as ginger beer but a number of sharp single note calls likened as pick are also produced.

**Habitat:** This is a bird of dry scrub, open forest, plains and cultivated lands.

**Feeding:** They consume leaves, flowers, buds, nectar, pollen, fruits, berries, and figs. Animal matter mainly includes insects and spiders. They were also found to prey on garden lizards and geckos.

**Breeding Season:** June to September

**Nesting Pattern:** Red-vented bulbuls build their nests in bushes at a height of around 2–3 m.

**Predators:** Predation cats, the small Indian mongoose and the Rat were also found to prey on eggs, nestlings and adult birds.



**Nesting of Red Vented Bulbul      Male female birds is alike**

**T) Common Name: Scaly Breasted Munia**

**Zoological Name:** *Lonchura punctulata*

**Family:** Estrildidae

**Conservation Status:** Least Concern

**Voice Call:** Soft contact call a repeated "tit-ti, tit-ti"; loud contact call "kit-tee, kit-tee."

**Habitat:** Scaly-breasted munias are found in a range of habitats but are usually close to water and grassland.

**Feeding:** They are especially common in paddy fields where they are considered a minor pest on account of their feeding on grain

**Breeding Season:** The breeding season is during the summer rainy season (mainly June to August in India) but can vary

**Nesting Pattern:** The nest is a large domed structure loosely woven from blades of grass, bamboo or other leaves with a side entrance and is placed in a tree or under the eaves of a house.



**Nesting Pattern**



**Male female birds is alike**

**U) Common Name: Jungle Prinia**

**Zoological Name:** *Prinia sylvatica*

**Family:** Cisticolidae

**Conservation Status:** Least Concern

**Voice Call:** The song is a repetitive pit-pretty, pit-pretty, pit-pretty.

**Habitat:** Favours dry scrubby bush-jungle, with boulders and grassland intermixed.

**Feeding:** Takes variety of small invertebrates, chiefly insects and their larvae.

**Breeding Season:** Season Mar–Oct, chiefly during Jun–Sept monsoon.

**Nesting Pattern:** It builds its nest in a shrub or tall grass.



Nesting of Jungle prinia



Male female birds is alike

V) **Common Name: Plain Prinia**

**Zoological Name:** *Prinia inornata*

**Family:** Cisticolidae

**Conservation Status:** Least Concern

**Voice Call:** The song is a repetitive tlee-tlee-tlee.

**Habitat:** This skulking passerine bird is typically found in wet lowland grassland, open woodland, scrub and sometimes gardens.

**Feeding:** Takes variety of small invertebrates, chiefly insects and their larvae.

**Breeding Season:** In India, chiefly during Jun–Oct monsoon in North and Mar–Jul in South.

**Nesting Pattern:** The plain prinia builds its nest in a shrub or tall grass and lays three to six eggs.



Nesting of Plain Prinia



Male female birds is alike

W) **Common Name: Red avadavat**

**Zoological Name:** *Amandava amandava*

**Family:** Estrildidae.

**Conservation Status:** Least Concern

**Voice Call:** Call a high "teei" or "tsi", also high-pitched chirps.

**Habitat:** Red avadavats are found mainly on flat plains, in places with tall grasses or crops, often near water.

**Feeding:** They feed mainly on grass seeds but will also take insects such as termites when they are available.

**Breeding Season:** Breeding can occur from January to April, varying regionally.

**Nesting Pattern:** They build a globular nest made of grass blades.



**Nesting material**



**Female**



**Male**

## ANNEXURE 4 REPTILES

**Common Name:** Indian Python

**Zoological Name:** *Python molurus*

**Family:** Pythonidae

**Conservation Status:** Near Threatened

**Description:** In India, the nominate subspecies grows to 3 metres (9.8 ft) on average. This value is supported by a 1990 study in Keoladeo National Park, where the biggest 25% of the python population was 2.7–3.3 metres (8.9–10.8 ft) long. Only two specimens even measured nearly 3.6 metres (11.8 ft). Because of confusion with the Burmese Python, exaggerations and stretched skins in the past, the maximum length of this subspecies is hard to tell.

**Habitat:** Occurs in a wide range of habitats, including grasslands, swamps, marshes, rocky foothills, woodlands, "open" jungle and river valleys. They depend on a permanent source of water. Sometimes they can be found in abandoned mammal burrows, hollow trees, dense water reeds and mangrove thickets.

**Feeding:** Like all snakes, Indian Pythons are strict carnivores and feed on mammals, birds and reptiles indiscriminately, but seem to prefer mammals.

**Reproduction:** Oviparous, up to 100 eggs are laid by the animal, which are protected and incubated by the female. Towards this end, it has been shown that

they are capable of raising their body temperature above the ambient level through muscular contractions. The



hatchlings are 45–60 cm (18–24 in) in length and grow quickly.

**Common Name:** Russell's Viper

**Zoological Name:** *Daboia russelii*

**Family:** Viperidae

**Description:** *D. russelii* can grow to a maximum total length (body + tail) of 166 cm (5.5 ft) and averages about 120 cm (4 ft) on mainland Asian populations, although island populations may be slightly smaller on average. It is more slenderly built than most other vipers.

**Habitat:** *D. russelii* is not restricted to any particular habitat, but does tend to avoid dense forests. The snake is mostly found in open, grassy or bushy areas, but may also be found in second growth forests (scrub jungles), on forested plantations and farmland. It is most common in plains, coastal lowlands, and hills of suitable habitat.

**Feeding:** *D. russelii* feeds primarily on rodents, especially murid species. However, it will eat just about anything; including rats, mice, shrews, squirrels, lizards, land crabs, scorpions, and other arthropods. Juveniles are crepuscular, feeding on lizards and foraging actively.

**Reproduction:** *D. russelii* is ovoviparous. Mating generally occurs early in the year, although gravid females may be found at any time. The gestation period is more than six months. Young are produced from May to November, but mostly in June and July.



**Common Name:** Common Krait

**Zoological Name:** *Bungarus caeruleus*

**Family:** Elapidae

**Description:** The average length is 0.9 m (3.0 ft), but they can grow to 1.75 m (5 ft 9 in). Males are longer, with proportionately longer tails. The head is flat and the neck hardly evident. The body is cylindrical, tapering towards the tail. The tail is short and rounded. The eyes are rather small, with rounded pupils, indistinguishable in life. The head shields are normal, with no loreals; four shields occur along the margin of the lower lip; the third and fourth supraoculars touch the eye. The scales are highly polished, in 15-17 rows; the vertebral row is distinctly enlarged and hexagonal. Ventrals number 185-225 and caudals 37-50, entire.

**Habitat:** Its range comprises a wide variety of habitats. It is found in fields and low scrub jungle, as well as inhabited areas. It is known to take up residence in termite mounds, brick piles, rat holes, even inside houses. It is frequently found in water or in proximity to a water source.

**Feeding:** The Common Krait feeds primarily on other snakes, including: "blind worms" (snakes of the genus *Typhlops*); and cannibalizes on other kraits, including the young. It also feeds on small mammals (such as rats, and mice), lizards and frogs.

The young are known to eat arthropods.

**Reproduction:**  
oviparousk



**Common Name:** Banded Krait

**Zoological Name:** *Bungarus fasciatus*

**Family:** Elapidae

**Conservation Status:** Least Concern

**Description:** The Banded Krait is easily identified by its alternate black and yellow crossbands, its triangular body cross section, and the marked vertebral ridge consisting of enlarged vertebral shields along its body. The head is broad and depressed. The eyes are black. It has arrowhead-like yellow markings on its otherwise black head and has yellow lips, lores, chin, and throat. The longest banded Krait measured was 2.25 m (7 ft 5 in) long, but normally the length encountered is 1.8 m (5 ft 11 in).

**Habitat:** Banded kraits may be seen in a variety of habitats, ranging from forests to agricultural lands. They inhabit termite mounds and rodent holes close to water, and often live near human settlement, especially villages, because of their supply of rodents and water.

**Feeding:** The Banded Krait feeds mainly on other snakes, but is also known to



eat fish, frogs, skinks, and snake eggs.

**Reproduction:** Little is known of its breeding habits. In Myanmar, a female has been dug out while incubating a clutch of eight eggs, four of which hatched in May. Young have been recorded to measure 298 to 311 mm on hatching. The snake is believed to become adult in the third year of its life, at an approximate length of 914 mm.

**Common Name:** Chameleons or Chamaeleons

**Zoological Name:** *Chamaeleo zeylanicus*

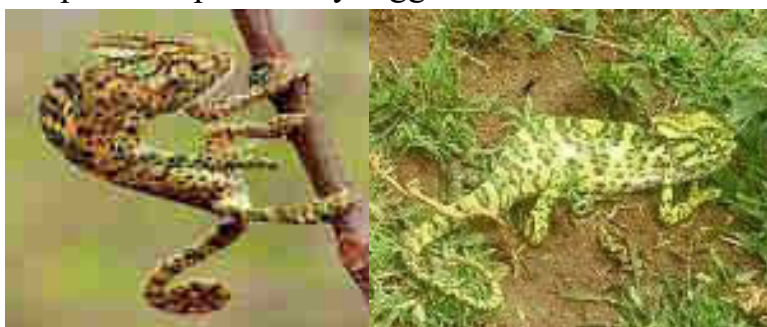
**Family:** Chamaeleonidae

**Description:** Chameleons vary greatly in size and body structure, with maximum total lengths varying from 15 mm (0.59 in) in male *Brookesia micra* (one of the world's smallest reptiles) to 68.5 cm (27.0 in) in the male *Furcifer oustaleti*.

**Habitat:** Chameleons inhabit all kinds of tropical and mountain rain forests, savannas, and sometimes deserts and steppes. The typical chameleons from the subfamily Chamaeleoninae are arboreal, usually living in trees or bushes, although a few (notably the Namaqua chameleon) are partially or largely terrestrial.

**Feeding:** All chameleons are primarily insectivores that feed by ballistically projecting their long tongues from their mouths to capture prey located some distance away.

**Reproduction:** Chameleons are mostly oviparous, with some being ovoviviparous. The oviparous species lay eggs three to six weeks after copulation. The female will dig a hole — from 10–30 cm (4–12 in), deep depending on the species — and deposit her eggs.



**Common Name:**  
Monitor Lizards

**Zoological Name:** *Varanus varius*

**Family:** Varanidae



**Conservation Status:** According to IUCN Red List of threatened species, most of the Monitor lizard's species fall in the categories of least concern but the population is decreasing globally.

**Description:** The various species cover a vast area, occurring through Africa, the Indian Subcontinent, to China, down Southeast Asia to Brunei, Indonesia, the Philippines, New Guinea, Australia and islands of the Indian Ocean, and the South China Sea.

**Habitat:** Monitor lizards are, as a rule, almost entirely carnivorous, consuming prey as varied as insects, crustaceans, arachnids, myriapods, mollusks, fish, amphibians, reptiles, birds, and mammals. Most species feed on invertebrates as juveniles and shift to feeding on vertebrates as adults.

**Feeding:** The meat of monitor lizards is eaten by some tribes in India, Thailand, and Australia and in



West Africa as a supplemental meat source. The meat of monitor lizards is used in Nepal for medicinal and food purpose.

**Common Name:** Common House Gecko

**Zoological Name:** *Hemidactylus frenatus*

**Family:** Gekkonidae

**Conservation Status:** Least Concern

**Description:** Like many geckos, this species can lose its tail when alarmed. Its call or chirp rather resembles the sound "gecko, gecko". However, this is an interpretation, and the sound may also be described as "tchak tchak tchak" (often sounded three times in sequence).

**Habitat:** Most geckos are nocturnal, hiding during the day and foraging for insects at night. They can be seen



climbing walls of houses and other buildings in search of insects attracted to porch lights, hence their name "house gecko".

**Common Name:** Lizards

**Zoological Name:** *Hemidactylus flaviviridis*

**Family:** Gekkonidae

**Description:** Aside from legless lizards, most lizards are quadrupedal and move using gaits with alternating movement of the right and left limbs with substantial body bending. This body bending prevents significant respiration during movement, limiting their endurance, in a mechanism called Carrier's constraint. Several small species such as those in the genus *Draco* can glide: some can attain a distance of 60 metres (200 feet), losing 10 metres (33 feet) in height.

**Habitat:** Lizards are found worldwide, excluding the far north and Antarctica, and some islands. They can be found in elevations from sea level to 5,000 m (16,000 ft). They prefer warmer, tropical climates but are adaptable and can live in all but the most extreme environments.

**Feeding:** The majority of lizard species are predatory and the most common prey items are small, terrestrial invertebrates, particularly insects.

**Reproduction:** Most social interactions among lizards are between breeding individuals. Territoriality is common and is correlated with species that use sit-and-wait hunting strategies. Males

establish and maintain territories that contain resources which attract females and which they defend from other males.



## ANNEXURE 5 MAMMALS

### **Common Name: Greater Short-nosed fruit Bat**

**Zoological Name:** *Cynopterus sphinx*

**Family:** Pteropodidae

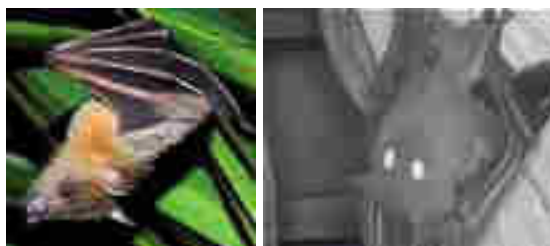
**Conservation Status:** Least Concern

**Description:** These bats have a relatively long snout. Their upper parts are brown to grey-brown with paler under parts. The fur is very fine and silky. The ears and wing bones of *C. sphinx* are edged in white. Lower cheek teeth rounded without accessory cusps. The wing span of the adult is about 48 cm. Juveniles are lighter than adults. Average forearm length 70.2mm (64-79mm).

**Habitat:** The greater short-nosed fruit bat is found from Pakistan to Vietnam. It is common in tropical forests and areas where fruit crops are cultivated.

**Feeding:** These bats are frugivorous, locate their preferred food items by scent. They have been described as voracious feeders, eating more than their body weight in food in one sitting. Some preferred fruits include ripe guava, banana, chikoo, dates and lychees. Short-nosed fruit bats inflict serious damage on many fruit crops, and are considered pests.

**Reproduction:** The adult sex ratio is very female biased. Researchers attribute this to the relatively rapid maturation of females compared to males.



### **Common Name: Black-bearded Tomb Bat**

**Zoological Name:** *Taphozous melanopogon*

**Family:** Emballonuridae

**Conservation Status:** Least Concern

**Description:** Head and body length is 9–10 cm. Forearm 6 cm. Wingspan 37–40 cm. Tip of the tail is conspicuous and free. Grayish brown above with a grizzled appearance. Lighter on the shoulders, hind neck, and underside. Fur short and dense. Body appears rather flattened above and below. Hairy chin. In older males, at about 5–6 months, a blackish beard can be seen. Claws purplish with whitish tip. Young are grayer and darker. No gular sacs as in *Taphozous longimanus*. It has only small pores.

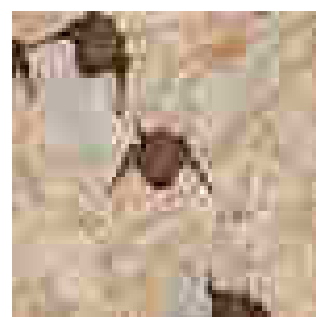
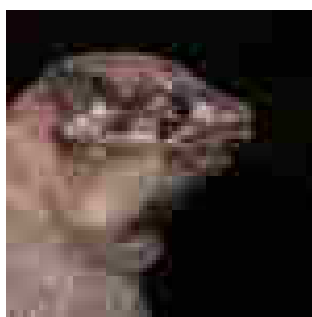
**Habitat:** Black-bearded tomb bats are found in habitats including rainforests, woodlands, tombs, deserted buildings, rock formations, caverns, cliffs, and arid country plains. They prefer densely sheltered areas.

**Feeding:** *Taphozous melanopogon* feeds primarily on flying insects, although it also sometimes feeds on small fruits. It hunts by echolocation emitting a "click" or "tic" that can be faintly audible, to humans. (Boonsong and McNeely, 1988)

Primary Diet, carnivore, insectivore Animal Foods insects, Plants foods Fruits

**Reproduction:** Information on mating systems is not available. The mating season lasts for only a few weeks

in the winter. The female gives birth to one live infant sometime in early spring. (Hill and Smith, 1986; Kunz and Pierson, 1994; Lekagul and McNeely, 1988).



**Common Name:** Field Rat

**Zoological Name:** *Bandicota bengalensis*

**Family:** Muridae

**Conservation Status:** Least Concern

**Description:** The lesser bandicoot and two other species are nocturnal or most active at twilight. They construct burrows to nest and bear their litters. The number of bandicoot babies can range from two to 18. Their staple diet is grains, fruit, and invertebrates. They are prone to destroying cultivated crops in fields. Of all the three species, the lesser bandicoot is an especially aggressive burrower and has been reported to make tunnels in concrete cellars.

**Habitat:** These rats are also known to inhabit houses in villages and are particularly aggressive when threatened. The controls are done by mechanical (mouse trap etc.), rodenticides and biological control (by introducing rodent diseases etc.)

**Reproduction:** Female can have up to 10



litters. Young (10-12 per litter) are born blind and naked. Young reach sexual maturity around 60 days after birth. Lifespan of adults is about 8–9 months.

**Common Name:** Indain Bush Rat

**Zoological Name:** *Golunda ellioti*

**Family:** Muridae

**Conservation Status:** Least Concern

**Description:** Head and body length is 12–14 cm. Tail is 9-11. Yellowish brown upperparts are speckled with black and reddish yellow. Ventral surface grayish with a yellowish speckle, Orange-yellow incisor teeth, Tail, dark above and yellowish below, Body fur spiny, Rounded head with a blunt nose, with small eyes mark, Relatively short bill.

**Habitat:** It is a partially diurnal, fossorial also terrestrial, semi-arboreal, not particularly gregarious, herbivorous species. It is found in varied habitat conditions from tropical dry deciduous, dry wood, shrub, tropical thorn forests and grassy clumps, may venture in to cultivated lands, bushes, orchards, scrublands, grasslands close to streams, Tropical dry deciduous, except cold deserts. Also found near granite hills with sandy loam and silty soil. It has been found to occupy rocky and hilly tracts, burrows, grassland close to streams, build nests on thick bush, shrubs (Molur *et al.* 2005). This can be a serious agricultural pest species (Corbet and Hill 1992).



**Common Name:** Black Rat

**Zoological Name:** *Rattus rattus*

**Family:** Muridae

**Conservation Status:** Least Concern

**Description:** The black rat originated in India and Southeast Asia, and spread to the Near East and Egypt, and then throughout the Roman Empire, reaching Great Britain as early as the 1st century. Europeans subsequently spread it throughout the world. The black rat is again largely confined to warmer areas, having been supplanted by the brown rat (*Rattus norvegicus*) in cooler regions and urban areas. In addition to being larger and more aggressive, the change

from wooden structures and thatched roofs to bricked and tiled buildings favored the burrowing brown rats over the arboreal black rats.

**Habitat:** Black rats adapt to a wide range of habitats. In urban areas they are found around warehouses, residential buildings, and other human settlements. They are also found in agricultural areas, such as in barns and crop fields. In urban areas, they prefer to live in dry upper levels of buildings, so they are commonly found in wall cavities and false ceilings.

**Reproduction:** They often meet and forage together in close proximity within and between sexes. Rats tend to forage after sunset.



**Common Name:** Indian House Screw

**Zoological Name:** *Suncus murinus*

**Family:** Soricidae

**Conservation Status:** Least Concern

**Description:** The house shrew has a uniform, short, dense fur of mid-grey to brownish-grey color. The tail is thick at the base and a bit narrower at the tip, and is covered with a few long, bristle-like hairs that are thinly scattered. They have short legs with five clawed toes. They have small external ears and an elongated snout. They also emit a strong odor of musk, derived from musk glands that are sometimes visible on each side of the body. The odor is especially noticeable during the breeding season.



**Habitat:** It is widespread and found in all habitats, including deserts and human habitations. The habitat of this species is normally near human settlement, specifically near the house.

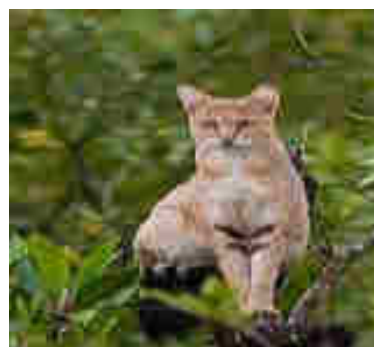
**Common Name:** Jungle Cat

**Zoological Name:** *Felis chaus*

**Family:** Felidae

**Conservation Status:** Least Concern

**Description:** The distribution of jungle cat is largely oriental; it occurs in the Middle East, the Indian



subcontinent, central and Southeast Asia, Sri Lanka and in southern China. It is the most common small wild cat in India

**Habitat:** The distribution of jungle cat is largely oriental; it occurs in the Middle East, the Indian subcontinent, central and Southeast Asia, Sri Lanka and in southern China. It is the most common small wild cat in India.

**Reproduction:** Both sexes become sexually mature by the time they are one year old. Females enter oestrus lasting for about five days, from January to March. In males, spermatogenesis occurs mainly in February and March.

**Common Name:** Indian Wildboar

**Zoological Name:** *Sus scrofa cristatus*

**Family:** Suidae

**Conservation Status:** Least Concern

**Description:** The Indian boar differs from its European counterpart by its large mane which runs in a crest along its back from its head to lower body, larger, more sharply featured and straighter skull, its smaller, sharper ears and overall lighter build. It is taller and more sparsely haired than the European form, though its back bristles are much more developed.

**Habitat:** The animal's primary habitat consists of well developed, broad-leaved and mixed forests, along with marshy mixed forests, with coniferous forests and undergrowths being of secondary importance. Forests made up entirely of oak groves and beeches are used only during the fruit-bearing season.

**Reproduction:** The breeding period in most areas lasts from November to January, though most mating only lasts a month and a half. Prior to mating, the males develop their subcutaneous armor, in preparation for confronting rivals.



**Common Name:** Common Mongoose

**Zoological Name:** *Herpestes edwardsi*

**Family:** Herpestidae

**Conservation Status:** Least Concern

**Description:** The Indian greymongoose or common grey mongoose (*Herpestes edwardsi*) is a mongoose species mainly found in West Asia and on the Indian subcontinent. In North Indian languages (Hindi/Punjabi) it is called Nevlaa.



**Habitat:** They appear to be able to occupy a wide variety of habitats but preferring open types. These include grasslands, open areas, rocky patches, scrub, semi-desert, cultivated fields and other disturbed areas, areas of thickets, bushy vegetation, dry secondary forest, thorn forest, forest edges, and also near human settlement.

**Reproduction:** The Indian grey mongoose mates between March and October, it breeding two to three times each year. The gestation period lasts for 60 to 65 days; the female gives birth to two to four offsprings.



**Common Name:** Rhesus Macaque

**Zoological Name:** *Herpestes edwardsi*

**Family:** Herpestidae

**Conservation Status:** Least Concern

**Description:** The rhesus macaque is brown or grey in color and has a pink face, which is bereft of fur. Its tail is of medium length and averages between 20.7 and 22.9 cm (8.1 and 9.0 in). Adult males measure about 53 cm (21 in) on average and weigh about 7.7 kg (17 lb). Females are smaller, averaging 47 cm (19 in) in length and 5.3 kg (12 lb) in weight. Rhesus macaques have, on average, 50 vertebrae.

**Habitat:** Rhesus macaques are native to India, Bangladesh, Pakistan, Nepal, Burma, Thailand, Afghanistan, Vietnam, southern, China, and some neighboring areas. Inhabiting arid, open areas, rhesus macaques may be found in grasslands, woodlands, and in mountainous regions up to 2,500 m (8,200 ft) in elevation.

**Reproduction:** Adult male macaques try to maximize their reproductive success by entering into sex with females, both in and outside the breeding period. Females prefer to mate with males that will increase the survival of their young. Thus, a consort male provides resources for his female and protects her from predators. Larger, more dominant males are more likely to provide for the females. The breeding period can last up to 11 days, and a female usually mates with four males during that time.



**Common Name-** Common Indian Hare

**Zoological Name-** *Lepus nigricollis ruficaudates*

**Family-** Liporadae

**Conservation Status-** Least Concern



**Habitat-** *Lepus nigricollis* are generally found in areas where large tracts of bush and jungle alternate with farm land. They are also commonly sighted in coastal herb communities. Hilly areas, particularly the depressions at the base of hills, are preferred habitats for *Lepus nigricollis*.

**Physical Description-** *Lepus nigricollis* are also called black-naped hares due to the patch of black fur that runs along the nape of the neck. The top of the tail is also black and the back and face are brown with black hairs scattered throughout. The under parts are white. Total length ranges from 40 to 70 cm and weight ranges from 1.35 to 7 kg.

**Reproduction-** During mating season, male *Lepus nigricollis* become aggressive, spar ring with other males using their forepaws and "boxing" with their hind feet. Males will attempt to mate with as many females as they can.

**Common Name-** The Three Striped Palm Squirrel

**Zoological Name-** *Funambulus palmarum*

**Family-** Sciuridae

**Conservation Status-** Least Concern

**Habitat-** This is a very adaptable species. It is a diurnal and semi-arboreal. This species occurs in tropical and subtropical dry deciduous forest, mangrove forest, grasslands, scrublands, plantations, rural gardens and urban areas. In Sri Lanka, found throughout the island except in deep jungles.

**Physical Description-** The palm squirrel is about the size of a large chipmunk, with a bushy tail slightly shorter than its body. The back is a grizzled, grey-brown colour with three conspicuous white stripes which run from head to tail. The two outer stripes run from the forelegs to the hind legs only. It has a creamy-white belly and a tail covered with interspersed, long, black and white hair. The ears are small and triangular. Juvenile squirrels have significantly lighter coloration, which gets progressively darker as they age. Albinism is rare, but exists in this species.



**Reproduction-** Naturally active, their activity reaches levels of frenzy during the mating season. They tend to be very protective of their food sources, often guarding and defending them from birds and other squirrels. Unlike some other species of squirrel, the Indian palm squirrel does not hibernate.

**Common Name- Timber Wolf**

**Zoological Name-** *Canis lupus pallipes*

**Family-** Canidae

**Conservation Status -** Least Concern

**Habitat -** The gray wolf is a habitat generalist, and can occur in deserts, grasslands, forests and arctic tundras. Habitat use by gray wolves is strongly correlated with the abundance of prey, snow



conditions, absence or low livestock densities, road densities, human presence and topography. In cold climates, the gray wolf can reduce the flow of blood near its skin to conserve body heat.

**Physical Description-** A small wolf with pelage shorter than that of northern wolves. Fur color ranges from greyish-red to reddish-white with black tips. The dark V shaped stripe over the shoulders is much more pronounced than in northern wolves. The under parts and legs are more or less white. Generally, wolves have a high heart weight of 0.93%-1.07% total body mass compared to the average mammal at 0.59% total body mass.

**Reproduction-** The gray wolf is generally monogamous with mated pairs usually remaining together for life. Upon the death of one mated wolf, pairs are quickly re-established. Since males often predominate in any given wolf population, unpaired females is a rarity.

**Common Name- Striped Hyaena**

**Zoological Name-** *Hyaena hyaena*

**Family-** Hyaenidae

**Conservation Status-** Near- Threatened

**Habitat-** The Striped Hyena typically inhabits deserts, semi deserts, scrub forests, woodlands, grasslands, acacia bushlands, rocky terrain and



tropical savannas. Family groups live in dens which are usually caves with narrow entrances and are concealed with large boulders. Dens can extend over a distance of 4 – 5 metres.

**Physical Description-** Male and female striped hyenas are very similar in appearance, although males are slightly larger. Striped hyenas generally measure

between 1 – 1.15 metres in length excluding the tail (which measures 12.5 inches), and stand 0.66 – 0.75 metres at the shoulder. Males weigh between 26 – 41 kilograms (57 – 90 pounds) and females weigh 26 – 34 kilograms (57 – 75 pounds). Their coats are generally light grey to beige in colour and they have a black patch on their throat.

**Reproduction-** There is no specific breeding season for the Striped Hyena. After a gestation period of 90 – 92 days a litter of 2 – 4 helpless cubs are born in nesting dens. Hyena cubs are born blind and their ear canals are closed. Their coats are white to grey with clear black stripes. After 7 – 8 days, the cubs are able to open their eyes and their teeth develop after 3 weeks.

**Common Name-** Indian Fox

**Zoological Name** *Vulpes bengalensis*

**Family-** Canidae

**Conservation Status-** Least Concern

**Habitat-** The Indian Fox prefers semi-arid, flat to undulating terrain, scrub and grassland habitats where it is easy to hunt and dig dens. It avoids dense forests, steep terrain, tall grasslands and true deserts (Johnsingh and Jhala 2004).



**Physical Description-** The Bengal Fox is a medium-sized fox with an elongated muzzle with black hair in small patches on the upper part of the muzzle. Its large, bushy, black-tipped tail is its most prominent feature, accounting for as much as 60% of the length of its body.

**Reproduction-** Bengal foxes are usually monogamous and form pair bonds that may last for their lifetime. The breeding season is from December to January, announced by digging a new den or re-excavating an old one. Pups are born from January to March. The gestation period is 50–60 days, and between 3 to 6 pups are born within a den. Both mother and father help to raise the pups, which are weaned at about 1 month old. Pups are sometimes nursed by a number of females. In the daytime they are likely to rest under bushes, but in summer they rest in dens. Independence is reached at 4 - 5 months old and sexual maturity by 1 - 2 years old.

**AGENCY COPY**

यूनियन बैंक  Union Bank  
of India

NEFT / RTGS CHALLAN for CAMPA Funds  
Date : 24-08-2022

Agency Name:	SOUTH EASTERN COALFIELDS LIMITED
Application No.	5816237745
MoEF/SG File No.	B-15/2021-FC
Location:	CHATTISGARH
Address:	Post Box No 50 Seepal Road Bilaspur Chhattisgarh Bilaspur
Amount(In Rs)	891115814.83/-

Amount in Words: Eighty-Nine Crore Eleven Lakh Fifteen Thousand Eight Hundred and Fifteen Rupees Only

**NEFT/RTGS to be made as per following details:**

Beneficiary Name:	CHATTISGARH CAMPA
IFSC Code:	UBIN0996335
Pay to Account No.:	150645810237745 Valid only for this challan amount.
Bank Name & Address:	Union Bank Of India Lodhi Complex Branch, Block 11, CGO Complex, Phase I, Lodhi Road, New Delhi -110003

\* This Challan is strictly to be used for making payment to CAMPA by NEFT/RTGS only

**BANK COPY**

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After making successful payment, User Agencies may send a line of confirmation through Email: helpdeskcompa@corpbank.co.in

Note: After making the required payment through challan, if the payment status has not been updated even after 7 working days, then kindly mail a copy of your challan with transaction date to Email: eb0371@unionbankofindia.com

UTR UTIBR52022090100354111

Authorized Officer, Authorized Signatory  
South Eastern Coalfields Limited,  
Raigarh Area

250260

31 AUG 2022

**ABHISHEK KEDIA**  
DVP & BRANCH HEAD  
SS No. - 8885  
RAIGARH (490) BRANCH

31/08/22

TRANSACTION REPORT

CHITTARANJAN SAHU

Payment Detail

To: SOUTH EASTERN COAL FIELDS LIMITED RAIGARH  
AREA FINANCE DEPARTMENT SECL SIPAT ROAD, BILASPUR  
BILASPUR CHHATTISGARH

From: SOUTH EASTERN COAL FIELDS LIMITED RAIGARH  
AREA FINANCE DEPARTMENT SECL SIPAT ROAD, BILASPUR  
BILASPUR CHHATTISGARH

Name: CHATTISGARH CAMPA

Credit Account: XXXXXXXXXXXXX71117

Address:

Bank Transaction ID: 1914XV135824

Bank Name: CHATTISGARH CAMPA

UTR Number: UT18072023072600069058

Bank Code: 001008876A

Amount: 4,24,23,148.00 (Four Crore Twenty-Four Lakh Twenty-Three  
Thousand One Hundred Forty-Eight Rupees Only)

City Number: 2000089159

Value Date: 06-07-2023

Invoice: [Download](#)

Enrichment

AK219



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# SOIL CONSERVATION PLAN IN COMPLIANCE TO THE CONDITION NO. X OF STAGE- I FOREST CLEARANCE

F.NO. 8-15/2021-FC

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FOR CHHAL OPENCAST MINE OF SECL, RAIGARH AREA

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*Condition – x: The following activities shall also be undertaken in the lease area by the User Agency under the supervision of the State Forest Department at the project cost;*

- a. Mitigative measures to minimize soil erosion and choking of stream shall be implemented within a period of three year with effect from the issue of Stage-II clearance in accordance with the approved Plan in consultation with the State Forest Department;*
  - b. Planting of adequate drought hardy plant species and sowing of seeds, in the appropriate area within the mining lease to arrest soil erosion in accordance with the approved scheme;*
  - c. Construction of check dams, retention /toe walls to arrest sliding down of the excavated material along the contour in accordance with the approved scheme;*
  - d. Stabilize the overburden dumps by appropriate grading/benching, in accordance with the approved scheme, so as to ensure that angles of repose at any given place is less than 28°; and*
  - e. Strict adherence to the prescribed top soil management.*
- 

**SOUTH EASTERN COALFIELDS LIMITED**  
**Raigarh Area, District Raigarh, Chhattisgarh**

**SOIL AND MOISTURE CONSERVATION PLAN IN COMPLIANCE TO**  
**THE CONDITION No. X OF STAGE- I FOREST CLEARANCE.**

**INTRODUCTION**

**Location and accessibility**

The project is located south of village Chhal at an approximate distance of 2.5 km on Kharsia - Dharamjaygarh State Highway and 16 km from Kharsia town. The block is bounded by latitude 22°4'40" and 22°6'27" N and longitudes 83°6'10" and 83°9'10" E and is included in the Survey of India Topo Sheet No. 64 N/4. It is situated in the Raigarh district of Chhattisgarh.

Mand-Raigarh Coalfield in general and Chhal Block in particular are well connected by two all weather motorable roads from Kharsia and Raigarh Railway Stations on Howrah-Nagpur



section of South Eastern Railway. The distance of Chhal Block from Kharsia and Raigarh are only 16 km and 65 km respectively. Chhal Block is also connected with Bilaspur and Ranchi by all weather motrable road and is located at a distance of 160 km and 310 km from Bilaspur and Ranchi respectively. Chhal Block is also accessible by unmetalled roads of forest department.

**Other relevant project specific information**

Total geological reserve in the mine lease area is 197.257 MT with 151.36 MT mineable reserve and 852.07 Mm<sup>3</sup> of overburden is to be removed with an average stripping ratio of 5.63 cum/tonne. 13 seams with thickness ranging from 0.5 m to 11 m are workable. Grade of coal is G-11 while gradient of coal seams are ranging from is 4° to 11°.

Total land requirement of project is 1342.86 ha. Out of this, forest land is 240.867 Ha. of forest land (185.017 Ha. is Revenue Forest land and 55.850 Ha. is Deemed Forest land). There are 7 villages namely, Khedapali, Bandhapali, Chhal, Navapara, Chandrasekharpur (Edu), Pusalda & Lat involved in the project.

### **Physiography and Drainage**

The Chhal Block is largely characterised by a plain country. The altitude varies between 231 m in the west to 267 m above MSL in the north eastern part of the block. The elevation of the ground varies between 255 m to 267 m along a linear patch running NE-SW in the central part of the property. The ground has a general slope towards NE, SE & SW. Most of the area is covered by soil and cultivate land. The southerly flowing Mand River and westerly flowing Kurket River with their tributaries form the main drainage of the Chhal Block. A small earthen dam has been constructed for the purpose of irrigation near village Khedapali in the eastern part of the block.

### **Mine water environment:**

**Surface Water Sources:** The drainage pattern in the area is controlled by Mand River which flows southerly, and drains through the north and western part of the block. Kurket River, flowing along east-west direction, joins Mand River near to south of Chhal OCP. The Project area is traversed by a small first order stream, flowing along south-north and joining a nala in north. This nalla joins with the master drainage Mand River.

Other nallas which drain the buffer zone are Dom nalla, Jhampi nalla, Sukhia nalla, Chinni nalla etc. Borai River drains the extreme western part of the study area. The drainage is mostly dendritic in nature.

**Ground Water Sources:** The formations within the study area are Gondwanas, Talchirs and Metamorphics. The project area is situated on Barakars consisting mainly of fine to coarse grained sandstone with shale beds and coal seams. The permeable sandstone beds become saturated and behave as aquifers. Impermeable shale and thick coal seam act as aquiclude. Stratification and presence of aquiclude divide the aquifer into multiaquifer system.

The formation comprising mainly of alluvium and weathered sandstone lying above the topmost working coal seam VI behave as unconfined aquifer. The permeable formations sandwiched between the confining layers (i.e. coal seams and shale beds) act as semi-confined to confined aquifer. In the unconfined aquifer ground water movement follows the topographical slopes. The ground water flows towards south to southeast.



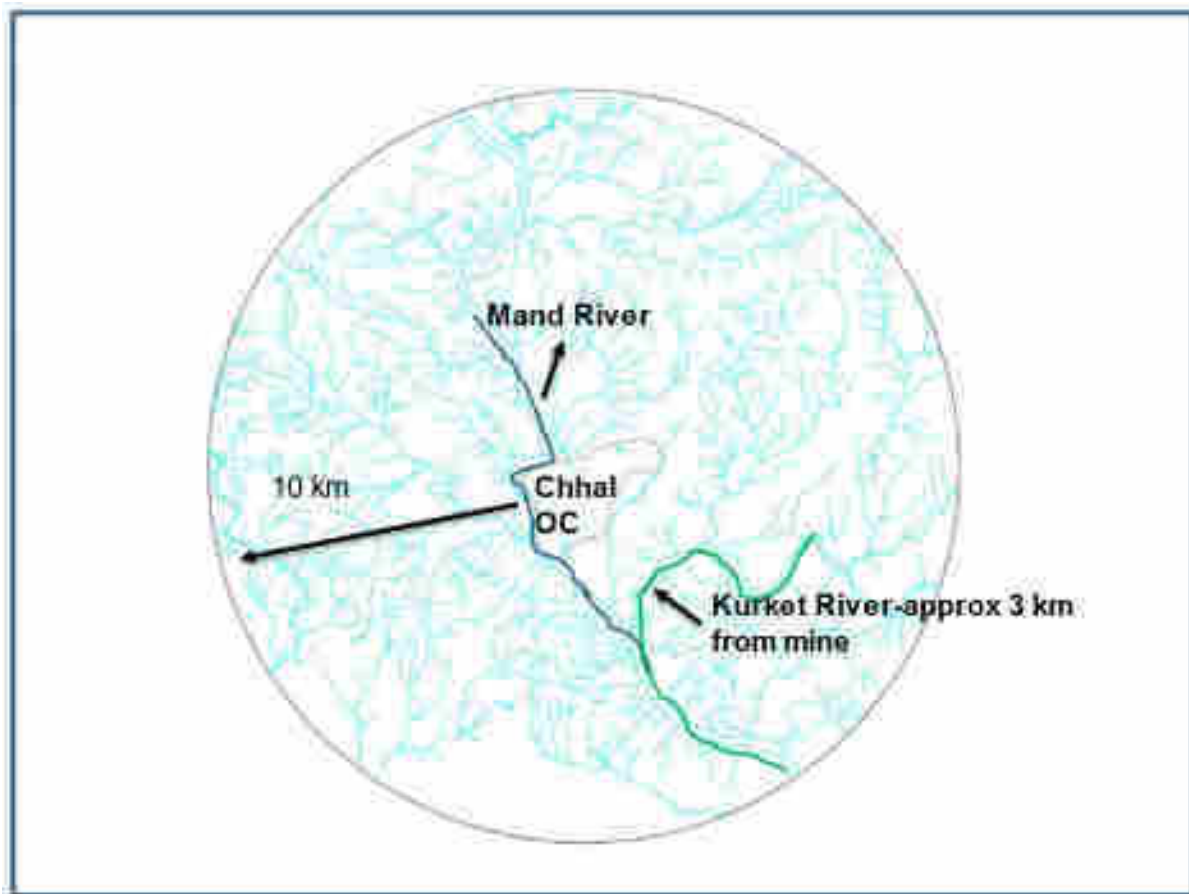


Fig. Plan showing hydrological features of the area

**a. Preparation and implementation of a plan containing appropriate mitigative measures to minimize soil erosion and choking of streams;**

**Soil erosion**

Soil conservation in its widest sense includes not only control over erosion but all those measures like correction of soil defects, application of manures and fertilizers, proper crop rotations, irrigation, drainage etc. which aim at maintaining the productivity of the soil at a high level. In this sense, soil conservation is closely allied to improvement of land use in general.

In OC mines, the earth material is dug out to extract coal. The excavated over burden material consists of alluvial, top soil, sub soil and rocks. The OB is placed in the nearby areas in the form of dumps. If no measures are taken for the management of OB dumps, after precipitation, water will take away the soil particles along with itself thereby causing soil erosion.

This eroded soil will flow into the nearby streams, rivers, water channels and cause choking/contamination of the water bodies.

In order to prevent this, an effective soil erosion management plan needs to be prepared and implemented.

## **Mitigative measures to minimize Soil Erosion and choking of streams**

In order to control soil erosion, a step by step procedure needs to be adopted so that the water flows through a proper path and does not take away with it the essential soil material. The steps to be followed are:

- I. **Garland Drains:** Garland drains will be made around the periphery of the quarry. These garland drains will be connected to the local nalla which is not likely to be disturbed by mining operation. In the workings, heavy duty pumps will be deployed in rainy season which will throw the accumulated water from the working face into these garland drains. As the extraction of the quarry advances, the position of garland drain will also advance. Thus these garland drains will drain of the rain water away from the workings. Catch pits will be provided at suitable regular intervals to allow the silt and sedimentations to settle down. The effectiveness of the drainage system depends on proper maintenance of all drainage pipes/channels. Regular cleaning of drains will be done to remove accumulated sludge/sediments. The catch-pits linked to the storm water drainage system from the areas will also be regularly cleaned to ensure their effectiveness. This exercise will be carried out during the pre-monsoon.
- II. **Water Coursing Channel:** The topography of the area is planned and designed in such a way that the water takes a pre-determined path to flow and does not reach the other areas. In between the two OB dump slopes, a narrow water coursing channel is made in which water flown down the slopes gets collected and drifts through a preset channel.

Initial provision of Rs.40 lakhs has been made in the project report. Subsequent additional provision will be made as and when required.

### ***b. Planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease to arrest soil erosion;***

In view of importance of vegetal cover towards environment, the technical reclamation will be strengthened by biological reclamation for conserving the environment.

#### **Plantation Technique on Overburden Dumps**

The top surface of the overburden dumps selected for afforestation will be roughly levelled by dozer keeping a mild slope of about 1 in 200 for surface water drainage.

Seeds of grass legumes will be sown on beds of 1.5 m x 0.5 m, alternating with slopes to be planted with tree species. Gully plugging and constructing check dams on water courses flowing through OB dumps with boulders, will also be made to arrest soil erosion.

The pit of sizes 45x45x45 cm will be dug at spacing of 2.0x2.0 metre on the top surface as well as on the gentle slopes of the dumps.

In SECL plantations are carried out by CGRVVN (Chhattisgarh Rajya Van Vikas Nigam Limited.) Long term MoU was signed between SECL and CGRVVN Ltd. Raipur for five consecutive years plantation works i.e. 2018-19 to 2022-23 with subsequent maintenance of four years in SECL command area in Chhattisgarh state at a total value of Rs. 98,35,17,705.81/- only .

Various species suggested for Plantation.

- Fruit Bearing Trees: Jamun, Imli, Ganga Imli, Bel, Mango, Sitaphal etc.,
- Medicinal / Herbal Plants: Neem, Karanj, Harra, Bahera, Aonla (Amla), Arjun, Shekakai, Kusum, Mahua, etc.,
- Timber Value Trees: Teak, Shivan / Ghamar, Sissoo, Kala Sisham, Safed Sirus, Bamboo, Peltaform, Babool, Acacia Auriculiformis etc.,
- Ornamental / Avenue Plants (by the side of roads and colonies): Gulmohar, Kachnar, Amaltas, Saptarni, Gravalia, Peepal, Palm tree etc.,

### **Green Belt Development**

In the directions where natural forest does not exist, there is need for creating green belt of adequate width as an effective dust and sight curtain in the periphery of mining area. The trees planted in the green belt area shall act as buffers and shock absorber against dusts, noise and stone flying. The trees in the green belt will be tall, wind firm, broad leaved and evergreen. A green belt of adequate width on either side of the haul road will be raised and the existing vegetation will be protected. The plants will be raised at spacing of 2.0x2.0 metre. Along the roads other than the haul roads also, dust resistant plants as mentioned above will be planted.

#### ***c. Construction of check dams, retention/toe walls along the contour to arrest sliding down of the excavated material;***

- I. **Toe walls:** Toe walls are low walled structures constructed at the bottom of an embankment to prevent slippage or spreading of the soil. Toe walls shall be provided around the top soil dump.
- II. **Gabion Structures:** A gabion wall is a retaining wall made of stacked stone-filled gabions tied together with wire. For erosion control, caged riprap is used
- III. **Check Dams:** A **check dam** is a small, sometimes temporary, dam constructed across a swale, drainage ditch, or waterway to counteract erosion by reducing water flow velocity. Gully plugging and constructing check dams on water courses flowing through OB dumps with boulders, will also be made to arrest soil erosion.



**Fig. Gabion structure**



**Fig. Check dams**

- d. Stabilize the overburden dumps by appropriate grading/benching so as to ensure that that angles of repose at any given place is less than 28°; and*

## **Planning of OB dumps**

### **A) Dumping strategy**

The proposed sequence of mining is ideally suited for achieving the objective of placing maximum possible waste in the internal dumps. External dumps will be created mainly during the initial years of mine expansion. The proposed reconstruction of the mine gives best possible back-filling opportunity. Thus, external dump quantities will be minimized.

By adopting the proposed sequence of mining, as the quarry advances, the amount of external dump will decrease and that of internal dump will increase as more space for the economic dumping is created. From the sixth year onwards majority dump will be accommodated internally.

The total volume of overburden has been estimated as 852.07 Mcum, including 40 Mcum rehandling. 71.52 Mcum will be placed in the external dumps located on the present site of external dumping. The balance 780.55 Mcum will be accommodated in the internal dump.

The land for external dump site will have to be acquired. Internal dump, due to the position of haul road, has been divided into two parts i.e. north-eastern dump and south-western dump.

The spoil dump in the internally backfilled OB will be in the form of benches. With the sufficient advance of coal production bench, the non-active backfilled OB will be levelled with dozer. Dumper/Tipper will transport soil/alluvium OB from the top OB bench and will dump the soil directly on the leveled backfilled OB.

Otherwise; top soil will be removed and stored separately. This soil will be directly spread over the levelled graded backfilled spoil for reclamation of the quarried-out land. OB dumps will be properly benched and the maximum height of the bench will be kept not more than 30m. Dump benches will have a mild gradient of 0.6% to facilitate the drainage. Wherever possible, simultaneous land reclamation will be done along with the OB dumping.

### **B) Dumping arrangements**

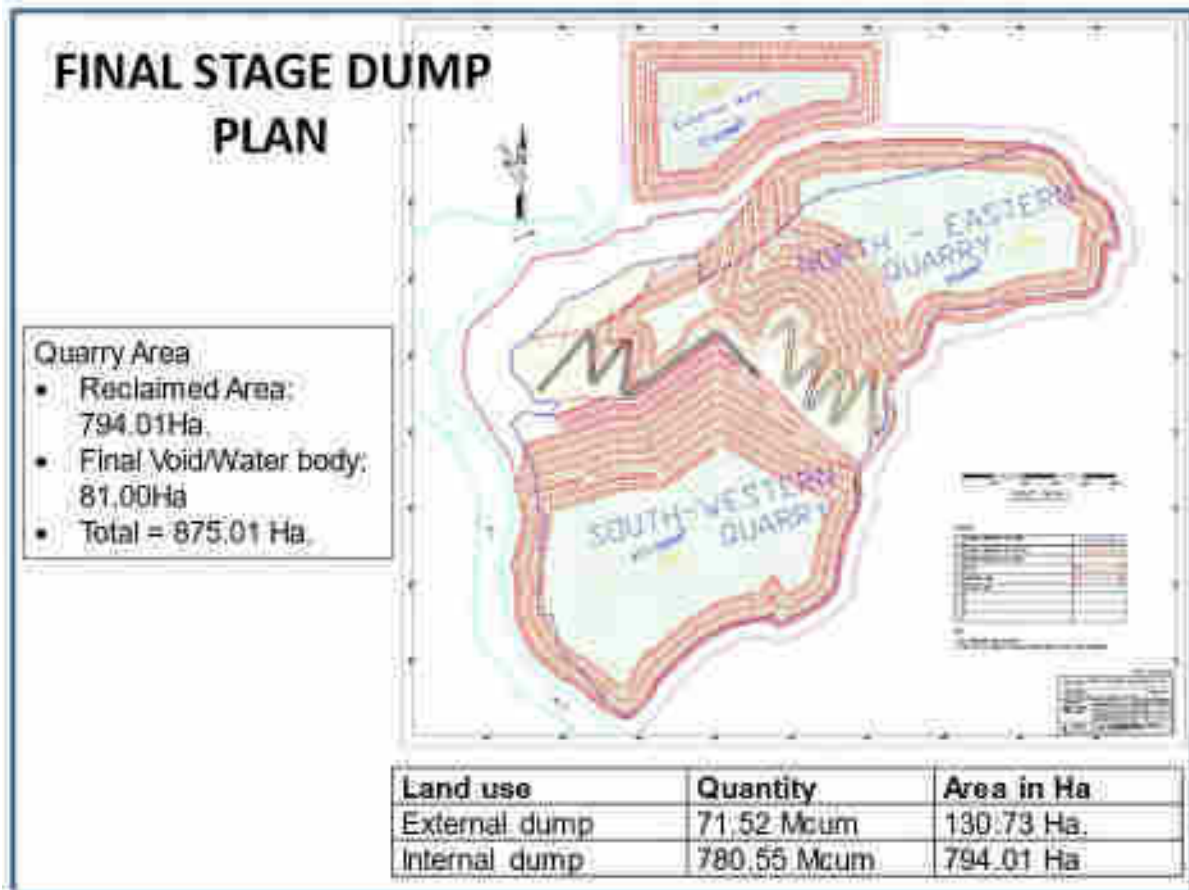
The following design criteria have been considered for waste dumps.

- (i) OB in external dumps will be stacked in 30 m high benches.
- (ii) OB in internal dumps will also be stacked in 30 m high benches.
- (iii) A berm width of 30 m has been provided for transport etc.
- (iv) Dump slope for each deck to be at natural repose (37°).

(v) Dozers to be deployed for shaping the dumps overall slope to 280.

Final reclamation will be achieved using the equipment provided for the purpose.

Once, the external dumping is completed, the spoil will be graded and landscaped in harmony with surrounding topography and biological reclamation carried out. The final void at the end of mining operations in the mine can be converted into a water reservoir. The total final void left at the end of the mining operations will be 81 Ha.



OB dump management of Chhal OC Seam-III 6.0 MTY Project

**e. Strict adherence to the prescribed topsoil management**

**Systematic handling of topsoil**

For surface mining activities are required to remove topsoil or other approved plant growth materials before beginning operations, save it for a later use in a manner conducive to protecting the primary root medium from contamination and erosion, and enhance its productivity. Topsoil shall be removed before any drilling, blasting, mining, or other surface disturbance. The stock piling of topsoil will be as follows:

- Top soil and other materials removed shall be stock-piled only when it is impractical to promptly redistribute such materials on regraded areas.
- Stock-piled materials shall be selectively placed on a stable area, not disturbed, and protected from wind and water erosion, unnecessary compaction, and contaminants which lessen the capability of-the materials to support vegetation when redistributed.

### Topsoil redistribution

After the final grading the topsoil would be redistributed in a manner that achieves an approximate uniform stable thickness consistent with the post mining land uses, contours, and surface water drainage system.

### Biological Reclamation

In view of importance of vegetal cover towards environment, the technical reclamation will be strengthened by biological reclamation for conserving the environment.

## Financial Provisions

### I. Financial provision for soil erosion management

Initial Financial provision have been made in the Project Report is as shown below:

S. No.	Activity	Amount (in Rs. Lakhs)
1.	Garland Drains	10.00
2.	Arboriculture/plantation in industrial area	10.00
3.	Barbed fencing/boundary walls/Toe walls/Gabion structures for the project	30.00
4.	Reclamation of Dumps	10.00
6	Green Belt in and around the Mine	20.00
	<b>Total</b>	<b>80.00</b>

\* Subsequent additional provision will be made as and when required.

### II. Mine Closure cost for OC Mine

Mine closure plan has been approved by SECL Board on 16.12.2013

As per the guidelines of the MoC, the cost of the mine closure is to be computed based on the basis of project area involved in the project.

In Chhal OC (Seam III), the total mining lease area is 1226.67 Ha. So, the closure cost is to be computed considering a total project area of 1342.86 Ha. Considering the wholesale price index as 171.6 as on May 2013, the updated cost of the mine closure is estimated to be Rs. 7.94 lakhs per hectare considering the admissible escalation over Rs. 6.00 lakh per Ha as on August 2009 when wholesale price index was 129.60.

Total Final mine closure cost (@ Rs.7.94/Ha.):**Rs. 10662.31lakhs** upto two decimal place.

### III. Detail of Escrow Account

The current value of corpus is Rs.10662.31 Lakhs (as on May. 2013). This corpus is to be divided by balance life of mine. Since, this is a running mine and the balance life after expansion is estimated as 30 years as on 01/04/2013, the annual corpus comes to Rs. 355.41 Lakhs (up to

two decimal place) by dividing 30 years. This amount is to be deposited in escrow account every year.

This amount is to be deposited in escrow account every year with 5% annual escalation.

**Fund to be deposited in escrow account and reimbursement schedule**

Year	Fund Deposited in Escrow Fund	Fund to be Reimbursed (Maximum)	
1	355.41	Nil	(+) accrued interest as applicable
2	373.18	Nil	
3	391.84	Nil	
4	411.43	Nil	
5	432.00	Nil	
<b>Phase-1 Total</b>	<b>1963.86</b>	<b>1571.09</b>	
6	453.60	Nil	
7	476.28	Nil	
8	500.10	Nil	
9	525.10	Nil	
10	551.36	Nil	
<b>Phase-2 Total</b>	<b>2506.44</b>	<b>2005.16</b>	
11	578.93	Nil	
12	607.87	Nil	
13	638.27	Nil	
14	670.18	Nil	
15	703.69	Nil	
<b>Phase-3 Total</b>	<b>3198.93</b>	<b>2559.14</b>	
16	738.87	Nil	
17	775.82	Nil	
18	814.61	Nil	
19	855.34	Nil	
20	898.10	Nil	
<b>Phase-4 Total</b>	<b>4082.73</b>	<b>3266.19</b>	
21	943.01	Nil	
22	990.16	Nil	
23	1039.67	Nil	
24	1091.65	Nil	
25	1146.23	Nil	
<b>Phase-5 Total</b>	<b>5210.72</b>	<b>4168.57</b>	
26	1203.54	Nil	
27	1263.72	Nil	
28	1326.91	Nil	
29	1393.25	Nil	
30	1462.92	Nil	
<b>Final Stage-Total</b>	<b>6650.34</b>	<b>5320.27</b>	
<b>Grand Total</b>	<b>23613.03</b>		

**IV. Tentative Final Mine Closure Activities and Cost Break-up**



**Type of mine:** Open cast  
**Mining Lease Area:** 1342.855 Ha.

**Production Capacity:** 6.0 MTY  
**Depth of the mine:** 300m

Sl. No.	Major Closure Activities	Quantity	% of Total Closure Cost
<b>A</b>	<b>Dismantling of Structures</b>		
	Service Buildings		0.20
	Residential Buildings,		2.67
	Industrial Structures i.e. workshop complex, 33kv/3.3kv Sub-Station, Unit Stores, Security Barrack		0.30
<b>B</b>	<b>Permanent fencing of mine void &amp; other dangerous areas</b>		
	Random rubble masonry of height 1.2m including levelling up in cement concrete 1:6:12 in mud mortar.		1.50
<b>C</b>	<b>Grading of highwall slopes</b>		
	Levelling & grading of highwall slopes		1.77
<b>D</b>	<b>OB Dump Reclamation</b>		
	Handling/Dozing of external OB dump into mine void.		88.66
	Bio-reclamation including soil spreading, plantation & maintenance.		0.00
<b>E</b>	<b>Landscaping</b>		
	Landscaping of the cleared land for improving its esthetic		0.30
<b>F</b>	<b>Plantation</b>		
	Plantation over area obtained after dismantling.		0.50
	Plantation around fencing		0.20
	Plantation over the cleared off external OB dump.		0.00
<b>G</b>	<b>Monitoring / testing of environmental parameters for three years.</b>		
	Air quality		0.22
	Water quality		0.20
<b>H</b>	<b>Entrepreneurship development (vocational and skill development training for sustainable income of affected people)</b>		0.26
<b>I</b>	<b>Miscellaneous &amp; other mitigative measures</b>		2.60
<b>J</b>	<b>Manpower Cost for supervision</b>		0.80
	<b>Total (%)</b>		<b>100.00</b>

**Note :-** The above cost expenditure will be met from the corpus escrow account deposited by the mine operator. In case of mines having acid mine drainage, post closure acid mine drainage management cost shall also be included in the total closure cost.

However, the additional amount beyond the escrow account will be provided by the mine operator after estimating the final mine closure cost five years prior to mine closure (as per the mine closure guidelines).

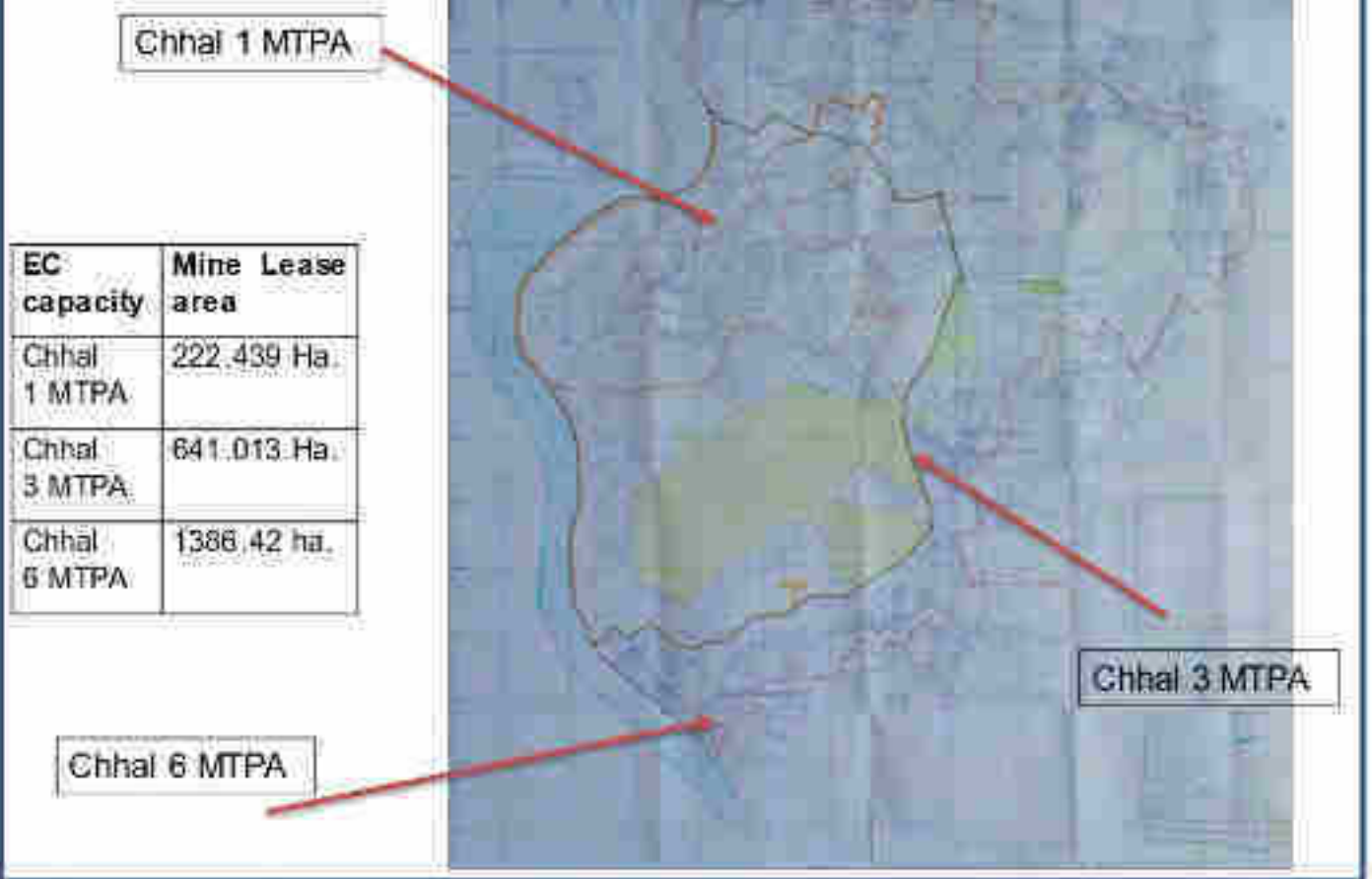
## Time Schedule

The different activities considered for mine closure are mentioned along with their schedule for implementation in the Figure below:

**Schedule for implementation of progressive mine closure activities**

S. No.	Activities in Reclamation Phase	1 <sup>st</sup>			2 <sup>nd</sup>			3 <sup>rd</sup>			4 <sup>th</sup>			5 <sup>th</sup>			6 <sup>th</sup>			MC				
<b>For Chhal OCP (30 Years)</b>																						1	2	3
1	Grading of External dump																							
A	Internal dump																							
a	Filling and simultaneous Leveling																							
2	Provision of water coursing channels																							
3	Provision of Sedimentation Pond																							
4	Provision of Garland Drains																							
5	Provision of Check dams at high velocity points																							
6	Topsoil Preservation & Application																							
7	Topsoil Application																							
8	Site preparation and plantation																							
a	Within de-coaled area																							
b	Out of de-coaled area																							
9	Environmental Monitoring																							

## CHHAL OC EXP. PROJECT LAND BOUNDARY (INCLUDING BOUNDARY FOR EARLIER CAPACITIES)



### References:-

- *Project Report of Chhal OC seam-III 6.0 MTY Project*
- *Environment Impact Assessment report*
- *Environment Management Plan*
- *Progressive Mine Closure Plan of Chhal OC seam-III 6.0 MTY Project.*

# छत्तीसगढ़ शासन वन विभाग



जनसम्पर्क कालास

## परियोजना प्रतिवेदन

### एस.ई.सी.एल.छाल गैप वृक्षारोपण एड्ड

कक्षा क्र.	-	479 आर.एफ.
कुल रकमा	-	97.076 हे.
कार्य रकमा	-	10.000 हे.
प्रजाति	-	मिश्रित वृक्षारोपण
परिस्तर	-	एड्ड
प.स. वृत्त	-	छाल
परिक्षेत्र	-	छाल
वन मंडल	-	धरमजयगढ़
परियोजना वर्ष	-	2023 - 24 से 2032 - 33
लगात राशि	-	9666600.00 रु.
मद	-	राज्य कॅम्पा

वन परिक्षेत्र छाल - वन मंडल धरमजयगढ़ (छ0ग0)

## प्राक्कलन प्रतिवेदन

भाग - 1

वन परिक्षेत्र - छाल, वन मंडल धरमजयगढ़

कुल रकबा	=	97.076 हे.
प्रस्तावित रकबा	=	10.000 हे.
योजना	=	राज्य कौम्या निधि से दत्तिपूर्ति वृक्षारोपण एडू कबा क्र. 479 आर.एफ. रकबा 10 हे.
वनमंडल	=	धरमजयगढ़
परिक्षेत्र	=	छाल
केन्द्रीय प.स. वृत्त	=	छाल
परिसर	=	एडू
विधानसभा	=	धरमजयगढ़
तहसील	=	धरमजयगढ़
विकासखण्ड	=	धरमजयगढ़
परियोजना अवधि	=	2023 - 24 से 2032 - 33
मद	=	राज्य कौम्या
परियोजना लागत राशि	=	9666660.00 रु.
बीट अधिकारी	=	श्री जय प्रकाश एफका " गेम गार्ड "
सर्किल ऑफिसर	=	श्री चन्द्रविजय सिंह सिदार " सप वन्यजीवपाल "
रेन्ज ऑफिसर	=	मुनेश्वर सिंह मर्सिकोले " वन क्षेत्रपाल "

  
वन परिक्षेत्राधिकारी  
वन परिक्षेत्र छाल

## भाग - 2

### उपचार कार्यो का विवरण

- 1) योजना का उद्देश्य - 1. वन क्षेत्र की वन औषधि की उत्पादकता में वृद्धि ।  
2. कट बीक के द्वारा पुनरुत्पादन को बढ़ावा ।  
3. वन क्षेत्र में मृमि क्षरण रोकना एवं जल संरक्षण - संवर्धन  
4. प्राणीयो में वनी के प्रति आस्था स्थापित करना ।  
5. ग्रामीणो को रोजगार उपलब्ध कराना ।
- 2) उपचार कार्यो का संक्षिप्त विवरण - 1. क्षेत्र में फसिंग तार से घेराव कार्य ।  
2. आवश्यकतानुसार सिंचाई कार्य ।
- 4) योजना की अवधि - 2023 - 24 से 2032 - 33
- 5) योजना पर होने वाला कुल संभावित व्यय - 9666660.00 रुपये

  
उप वन सहायक अधिकारी  
बदरमजरागाड़ उप वन संजाल

  
वन परिधीन अधिकारी  
वन परिशेष छाल

भाग - 3

प्रमाण पत्र

प्रमाणित किया जाता है कि राज्य कम्पा निधि से क्षतिपूर्ति वृक्षारोपण परिसर एडू कस का. 479 आर.एफ. में प्रस्तावित रकबा 10.000 हे. वृक्षारोपण कार्य हेतु मेरे द्वारा भीका स्थल निरीक्षण किया गया है निरीक्षण में वृक्षारोपण कार्य हेतु क्षेत्र उपयुक्त है एवं सही है।

वृक्षारोपण क्षेत्र प्रस्तावित उपचार कार्यो के लिए योग्य है।

  
वन अधिकारी  
वन परिक्षेत्र छाल

निरीक्षण दिनांक

अनुमोदन की अनुमति भी जाती है।

  
उपवनमंडलाधिकारी  
धरमजयगढ़ उपवनमंडल

  
वनमंडलाधिकारी  
धरमजयगढ़ वनमंडल

परिक्षेत्र अधिकारी का प्रमाण पत्र

मै मुनेश्वरसिंह मर्तकोले " वनखेजमाल" वन परिक्षेत्र अधिकारी छाल परिक्षेत्र धरमजयगढ़ वन मंडल प्रमाणित करता हूँ कि राज्य कैम्पा निधि से क्षतिपूर्ति वृक्षा रोपण परिसर एडू कच क्र. 479 जार.एफ. प्रस्तावित रकम 10,000 है. जो परियोजना प्रतिवेदन में दर्शाए गये समस्त कार्य एवं तथ्यों का परीक्षण मेरे द्वारा किया गया है. तथा परियोजना प्रतिवेदन में दर्शाए गये उपचारण के कार्य का विवरण एवं मात्रा का विवरण मौके की आवश्यकता को अनुरूप है तथा इससे मैं तकनीकी / वानिधी को दृष्टिकोण से सहमत हूँ।

नाम :- मुनेश्वरसिंह मर्तकोले  
वन परिक्षेत्र अधिकारी  
वन परिक्षेत्र छाल

उप वन मंडलाधिकारी का प्रमाण पत्र

मै बालगोविन्द साहू, उप वन मंडलाधिकारी धरमजयगढ़ उप वन मंडल, धरमजयगढ़ वन मंडल प्रमाणित करता हूँ कि राज्य कैम्पा निधि से क्षतिपूर्ति वृक्षा रोपण परिसर एडू कच क्र. 479 जार.एफ. प्रस्तावित रकम 10,000 है. जो परियोजना प्रतिवेदन में दर्शाए गये समस्त कार्य एवं तथ्यों का परीक्षण मेरे द्वारा किया गया है। तथा परियोजना प्रतिवेदन में दर्शाए गये उपचारण के कार्य का विवरण एवं मात्रा का गैर द्वारा मौके पर आवश्यकता को अनुरूप होना था। मैं इस परियोजना प्रतिवेदन से सहमत हूँ तथा कार्य कराये जाने की अनुमति करता हूँ।

नाम :- बालगोविन्द साहू  
उप वन मंडलाधिकारी  
धरमजयगढ़



## उपयुक्तता प्रमाण पत्र

क्षतिपूर्ति बनीकरण योजनांतर्गत उच्च तकनीकी वृक्षारोपण कार्य

प्रमाणित किया जाता है कि प्रस्तावित वन भूमि के बदले क्षतिपूर्ति बनीकरण हेतु वन परिक्षेत्र छाल के परिसर एडु वनखंड कड्ड अ. 479 आर.एफ. प्रस्तावित एकरा 10,000 हे. में वृक्षारोपण हेतु उपयुक्त क्षेत्र का चयन किया गया है, उक्त प्रस्तावित क्षेत्र का भेरे द्वारा मौका स्थल निरीक्षण किया गया। उक्त क्षेत्र क्षतिपूर्ति वृक्षारोपण हेतु उपयुक्त है, प्रस्तावित स्थल अतिक्रमण रहित है तथा पूर्व में उक्त प्रस्तावित क्षेत्र में कोई भी वाणिज्यी कार्य नहीं किया गया है।

  
वन परिक्षेत्राधिकारी  
वन परिक्षेत्र छाल


  
उप वनमंडलाधिकारी  
धरमजयगढ़ उप वनमंडल

  
वनमंडलाधिकारी  
धरमजयगढ़ वनमंडल

## क्षेत्र का जी.पी.एस. रीडिंग

राज्य कौन्सिल से क्षतिपूर्ति वृद्धारोपण एंडू कक्ष क्र. 479 आर एफ. रकबा 10.000 हे.

क्रमांक	अभिलेखी का विवरण	विशेष	
1	प्रस्तावित वृद्धारोपण क्षेत्र का GPS द्वारा सर्वे रिपोर्ट	A	N- 22°06'36.44" E- 083°09'12.48"
		B	N- 22°06'38.08" E- 083°09'21.20"
		C	N- 22°06'35.78" E- 083°09'28.77"
		D	N- 22°06'21.03" E- 083°09'35.45"
		E	N- 22°06'21.29" E- 083°09'27.30"
		F	N- 22°06'31.87" E- 083°09'28.27"

  
धन वन मंडलाधिकारी  
धरमजयगढ़ उप वन मंडल

  
वन परिचर अधिकारी  
वन परिसर छाल

**प्रत्येक वर्ष के लिए**  
**राज्य के लिए निधि से आवंटित अनुदानों का विवरण**

वर्ष 2023-24	2023-24	वर्ष 2023-24	2023-24
--------------	---------	--------------	---------

वर्ष 2023-24	2023-24	वर्ष 2023-24	2023-24
वर्ष 2023-24	2023-24	वर्ष 2023-24	2023-24
वर्ष 2023-24	2023-24	वर्ष 2023-24	2023-24
वर्ष 2023-24	2023-24	वर्ष 2023-24	2023-24
वर्ष 2023-24	2023-24	वर्ष 2023-24	2023-24
वर्ष 2023-24	2023-24	वर्ष 2023-24	2023-24

**वर्ष 2023-24**

क्र.	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24		वर्ष 2023-24	वर्ष 2023-24
					वर्ष 2023-24	वर्ष 2023-24		
1	2	3	4	5	6	7	8	9
1		वर्ष 2023-24						
1.1	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24
1.1.1	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24
1.1.2	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24
1.1.3	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24
1.1.4	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24
1.2		वर्ष 2023-24						
1.2.1	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24
1.2.2	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24	वर्ष 2023-24
















वर्षावधि (वर्ष)								
		वर्षावधि (वर्ष) का विवरण एवं धारा 17(1) के अन्तर्गत कर की दर का प्रतिशत (अनुसूची 1 के अनुसार)।						
	Special Rate	एक सप्ताह से कम की अवधि के लिए निर्धारित दर (अनुसूची 1 के अनुसार)	4	Dy	4000	₹ 1920 / ₹ 1000 (अनुसूची 1 के अनुसार)	140	42240.00
	Special Rate	एक सप्ताह से अधिक की अवधि के लिए निर्धारित दर (अनुसूची 1 के अनुसार)	4	Dy	4000	₹ 1920 / ₹ 1000 (अनुसूची 1 के अनुसार)	140	42240.00
	Special Rate	एक से अधिक की अवधि के लिए निर्धारित दर (अनुसूची 1 के अनुसार)	4	Dy	4000	₹ 1920 / ₹ 1000 (अनुसूची 1 के अनुसार)	210	63504.00
		एक से अधिक की अवधि के लिए निर्धारित दर (अनुसूची 1 के अनुसार)	La					197760.00
							निर्धारित कर का योग :-	350784.00
							आवधिकार शुल्क	0.00
		वर्षावधि (वर्ष) के अनुसार निर्धारित दर (अनुसूची 1 के अनुसार)	10	best	0	₹ 0.00 / ₹ 1000	40	1200.00
							एक सप्ताह से अधिक की अवधि के लिए निर्धारित दर (अनुसूची 1 के अनुसार)	18864.00
							कुल कर का अनुमानित योग :-	
	Special Rate	कुल कर का अनुमानित योग (अनुसूची 1 के अनुसार)।	5	00	20	₹ 0.00 / ₹ 1000	212	96408.00
							एक सप्ताह से अधिक की अवधि के लिए निर्धारित दर (अनुसूची 1 के अनुसार)	19200.00
							कुल कर का अनुमानित योग :-	225648.00
							कर का अनुमानित योग (अनुसूची 1 के अनुसार)	225648.00
		कर का अनुमानित योग (अनुसूची 1 के अनुसार)	10%					22564.80
		कर का अनुमानित योग (अनुसूची 1 के अनुसार)	10%					22564.80
							कर का अनुमानित योग :-	52564.80
							कुल कर का अनुमानित योग :-	1071521.76
							कर का अनुमानित योग :-	1071521.00
							कर का अनुमानित योग :-	1071521.00

  
**प्रमुख कार्यकारी अधिकारी**  
**कर विभाग, अहमदाबाद**

  
**उप-प्रमुख कार्यकारी अधिकारी**  
**कर विभाग, अहमदाबाद**

  
**सहायक प्रमुख कार्यकारी अधिकारी**  
**कर विभाग, अहमदाबाद**

**प्रत्यक्ष सर्वेक्षण कार्य (2025-27)**

क्र.	विवरण	मात्रा	इकाई	दर		कुल मात्रा	कुल मूल्य
				म.दि.	रशि/प्रति		
1	2	3	4	5	6	7	8
	<b>राज्य अधीनस्थ एवं अधीनस्थित विभाग</b>						
1.1	दस्तावेज सेवा	भू-सूचना एवं भू-सूचना - विभाग क्षेत्र में स्थित क्षेत्रों की सहायता एवं सेवाएं प्रदान करने के लिए एक अनुसूचित क्षेत्र (अनुसूचित क्षेत्रों में सेवाएं प्रदान करने के लिए)।		1.5			8778.00
	कुल की तुलना पर कुल मूल्य :-						8778.00
2	प्रशिक्षण कार्य						
3	नया प्रकल्प शुरू का प्रस्ताव						
4	निर्माण के बीच मेंवारी कार्य का व्यय						
5	प्रकल्प शुरू का प्रस्ताव						
6.1	विभागीय कार्य						
6.1.1	1. प्रकल्प निर्माण - प्रस्तावित 100 प्रकल्प क्षेत्रों में की जाएगी, जिसमें प्रत्येक प्रकल्प क्षेत्रों की कार्यवाही, भूमिगत सेवा (विद्युत, पानी) कार्य कराया जाएगा। (अनुसूचित क्षेत्रों में सेवाएं प्रदान करने के लिए)।	12750	Plants	1	म.दि./प्रति	255.6	7980.00
6.1.2	2. विद्युत निर्माण - प्रस्तावित 100 प्रकल्प क्षेत्रों में प्रकल्प क्षेत्रों की कार्यवाही - प्रकल्प क्षेत्रों में 10 म.दि., प्रति प्रकल्प।	12760		2	म.दि./प्रति	255.2	7980.00
6.2	3. विद्युत कार्य - प्रस्तावित 100 प्रकल्प क्षेत्रों में 100 म.दि. प्रति प्रकल्प (विभागीय कार्य) की कार्यवाही।	204	Kg	28	रशि/प्रति		7392.00
	विभागीय कार्य पर कुल मूल्य :-						16522.00
7	1. प्रकल्प शुरू का प्रस्ताव						
8	2. विभागीय कार्य						
9	3. प्रकल्प शुरू का प्रस्ताव						
9.1	विभागीय कार्य						
9.1.1	1. प्रकल्प शुरू का प्रस्ताव - प्रस्तावित 100 प्रकल्प क्षेत्रों में प्रकल्प क्षेत्रों की कार्यवाही - प्रकल्प क्षेत्रों में 10 म.दि., प्रति प्रकल्प।	1	12	25	म.दि./प्रति	312	9648.00
9.1.2	2. प्रकल्प शुरू का प्रस्ताव - प्रस्तावित 100 प्रकल्प क्षेत्रों में प्रकल्प क्षेत्रों की कार्यवाही - प्रकल्प क्षेत्रों में 10 म.दि., प्रति प्रकल्प।						
9.1.3	3. प्रकल्प शुरू का प्रस्ताव - प्रस्तावित 100 प्रकल्प क्षेत्रों में प्रकल्प क्षेत्रों की कार्यवाही - प्रकल्प क्षेत्रों में 10 म.दि., प्रति प्रकल्प।						
9.1.4	4. प्रकल्प शुरू का प्रस्ताव - प्रस्तावित 100 प्रकल्प क्षेत्रों में प्रकल्प क्षेत्रों की कार्यवाही - प्रकल्प क्षेत्रों में 10 म.दि., प्रति प्रकल्प।						
9.1.5	5. प्रकल्प शुरू का प्रस्ताव - प्रस्तावित 100 प्रकल्प क्षेत्रों में प्रकल्प क्षेत्रों की कार्यवाही - प्रकल्प क्षेत्रों में 10 म.दि., प्रति प्रकल्प।						
9.1.6	6. प्रकल्प शुरू का प्रस्ताव - प्रस्तावित 100 प्रकल्प क्षेत्रों में प्रकल्प क्षेत्रों की कार्यवाही - प्रकल्प क्षेत्रों में 10 म.दि., प्रति प्रकल्प।						
9.1.7	7. प्रकल्प शुरू का प्रस्ताव - प्रस्तावित 100 प्रकल्प क्षेत्रों में प्रकल्प क्षेत्रों की कार्यवाही - प्रकल्प क्षेत्रों में 10 म.दि., प्रति प्रकल्प।						
9.1.8	8. प्रकल्प शुरू का प्रस्ताव - प्रस्तावित 100 प्रकल्प क्षेत्रों में प्रकल्प क्षेत्रों की कार्यवाही - प्रकल्प क्षेत्रों में 10 म.दि., प्रति प्रकल्प।						
9.1.9	9. प्रकल्प शुरू का प्रस्ताव - प्रस्तावित 100 प्रकल्प क्षेत्रों में प्रकल्प क्षेत्रों की कार्यवाही - प्रकल्प क्षेत्रों में 10 म.दि., प्रति प्रकल्प।						
9.1.10	10. प्रकल्प शुरू का प्रस्ताव - प्रस्तावित 100 प्रकल्प क्षेत्रों में प्रकल्प क्षेत्रों की कार्यवाही - प्रकल्प क्षेत्रों में 10 म.दि., प्रति प्रकल्प।						
	कुल प्रकल्प शुरू का प्रस्ताव पर कुल मूल्य :-						32206.00
10	1. प्रकल्प शुरू का प्रस्ताव						
10.1	1. प्रकल्प शुरू का प्रस्ताव	10%					7340.00
10.2	2. प्रकल्प शुरू का प्रस्ताव	15%					48300.00
	कुल प्रकल्प शुरू का प्रस्ताव पर कुल मूल्य :-						55640.00
	कुल मूल्य :-						55292.00
	कुल मूल्य :-						55292.00

  
 जिला अभियंता  
 नगरपालिका, प्रस्तावकर्ता

  
 जिला अभियंता  
 नगरपालिका, प्रस्तावकर्ता

  
 जिला अभियंता  
 नगरपालिका, प्रस्तावकर्ता

संभव वार्षिक खर्च/आय का विवरण (2022-23)

क्र.	वर्ग का क्र.	वर्ग विवरण	आय स्रोत	प्रकार	दर		कुल म.रि.	कुल राशि
					रा.दि.	राशि/प्रकार		
1	2	3	4	5	6	7	8	9
1		उच्च शैक्षणिक एवं शैक्षणिक विकास						
1.1	अनुसंधान	अनुसंधान एवं पुस्तकालय :- विभिन्न क्षेत्रों में शैक्षणिक क्षेत्रों को प्रोत्साहित एवं प्रोत्साहित करने के लिए आ-आपसी मदद प्रदान करने के लिए / प्रवर्धन / प्रवर्धन के लिए प्रदान की जाने वाली राशि।	1.1					8590.00
								8590.00
2		शैक्षणिक कार्य						
2.1		शैक्षणिक कार्यक्रम (उप-प्रयोग)						36896.70
								36896.70
3		उच्च शिक्षण क्षेत्र का विकास						
4		शैक्षणिक क्षेत्र में शैक्षणिक विकास के लिए मदद						
5		शैक्षणिक क्षेत्र का विकास						
6		शु - शिक्षण कार्यक्रम						
6.1		उच्च शैक्षणिक क्षेत्र/कार्यक्रमों का विकास (उप-प्रयोग)						36972.00
								36972.00
7		अन्य शैक्षणिक कार्य						
8		अन्य शैक्षणिक कार्यक्रम						
9		अन्य शैक्षणिक कार्यक्रम						
11	11.1	उच्च शैक्षणिक क्षेत्र का विकास (उप-प्रयोग) :- उच्च शैक्षणिक क्षेत्र/कार्यक्रमों को प्रोत्साहित करने के लिए आ-आपसी मदद प्रदान करने के लिए / प्रवर्धन / प्रवर्धन के लिए प्रदान की जाने वाली राशि। नोट - प्रस्ताव को अंतिम रूप में प्रस्तुत करने के लिए शैक्षणिक क्षेत्र/कार्यक्रमों को प्रोत्साहित करने के लिए आ-आपसी मदद प्रदान करने के लिए / प्रवर्धन / प्रवर्धन के लिए प्रदान की जाने वाली राशि। प्रस्ताव को अंतिम रूप में प्रस्तुत करने के लिए शैक्षणिक क्षेत्र/कार्यक्रमों को प्रोत्साहित करने के लिए आ-आपसी मदद प्रदान करने के लिए / प्रवर्धन / प्रवर्धन के लिए प्रदान की जाने वाली राशि। प्रस्ताव को अंतिम रूप में प्रस्तुत करने के लिए शैक्षणिक क्षेत्र/कार्यक्रमों को प्रोत्साहित करने के लिए आ-आपसी मदद प्रदान करने के लिए / प्रवर्धन / प्रवर्धन के लिए प्रदान की जाने वाली राशि। प्रस्ताव को अंतिम रूप में प्रस्तुत करने के लिए शैक्षणिक क्षेत्र/कार्यक्रमों को प्रोत्साहित करने के लिए आ-आपसी मदद प्रदान करने के लिए / प्रवर्धन / प्रवर्धन के लिए प्रदान की जाने वाली राशि।	11	11	24	रा.दि./प्रकार	312	103384.00
12		अन्य शैक्षणिक क्षेत्र का विकास (उप-प्रयोग) :- उच्च शैक्षणिक क्षेत्र/कार्यक्रमों को प्रोत्साहित करने के लिए आ-आपसी मदद प्रदान करने के लिए / प्रवर्धन / प्रवर्धन के लिए प्रदान की जाने वाली राशि।						243331.00
								243331.00
13		अन्य शैक्षणिक क्षेत्र का विकास (उप-प्रयोग)						
13.1		अन्य शैक्षणिक क्षेत्र का विकास (उप-प्रयोग)		10%				3688.70
13.2		अन्य शैक्षणिक क्षेत्र का विकास (उप-प्रयोग)		40%				31800.00
								35488.70
								463251.70
								463251.70
								463251.70

संभव वार्षिक खर्च/आय का विवरण

उच्च शैक्षणिक क्षेत्र का विकास

अन्य शैक्षणिक क्षेत्र का विकास



बजट का सारांश वर्ष 2024-25

क्र.	वर्ग सं.	वर्ग नाम	वर्ग सं.	वर्ग सं.	वर्ग		कुल सं.	कुल राशि
					सं.	राशि / वस्तु		
1	2	3	4	5	6	7	8	9
1	1.1	विशेष प्रा. अनुदान - राजस्व से आवंटित राशि को लेकर एक लाख 75 हजार 250 रुपये का राशि का अनुदान प्रदान करने के लिए।	1.1					2251.00
कुल राशि का कुल योग :-								2251.00
2		सिमेंट का						
2.1		सिमेंट का (25 टन)	1.1					27663.10
कुल राशि का कुल योग :-								27666.00
3		सिमेंट का						
3.1		सिमेंट का (25 टन)	1.1					39771.00
कुल राशि का कुल योग :-								36722.80
4		विशेष प्रा. अनुदान						
4.1	Special Rate	विशेष प्रा. अनुदान - राजस्व से आवंटित राशि को लेकर एक लाख 75 हजार 250 रुपये का राशि का अनुदान प्रदान करने के लिए।	1	10	20	सं. राशि / वस्तु	30	103884.00
4.2		विशेष प्रा. अनुदान - राजस्व से आवंटित राशि को लेकर एक लाख 75 हजार 250 रुपये का राशि का अनुदान प्रदान करने के लिए।						180223.00
कुल राशि का कुल योग :-								284907.00
5		विशेष प्रा. अनुदान						
5.1		विशेष प्रा. अनुदान	45%					130470.00
कुल राशि का कुल योग :-								130470.00
कुल राशि :-								491263.85
कुल राशि :-								491264.00
कुल राशि का कुल योग :-								49226.40

मुख्य अधिकारी  
राजस्व विभाग

मुख्य अधिकारी  
राजस्व विभाग

मुख्य अधिकारी  
राजस्व विभाग



**मानव संसाधन रखरखाव कार्य (2021-22)**

क्र. सं.	कार्य पर धरा	कार्य विवरण	कार्य मात्रा	दर	राशि		वृत्त सं. सं.	कुल राशि	
					राशि	राशि / एकाई			
1	2	3	4	5	6	7	8	9	
1		सीक्रेटरी कार्यालय एवं कार्यालयीय सुविधाएँ							
	1.1	सिस्टम का रखरखाव एवं सुधारण - वेबसाइट में पोस्टिंग पोस्टिंग एवं अपडेटिंग एवं वेबसाइट को सुरक्षित रखना एवं अपडेटिंग एवं वेबसाइट को सुरक्षित रखना।	1.1					20000.00	
		वेबसाइट को सुरक्षित रखना एवं सुधारण							20000.00
2		वैयक्तिक कार्य							
	2.1	वैयक्तिक सहाय्यक कार्य (100 घण्टियाँ)	1.2					34000.00	
		वैयक्तिक सहाय्यक कार्य (100 घण्टियाँ) पर कुल राशि							34000.00
3		अन्य सहाय्यक कार्य एवं सुधारण							
4		वेबसाइट में पोस्टिंग पोस्टिंग एवं अपडेटिंग							
5		वैयक्तिक सहाय्यक कार्य							
6		दूसरे - अन्य कार्य							
	4.1	अन्य सहाय्यक कार्य (100 घण्टियाँ) का रखरखाव - कार्य (100 घण्टियाँ)	1.3					20000.00	
		अन्य सहाय्यक कार्य (100 घण्टियाँ) पर कुल राशि							20000.00
7		अन्य विभागीय कार्य							
8		अन्य सहाय्यक कार्य							
9		पुस्तक एवं अन्य साहित्यिक कार्य							
	8.1	Special Rate पुस्तक सहाय्यक कार्य (100 घण्टियाँ) हेतु एक सहाय्यक सहाय्यक कार्य (100 घण्टियाँ) पर 00 सहाय्यक कार्य नोट - पुस्तक सहाय्यक कार्य एवं सहाय्यक कार्य के द्वारा किए गए कार्यों को सहाय्यक कार्य के रूप में माना जाएगा और सहाय्यक कार्य के द्वारा किए गए कार्यों को सहाय्यक कार्य के रूप में माना जाएगा और सहाय्यक कार्य के द्वारा किए गए कार्यों को सहाय्यक कार्य के रूप में माना जाएगा।	1.4	12	20	राशि / एकाई	312	101394.80	
	8.2	अन्य सहाय्यक कार्य (100 घण्टियाँ) हेतु कार्य (100 घण्टियाँ) / वैयक्तिक कार्य एवं सहाय्यक कार्य						227633.00	
		पुस्तक एवं अन्य साहित्यिक कार्य पर कुल राशि							101394.80
		वेबसाइट / वेबसाइट पर नवीकरणात्मक कार्य							
	8.3	वेबसाइट को नवीकरणात्मक कार्य	1.5					48890.00	
		वेबसाइट को नवीकरणात्मक कार्य पर कुल राशि							48890.00
		<b>योग कुल :-</b>							<b>423664.00</b>
		<b>अनुमान :-</b>							<b>423664.00</b>
		<b>अनुमान :-</b>							<b>423664.00</b>

  
 राजभाषा विभागीय अधिकारी  
 राजभाषा विभाग, राजभाषा विभाग

  
 सहाय्यक सहाय्यक अधिकारी  
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 सहाय्यक सहाय्यक अधिकारी  
 सहाय्यक सहाय्यक अधिकारी



दसम वर्ष रखरखान कार्य (2032-33)

क्र.	कार्य का क्र.	कार्य विवरण	कार्य मात्रा	दुर्ग	दर		कुल मात्रा	कुल लागत
					प्र.दि.	शर्ति/रखरख		
1	2	3	4	5	6	7	8	9
1		सामान्य रखरख एवं परिवर्धन कार्य						
1.1	विशेष कार्य	सड़क काटने एवं सुधारण :- सड़क काटने में सड़क चौड़ाई को बढ़ाकर एवं सड़कें एवं सड़कें काटने का कार्य एवं सड़कें एवं सड़कें / सड़कें में कार्य करना	1.5					10724.00
2		सामान्य कार्य						
2.1		सड़क काटने का कार्य	1.5					18000.00
3	3	सड़क काटने का कार्य						
4	4	सड़क काटने का कार्य						
5	5	सड़क काटने का कार्य						
6	6	सड़क काटने का कार्य						
7	7	सड़क काटने का कार्य						
8	8	सड़क काटने का कार्य						
8.1.1		सड़क काटने का कार्य :- सड़क काटने का कार्य में सड़क चौड़ाई को बढ़ाकर एवं सड़कें एवं सड़कें काटने का कार्य एवं सड़कें एवं सड़कें / सड़कें में कार्य करना। इससे सड़क चौड़ाई को बढ़ाकर एवं सड़कें एवं सड़कें काटने का कार्य।	8.000	मात्र	21	प्र.दि. / रकम	200	68400.00
9		सड़क काटने का कार्य						
9.1	विशेष कार्य	सड़क काटने का कार्य में सड़क चौड़ाई को बढ़ाकर एवं सड़कें एवं सड़कें काटने का कार्य एवं सड़कें एवं सड़कें / सड़कें में कार्य करना। इससे सड़क चौड़ाई को बढ़ाकर एवं सड़कें एवं सड़कें काटने का कार्य।	1	10	20	प्र.दि. / रकम	200	85320.00
9.2		सड़क काटने का कार्य						201471.00
10		सड़क काटने का कार्य						300795.30
10.1		सड़क काटने का कार्य	45%					130403.75
								138487.75
								853356.75
								491317.60
								49723.70

कार्य प्रमुख, अहमदाबाद


कार्य प्रमुख, अहमदाबाद

कार्य प्रमुख, अहमदाबाद

## वार्षिक परियोजना लागत गोश्वारा

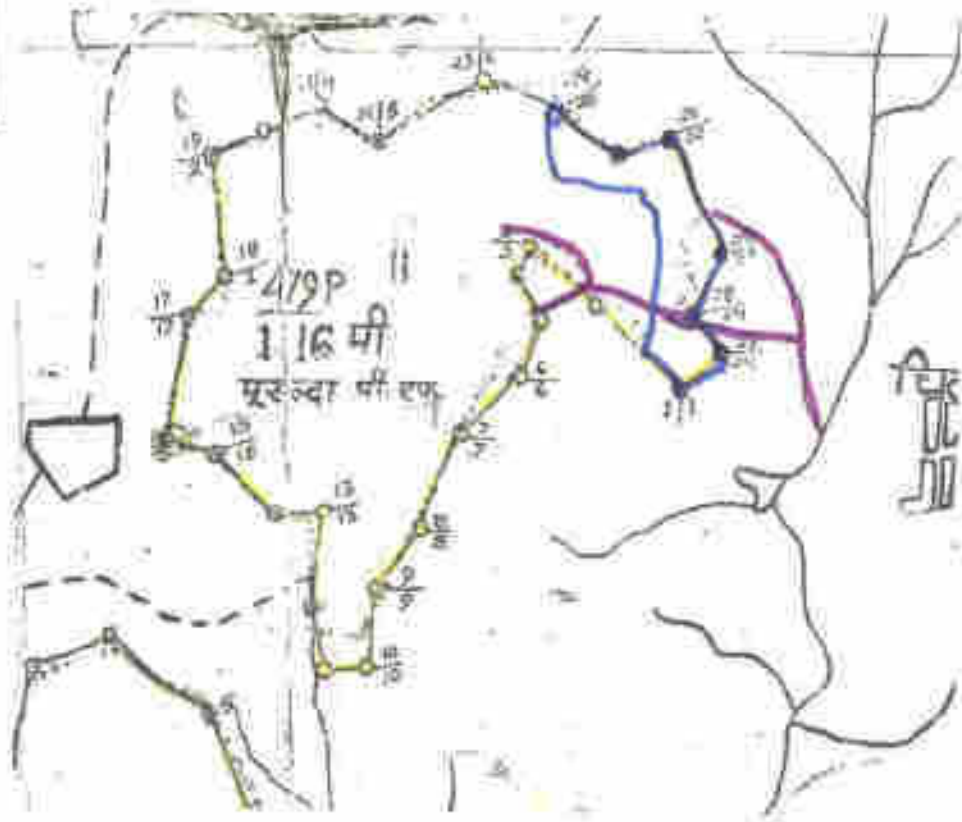
क्र.	वर्ष	भाष्यकृतित त्रुति			कुल त्रुति	प्रति डेसकतद त्रुति
		कंसित	तदतदतद	तदतद		
1	प्रथम वर्ष अत्र तदतदतद (तदतदतद) (2023 - 2024)	211088.93	2583080.07	2794170.00	2794170.00	279417.00
2	द्वितीय वर्ष (2024 - 2025)				2615472.00	261547.20
3	तृतीय वर्ष (2025 - 2026)				1071522.00	107152.20
4	चतुर्थ वर्ष (2026 - 2027)				552927.00	55292.70
5	पंचम वर्ष (2027 - 2028)				465253.00	46525.30
6	षष्ठम वर्ष (2028 - 2029)				391344.00	39134.40
7	सप्तम वर्ष (2029 - 2030)				492364.00	49236.40
8	अष्टम वर्ष (2030 - 2031)				382687.00	38268.70
9	नवम वर्ष (2031 - 2032)				423664.00	42366.40
10	दशम वर्ष (2032 - 2033)				497357.00	49735.70
	योग -				9666660.00	966666.00

  
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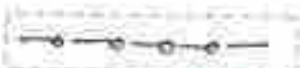




  
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## :- संनिधी मानचित्र :-



वन परिक्षेत्र - छाल  
 प. स. परिवृत्त - छाल  
 परिसर - एडू  
 कक्ष क्रमांक - 479 आर.एफ.  
 कुल रकबा - 97.076 हे.  
 प्रस्तावित रकबा-10.000 हे.

### संकेत

- वनखण्ड सीमा रेखा- 
- कक्ष सीमा रेखा- 
- प्रस्तावित कार्य क्षेत्र- 
- नदी/नाला- 
- सड़क- 

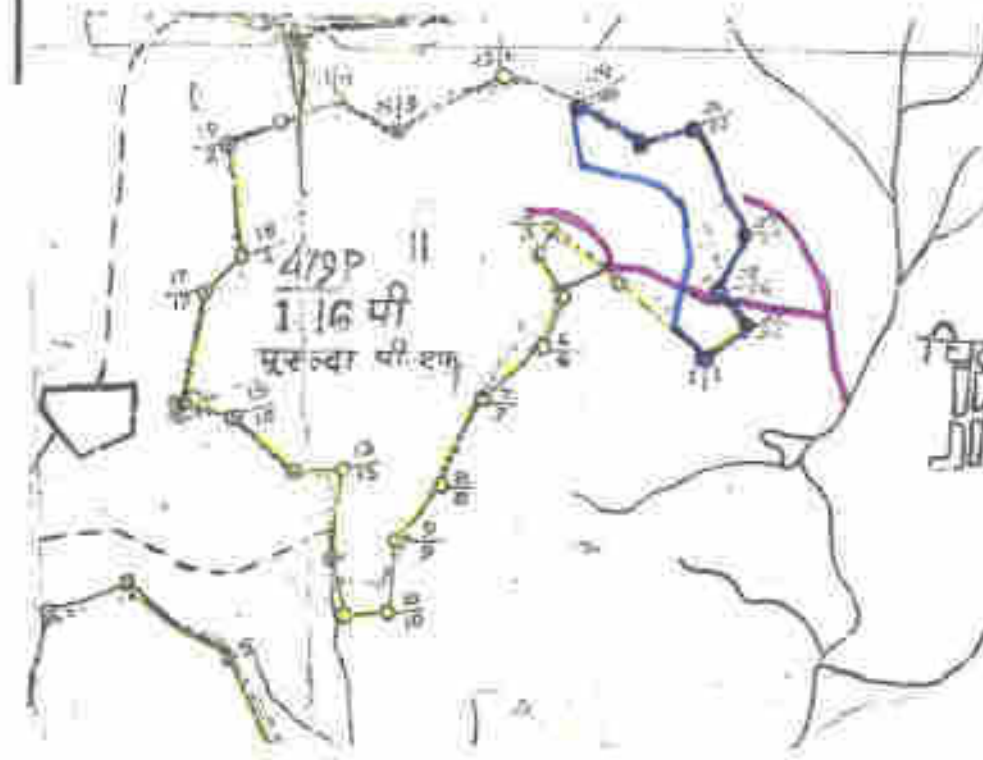
परिसर रेखांक  
एडू

परिक्षेत्र सहायक  
छाल

वन परिक्षेत्राधिकारी  
छाल परिक्षेत्र

नोट- इस मानचित्र की कला मेम से निर्धारित स्केल 1:15000 पैमाना के अनुसार तैयार किया गया है।

## :- पुनरीक्षित संनिधि मानचित्र :-



वन परिक्षेत्र - छाल  
 प. स. परिवृत्त - छाल  
 परिसर - एडू  
 कक्ष क्रमांक - 479 आर.एफ.  
 कुल रकबा - 97.076 हे.  
 प्रस्तावित रकबा-10.000 हे.

### संकेत

- वनखण्ड सीमा रेखा-
- कक्ष सीमा रेखा-
- प्रस्तावित कार्य क्षेत्र-
- नदी/नाला-
- सड़क-

परिसर रकबा  
एडू

परिक्षेत्र सहायक  
छाल

वन परिक्षेत्र अधिकारी  
छाल परिक्षेत्र

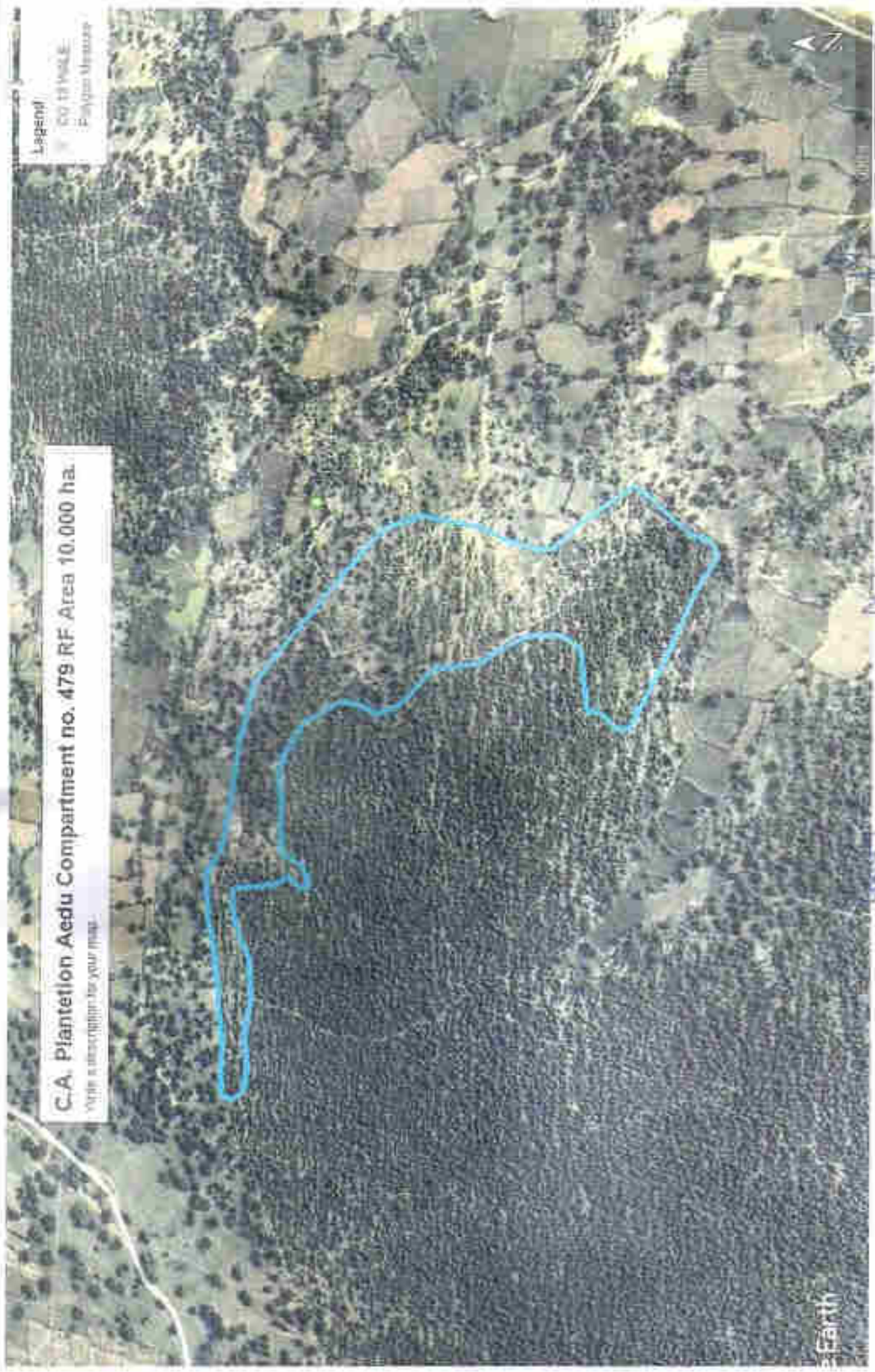
नोट- उक्त मानचित्र बीट नक्शा पीए से निर्धारित स्केल 1:150000 पैमाने से अनुसरण तैयार किया गया है।

C.A. Plantation Aedu Compartment no. 479 RF Area 10.000 ha.

Write a description for your map.

Legend

- CO 18 MOLE
- Polysun Messuar



पत्र परिशिष्टांक (1)

पशुधन विभाग

परिसर विभाग

रा



## छत्तीसगढ़ राज्य वन विकास निगम लिमिटेड

कार्यालय - मण्डल प्रबंधक, औद्योगिक वृक्षारोपण मण्डल, रायगढ़ (छ.प्र.)

अल्ट्रा गुडा, टी.पी. डॉवर रोड, उत्तरी चक्रधर नगर, रायगढ़ (छ.प्र.) पिन नं. 496001

Email : dmipdraigerb01@gmail.com

प.क्र./विविधि/ओ.ग.म./स्था./2023/363

रायगढ़ दिनांक 18.05.2023

प्रति,

मोडल आफिसर (पर्यावरण)  
एस.ई.सी.एल.  
रायगढ़ (छ.प्र.)

विषय :- एस.ई.सी.एल. रायगढ़ के छाल ओ.सी.पी. में 17.500 कि.मी. में किये जाने वाले शेफ्टीजोन वृक्षारोपण का बजटीय प्रस्ताव के संबंध में।

संदर्भ :- आपका पत्र क्रमांक 755 रायगढ़ दिनांक 18.05.2023

—00—

महोदय,

उपरोक्त विषयांतर्गत संदर्भित पत्र के संबंध में लेख है कि एस.ई.सी.एल. छाल ओ.सी.पी. में 17.500 कि.मी. शेफ्टीजोन विकसित करने हेतु राशि क्र. 70727282.50 का प्राकल्पन प्रस्तुत है। (संलग्न)

क्षेत्रीय महाप्रबंधक कार्यालय बिलासपुर द्वारा अपने पत्र क्र. 1276 दिनांक 12.12.2022 द्वारा दीर्घकालीन एम.ओ.यू. 2023-24 से 2027-28 हेतु प्रेषित प्रस्तावित बर के अनुरूप है (संलग्न)। नियम, शर्त एवं दुरुद्धि, पूर्व में हुए अनुबंध के अनुरूप लागू रहेंगे।

कृपया उपरोक्त बजटीय प्रस्ताव को अनुमोदित करते हुए कार्य आदेश जारी करने का कष्ट करें।

धन्यवाद,

संलग्न :- उपरोक्तानुसार।

मण्डल प्रबंधक  
औद्योगिक वृक्षारोपण मण्डल  
रायगढ़ (छ.प्र.)

प.क्र./विविधि/ओ.ग.म./स्था./2023/364

रायगढ़ दिनांक- 18.05.2023

प्रतिविविधि :-

01. प्रबंध संचालक, छ.प्र. राज्य वन विकास निगम लिमि. रायपुर की ओर सूचनार्थ सादर संप्रेषित।
02. क्षेत्रीय महाप्रबंधक कार्यालय बिलासपुर, की ओर सूचनार्थ सादर संप्रेषित।
03. महाप्रबंधक एस.ई.सी.एल. रायगढ़ एरिया की ओर सूचनार्थ सादर प्रेषित।

मण्डल प्रबंधक

**CHHATTISGARH RAJYA VAN VIKAS NIGAM LIMITED**  
**INDUSTRIAL PLANTATION DIVISION RAIGARH (C.G.)**

Mhour base rate - Rs.173.08 w.e.f. 01.10.2022

**SCHEDULE**

Estimate for 17.5 km safety zone at SECL Chhal OCP.

S.N	Particulars of work	Unit	Rate per km.	Amount
1	2	4	5	6
01-	<b>First year plantation &amp; its maintenance : ( 2023-24)</b>			
1	For safety zone with fencing strip of safety zone of 7.5m width with fencing ( on both side) including plantation 2000nos. Per km. as per specification with Goose neck R.C.C. pole ( 1.8 mtr high fencing with 2.4 mtr long RCC pole) as per specification placed every 2.5 mtr apart embedded in cement concrete block ( 1.5:10) and every 15th pole last but one end post and corner pole struted on both side and end pole on one side only. provided with 7 horizontal line and two diagonal of barbed-wire (18.76mtr in per kg) between 2 poles fitted and fixed with iron clips made in RCC poles, including chain link mesh 4"x4" with 10 gauge GI wire up to 5ft. height. Raising of nursery and supply of seedlings in poly pots, digging pits in the 1st year (2023-24.)	17.5 km	2149891.00	37623092.50
	<b>Total</b>		<b>2149891.00</b>	<b>37623092.50</b>
02-	<b>Second year maintenance : ( 2024-25)</b>			
	Plantation of seedling, casualty replacement, weeding, application of fertilizer and pesticides, cutback grasses, fire protection and watering work etc.	17.5 km	528779.00	9233632.50
			<b>528779.00</b>	<b>9233632.50</b>
03-	<b>Third year maintenance : ( 2025-26)</b>			
	Casualty replacement, weeding, application of fertilizer and pesticides, cutback grasses, fire protection and watering work etc.	17.5 km	381805.00	6681587.50
			<b>381805.00</b>	<b>6681587.50</b>
04-	<b>Fourth year maintenance : ( 2026-27)</b>			
	Weeding, cutback grasses, fire protection work etc.	17.5 km	211066.00	3693655.00
			<b>211066.00</b>	<b>3693655.00</b>
05-	<b>Fifth year maintenance : ( 2027-28)</b>			
	protection & maintenance work etc.	17.5 km	153509.00	2686407.50
			<b>153509.00</b>	<b>2686407.50</b>
	<b>Total</b>		<b>3425050.00</b>	<b>59938375.00</b>
	<b>G.S.T. (18%)</b>		<b>616509.00</b>	<b>10783907.50</b>
	<b>Total</b>		<b>4041559.00</b>	<b>70727282.50</b>

Project Engineer Officer

Asstt. Manager (A/C)

Dy. DM

Divisional Manager

I.P.D.

Industrial Plantation Division

Raigarh (C.G)

Raigarh (C.G)



**CHHATTISGARH RAJA VAN VIKAS NIGAM LIMITED**  
Office of the Regional General Manager, Mangla Chowk, Bilaspur (C.G.)  
Tel. - 07732-418735, E-mail - rgvnffo\_bil@rgvnvl.com

VVN/RGM/Exp/2022/ 12.74

Bilaspur/Dated -12/11/2022

To:-  
The General Manager (ENVT & Forest)  
SECL Headquarter  
Sipat Road, Bilaspur (C.G.)

Subject:- Proposed Rate for long-term MOU for the year 2023-24 to 2027-28.

Ref:- Meeting dated 23.11.2022 & this office Letter No 1197 dated 23.11.2022 & this office Letter no. 1258 dated 06.12.2022 & discussion held with on 10.12.2022

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Dear Sir,

As per discussion held on 10.12.2022 the year-wise breakup of safety zone and rate for CPT & CPW is as follows :-

Particular/Name of Work	Year	Approved rate for 2018 Plantation including overhead charges		Proposed Rate for 2023-24 Plantation including overhead charges		Remark
		Unit	Rate	Rate Increased	Rate	
Plantation Dump/Non- Dump	1st	Per Plant	159.58	21.64	194.60	
	IIInd	Per Plant	58.66	21.64	71.95	
	IIIInd	Per Plant	33.70	21.64	40.99	
	Vith	Per Plant	21.57	21.64	26.24	
	Vith	Per Plant	19.18	21.64	23.33	
	Total			293.09	108.20	356.51
Safety Zone	1st	Per Km	1704301.05	26.15	2149891.00	
	IIInd	Per Km	419183.15	26.15	528779.00	
	IIIInd	Per Km	302671.80	26.15	381805.00	
	Vith	Per Km	167320.00	26.15	211066.00	
	Vith	Per Km	221680.00	26.15	153509.00	
	Total			2715156.00		3425050.00
Grid Rod		Per Rod	100.04	19.55	119.60	
Grid Wire		Rm	367.80	23.39	466.54	
Open Trench		Per Trench	49.92	19.55	59.68	
Check Dam		Per Cmt	187.20	19.55	223.80	
Band with Box		Per Cmt	202.80	19.55	242.45	



Cable Proof Trench	Ist	Per Rmt			298.55	As per PCCF SOR 1.6.1.2
CPT Repair	IInd	Per Rmt			48.50	1.7.2.1
CPT Repair	IIIRD	Per Rmt			48.50	1.7.2.1
	Total				335.55	
Constn. CPW	Ist	Per Rmt			279.81	As per PCCF SOR 1.6.1.2
CPW Repair	IInd	Per Rmt			27.98	10% of 1st year
CPW Repair	IIIRD	Per Rmt			27.98	10% of 1st year
	Total				335.77	

Price rate was taken from long term MOU of 2018-2022. At that time of MOU the labour rate was Rs. 312/- per man days w.e.f. 01.04.2018. The present labour rate is Rs. 373.08 w.e.f. 01.10.2022, similarly wholesale price index was in 2018 is 117.3 w.e.f. April 2018 while present price index is 152.5 w.e.f. Oct. 2022 which will be base rate of escalation.

The rate quoted by us is excluding GST, GST is to be paid according to the rule applicable as per GOL.

Hence you are requested to kindly finalize the rate and issue long-term MOU without any further delay.

Thanking you

Yours Faithfully

(Manoj Kumar Pandey) IFS  
Regional General Manager  
Bilaspur Region (C.G.)  
Bilaspur/Dated - 12/12/2022

Encl. No. VVN/RGM/Exp/2022/ 12-77

Copy Forwarded to 1-

1. Managing Director, CGRVVN Ltd., Raipur with reference to 1258 dtl. 06.12.2022 for kind information

(Manoj Kumar Pandey) IFS  
Regional General Manager  
Bilaspur Region (C.G.)

कार्यालय कलेक्टर भू-अभिलेख रायगढ़ (छ.ग.)

क्रमांक/ 4042 /स.अ.भू.अ./2023

रायगढ़ दिनांक 18 / 05 / 2023

प्रति,

जयर प्रधान मुख्य वन संरक्षक (भू-प्रबंध/व.स.अ.)  
अरण्य भवन मेडिकल कालेज रोड  
रायपुर (छ.ग.)

विषय :- वन संरक्षण अधिनियम 1980 अन्तर्गत व्यपवर्तित की जाने वाले वन भूमि के लिए वन अधिकार अधिनियम 2008 से प्राक्खान अनुसार प्रदर्श "स" प्रदाय करने बाबत।

संदर्भ :- एसईसीएल छोटे अतरमुका रायगढ़ का पत्र क्रमांक SECL/GM/  
RGH/S.O.(P&P)/2023/196 Dated 27/04/2023

विषयान्तर्गत महाप्रबंधक एसईसीएल रायगढ़ क्षेत्र, छाल उपक्षेत्र द्वारा छाल खुली खान Seam-III परियोजना (GMTY) हेतु रायगढ़ जिले के धरमजयगढ़ वन मण्डल के अन्तर्गत ग्राम - बांधापाली, तहसील - छाल स्थित वन भूमि कुल रकबा 55.850 हेक्टेयर गैर वानिकीय उपयोग हेतु वन संरक्षण अधिनियम 1980 के अन्तर्गत व्यपवर्तित की जाने वाली वन भूमि के लिए वन अधिकार अधिनियम 2008 के तहत प्रदर्श "स" में प्रमाण पत्र हेतु आवेदन प्रस्तुत किया गया है। अनुविभागीय अधिकारी (राजस्व), धरमजयगढ़ से उपरोक्तानुसार ग्राम - बांधापाली का प्रदर्श "स" में प्रमाण पत्र लिया गया।

अतः अनुविभागीय अधिकारी (राजस्व), धरमजयगढ़ के प्रमाण पत्र अनुसार प्रदर्श "स" सादर सम्प्रेषित है।

संलग्न :- उपरोक्तानुसार।

Tara

कलेक्टर  
रायगढ़ (छ.ग.)

पू.क्रमांक/ 4042

/स.अ.भू.अ./2023 रायगढ़ दिनांक 18 / 05 / 2023

प्रतिलिपि :-

1. सचिव, छ.ग. शासन एवं आपदा प्रबंधन विभाग, मंत्रालय, महानदी भवन नया रायपुर की ओर सादर सूचनाार्थ सम्प्रेषित।
2. वन मण्डलाधिकारी, धरमजयगढ़ को सूचनाार्थ।
3. महाप्रबंधक, एसईसीएल, रायगढ़ क्षेत्र को सूचनाार्थ।

Tara

कलेक्टर  
रायगढ़ (छ.ग.)

प्रमाण-पत्र

प्रदर्श-“स”

वेसत एनईसीएल रायगढ़ क्षेत्र की प्रस्तावित जल शुली खान Seam-III परियोजना (GMTY) के लिये ग्राम - बांधापाली के Deemed Forest खसरा नंबर 410 रकबा 55.850 हेक्टेयर के प्रकरण में अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2006 का फलन प्रतिवेदन।

1. प्रमाणित किया जाता है कि अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2006 में निम्न सम्पूर्ण प्रक्रिया का फलन कर अधिकारों को स्थापित किया गया है तथा सम्पूर्ण प्रस्तावित क्षेत्र की ग्राम - बांधापाली के Deemed Forest खसरा नंबर 410 रकबा 55.850 हेक्टेयर जो इस कार्य हेतु व्यपवर्तित की जाती है तथा ग्राम - बांधापाली, थरदिल - छात, जिला - रायगढ़ (छ.ग.) में स्थित है, में उदनुसार यह कार्यवाही की गई है।

ग्राम सभा की बैठक एवं उसमें पारित प्रस्ताव दिनांक 08/10/2014 को सम्बन्ध ग्राम बांधापाली जो कि ग्राम बांधापाली के अन्तर्गत आता है जिसका ग्राम सभा एवं राज्य विभाग संयुक्त जांच प्रतिवेदन (प्रदर्श-“ब”) दर्शित है।

2. प्रमाणित किया जाता है कि उपर प्रकरण का प्रस्ताव ग्राम बांधापाली के सदस्य श्री रामसिंह की अध्यक्षता में हुई। ग्राम सभा की बैठक दिनांक 08/10/2014 में रखा था एवं इसमें 60 प्रतिशत ग्राम सभा के तथा ग्राम सभा समिति के सदस्य उपस्थित थे, जिनकी परियोजना के क्रियान्वयन एवं प्रकरण के पूर्ण विवरण तथा प्रभाव से अवगत कराकर विस्तार से समझाईस हिन्दी एवं स्थानीय भाषा में दी गई। यह पाया गया कि इस क्षेत्र में उपरोक्त अधिनियम के तहत वन अधिकार की मान्यता पत्र की प्रत्यता रखने वाले व्यक्ति नहीं है।

अर्थात्

प्रस्तावित Deemed Forest खसरा नंबर 410 रकबा 55.850 हेक्टेयर में प्रदात वन अधिकार मान्यता पत्र धारकों की संख्या निम्नानुसार है :-

क्रमांक	ग्राम का नाम	वन अधिकार मान्यता पत्र धारक का नाम	रकबा (हेक्टेयर में)
	बांधापाली	निरंक	निरंक

1. प्रमाणित किया जाता है कि जो भी चर्चा एवं निर्णय लिये गये उसमें ग्राम सभा के न्यूनतम 50 प्रतिशत सदस्यों की उपस्थिति का कोरम पूर्ण था।
4. यह प्रमाणित किया जाता है कि संयुक्त साक्षात्पत्र प्रतिवेदन एवं ग्राम सभा के उद्देश्य प्रस्ताव दिनांक 08/10/2014 अनुसार ऐसे विलुप्तग्राम जनजाति समूह (बी.टी.जी.) के सदस्य व्यपवर्तित हेतु प्रस्तावित वन भूमि पर निरासता नहीं है, जिनका वन अधिकार "अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2006" की धारा 3(1)(c)अन्तर्गत विशेष रूप से संरक्षित रचना है।
5. संयुक्त साक्षात्पत्र प्रतिवेदन एवं ग्राम सभा के दिनांक 08/10/2014 के संकल्पों के अन्तर्गत यह प्रमाणित किया जाता है कि व्यपवर्तित के लिये प्रस्तावित Deemed Forest खसरा नंबर 410 रकबा 55.850 हेक्टेयर भूमि पर अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2006 की धारा 3(2)अन्तर्गत शासन द्वारा संघालित कोई सुविधा विद्यमान नहीं है।

संलग्न - उपरोक्तानुसार।

दिनांक

  
 उप-विभागीय अधिकारी (संघ)  
 रायगढ़ जिला

  
 कलेक्टर  
 एवं

अध्यक्ष - जिला वन अधिकार समिति, जिला - रायगढ़ (छ.ग.)

## FORM-II

(For project other than linear projects)

Government of Chhattisgarh

Officer of the District Collector Raigarh

\*\*\*\*\*

No. 4042

Dated 16/05/2023

**TO WHOM SO EVER IT MAY CONCERN**

In compliance of the Ministry of Environment and Forests (MoEF), Government of India's letter No. 11-9/98-FC(pt.) dated 3rd August 2009 wherein the MoEF issued guidelines on submission of evidences for having initiated and completed the process of settlement of rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Right) Act, 2006 ('FRA', for short) on the forest land proposed to be diverted for non-forest purposes, it is certified that 55.850 hectares of deemed forest land proposed to be diverted in favour of SECL Chhal OC Seam-III Project(6MTY) for Coal Mine in Raigarh district falls within jurisdiction of Bandhapali village in Dharamjalgarh tehsil.

It is further certified that:

- a) The complete process for identification and settlement of rights under the FRA has been carried out for the entire 55.850 hectares of deemed forest land proposed for diversion. A copy of records of all consultations and meetings of the Forest Right Committee (s), Gram Sabha (s), Sub-Division Level Committee (s) and the District Level Committee are enclosed.
- b) The proposal for such diversion (with full details of the project and its implications, in vernacular/ local language) have been placed before each concerned Gram Sabha of forest-dwellers, who are eligible under the FRA.
- c) The each concerned Gram Sabha (s) has certified that all formalities/processes under the FRA have been carried out, and that they have given their consent to the proposed diversion and the compensation and ameliorative measures, if any, 'having understood the purpose and details of proposed diversion.
- d) The discussion and decisions on such proposals had taken place only when there was a quorum of minimum 50% of the members of Gram Sabha present.
- e) The diversion of forest land for facilities managed by the Government as required under section 3 (2) of the FRA have been completed and the Gram Sabha have given their consent to it.
- f) The rights of Primitive Tribal Groups and Pre-Agriculture Communities, where applicable have been specifically safeguards as per section 3(1)(e) of the FRA.

Encl: As above

*Taran*

District Collector  
Raigarh (C.G.)

**उप खण्ड स्तरीय वन अधिकार समिति धरमजयगढ़ की बैठक दिनांक 18.05.2023**

**-- प्रमाण-पत्र --**

रायगढ़ जिले के वन मण्डल धरमजयगढ़ के अन्तर्गत आने वाले एस.ई.सी.एल छाल की खुली खदान Seam-III(Ginty) परियोजना हेतु अधिग्रहण क्षेत्र अन्तर्गत वन भूमि कुल रकबा 240.887 हे० प्रभावित हो रहा है। जिसमें तहसील धरमजयगढ़ के अन्तर्गत आने वाले ग्राम लात के संरक्षित वन कल क्रमांक 1115/478 रकबा 176.710 हे०, ग्राम खेदापाली के राजस्व वन भूमि खसरा नंबर 87/2क, 85/2क एवं 5/2 कुल खसरा नंबर 03 कुल रकबा 8.307 हे० तथा ग्राम बांधापाली के राजस्व भूमि (डिम्ड फॉरेस्ट) खसरा नंबर 410 रकबा 55.650 हे० है। इस व्यपर्वतन प्रकरण के परिपेक्ष्य में अनुसूचित जाति एवं परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2008 नियम 2007 यथा संशोधित नियम 2012 के नियम एवं प्रावधानों पर चर्चा की गई, जो संरक्षित वन भूमि ग्राम लात एवं राजस्व वन भूमि ग्राम खेदापाली कार्य के व्यपर्वतन के लिए प्रस्तावित है। उक्त भूमि पर कोई भी वन अधिकार पत्र (व्यक्तिगत या सामुदायिक) किसी आदिवासी या गैर परम्परागत वनवासी को इस प्रस्तावित वन भूमि/राजस्व वन भूमि पर नहीं दिया गया है और वन अधिकार मान्यता प्रदान करने के संबंध में कोई भी आवेदन ग्राम स्तरीय वन अधिकार समिति या उपखण्ड स्तरीय वन अधिकार समिति के समक्ष लंबित नहीं है। ग्राम बांधापाली के प्रस्तावित उक्त भूमि खसरा नंबर 410 रकबा 55.650 हे० भूमि पर कोई भी ऐतिहासिक धार्मिक स्थल, शासकीय भवन आदि शासकीय परिसम्पत्ति स्थित नहीं है।

यह प्रमाण पत्र ग्राम सभा लात की बैठक दिनांक 02.10.2013 एवं ग्राम सभा खेदापाली के बैठक दिनांक 08.10.2014 के आधार पर जारी करने का प्रस्ताव उप खण्ड स्तरीय वन अधिकार समिति धरमजयगढ़ द्वारा सर्व सम्मति से पारित किया गया।

अनुविभागीय अधिकारी(वन) सह  
सचिव खण्ड स्तरीय वन अधिकार  
समिति धरमजयगढ़

अनुविभागीय अधिकारी(वन) सह  
अध्यक्ष खण्ड स्तरीय वन अधिकार  
समिति धरमजयगढ़

अध्यक्ष जनपद पंचायत सह  
सदस्य खण्ड स्तरीय वन अधिकार  
समिति धरमजयगढ़

उपाध्यक्ष जनपद पंचायत सह  
अध्यक्ष खण्ड स्तरीय वन अधिकार  
समिति धरमजयगढ़

मुख्य कार्यपालन अधिकारी जनपद  
पंचायत सह सदस्य खण्ड स्तरीय वन  
अधिकार समिति धरमजयगढ़

मालती राईजा  
जिला पंचायत सदस्य सह  
सदस्य खण्ड स्तरीय वन अधिकार  
समिति धरमजयगढ़

**SOUTH EASTERN COALFIELDS LIMITED**

**(A MINI RATNA COMPANY)**

**BILASPUR (CHHATTISGARH)**

**CHHAL OC PROJECT**



**PROJECT REPORT**


**ON**

**DESILTATION OF PONDS**

**LOCATED WITHIN FIVE KM FROM THE CHHAL OC PROJECT**

**DETAILS OF DESALTATION PONDS LOCATED WITHIN FIVE KM FROM CHHAL OC PROJECT**

S. NO.	VILLAGE NAME	Length (m)	Width (m)	Desalination Depth (m)	Volume (m <sup>3</sup> )	Rate (per m <sup>3</sup> )	Total	GPS LOCATION	
								LATITUDE	LONGITUDE
<b>I MAWAPARA</b>									
1	Right Pond	104	85	1.5	13416	194.58	2610420	22°07'00" N	83°08'54" E
2	Pond near weekly Market	71	51	1.5	5431	194.58	1065763	22°07'10" N	83°08'32" E
3	Pond behind Newborn colony	77	53	1.5	5724	194.58	1113776	22°07'34" N	83°08'28" E
4	Pond near Temple	89	59	1.5	6752	194.58	1304813	22°07'14" N	83°08'43" E
<b>II Bogy</b>									
5	Outdoor Pond	85	58	1.5	7395	194.58	1438818	22°07'13" N	83°09'12" E
6	Urush	95	70	1.5	8075	194.58	1540925	22°07'51" N	83°09'30" E
<b>III OSTAPAI</b>									
7	New Pond	85	50	1.5	4125	194.58	802642	22°09'25" N	83°10'07" E
8	Sand Pond	79	58	1.5	6773	194.58	1337548	22°09'33" N	83°10'04" E
<b>IV Gadakinfawri</b>									
9	Pond-1	68	50	1.5	4725	194.58	919390	22°07'33" N	83°08'33" E
10	Pond-2	59	48	1.5	4348	194.58	836575	22°07'56" N	83°08'33" E
11	Pond-3	85	54	1.5	5280	194.58	1024469	22°07'47" N	83°08'34" E

Measurement taken   
By Justice Prasad Kumar Mishra

  
INGM (Hydro Area Manager)  
Chhal Sub Area, SOG  
Rajapur Area

उप वन अधिकारी  
अनन्तराव उप वन मण्डल

उप वन अधिकारी  
अनन्तराव उप वन मण्डल  
विश्व राजपुर (क.प.)

S. NO.	VILLAGE NAME	Length (m)	Width (m)	Desiltation Depth (m)	Volume (m <sup>3</sup> )	Rate (per m <sup>3</sup> )	Total	GPS LOCATION	
								LATITUDE	LONGITUDE
<b>V</b>		<b>Domnara</b>							
12	Lahmoree pond	94	55	1.5	2755	194.58	1508967	22°04'40" N	83°06'01" E
13	Shenkar pond	94	62	1.5	8742	194.58	1701038	22°04'45" N	83°05'47" E
<b>VI</b>		<b>Farkanara</b>							
14	Budakha pond	178	78	1.5	20826	194.58	4052323	22°05'55" N	83°03'44" E
15	Dandhi pond	61	60	1.5	5490	194.58	1068244	22°05'19" N	83°04'24" E
<b>VII</b>		<b>Chhote Pandarmuda</b>							
16	Indira sagar	95	85	1.5	8262	194.58	1802206	22°05'04" N	83°04'51" E
17	Awas, muhalla pond	62	50	1.5	4650	194.58	904797	22°05'12" N	83°05'07" E
<b>VIII</b>		<b>AGASMAR</b>							
18	Pond 1	94	66	1.5	9306	194.58	1810761	22°03'45" N	83°05'32" E
<b>IX</b>		<b>CHIRPANI</b>							
19	Pond 1	228	50	1.5	17100	194.58	3327318	22°04'07" N	83°05'08" E
<b>X</b>		<b>BARSHAUNA</b>							
20	NR AK PRIMARY SCHOOL	97	65	1.5	9457	194.58	1840240	22°04'17" N	83°08'50" E
21	UPPER POND	175	60		15750	194.58	3064635	22°04'03" N	83°09'06" E
<b>XI</b>		<b>CHANDRASHEKHARPUR</b>							
22	POND 1	84	81	1.5	10206	194.58	1983883	22°04'16" N	83°07'18" E

*Signature*  
Chairman

*Signature*  
S. D. J. & Co. Surveyors  
Civil & Arch. SECS  
Kalyan, N. Area,  
Mumbai - 400 075

*Signature*  
उप वन सहायिका  
परमज्योत्सव उप वन परियोजना

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उप वन सहायिका  
परमज्योत्सव उप वन परियोजना  
जिल्हा कार्यालय (उ. व. व.)



S. NO.	VILLAGE NAME	Length (m)	Width (m)	Desiltation Depth (m)	Volume (ml)	Rate (per ml)	Total	GPS LOCATION	
								Latitude	Longitude
<b>XII GURDA</b>									
23	DARRAMUDA POND	116	80	1.5	14600	194.58	3047122	22°02'56" N	83°09'29" E
<b>XIII CHUAL</b>									
NEAR MAA CHANDI HASINI									
24	TEMPLE Pond	55	52	1.5	4372	194.58	800801	22°07'25" N	83°07'16" E
25	JAMINDAR PARKA BOND	85	72	1.5	10200	194.58	1996550	22°07'47" N	83°07'06" E
26	NEAR BOYS HOSTEL	72	55	1.5	6951	194.58	1236065	22°08'11" N	83°07'11" E
<b>XIV PUNARWAS LAAT</b>									
27	Pond 1	72	50	1.5	5400	194.58	3030732	22°08'10" N	83°07'31" E
<b>XV PUSALDAH</b>									
28	NEAR PRIMARY SCHOOL Pond	90	52	1.5	7020	194.58	1369951	22°08'22" N	83°08'14" E
<b>XVI DEHJARI</b>									
29	Pond 1	122	62	1.5	15702	194.58	3063467	22°02'38" N	83°07'31" E
<b>XVII TUMIDIN</b>									
30	POND 1	81	83	1.5	11578	194.58	2252944	22°08'17" N	83°08'27" E
<b>XVIII NAGCI</b>									
31	POND 1	96	90	1.5	12860	194.58	2521756	22°07'30" N	83°04'25" E
32	POND 2	86	58	1.5	7442	194.58	1137278	22°07'50" N	83°05'18" E
33	POND 3	80	50	1.5	6000	194.58	875510	22°07'48" N	83°05'09" E
34	POND 4	118	88	1.5	15600	194.58	3057122	22°07'43" N	83°04'38" E

*Shade*  
K. K. K. K.

*Signature*  
J.V.G.M.(M)/Sub Area Manager  
Chief Sub Area, SERI  
Raigarh Area

*PS*  
उप वन अधिकारी  
भारतखण्ड उप वन मण्डल

*Signature*  
वन मन्त्रालय  
राज्य वन मन्त्रालय  
जि.प. कार्यालय (ज.प.)

S. NO.	VILLAGE NAME	Length (m)	Width (m)	Desiltation Depth (m)	Volume (m <sup>3</sup> )	Rate (per m <sup>3</sup> )	Total	GPS LOCATION	
								LATITUDE	LONGITUDE
XI GURDA									
23	DARRAMUDA POND	116	90	1.5	15850	194.58	3077132	22°07'56" N	83°09'29" E
XII CHHAL									
	NEAR MAA CHANDRAMASRI TEMPLE Pond	55	53	1.5	4372	194.58	850801	22°07'25" N	83°07'18" E
24	JAMINDAR PABA POND	95	72	1.5	10260	194.58	1996390	22°07'47" N	83°07'08" E
25	NEAR BOYS HOSTEL	77	55	1.5	6352	194.58	1236009	22°08'11" N	83°07'11" E
XIII PUNARWAS LAAT									
27	Pond 1	72	50	1.5	5400	194.58	1050737	22°08'10" N	83°07'31" E
XIV PUSALDAH									
28	NEAR PRIMARY SCHOOL Pond	90	52	1.5	7020	194.58	1365351	22°08'21" N	83°08'14" E
XV DEHUARI									
29	Pond 3	128	82	1.5	15744	194.58	3083467	22°08'36" N	83°07'51" E
XVI TUMIDOH									
30	POND 1	53	53	1.5	41578	194.58	2252944	22°08'51" N	83°05'27" E
XVII NAGDI									
31	POND 1	96	90	1.5	12960	194.58	2521756	22°07'20" N	83°04'21" E
32	POND 2	66	18	1.5	5742	194.58	1117276	22°07'50" N	83°05'18" E
33	POND 3	60	30	1.5	4500	194.58	875810	22°07'49" N	83°05'09" E
34	POND 4	118	90	1.5	15840	194.58	3092122	22°07'48" N	83°04'28" E


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Chhal = 1/11/11

Chhal Sub Area SECL  
Research Area

उप वन मण्डलाधिकारी  
धरमकांगड़ उप वन मण्डल

उप वन मण्डलाधिकारी  
धरमकांगड़ उप वन मण्डल  
जिला रायचूर (झ.प्र.)

S. NO.	VILLAGE NAME	Length (m)	Width (m)	Deslitation Depth (m)	Volume (m <sup>3</sup> )	Rate (per m <sup>3</sup> )	Total	GPS LOCATION	
								LATITUDE	LONGITUDE
XIX NANDGAON									
55	POND 1	117	66	1.8	11883	194.58	2253820	22°06'48" N	81°01'09" E
XX PUCHHIYAPALI									
38	POND 1	68	48	1.5	7056	194.58	1372958	22°06'11" N	81°02'29" E
57	POND 2	107	54	1.5	10772	194.58	1998725	22°06'11" N	81°02'46" E
TOTAL					33861		8589390		

  
 Measurement taken by  
 Jamuna Prasad  
 Head chBaman  
 Chhal Sub Area

H.O.M. (P) Sub Area Manager  
 Chhal Sub Area, SEC  
 Baramba Area

  
 उप वन मण्डलाधिकारी  
 बरम्बावाड़ा उप वन मण्डल

  
 वन मण्डलाधिकारी  
 बरम्बावाड़ा उप वन मण्डल  
 जिला बरम्बा (B.M.)

**NAME OF WORK: DESILTATION OF PONDS / WATER BODIES LOCATED WITHIN FIVE KM FROM THE CHHAL OC PROJECT**

S. NO	DESCRIPTION OF WORK	ESTIMATED AMOUNT			JUSTIFIED AMOUNT (AS PER ANALYSIS)		REMARKS
		QTY M3	RATE (PER M3)	AMOUNT (Rs.)	RATE (PER M3)	AMOUNT (Rs.)	
1	37 ponds located within 5 km	338642	146.50	49611053	194.58	65892960	Item no.2.6.1 in DSOR 2013 & analysis of rate

*[Signature]*  
 Measurement taken  
 by  
 Jasmira Prasad  
 Head Chain Man  
 Chhal Sub Area

*[Signature]*  
 M.L.M. (M)/Sub Area Manager  
 Chhal Sub Area, SEC  
 Raigarh Area

*[Signature]*  
 उप वन संपदाधिकारी  
 वनसंरक्षण एवं वन सावधान

*[Signature]*  
 वन संपदाधिकारी  
 वनसंरक्षण एवं वन सावधान  
 जिला रायगढ़ (छ.ग.)

**(ix) User Agency has uploaded compliance report of conditions on e-portal only for 185.017 ha of forest land. Compliance report for entire area need to be uploaded on e-portal.**

It is a combined proposal of 240.867 Ha. of forest land (Stage-I FC for 2040.867 Ha. (185.017+55.85) was also granted in the same line). Proposal No. FP/CG/MIN/39334/2019 (55.85 Ha.) is rediverted with FP/CG/MIN/16237/2015 (185.017 Ha.) in PARIVESH portal. Compliance report of Stage-I FC conditions for entire forest land of 240.867 Ha. of the Project has been uploaded on e-portal.

*Handwritten signature and date: 07/10/23*

NADAL OFFICER (FOREST)  
RAIGARH AREA, S.E.C.L.



"Under jurisdiction of Raigarh Court only"  
 SOUTH EASTERN COAL FIELDS LIMITED  
 A MINIRATNA COMPANY  
 CIN: U10102CT19ESGO1003161  
 (A Subsidiary of Coal India Limited)  
 Regd. Office: BSEPAT ROAD, BILASPUR (CG) 495006  
 Website: www.secl.gov.in

Office of the Dy. G.M. (Min)/Sub Area Manager  
 CHHAL SUB AREA, RAIGARH AREA  
 At/PO, Chhal, Distt: Raigarh  
 Chhattisgarh PIN - 496665  
 Phone - 07766-277629  
 Fax - 07766-277629  
 Email - [chhal@secl.com](mailto:chhal@secl.com)

Ref. No. : SECL/RGH/SAM/CSA/2022/ 2746

Date 31/10/2022

प्रति  
 वनमण्डलाधिकारी,  
 धरमजयगढ वनमण्डल, धरमजयगढ  
 छ.ग.।

Sub:- Proposal for non-forestry use of 240.867 ha (185.017 ha Revenue Forest Land + 55.850 ha Deemed Forest) forest land under Forest (Conservation) Act, 1980 for Chhal OC seam III 6 MTY project of SECL in Raigarh District of Chhattisgarh.

Ref. : (i) भारत सरकार पर्यावरण, वन एवं जलवायुमंत्रालय, नई दिल्ली का पत्र क्र./F.C.8-15/2021-FC,

दिनांक 06/07/2022

(ii) क्र./मू-प्रबंध/खनिज/331-259/1744 रायपुर, दिनांक 20.07.2022

(iii) क्र./मा.वि./3211 धरमजयगढ, दिनांक 08-08-2022

महोदय,

उपरोक्त विषयान्तर्गत संदर्भित पत्र के तहत भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय नई दिल्ली के पत्र क्र./F.C.8-15/2021-FC, दिनांक 06/07/2022 द्वारा वन मंजूरी के प्रथम चरण (सीध्दांतिक) स्वीकृति प्रदान की गई है।

उक्त स्वीकृति में अधिरोपित समस्त शर्तों का बिन्दुवार पालन प्रतिवेदन मग पृथक-पृथक चयन पत्र निम्नानुसार है :-

**A. COMPLIANCE OF STAGE-I FC CONDITIONS FOR 240.867 HA (185.017 HA OF REVENUE FOREST LAND + 55.850 HA OF DEEMED FOREST) OF CHHAL OCP PRIOR TO HANDING OVER OF FOREST LAND BY THE STATE FOREST DEPARTMENT**

Sl. No.	Conditions	Status of compliance
i	Compensatory Afforestation: The cost of compensatory afforestation at the prevailing wage rates as per compensatory afforestation scheme and the cost of survey, demarcation and erection of permanent pillars, if required on the CA land, shall be deposited in advance with the Forest Department by the user agency. The CA will be maintained for 10 years. The scheme	An amount of Rs.89,11,15,814.83 (Eighty-Nine Crore Eleven Lakh Fifteen Thousand Eight Hundred Fourteen Rupees and Eighty-three paise only) has been deposited in Chhattisgarh State CAMPA A/C No.150645816237745, IFSC Code-UBIN0996335 maintained at Union Bank of India, Lodhi Complex Branch, Block-11, CGO Complex, Phase-I, Lodhi Road, New Delhi - 110003 through NEFT/RTGS by e-challan

05/33  
 31/10/22  
 10/10/22

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	may include appropriate provision for anticipated cost increase for works scheduled for subsequent years.	vide UTR No.UTIBR52022090100354111 as per the demand raised by DFO, Dharamjaigarh Forest Division vide letter क्रमांक / मा. / रि. / 3370 धरमजयगढ़ दिनांक 18/08/2022 which includes <ul style="list-style-type: none"> <li>Rs.42,42,30,030.315/-towards the cost of compensatory afforestation.</li> <li>Rs. 2,07,08,615.655/- towards afforestation over safety zone area (copy enclosed as Annexure-01).</li> </ul>
ii	The KML files of diverted area, the CA areas, the proposed SMC treatment area and the WLMP area shall be uploaded on the e-Green watch portal with all requisite details prior to Stage II approval.	Relates to State Forest department.
iii	Land identified for raising compensatory afforestation shall be notified as PF under the Indian Forest Act, 1927 or local Forest Act before grant of Stage-II approval, if applicable.	Relates to State Forest department.
iv	A Soil and Moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local river shall be prepared by the user agency in consultation with the State Forest Department and the same shall be submitted along with Stage-I compliance. Cost of implementation of the provisions of the said Plan will be deposited into the CAMPA and the same shall be intimated to the Ministry before Stage-II approval.	An amount of Rs.89,11,15,814.83 (Eighty-Nine Crore Eleven Lakh Fifteen Thousand Eight Hundred Fourteen Rupees and Eighty-three paise only) has been deposited in Chhattisgarh State CAMPA A/C No.150645816237745, IFSC Code-UBIN0996335 maintained at Union Bank of India, Lodhi Complex Branch, Block-11, CGO Complex, Phase-I, Lodhi Road, New Delhi - 110003 through NEFT/RTGS by e-challan vide UTR No.UTIBR52022090100354111 (copy enclosed as Annexure-01) as per the demand raised by DFO, Dharamjaigarh Forest Division vide letter क्रमांक / मा. / रि. / 3370 धरमजयगढ़ दिनांक 18/08/2022 which includes Rs.3,05,00,000.00towards the cost of implementation of the provisions of the Soil and Moisture Conservation (SMC) work plan (copy enclosed as Annexure-02).
v	Elephant/Wildlife Management Plans should be prepared keeping in view the locality factors, occurrence of wildlife, management interventions required for areas. State Government may also get the Plan verified by the Project Elephant Division of the Ministry. Cost of implementation of the Plan so finalized shall be deposited into State CAMPA and detail of the same along with approved Plan shall be submitted to the Ministry before Stage-II approval.	An amount of Rs.89,11,15,814.83 (Eighty-Nine Crore Eleven Lakh Fifteen Thousand Eight Hundred Fourteen Rupees and Eighty-three paise only) has been deposited in Chhattisgarh State CAMPA A/C No.150645816237745, IFSC Code-UBIN0996335 maintained at Union Bank of India, Lodhi Complex Branch, Block-11, CGO Complex, Phase-I, Lodhi Road, New Delhi - 110003 through NEFT/RTGS by e-challan vide UTR No.UTIBR52022090100354111 (copy enclosed as Annexure-01) as per the

		demand raised by DFO, Dharamjaigarh Forest Division vide letter क्रमांक/मा./चि./3370 धरमजयगढ़ दिनांक 18/08/2022 which includes Rs.12,20,00,000.00 towards the cost of implementation of the provisions of Wildlife Management Plan (copy enclosed as Annexure-03).
vi	Proposal involves displacement from non-forest land. A copy of approved R&R plan, prepared in consonance with the R&R policy of the State, shall be submitted along with the compliance of Stage-I approval.	A copy of the approved R&R plan of the project under reference prepared in consonance with the R&R policy of Chhattisgarh State is enclosed herewith as Annexure-04.
vii	The user agency shall prepare and submit a consolidated Reclamation Plan of the areas mined out completely which are not required for future mining and areas to be reclaimed in future in consonance with the Progressive Mine Closure Plan and detail of the same shall be submitted along with compliance of Stage-I approval.	A copy of the Progressive Mine Closure Plan of the project covering Reclamation Plan of the areas mined out completely which are not required for future mining and areas to be reclaimed in future with detail of the same is enclosed herewith as Annexure-05.
viii	The User Agency shall transfer online, the Net Present Value (NPV) of the forest land being diverted under this proposal, as per the guidelines issued by this Ministry vide its letters No. 5-3/2011-FC (Vol.) dated 06.01.2022 read with letter dated 22.03.2022. The requisite funds shall be transferred through online portal into National Authority (CAMPAs) account of the State Concerned, new NPV guidelines.	An amount of Rs.89,11,15,814.83 (Eighty-Nine Crore Eleven Lakh Fifteen Thousand Eight Hundred Fourteen Rupees and Eighty-three paise only) has been transferred online into Chhattisgarh State CAMPAs A/C No.150645816237745, IFSC Code-UBIN0996335 maintained at Union Bank of India, Lodhi Complex Branch, Block-11, CGO Complex, Phase-I, Lodhi Road, New Delhi - 110003 through NEFT/RTGS by e-challan vide UTR No.UTIBR52022090100354111, dtd.31.08.2022 (copy enclosed as Annexure-01) as per the demand raised by DFO, Dharamjaigarh Forest Division vide letter क्रमांक/मा./चि./3370 धरमजयगढ़ दिनांक 18/08/2022 which includes Rs.29,36,77,168.86 towards the Net Present Value (NPV) of the diversion of 240.867 Ha. of forest land under this proposal (Rs.22,50,60,417.36 for 185.017 Ha. of Revenue Forestland and Rs.6,86,16,751.50 for 55.850 Ha. of Deemed Forest land), as per the guidelines issued by this Ministry vide its letters No. 5-3/2011-FC (Vol.) dated 06.01.2022 read with letter dated 22.03.2022.
ix	Compensatory levies to be realized from the User Agency under the project shall be transferred/ deposited, through e-challan, into the account of CAMPAs pertaining to the State concerned	Compensatory levies amounting to Rs.89,11,15,814.83 (Eighty-Nine Crore Eleven Lakh Fifteen Thousand Eight Hundred Fourteen Rupees and Eighty-three paise only) has been transferred online



	through eportal ( <a href="https://parivesh.nic.in/">https://parivesh.nic.in/</a> ).	(NEFT/RTGS) into Chattisgarh State CAMPA A/C No.150645816237745, IFSC Code-UBIN0996335 maintained at Union Bank of India, Lodhi Complex Branch, Block-11, CGO Complex, Phase-I, Lodhi Road, New Delhi - 110003 vide UTR No.UTIBR52022090100354111 through e-challan generated using eportal ( <a href="https://parivesh.nic.in/">https://parivesh.nic.in/</a> ) (copy enclosed as <b>Annexure-01</b> ) as per the demand raised by DFO, Dharamjaigarh Forest Division vide letter क्रमांक/मा./वि./3370 शस्मजयगढ़ दिनांक 18/08/2022.
x	Following activities, as per approved plan / schemes, shall be undertaken in the lease area by the User Agency under the supervision of the State Forest Department. Approved scheme/plan shall be submitted to the Ministry along with compliance of Stage-I approval.	
a	Mitigative measures to minimize soil erosion and choking of stream shall be implemented within a period of three years with effect from the issue of Stage-II clearance in accordance with the approved Plan in consultation with the State Forest Department.	Agreed The undertaking of the Project Proponent/ Mine Management for compliance of the provision of the conditions stipulated in clause-a, b, c, d & e of condition no.x of Stage-I FC granted to Chhal OCP is enclosed herewith as <b>Annexure-06</b> .
b	Planting of adequate drought hardy plant species and sowing of seeds, in the appropriate area within the mining lease to arrest soil erosion in accordance with the approved scheme.	1. Presently, there one (01) external dump & 2 no. of internal dumps. The external dump demarcated as 'A' & it has already been biologically reclaimed during the year 2006 to 2009 & there is no problem of Soil erosion & choking of streams in the adjoining dump area. Internal Dump will be re-handled, hence it was not biologically reclaimed. The Internal Dumps are demarcated as B & C. Details enclosed in <b>Annexure-06</b> .
c	Construction of check dams, retention /toe walls to arrest sliding down of the excavated material along the contour in accordance with the approved scheme.	Renovation & re-alignment of drain all around the circumference of the mine.
d	Stabilize the overburden dumps by appropriate grading/benching, in accordance with the approved scheme, so as to ensure that angles of repose at any given place is less than 28°, and	Grass bedding on Dump Slope is taken up to prevent soil Erosion as per the requirement.
e	No damage shall be caused to the top-soil and the user agency will follow the top soil management plan.	2. Year wise Plantation details on Embankment areas & Dumps is enclosed in <b>Annexure-06</b> .  Plantation of 108000 Saplings Over an Area of 43.2 Ha. has been done from the year 2006 to 2022.  3. Check Dams in Dump Slope (Ext.

			dumpnos. A) Drainage System, catch drain of dimension 1.5m X 15.m has been provided in External Dump & internal dumps to Prevent soil Erosion & Siltation.
xi	User agency either himself or through the State Forest Department shall undertake gap planting and soil & moisture conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.40), if any, located in the area within 100 meters from outer perimeter of the mining lease. The plan for plantation and SMC activities will be prepared and submitted to MoEF&CC before Stage-II Clearance.	Agreed, The undertaking of the Project Proponent/ Mine Management to the effect that the Project Proponent shall carry out <b>gap plantation and soil &amp; moisture conservation activities</b> through CGRVN, CG to restock and rejuvenate the degraded open forests (having crown density less than 0.40), if any, located in the area within 100 meters from outer perimeter of the mining lease is enclosed herewith as <b>Annexure-07</b> .	
xii	The User Agency shall prepare a list of existing village tanks and other water bodies with GPS co-ordinates located within five km from the mine lease boundary. This list is to be duly verified by the concerned Divisional Forest Officer. The User Agency shall regularly undertake desilting of these village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/water bodies. A detailed approved plan for desilting of identified ponds and water bodies to be prepared in consultation with forest department and shall be submitted to MoEF& CC before Stage-II approval.	Agreed, Regular desilting of existing village ponds and water bodies located within five km from the mine lease boundary as identified in consultation with forest department shall be undertaken to mitigate the impact of siltation of such tanks/water bodies as delineated in the Desiltation Scheme of Village Tanks/Other water bodies (Copy of the Desiltation Scheme is enclosed herewith as <b>Annexure-08</b> ).	
xiii	Safety Zone Management: Following activities, at project cost, shall be undertaken by the user agency for the management of safety zone as per relevant guidelines issued by the Ministry's guidelines:		
	a) User agency shall ensure demarcation of safety zone (7.5-meter strip all along the inner boundary of the mining lease area), and its fencing, protection and regeneration by erecting adequate number of 6 feet high RCC boundary pillars inscribed with DGPS coordinates with barbed wire fencing and deploying adequate number of watchers under the supervision of the State Forest Department.	Agreed, SECL and Chhattisgarh Rajya Van Vikas Nigam Limited (CGRVN) Ltd. Raipur has MoU for plantation and safety zone fencing work. A) Demarcation of Safety Zone (7.5-meter strip all along the inner boundary of the mining lease area), and its fencing, protection and regeneration by erecting adequate number of 6 feet high RCC boundary pillars inscribed with DGPS coordinates with barbed wire fencing will be done by CGRVN, CG at the project cost (Undertaking attached as Annexure-09).	
	b) Boundary of the safety zone of the mining lease, adjacent to habitation/roads, should be properly fenced by the user agency.		
	c) Safety zone shall be maintained as		

	green belt around mining lease and to ensure dense canopy in the area, regeneration shall be taken up in this area by the user agency at project cost under the supervision of the State Forest Department.	B) Fencing will be done by CGRVN, CG at the project cost (Undertaking attached as Annexure-09)  C) Safety zone shall be maintained as green belt around mining lease and to ensure dense canopy in the area, regeneration shall be taken up in this area by CGRVN at project cost (Undertaking attached as Annexure-09).
d	The State Government and the user agency shall ensure that safety zone is maintained as per the prescribed norms.	
e	The cost of felling of trees shall be deposited by the User Agency with the State Forest Department.	D) Agreed. (Undertaking attached as Annexure-09).  E) Agreed. (Undertaking attached as Annexure-09).
xiv	State Government shall complete settlement of rights, in term of the Scheduled Tribes and Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, if any, on the forest land to be diverted and submit the documentary evidence as prescribed by this Ministry's letter No. 11-9/1998-FC (Pt.) dated 03.08.2009 read with 05.07.2013, in support thereof, and	Documentary evidence as to completion of settlement of rights in respect of the proposed diversion of 240.867 Ha. of forest land of Chhal OCP, in terms of the Scheduled Tribes and Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 as prescribed by the Ministry's letter No. 11-9/1998-FC (Pt.) dated 03.08.2009 (read with 05.07.2013) is enclosed herewith as Annexure-10.
xv	The complete compliance report of the conditions stipulated in this approval shall be uploaded on e-portal ( <a href="https://parivesh.nic.in/">https://parivesh.nic.in/</a> ).	Agreed to comply the provision of the condition stipulated.

*Signature*

**TO BE SUBMITTED IN THE FORM OF UNDERTAKING PRIOR TO  
STAGE-II APPROVAL**

**B. COMPLIANCE OF STAGE-I FC CONDITIONS FOR 240.867 HA (185.017 HA OF REVENUE FOREST LAND + 55.850 HA OF DEEMED FOREST) OF CHHAL OCP AFTER HANDING OVER OF FOREST LAND BY THE STATE FOREST DEPARTMENT**

Sl. No.	Conditions	Status of compliance
i	Legal status of the diverted forest land shall remain unchanged	Undertaking enclosed as Annexure-A.
ii	Compensatory afforestation over orange forest land, double in extent to the forest land being diverted, shall be raised by the State Forest Department at the project cost within three years from the date of grant of Stage - II approval.	Undertaking enclosed as Annexure-B.
iii	The user agency shall keep minimum of 120 meters distance from the bank of Mand River as intact and no mining should be carried out in this area. Embankment should be constructed to ensue protection of river and its hydrology from the mining.	Undertaking enclosed as Annexure-C.
iv	At the time of payment of the Net Present Value (NPV) at the present rate, the user agency shall furnish an undertaking to pay the additional amount of NPV, if so determined, as per the final decision of the Hon'ble Supreme Court of India.	Undertaking enclosed as Annexure-D.
v	Trees should be felled in phased manner as per the requirement in the approved Mining Plan with prior permission of concerned DFO.	Undertaking enclosed as Annexure-E.
vi	The user agency shall explore the possibility of translocation of maximum number of trees identified to be felled and shall ensure that any tree felling shall be done only when it is unavoidable and that too under strict supervision of the State Forest Department.	Undertaking enclosed as Annexure-F.
vii	The User Agency shall comply with the Hon'ble Supreme Court order on re-grassing, and re-grass the mining area and any other areas which may have been disturbed due to mining to restore them to a condition which is fit for growth of fodder, flora, fauna, etc. in a	Undertaking enclosed as Annexure-G.

*[Handwritten Signature]*

	timely manner.	
viii	The User Agency shall undertake mining in a phased manner after taking due care for reclamation of the mined over area. The concurrent reclamation plan as per the approved mining plan shall be executed by the User Agency from the very first year, and an annual report on implementation thereof shall be submitted to the Nodal Officer, Forest (Conservation) Act, 1980, in the concerned State Government and the concerned Integrated Regional Office of the Ministry. If it is found from the annual report that the activities indicated in the concurrent reclamation plan are not being executed by the User Agency, the Nodal Officer or the concern Head of the Integrated Regional Office may direct that the mining activities shall remain suspended till such time, such reclamation activities area satisfactorily executed.	Undertaking enclosed as Annexure-H.
ix	Period of diversion of the said forest land under this approval shall be for a period co-terminus with the period of the mining lease proposed to be granted under the Mines and Minerals (Development and Regulation) Act, 1957, as amended and the Rules framed there-under.	Undertaking enclosed as Annexure-I.
x	The User Agency shall obtain the Environment Clearance as per the provisions of the Environmental (Protection) Act, 1986, if required.	The User Agency/Project Proponer has already obtained Environment Clearance from MOEF & CC, GOI, New Delhi for the project under reference vide FileNo. J-11015/1000/2007-IA,II(M), Dtd. 02.08.2022. (Copy enclosed as Annexure-J).
xi	No labour camp shall be established on the forest land and the User Agency shall provide fuels preferably alternate fuels to the labourers and the staff working at the site so as to avoid any damage and pressure on the nearby forest areas.	Undertaking enclosed as Annexure-K.
xii	The boundary of the diverted forest land, mining lease and safety zone, as applicable, shall be demarcated on ground at the project cost, by erecting four feet high reinforced cement concrete pillars, each inscribed with its serial number, distance from pillar to pillar and GPS coordinates.	Undertaking enclosed as Annexure-L.
xiii	The layout plan of the mining plan/	Undertaking enclosed as Annexure-M.

	proposal shall not be changed without the prior approval of the Central Government and the forest land shall not be used for any purpose other than that specified in the proposal.	
xiv	The forest land proposed to be diverted shall under no circumstances be transferred to any other agency, department or person without prior approval of the Central Government.	Undertaking enclosed as Annexure-N.
xv	No damage to the flora and fauna of the adjoining area shall be caused.	Undertaking enclosed as Annexure-O.
xvi	Any other condition that the concerned Regional Office of this Ministry may stipulate with the approval of competent authority in the interest of conservation, protection and development of forests & wildlife; and	Undertaking enclosed as Annexure-P.
xvii	The user agency shall comply all the provisions of all the Acts, Rules, Regulations, Guidelines, Hon'ble Court Order (s) and NGT Order (s) pertaining to this project, if any, for the time being in force, as applicable to the project.	Undertaking enclosed as Annexure-Q.
xviii	Violation of any of these conditions will amount to violation of Forest (Conservation) Act, 1980 and action would be taken as prescribed in para 1.21 of Chapter 1 of the Handbook of comprehensive guidelines of Forest (Conservation) Act, 1980 as issued by this Ministry's letter No. 5- 2/2017-FC dated 28.03.2019.	Undertaking enclosed as Annexure-R.
xix	The User Agency shall submit the annual self -compliance report in respect of the above stated conditions to the State Government, concerned Regional Office and to this Ministry by the end of March every year regularly.	Undertaking enclosed as Annexure-S.

यह अग्रिम आवश्यक कार्रवाई हेतु आपकी ओर सादर प्रेषित है।

भवदीय

  
उपक्षेत्रीय प्रबंधक  
एसआईएस फ़ाल उपक्षेत्र



ग्रूम एशिया लिमिटेड  
"A Mini Ratna Company"  
A Subsidiary of Coal India Ltd.)  
Chhota Azamgah, Raigarh-495006  
G.M. Office (Forest & Env't)  
Website: [www.secl.gov.in](http://www.secl.gov.in)

फ़ोन नं.- 07 222 222 134  
Tel No:- 07762- 222008  
M.No:-9425282388  
E-mail-secrgh@gmail.com

ANNEXURE-01

CIN-U10102CT1985GO1003161

Ref: - SECLGM/RGH/S.O. (P&P)/2022/58

Date: - 20/10/2022

To,  
The Divisional Forest Officer  
Dharamjagarh Forest Division, C.G.

Subject: - Information of payment of Rs. 89,11,15,814.83 (Rupees Eighty-nine Crore Eleven Lakh Fifteen Thousand Eight Hundred ~~Five~~ and Eighty-three paise only) in Chhattisgarh State CAMPA A/C of Chhattisgarh for compliance of the requirement of conditions stipulated in Stage-I FC granted to Chhal OC Seam-III 6.0 MTY Project for 240.867 Ha. forest land (185.017 Ha. of Revenue Forest Land + 55.850 Ha. of Deemed Forest) for coal mining.

Ref:- letter क्रमांक/मा./वि./3370 धरमजयगढ़ दिनांक 18/08/2022

Sir,

In reference to your letter क्रमांक/मा./वि./3370 धरमजयगढ़ दिनांक 18/08/2022, Rs. 89,11,15,814.83 (Rupees Eighty-nine Crore Eleven Lakh Fifteen Thousand Eight Hundred ~~Five~~ and Eighty-three paise only) has been deposited online through RTGS/NEFT vide UTR No. UTIBR52022090100354111, dtd.01.09.2022 in Bank A/C No.150645816237745, IFSC Code: UBIN0996335 maintained at Union Bank Of India, Lodhi Complex Branch, Block 11, CGO Complex, Phase I, Lodhi Road, New Delhi - 110003 as per the e-challan generated in e-portal (<https://parivesh.nic.in/>) of MOEF & CC (Copy enclosed) for compliance of the conditions stipulated in Stage-I FC granted to Chhal OC Seam-III 6.0 MTY Project for 240.867 Ha. forest land (185.017 Ha. of Revenue Forest Land + 55.850 Ha. of Deemed Forest) for coal mining.

Kindly acknowledge the receipt of the same.

Encl- As above

Copy to:-

1. Sub-Area Manager, Chhal Sub-Area for kind information
2. AFM, Raigarh Area for kind information
3. SO(P&P), Raigarh Area for kind information
4. Office Copy

  
General Manager  
Raigarh Area, SECL  


AGENCY COPY



NEFT / RTGS CHALLAN for CAMPA Funds

Date : 24-08-2022

Agency Name.	SOUTH EASTERN COALFIELDS LIMITED
Application No.	5815237745
NoEP/SG File No.	B-15/2021-FC
Location.	CHATTISGARH
Address.	Post Box No 60 Seepat Road Bilaspur Chhattisgarh Bilaspur
Amount(in Rs)	59115814.83/-

Amount in Words: Fifty-Nine Crore Seven Lakh Fifty Thousand Eight Hundred and Fifteen Rupees Only

NEFT/RTGS to be made as per following details:

Beneficiary Name:	CHATTISGARH CAMPA
IFSC Code:	UBIN0996335
Pay to Account No.	150645815237745 Valid only for this challan amount.
Bank Name & Address:	Union Bank Of India Lodhi Complex Branch, Block 11, CGO Complex, Phase I, Lodhi Road, New Delhi -110003

This Challan is strictly to be used for making payment to CAMPA by NEFT/RTGS only

BANK COPY



NEFT / RTGS CHALLAN for CAMPA Funds

Date : 24-08-2022

Agency Name.	SOUTH EASTERN COALFIELDS LIMITED
Application No.	5815237745
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This Challan is strictly to be used for making payment to CAMPA by NEFT/RTGS only

After making successful payment, User Agencies may send a line of confirmation through Email: helpdeskcampa@corpbank.co.in

Note: After making the required payment through challan, if the payment status has not been updated even after 7 working days, then kindly mail a copy of your challan with transaction date to Email: cb0371@unionbankofindia.com

UTR UTIBR5202209010035411

Authorized Officer  
South Eastern Coalfields Limited  
Raigarh Area

019-250260

31 AUG 2022

ABHISHEK KEDIA  
DVP & BRANCH HEAD  
SS No.- 8885  
RAIGARH (490) BRANCH

31/08/22





# कार्यालय वनमण्डलाधिकारी, धरमजयगढ़

रायगढ़ रोड, धरमजयगढ़, जिला रायगढ़ (छ.ग. - 496116)

Email - dfo\_dharamajgarh@rediffmail.com Phone & Fax 07766-266599, 07766-266739

क्रमांक / मा.शि/  
प्रति

3370

धरमजयगढ़, दिनांक 18/8/22

उप महाप्रबंधक,  
साउथ इस्टर्न कोल फोल्डिंग लिमिटेड  
छात उपखेत्र SECL नावापारा छात जिला- रायगढ़ (छ.ग.)

विषय:-

Proposal for non- forestry use of 240.867 ha. (185.017) ha. Revenue Forest Land + 55.850 ha. Deemed Forest) forest land under Forest (Conservation) Act, 1980 for Chhal OC seam III 6 MTY project of SECL in Raigarh District of Chhattisgarh.

संदर्भ:-

1. भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, नई दिल्ली का पत्र क्र./ File No. FC-11/43/2021-FC दिनांक 07.06.2022
2. भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, क्षेत्रीय कार्यालय नागपुर का पत्र क्र./ File No. 8-15/2021-FC दिनांक 06.07.2022
3. अपर प्रधान मुख्य वनसंरक्षक (मू-प्रबन्ध) नवा रायपुर का पत्र क्र./मू-प्रबन्ध/अनिल /331-259/1744 दिनांक 20.07.2022

—o—

विषयांतर्गत प्रकरण में संदर्भित पत्र का अवलोकन करे, प्रकरण में SECL छात खुली खदान Seam III 6 MTY रकबा 185.017 हे. (संरक्षित वनभूमि 176.710 हे. एवं राजस्व वनभूमि 8.307 हे.) हेतु वनभूमि के गैर-पारिस्थिकी प्रकरण एवं अतिरिक्त क्षेत्र रकबा 55.850 हे. (Deemed Forest) कुल रकबा 240.867 हे. प्रकरण में भारत सरकार, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, क्षेत्रीय कार्यालय नागपुर का पत्र क्र./ File No. 8-15/2021-FC दिनांक 06.07.2022 द्वारा प्रथम चरण की स्वीकृति जारी की गई है। छोगो राज्य कैम्पा (CAMP) खाते में निम्नानुसार राशि जमा करना है:-

क्र.	विवरण	छोगो राज्य कैम्पा (CAMP) खाते में जमा योग्य राशि (रु. में)
1.	CA हेतु - 482.745 Ha X 878787 = 424230030.315 Rs.	424230030.315 Rs.
2.	NPV हेतु - 1- 185.017 हे. प्रकरण में - 225060417.36 Rs. 2- 55.850 हे. (डीम्ड फॉरेस्ट) में - 68616751.50 Rs. कुल NPV राशि - 293677168.86 Rs.	293677168.86 Rs.
3.	वन्द्याणी प्रबंधन योजना की राशि (संदर्भित पत्र क्र. 0) के परिचालन में - 6100000000 Rs. का 2% = 122000000.00 Rs.	122000000.00 Rs.

4.	Soil and Moisture Conservation Plan की राशि (सन्दर्भित पत्र क्र. D1 के परिपालन में - 6100000000 Rs. का 0.5 % = 30500000.00 Rs.	30500000.00 Rs.
5.	Safety Zone क्षेत्र का देह गुना क्षेत्र में वृक्षारोपण की राशि (Safety Zone Area- 15.71 Ha. का देह गुना क्षेत्र - 23.565 Ha. 23.565 X 878787 = 20708615.655Rs.	20708615.655Rs.
<b>TOTAL :-</b>		<b>891115814.83 Rs.</b>

अतः प्रथम चरण स्वीकृति में अधिशेषित शर्तों के परिपालन में राशि 891115814.83 रु. छोगो राज्य कैम्पा (CAMP) खाते में ई-पेमेंट के माध्यम से वेब पोर्टल द्वारा जमा करें एवं बलान की प्रति इस कार्यालय में प्रस्तुत करते हुए समस्त शर्तों का चिन्दुवार पालन प्रतिवेदन एवं चाही गई WPlan, SMC Plan आदि प्रस्तुत करें।

इसके अतिरिक्त वरिष्ठ कार्यालय/ वन विभाग को और भी राशि की आवश्यकता होती है तो आपको देय होगा।

वन मंडलाधिकारी

धरमजयगढ वनमण्डल

पृ. क्रमांक/मा.वि./2022/ 337/

/धरमजयगढ दिनांक 18/8/22

- प्रतिलिपि :-
1. अपर प्रधान मुख्य वनसंरक्षक (भू-वर्धन) नया रायपुर छोगो की ओर सूचनाार्थ सम्प्रेषित।
  2. मुख्य वनसंरक्षक बिलासपुर वृत्त बिलासपुर छोगो की ओर सूचनाार्थ सम्प्रेषित।

वनमंडलाधिकारी

धरमजयगढ वनमण्डल



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# SOIL CONSERVATION PLAN IN COMPLIANCE TO THE CONDITION NO. X OF STAGE- I FOREST CLEARANCE

F.NO. 8-15/2021-FC

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FOR CHHAL OPENCAST MINE OF SECL, RAIGARH AREA

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*Condition – x: The following activities shall also be undertaken in the lease area by the User Agency under the supervision of the State Forest Department at the project cost;*

- a. Mitigative measures to minimize soil erosion and choking of stream shall be implemented within a period of three year with effect from the issue of Stage-II clearance in accordance with the approved Plan in consultation with the State Forest Department;*
  - b. Planting of adequate drought hardy plant species and sowing of seeds, in the appropriate area within the mining lease to arrest soil erosion in accordance with the approved scheme;*
  - c. Construction of check dams, retention /toe walls to arrest sliding down of the excavated material along the contour in accordance with the approved scheme;*
  - d. Stabilize the overburden dumps by appropriate grading/benching, in accordance with the approved scheme, so as to ensure that angles of repose at any given place is less than 28°; and*
  - e. Strict adherence to the prescribed top soil management.*
- 

**SOUTH EASTERN COALFIELDS LIMITED**  
**Raigarh Area, District Raigarh, Chhattisgarh**

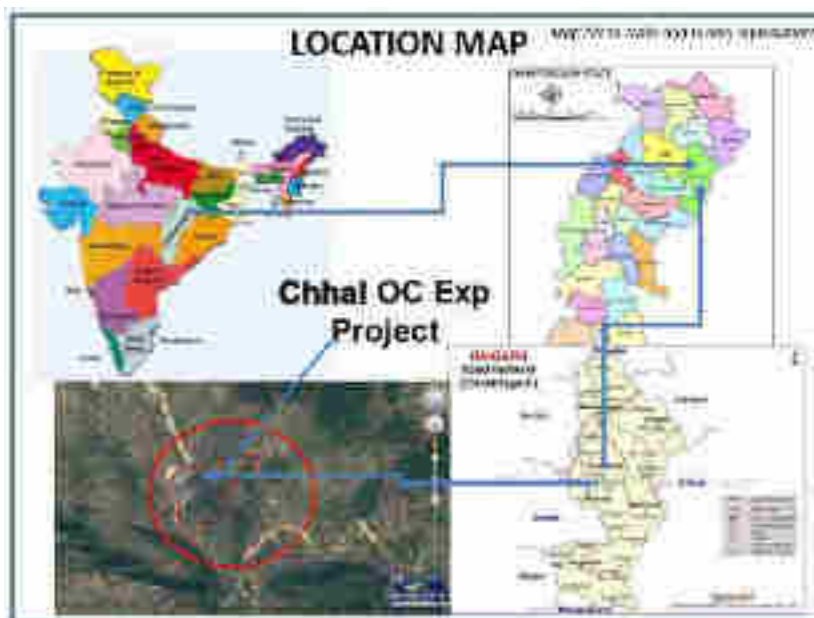
**SOIL AND MOISTURE CONSERVATION PLAN IN COMPLIANCE TO**  
**THE CONDITION No. X OF STAGE- I FOREST CLEARANCE.**

**INTRODUCTION**

**Location and accessibility**

The project is located south of village Chhal at an approximate distance of 2.5 km on Kharsia - Dharamjaygarh State Highway and 16 km from Kharsia town. The block is bounded by latitude 22°4'40" and 22°6'27" N and longitudes 83°6'10" and 83°9'10" E and is included in the Survey of India Topo Sheet No. 64 N/4. It is situated in the Raigarh district of Chhattisgarh.

Mand-Raigarh Coalfield in general and Chhal Block in particular are well connected by two all weather motorable roads from Kharsia and Raigarh Railway Stations on Howrah-Nagpur



section of South Eastern Railway. The distance of Chhal Block from Kharsia and Raigarh are only 16 km and 65 km respectively. Chhal Block is also connected with Bilaspur and Ranchi by all weather motorable road and is located at a distance of 160 km and 310 km from Bilaspur and Ranchi respectively. Chhal Block is also accessible by unmetalled roads of forest department.

**Other relevant project specific information**

Total geological reserve in the mine lease area is 197.257 MT with 151.36 MT mineable reserve and 852.07 Mm<sup>3</sup> of overburden is to be removed with an average stripping ratio of 5.63 cum/tonne. 13 seams with thickness ranging from 0.5 m to 11 m are workable. Grade of coal is G-11 while gradient of coal seams are ranging from is 4° to 11°.

Total land requirement of project is 1342.86 ha. Out of this, forest land is 240.867 Ha. of forest land (185.017 Ha. is Revenue Forest land and 55.850 Ha. is Deemed Forest land). There are 7 villages namely, Khedapali, Bandhapali, Chhal, Navapara, Chandrasekharpur (Edu), Pusalda & Lat involved in the project.

### **Physiography and Drainage**

The Chhal Block is largely characterised by a plain country. The altitude varies between 231 m in the west to 267 m above MSL in the north eastern part of the block. The elevation of the ground varies between 255 m to 267 m along a linear patch running NE-SW in the central part of the property. The ground has a general slope towards NE, SE & SW. Most of the area is covered by soil and cultivate land. The southerly flowing Mand River and westerly flowing Kurket River with their tributaries form the main drainage of the Chhal Block. A small earthen dam has been constructed for the purpose of irrigation near village Khedapali in the eastern part of the block.

### **Mine water environment:**

**Surface Water Sources:** The drainage pattern in the area is controlled by Mand River which flows southerly, and drains through the north and western part of the block. Kurket River, flowing along east-west direction, joins Mand River near to south of Chhal OCP. The Project area is traversed by a small first order stream, flowing along south-north and joining a nala in north. This nalla joins with the master drainage Mand River.

Other nallas which drain the buffer zone are Dom nalla, Jhampi nalla, Sukhia nalla, Chinni nalla etc. Borai River drains the extreme western part of the study area. The drainage is mostly dendritic in nature.

**Ground Water Sources:** The formations within the study area are Gondwanas, Talchirs and Metamorphics. The project area is situated on Barakars consisting mainly of fine to coarse grained sandstone with shale beds and coal seams. The permeable sandstone beds become saturated and behave as aquifers. Impermeable shale and thick coal seam act as aquiclude. Stratification and presence of aquiclude divide the aquifer into multiaquifer system.

The formation comprising mainly of alluvium and weathered sandstone lying above the topmost working coal seam VI behave as unconfined aquifer. The permeable formations sandwiched between the confining layers (i.e. coal seams and shale beds) act as semi-confined to confined aquifer. In the unconfined aquifer ground water movement follows the topographical slopes. The ground water flows towards south to southeast.

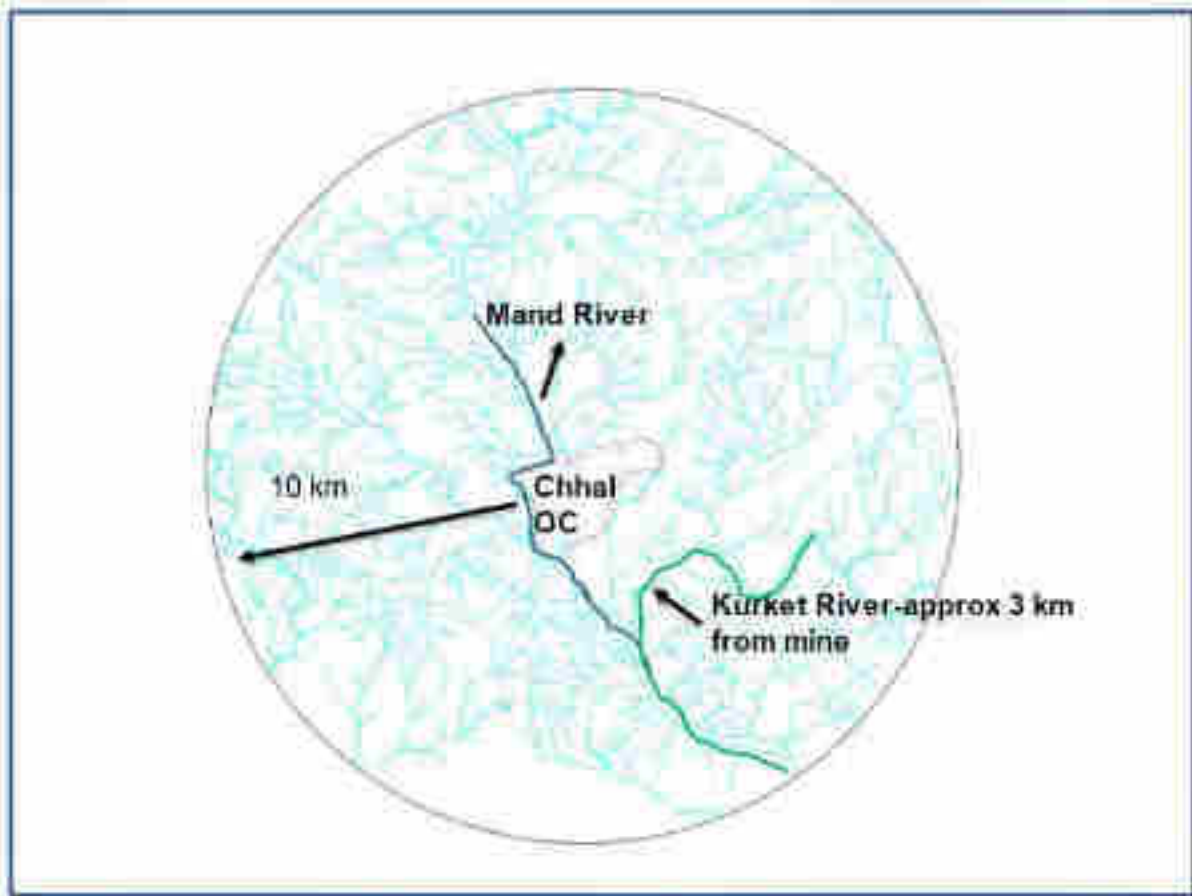


Fig. Plan showing hydrological features of the area

**a. Preparation and implementation of a plan containing appropriate mitigative measures to minimize soil erosion and choking of streams;**

**Soil erosion**

Soil conservation in its widest sense includes not only control over erosion but all those measures like correction of soil defects, application of manures and fertilizers, proper crop rotations, irrigation, drainage etc. which aim at maintaining the productivity of the soil at a high level. In this sense, soil conservation is closely allied to improvement of land use in general.

In OC mines, the earth material is dug out to extract coal. The excavated over burden material consists of alluvial, top soil, sub soil and rocks. The OB is placed in the nearby areas in the form of dumps. If no measures are taken for the management of OB dumps, after precipitation, water will take away the soil particles along with itself thereby causing soil erosion.

This eroded soil will flow into the nearby streams, rivers, water channels and cause choking/contamination of the water bodies.

In order to prevent this, an effective soil erosion management plan needs to be prepared and implemented.

## **Mitigative measures to minimize Soil Erosion and choking of streams**

In order to control soil erosion, a step by step procedure needs to be adopted so that the water flows through a proper path and does not take away with it the essential soil material. The steps to be followed are:

- I. **Garland Drains:** Garland drains will be made around the periphery of the quarry. These garland drains will be connected to the local nalla which is not likely to be disturbed by mining operation. In the workings, heavy duty pumps will be deployed in rainy season which will throw the accumulated water from the working face into these garland drains. As the extraction of the quarry advances, the position of garland drain will also advance. Thus these garland drains will drain of the rain water away from the workings. Catch pits will be provided at suitable regular intervals to allow the silt and sedimentations to settle down. The effectiveness of the drainage system depends on proper maintenance of all drainage pipes/channels. Regular cleaning of drains will be done to remove accumulated sludge/sediments. The catch-pits linked to the storm water drainage system from the areas will also be regularly cleaned to ensure their effectiveness. This exercise will be carried out during the pre-monsoon.
- II. **Water Coursing Channel:** The topography of the area is planned and designed in such a way that the water takes a pre-determined path to flow and does not reach the other areas. In between the two OB dump slopes, a narrow water coursing channel is made in which water flown down the slopes gets collected and drifts through a preset channel.

Initial provision of Rs.40 lakhs has been made in the project report. Subsequent additional provision will be made as and when required.

### ***b. Planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease to arrest soil erosion;***

In view of importance of vegetal cover towards environment, the technical reclamation will be strengthened by biological reclamation for conserving the environment.

#### **Plantation Technique on Overburden Dumps**

The top surface of the overburden dumps selected for afforestation will be roughly levelled by dozer keeping a mild slope of about 1 in 200 for surface water drainage.

Seeds of grass legumes will be sown on beds of 1.5 m x 0.5 m, alternating with slopes to be planted with tree species. Gully plugging and constructing check dams on water courses flowing through OB dumps with boulders, will also be made to arrest soil erosion.

The pit of sizes 45x45x45 cm will be dug at spacing of 2.0x2.0 metre on the top surface as well as on the gentle slopes of the dumps.

In SECL plantations are carried out by CGRVVN (Chhattisgarh Rajya Van Vikas Nigam Limited.) Long term MoU was signed between SECL and CGRVVN Ltd. Raipur for five consecutive years plantation works i.e. 2018-19 to 2022-23 with subsequent maintenance of four years in SECL command area in Chhattisgarh state at a total value of Rs. 98,35,17,705.81/- only .

Various species suggested for Plantation.

- Fruit Bearing Trees: Jamun, Imli, Ganga Imli, Bel, Mango, Sitaphal etc.,
- Medicinal / Herbal Plants: Neem, Karanj, Harra, Bahera, Aonla (Amla), Arjun, Shekakai, Kusum, Mahua, etc.,
- Timber Value Trees: Teak, Shivan / Ghamar, Sissoo, Kala Sisham, Safed Sirus, Bamboo, Peltaform, Babool, Acacia Auriculiformis etc.,
- Ornamental / Avenue Plants (by the side of roads and colonies): Gulmohar, Kachnar, Amaltas, Saptaparni, Gravalia, Peepal, Palm tree etc.,

### **Green Belt Development**

In the directions where natural forest does not exist, there is need for creating green belt of adequate width as an effective dust and sight curtain in the periphery of mining area. The trees planted in the green belt area shall act as buffers and shock absorber against dusts, noise and stone flying. The trees in the green belt will be tall, wind firm, broad leaved and evergreen. A green belt of adequate width on either side of the haul road will be raised and the existing vegetation will be protected. The plants will be raised at spacing of 2.0x2.0 metre. Along the roads other than the haul roads also, dust resistant plants as mentioned above will be planted.

#### ***c. Construction of check dams, retention/toe walls along the contour to arrest sliding down of the excavated material;***

- I. **Toe walls:** Toe walls are low walled structures constructed at the bottom of an embankment to prevent slippage or spreading of the soil. Toe walls shall be provided around the top soil dump.
- II. **Gabion Structures:** A gabion wall is a retaining wall made of stacked stone-filled gabions tied together with wire. For erosion control, caged riprap is used
- III. **Check Dams:** A **check dam** is a small, sometimes temporary, dam constructed across a swale, drainage ditch, or waterway to counteract erosion by reducing water flow velocity. Gully plugging and constructing check dams on water courses flowing through OB dumps with boulders, will also be made to arrest soil erosion.





**Fig. Gabion structure**



**Fig. Check dams**

- d. Stabilize the overburden dumps by appropriate grading/benching so as to ensure that that angles of repose at any given place is less than 28°; and*

## **Planning of OB dumps**

### **A) Dumping strategy**

The proposed sequence of mining is ideally suited for achieving the objective of placing maximum possible waste in the internal dumps. External dumps will be created mainly during the initial years of mine expansion. The proposed reconstruction of the mine gives best possible back-filling opportunity. Thus, external dump quantities will be minimized.

By adopting the proposed sequence of mining, as the quarry advances, the amount of external dump will decrease and that of internal dump will increase as more space for the economic dumping is created. From the sixth year onwards majority dump will be accommodated internally.

The total volume of overburden has been estimated as 852.07 Mcum, including 40 Mcum rehandling. 71.52 Mcum will be placed in the external dumps located on the present site of external dumping. The balance 780.55 Mcum will be accommodated in the internal dump.

The land for external dump site will have to be acquired. Internal dump, due to the position of haul road, has been divided into two parts i.e. north-eastern dump and south-western dump.

The spoil dump in the internally backfilled OB will be in the form of benches. With the sufficient advance of coal production bench, the non-active backfilled OB will be levelled with dozer. Dumper/Tipper will transport soil/alluvium OB from the top OB bench and will dump the soil directly on the leveled backfilled OB.

Otherwise; top soil will be removed and stored separately. This soil will be directly spread over the levelled graded backfilled spoil for reclamation of the quarried-out land. OB dumps will be properly benched and the maximum height of the bench will be kept not more than 30m. Dump benches will have a mild gradient of 0.6% to facilitate the drainage. Wherever possible, simultaneous land reclamation will be done along with the OB dumping.

### **B) Dumping arrangements**

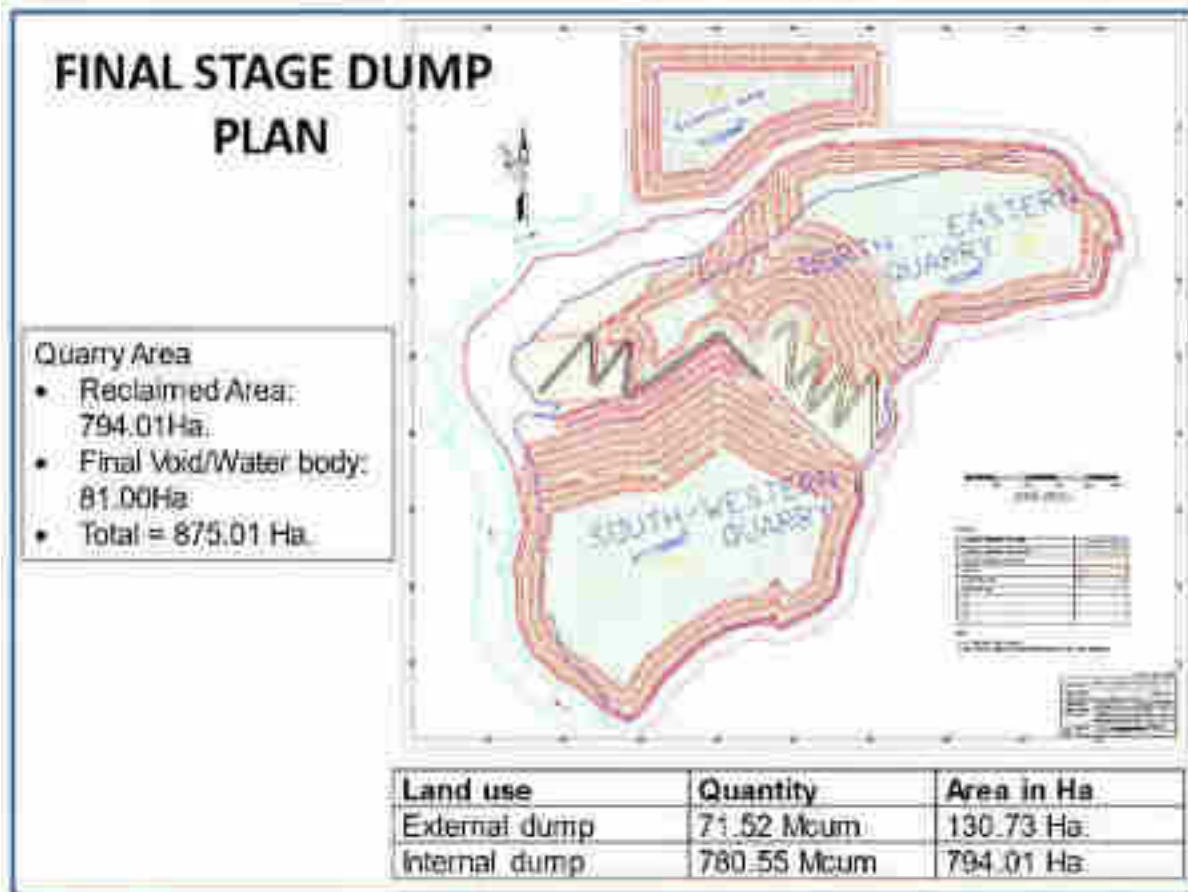
The following design criteria have been considered for waste dumps.

- (i) OB in external dumps will be stacked in 30 m high benches.
- (ii) OB in internal dumps will also be stacked in 30 m high benches.
- (iii) A berm width of 30 m has been provided for transport etc.
- (iv) Dump slope for each deck to be at natural repose (37°).

(v) Dozers to be deployed for shaping the dumps overall slope to 280.

Final reclamation will be achieved using the equipment provided for the purpose.

Once, the external dumping is completed, the spoil will be graded and landscaped in harmony with surrounding topography and biological reclamation carried out. The final void at the end of mining operations in the mine can be converted into a water reservoir. The total final void left at the end of the mining operations will be 81 Ha.



OB dump management of Chhal OC Seam-III 6.0 MTY Project

**e. Strict adherence to the prescribed topsoil management**

**Systematic handling of topsoil**

For surface mining activities are required to remove topsoil or other approved plant growth materials before beginning operations, save it for a later use in a manner conducive to protecting the primary root medium from contamination and erosion, and enhance its productivity. Topsoil shall be removed before any drilling, blasting, mining, or other surface disturbance. The stock piling of topsoil will be as follows:

- Top soil and other materials removed shall be stock-piled only when it is impractical to promptly redistribute such materials on regraded areas.
- Stock-piled materials shall be selectively placed on a stable area, not disturbed, and protected from wind and water erosion, unnecessary compaction, and contaminants which lessen the capability of-the materials to support vegetation when redistributed.

### **Topsoil redistribution**

After the final grading the topsoil would be redistributed in a manner that achieves an approximate uniform stable thickness consistent with the post mining land uses, contours, and surface water drainage system.

### **Biological Reclamation**

In view of importance of vegetal cover towards environment, the technical reclamation will be strengthened by biological reclamation for conserving the environment.

## **Financial Provisions**

### **I. Financial provision for soil erosion management**

Initial Financial provision have been made in the Project Report is as shown below:

<b>S. No.</b>	<b>Activity</b>	<b>Amount (in Rs. Lakhs)</b>
1.	Garland Drains	10.00
2.	Arboriculture/plantation in industrial area	10.00
3.	Barbed fencing/boundary walls/Toe walls/Gabion structures for the project	30.00
4.	Reclamation of Dumps	10.00
6	Green Belt in and around the Mine	20.00
	<b>Total</b>	<b>80.00</b>

\* Subsequent additional provision will be made as and when required.

### **II. Mine Closure cost for OC Mine**

Mine closure plan has been approved by SECL Board on 16.12.2013

As per the guidelines of the MoC, the cost of the mine closure is to be computed based on the basis of project area involved in the project.

In Chhal OC (Seam III), the total mining lease area is 1226.67 Ha. So, the closure cost is to be computed considering a total project area of 1342.86 **Ha**. Considering the wholesale price index as 171.6 as on May 2013, the updated cost of the mine closure is estimated to be Rs. 7.94 lakhs per hectare considering the admissible escalation over Rs. 6.00 lakh per Ha as on August 2009 when wholesale price index was 129.60.

Total Final mine closure cost (@ Rs.7.94/Ha.):**Rs. 10662.31lakhs** upto two decimal place.

### **III. Detail of Escrow Account**

The current value of corpus is Rs.10662.31 Lakhs (as on May. 2013). This corpus is to be divided by balance life of mine. Since, this is a running mine and the balance life after expansion is estimated as 30 years as on 01/04/2013, the annual corpus comes to Rs. 355.41 Lakhs (up to

two decimal place) by dividing 30 years. This amount is to be deposited in escrow account every year.

This amount is to be deposited in escrow account every year with 5% annual escalation.

**Fund to be deposited in escrow account and reimbursement schedule**

Year	Fund Deposited in Escrow Fund	Fund to be Reimbursed (Maximum)	
1	355.41	Nil	(+) accrued interest as applicable
2	373.18	Nil	
3	391.84	Nil	
4	411.43	Nil	
5	432.00	Nil	
<b>Phase-1 Total</b>	<b>1963.86</b>	<b>1571.09</b>	
6	453.60	Nil	
7	476.28	Nil	
8	500.10	Nil	
9	525.10	Nil	
10	551.36	Nil	
<b>Phase-2 Total</b>	<b>2506.44</b>	<b>2005.16</b>	
11	578.93	Nil	
12	607.87	Nil	
13	638.27	Nil	
14	670.18	Nil	
15	703.69	Nil	
<b>Phase-3 Total</b>	<b>3198.93</b>	<b>2559.14</b>	
16	738.87	Nil	
17	775.82	Nil	
18	814.61	Nil	
19	855.34	Nil	
20	898.10	Nil	
<b>Phase-4 Total</b>	<b>4082.73</b>	<b>3266.19</b>	
21	943.01	Nil	
22	990.16	Nil	
23	1039.67	Nil	
24	1091.65	Nil	
25	1146.23	Nil	
<b>Phase-5 Total</b>	<b>5210.72</b>	<b>4168.57</b>	
26	1203.54	Nil	
27	1263.72	Nil	
28	1326.91	Nil	
29	1393.25	Nil	
30	1462.92	Nil	
<b>Final Stage-Total</b>	<b>6650.34</b>	<b>5320.27</b>	
<b>Grand Total</b>	<b>23613.03</b>		

**IV. Tentative Final Mine Closure Activities and Cost Break-up**

**Type of mine:** Open cast  
**Mining Lease Area:** 1342.855 Ha.

**Production Capacity:** 6.0 MTY  
**Depth of the mine:** 300m

Sl. No.	Major Closure Activities	Quantity	% of Total Closure Cost
<b>A</b>	<b>Dismantling of Structures</b>		
	Service Buildings		0.20
	Residential Buildings,		2.67
	Industrial Structures i.e. workshop complex, 33kv/3.3kv Sub-Station, Unit Stores, Security Barrack		0.30
<b>B</b>	<b>Permanent fencing of mine void &amp; other dangerous areas</b>		
	Random rubble masonry of height 1.2m including levelling up in cement concrete 1:6:12 in mud mortar.		1.50
<b>C</b>	<b>Grading of highwall slopes</b>		
	Levelling & grading of highwall slopes		1.77
<b>D</b>	<b>OB Dump Reclamation</b>		
	Handling/Dozing of external OB dump into mine void.		88.66
	Bio-reclamation including soil spreading, plantation & maintenance.		0.00
<b>E</b>	<b>Landscaping</b>		
	Landscaping of the cleared land for improving its esthetic		0.30
<b>F</b>	<b>Plantation</b>		
	Plantation over area obtained after dismantling.		0.50
	Plantation around fencing		0.20
	Plantation over the cleared off external OB dump.		0.00
<b>G</b>	<b>Monitoring / testing of environmental parameters for three years.</b>		
	Air quality		0.22
	Water quality		0.20
<b>H</b>	<b>Entrepreneurship development (vocational and skill development training for sustainable income of affected people)</b>		0.26
<b>I</b>	<b>Miscellaneous &amp; other mitigative measures</b>		2.60
<b>J</b>	<b>Manpower Cost for supervision</b>		0.80
	<b>Total (%)</b>		<b>100.00</b>

**Note :-** The above cost expenditure will be met from the corpus escrow account deposited by the mine operator. In case of mines having acid mine drainage, post closure acid mine drainage management cost shall also be included in the total closure cost.

However, the additional amount beyond the escrow account will be provided by the mine operator after estimating the final mine closure cost five years prior to mine closure (as per the mine closure guidelines).

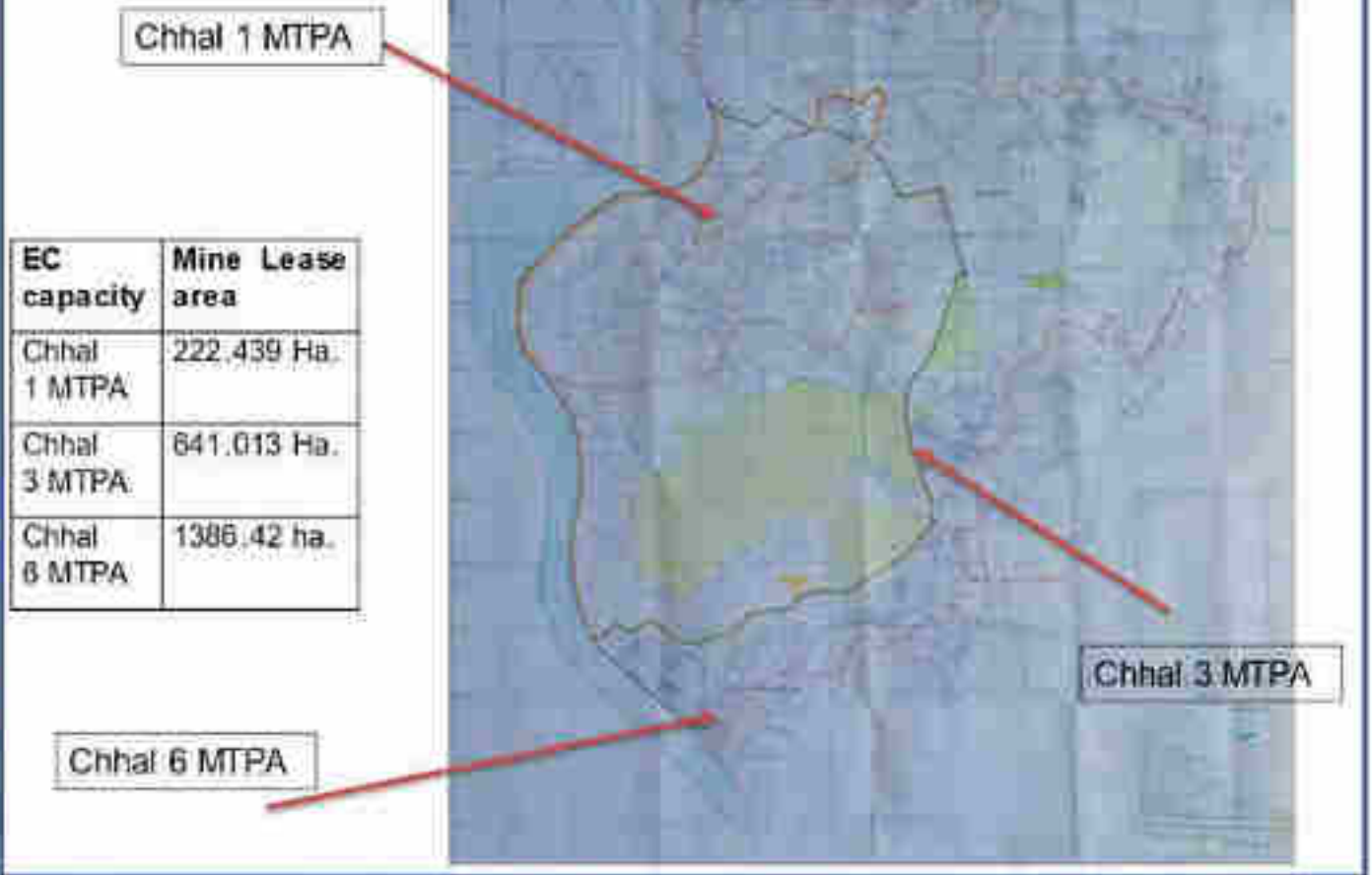
## Time Schedule

The different activities considered for mine closure are mentioned along with their schedule for implementation in the Figure below:

**Schedule for implementation of progressive mine closure activities**

S. No.	Activities in Reclamation Phase	1 <sup>st</sup>			2 <sup>nd</sup>			3 <sup>rd</sup>			4 <sup>th</sup>			5 <sup>th</sup>			6 <sup>th</sup>			MC			
<b>For Chhal OCP (30 Years)</b>																					1	2	3
1	Grading of External dump																						
A	Internal dump																						
a	Filling and simultaneous Leveling																						
2	Provision of water coursing channels																						
3	Provision of Sedimentation Pond																						
4	Provision of Garland Drains																						
5	Provision of Check dams at high velocity points																						
6	Topsoil Preservation & Application																						
7	Topsoil Application																						
8	Site preparation and plantation																						
a	Within de-coaled area																						
b	Out of de-coaled area																						
9	Environmental Monitoring																						

## CHHAL OC EXP. PROJECT LAND BOUNDARY (INCLUDING BOUNDARY FOR EARLIER CAPACITIES)



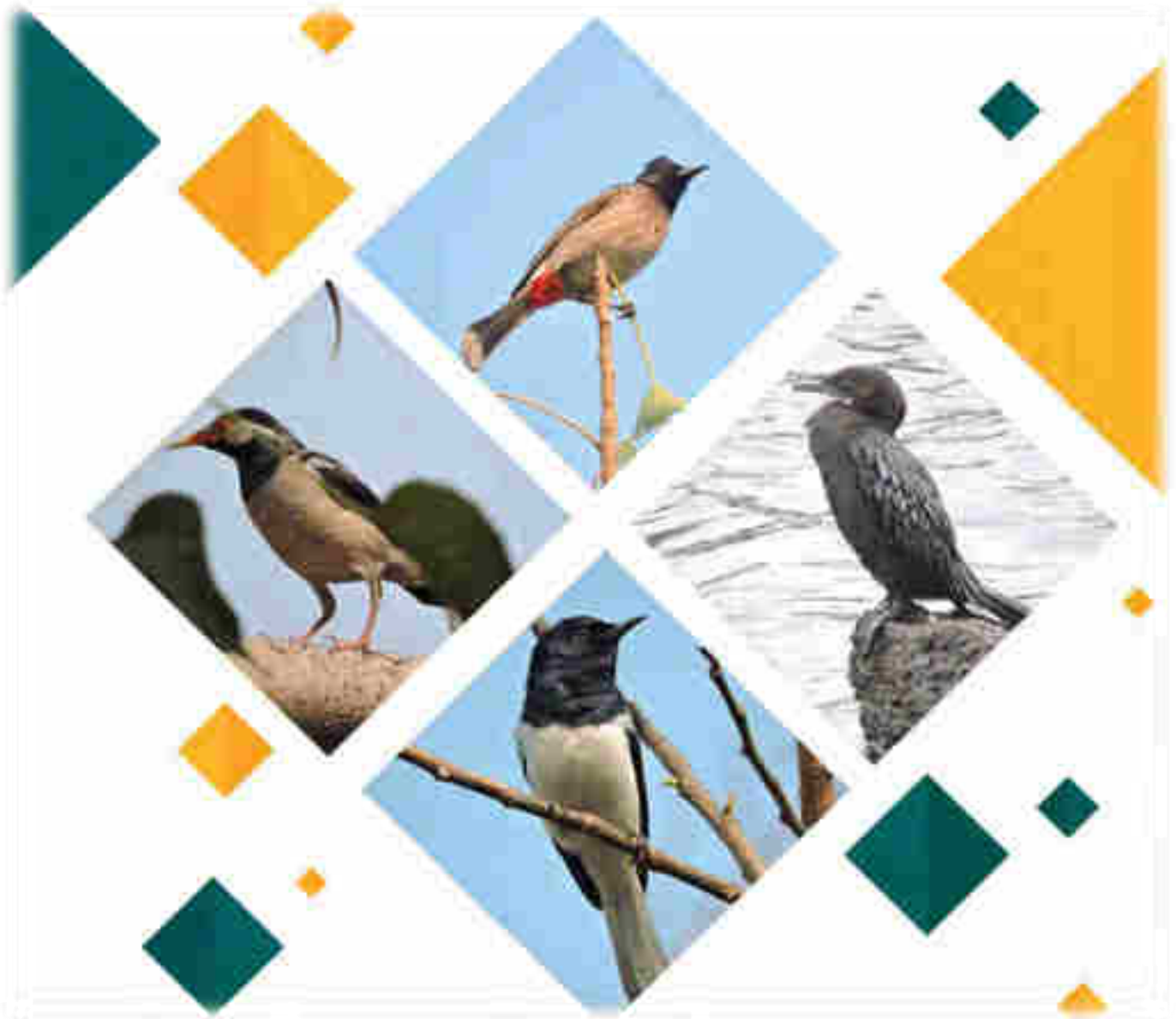
### References:-

- *Project Report of Chhal OC seam-III 6.0 MTY Project*
- *Environment Impact Assessment report*
- *Environment Management Plan*
- *Progressive Mine Closure Plan of Chhal OC seam-III 6.0 MTY Project.*





**“WILDLIFE CONSERVATION PLAN INCLUDING ALTERNATIVE  
HABITAT DEVELOPMENT PLAN FOR THE AFFECTED AVIFAUNA  
OF CORE AREA OF OCP CHAAL, RAIGARH AREA”**



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*Red Vented Bulbul, Little Cormorant, Oriental Magpie-robin and Pied Myna in core mining area of OCP Chhal, Dharamjaigarh, C.G.*

*Back Cover:*

*Indian Golden Orioles in core mining area of OCP Chhal, Dharamjaigarh, C.G.*

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## PREFACE

This project is a scientific and systematic study of real site-specific issues related to the conservation of wildlife and avifauna with the application of management concept and expertise. The project “Alternative Habitat Development Plan for affected Avifauna and Wildlife Conservation Plan for affected wildlife species of OCP Chhal, SECL Raigarh, Chhattisgarh” was proposed by the South Eastern Coalfield Limited (Coal India Limited), Open Cast Project Chhal, SECL Raigarh, for stage II clearance for the diversion of 185.155 hectare of Protected Forest and Revenue Forest land for Chhal Open Cast Mine (OCM) in Chhal Forest Range, Raigarh District, Chhattisgarh in favour of SECL and the project was undertaken by State Forest Research and Training Institute, Raipur (C.G).

The major objectives were:

1. To survey and documentation of the existing wildlife (mammals, reptiles) of OCP Chhal area (core and buffer zone).
2. To estimate species diversity and population dynamics of avifauna in the OCP Chhal area (core and buffer zone).
3. To study the habit, habitat and nesting pattern of different species of avifauna of core and buffer zone.
4. GPS survey of the densities, water bodies, nesting areas, migratory birds area, and wildlife corridor of any in the proposed study area.
5. To study the presence and movement of animals and birds by seasonal survey.
6. To study the impact assessment of proposed mining activities along with the existing biotic pressure on habit and habitat of the existing wildlife species including avifauna of the core zone.
7. Pilot testing, evaluation and monitoring of appropriate measures for the desired site.

8. Preparation of habitat enrichment/development plan for the wildlife species and avifauna of the core zone for preferential adoption of the surrounding area as alternative habitat.
9. Initial monitoring and guidance to the executing agency (Forest Department) for the implementation of the plan.

The research teams of State Forest Research and Training Institute Raipur (C.G) have conducted extensive scientific surveys and conceptualized the alternative plan for the avian species and the conservation plan for the affected wildlife species in the study area.

As result of three seasonal studies, 1653 individual from 106 different species of 32 families' avifauna were recorded in the affected area, which indicates the rich diversity of avian species in the study area. The alternative habitat as per the developed action plan is to be provided. The primary data analysis was based on "**Lines Transect Methodology**" in which the avian biodiversity as well as their habitat were studied and analyzed.

The project report attempts to bring under one cover the entire hard work and dedication put in by the research team for the completion of this work.

The key findings and recommendations have been provided in the document, which we trust, will be useful for all the stakeholders and decision makers associated with the OCP Chhal area. The final conclusion and the recommendations, along with the conservation plan and budget proposal have also been prepared for the implementation of the project.

I hope this report will help, not only the management of OCP Chhal but also help the Forest Department to conserve and protect the wildlife, avifauna and their habitat.



(S.S Bajaj IFS)  
APCCF

**State Forest Research and Training Institute  
Raipur, Chhattisgarh**

## Acknowledgement

The preparation of Wildlife Conservation Plan including Alternative Habitat Development Plan for Avifauna within the OCP Chhal lease area and its surroundings would not have taken shape but, for the valuable inputs, suggestions, guidance, support and efforts of a number of resource persons.

I would like to thank Shri Mudit Kumar Singh IFS, PCCF & HoFF, Director, State Forest Research and Training Institute for his continuous support, valuable suggestions and guidance.

I would also like to thank Shri A.B Minz IFS, Ex-Additional Director, SFRTI, and Smt. Nirmala Xess A.C.F, SFRTI for their help and support.

I would like to appreciate the efforts of Shri M.M Ujjaini, Technical Assistant and Project in-charge, Shri Jeevan Shirin Toppo S.R.F, Shri Vijay Kumar Bhagat J.R.F, Shri Kamlesh Kumar Dadsena J.R.F, Shri Amit Kumar Baghel J.R.F, Shri Rajesh Kumar Toppo F.A. and Shri Ashutosh Pandey Ex-S.R.F. in field survey, data collection, analysis and report writing.

My special thanks to Chief Conservator of Forest, Bilaspur, Divisional Forest Officer, Dharamjaigarh Forest Division, and his field staffs, General Manager SECL Raigarh, Sub-area Manager of OCP Chhal and Nodal officer SECL Raigarh and the officers involved with the project for sparing their valuable time and providing facilities for the research team.

The Conservation Management Plan remains open to alteration so as to offer protection to the local birds, wildlife species and their habitat. It should be interpreted as a static design remaining flexible to inputs from the concerned authorities, of whom I am appreciative in advance.

I hope this report will be helpful to develop alternative habitat for avifauna. Wildlife Conservation Plan will also ensure efficient protection, conservation & management for avifauna and wildlife species of the OCP Chhal mining area.



(S.S Bajaj IFS)  
APCCF

**State Forest Research and Training Institute  
Raipur, Chhattisgarh.**



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## Abbreviations

<b>OCP</b>	Open Cast Project
<b>SFRTI</b>	State Forest Research and Training Institute Raipur, C.G.
<b>ESMP</b>	Environmental and Social Mitigation Project
<b>MoEF</b>	Ministry of Environment and Forest
<b>CC</b>	Climate Change
<b>EIA</b>	Environmental Impact Assessment
<b>EMP</b>	Environmental Management Plan
<b>CIL</b>	Coal India Limited
<b>SECL</b>	South Eastern Coal Field Limited
<b>SC</b>	Scheduled Caste
<b>ST</b>	Scheduled Tribe
<b>FRA</b>	Forest Reclamation Approach
<b>SEIAA</b>	State Environment Impact Assessment Authority
<b>SPM</b>	Suspended Particulate Matter
<b>OB</b>	Overburden
<b>GLC</b>	Ground Level Concentrations
<b>NTFP</b>	Non Timber Forest Produce
<b>PPE</b>	Personal Protective Equipment
<b>LC</b>	Least Concern
<b>GPS</b>	Global Positioning System
<b>Hec</b>	Hectare
<b>CSBSAP</b>	Chhattisgarh Biodiversity Strategy and Action Plan
<b>IUCN</b>	International union for Conservation of Nature and Natural resources
<b>EX</b>	Extinct
<b>EW</b>	Extinct in the Wild
<b>CR</b>	Critically Endangered
<b>EN</b>	Endangered
<b>VU</b>	Vulnerable
<b>NT</b>	Near Threatened
<b>LC</b>	Least Concern
<b>DD</b>	Data Deficient
<b>NE</b>	Not Evaluated
<b>Land Cover Related Abbreviations Used in Datasheets</b>	
<b>R</b>	Resident
<b>B</b>	Barren land
<b>A</b>	Agriculture land

<b>G</b>	Grassland
<b>W</b>	Woodland
<b>S</b>	Scrubland
<b>Human settlement related Abbreviations used in datasheets</b>	
<b>S</b>	Settlement
<b>R</b>	Metal Road
<b>E</b>	Electricity
<b>P</b>	Pond
<b>W</b>	Well/Tube well
<b>Observations related Abbreviations used in datasheets</b>	
<b>1</b>	Illicit Felling
<b>2</b>	Girdling
<b>3</b>	Dead Tree
<b>4</b>	Living / Healthy Tree
<b>5</b>	Diseased Tree

## **EXECUTIVE SUMMARY**

Chhattisgarh state is identified as having one of the richest biodiversity habitats in the country; it has one of the densest forests in India, rich flora and fauna, several species of exotic flora and fauna and abundant non-timber forest products (NTFP's), with tremendous potential for value addition.

The variability among living organisms from all sources including Terrestrial, Marine and other Aquatic ecosystems and the ecological complexes to which they are part of, includes diversity within species, between species, and Ecosystems. Diversity within species (or genetic diversity) refers to variability in the functional units of heredity present in any material of plant, animal, microbial or another origin. Species diversity is used to describe the variety of species, whether wild or domesticated within a geographical area.

Similarly, Chhattisgarh is one of the richest Indian State in terms of mineral wealth, with 28 varieties of major minerals, including diamonds and rank second in the country in mineral production. The state holds a major share of coal deposits in India, which has led to the state also being a major power producer and being power surplus state.

The environmental impact of the coal industry involves issues like land degradation, waste disposal, water, air and noise pollution etc. caused by mining, processing and uses of coal products. In addition to atmospheric pollution, coal burning produces hundreds of millions of tons of solid waste products annually, including fly ash, bottom ash, and flue gas desulfurization sludge, that contain mercury, uranium, thorium, arsenic, and other heavy metals.

The removal of vegetative cover and activities associated with the construction of haul roads, stockpiling of topsoil, displacement of overburden and hauling of soil and coal increase the quantity of dust around mining operations. Dust degrades air quality in the immediate area, has an adverse impact on vegetative life, and creates health and safety hazards for mine workers and nearby residents.

Surface mining may affect groundwater in numerous ways like draining of usable water from shallow aquifers, lowering of water levels in adjacent areas and change in flow direction within aquifers, contamination of usable aquifers below mining area due to infiltration of poor quality mine water; and increased infiltration of rainwater on spoil piles.

Surface mining of coal causes direct and indirect damage to wildlife. The impact on wildlife stems primarily from disturbing, removing and redistributing the land surface. The most direct impact on wildlife is destruction or displacement of species in areas of excavation and spoils piling. Pit and spoil areas are not capable of providing food and cover for most species of wildlife. More sedentary animals like invertebrates, reptiles, burrowing rodents and small mammals may also disappear or destroyed due to mining activities.

Displacement of wildlife population from the mine site is another direct impact of mining. As mining proceeds on a site, wildlife moves to adjacent areas and establishes territories and home ranges.

In some species, reproduction is likely to be affected during the breeding season, when displacement occurs. Wildlife response to post-mining reclamation is based on the wildlife species in question, their habitat requirements, and presence of a source population to colonize the mine site and the structure and composition of the vegetation on the mine site post-reclamation and in the surrounding landscape. The majority of studies on wildlife response were focused simply on documenting the numerical response of species in question on the mine site for a brief period of post-reclamation.

Therefore the Ministry of Environment, Forest and Climate Change has notified the Environmental Impact Assessment (EIA) notification, 2006 under the provisions of the Environment (Protection) Act, 1986, which regulates development and their expansion/modernization of 39 sectors/activities listed in the schedule to the EIA notification, 2006. The Government of Chhattisgarh has identified the State Forest Department as nodal agency to prepare the Chhattisgarh Biodiversity Strategy and Action Plan i.e. CSBSAP.

The study involved detailed systematic and scientific processes of identifying, predicting, evaluating and analyzing the potential impacts of Open Cast Mining on avian bird species, wildlife and its habitat within the OCP Chhal boundary and surrounding area of Dharamjaigarh Forest Division. Extensive field studies were undertaken within the mining lease boundary of OCP Chhal and observations were made during the course of first and second seasonal field visits that formed the foundation of a conservation management plan for the betterment of affected species.

The major objectives were:

1. To survey and documentation of the existing wildlife (mammals, reptiles) of OCP Chhal area (core and buffer zone).
2. To estimate species diversity and population dynamics of avifauna in the OCP Chhal area (core and buffer zone).
3. To study the habit, habitat and nesting pattern of different species of avifauna of core and buffer zone.
4. GPS survey of the densities, water bodies, nesting areas, migratory birds area, and wildlife corridor of any in the proposed study area.
5. To study the presence and movement of animals and birds by seasonal survey.
6. To study the impact assessment of proposed mining activities along with the existing biotic pressure on habit and habitat of the existing wildlife species including avifauna of the core zone.
7. Pilot testing, evaluation and monitoring of appropriate measures for the desired site.
8. Preparation of habitat enrichment/development plan for the wildlife species and avifauna of the core zone for preferential adoption of the surrounding area as alternative habitat.
9. Initial monitoring and guidance to the executing agency (Forest Department) for the implementation of the plan.



The proposed mining area is located in the south of village Chhal at an approximate distance of 2.5 km on Kharsia - Dharamjaigarh State Highway and 16 km from Kharsia town. The block is bounded by latitude 22°04'40" and 22°06'27" and longitudes 83°06'10" and 83°09'10" and is included in the Survey of India Topo Sheet No. 64 N/4. It is situated in the Raigarh district of Chhattisgarh. There are about 826.07 hectare area lands to be acquired out of which 185.155 hectare of forest land in mining area will be proposed to acquire. Out of 185.155 hectare land 176 ha land including the protected forest area and rest 9.155 hectare area will be proposed from revenue forest area. Only one compartment should fall under proposed mining area namely comp. no. 478 PF.

Line transect method has been applied for the bird count and their habitat survey. Line-transect distance sampling methods were also used to estimate the abundance of many biological populations such as animals, birds and plant species including nonliving things. Total of 26 transects have been taken during the three seasonal field survey in the core and buffer zone. Distance sampling in every 300 m and 10 m circular quadrates have been taken for observation of vegetation composition (Grass, herb, shrub and regeneration).

On the basis of three seasonal field surveys, **total 1653 individuals of 106 different bird species** have been recorded. The 1653 individuals belongs to 106 species they are categorized on the basis of nesting pattern, the population of avifauna abundant by Purple Sun Bird, Jungle Babbler, Indian Silver Bill, Red Vented Bulbul, Green Bee Eater, Cattle Egret, Black Drongo, Eurasian Collared Dove, Sulphur Bellied Warbler and Common Myna etc. Mostly the birds found during the survey are endemic and resident. In the study area, dominated floral species found mainly Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Saja (*Terminalia tomentosa*), Dhawda (*Anogeissus latifolia*), Koriya (*Pinus koraiensi*), Teak (*Tectona grandis*), Bhelwa (*Semecarpus anacardium*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Tendu (*Diospyros melanoxylon*), Kekat (*Garuga pinnata*), Plash (*Butea monosperma*), Anjan (*Hardwickia binata*), Bargad (*Ficus bengalensis*), Harra

(*Terminalia chebula*), Baheda (*Terminalia bellerica*), Semal (*Bombax ceiba*), Jamun (*Syzygium cumini*) and Mahaneem (*Ailanthus excelsa*) etc.

The overall ecological value of an area, where mining is carried out, must also be considered. This should include the interconnections between habitats in the vicinity of the mining project which may be affected by fragmentation of the habitat. Many species, particularly avifauna, mammals and their dynamic territories that extend beyond site boundaries, making them vulnerable to changes in external or local environmental conditions.

The proposed coal mine would create an impact on the environment in two distinct phases; during the development phase, which may be regarded as temporary or short term. During the operation which would have long term effects. These impacts will have a negative effect on the avifauna of the area.

To minimize the impacts of mining on different environmental factors with reference to avifauna and wildlife species, recommendations are given as follows:

1. Green belts should be developed around the mining boundary, along the roads, lease periphery, benches and backfilled areas. The impact on the biological environment due to amount of dust generation is minimized by well-developed green belt in and around mining lease area.
2. The wastage coal dust particles in the dumping site of coal mine's should be managed properly to reduce air pollution and loss of avifaunal diversity & habitats.
3. Biological reclamation should be done to transform the degraded land and waste dump into a self - sustaining ecologically stable land form. Re-vegetation of waste dump is recommended to the slope stability, enhances the infiltration of rain water to increases the soil fertility.
4. Top soil management is needed to maintain the top soil stockpile to retain fertility. Excavated top soil can be dumped for future use such as meadow development and plantation purpose in order to further mitigation for habitat conservation of avifauna.

5. Fruit bearing and feeder tree species that are preferred by the birds available in the area, to be needed to plant in the buffer zone for plantation of avifauna conservation. Some of the tree species to be planted are: Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Pipal (*Ficus religiosa*), Bargad (*Ficus benghalensis*), Bhelwa (*Semecarpus anacardium*), Gular (*Ficus glomerata*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Baheda (*Terminalia bellerica*), Harra (*Terminalia chebula*), Tendu (*Diospyros melanoxylon*), Dhawda (*Anogeissus latifolia*) and Amaltas (*Cassia fistula*) etc.
6. Multiple water storage facilities are to be developed in the buffer boundaries to assure the water availability throughout the year. The existing ponds, river, dam and canals water resources recharge should be maintained.
7. The mining in the buffer zone along the river bank of Mand River must be avoided to insure of the river changing the path.
8. The social awareness program should be conducted among the local communities and villagers to provide information & awareness about birds and wild life their contribution in ecosystem and environment.
9. Artificial nest made up of local, light and fine wood materials. Nests will be prepared with the help of active JFM Committee and local forest staff and placed in the buffer area for the affected avifauna of core zone.
10. Assisted natural regeneration (ANR) should be done for the regeneration and reclamation, protection and preservation of natural tree seedlings in forest areas.
11. Best practices from forest department should be implemented for the prevention of forest fire.
12. Plantation and conservation efforts should be monitor regularly during various growth stages of site.
13. Establishment of artificial avifauna habitat “*Pakshi Vihar*” on dumping site.

# CHAPTER 1

## INTRODUCTION

---

### 1.1 BIODIVERSITY

The variability among living organisms from all sources including inter alia, Terrestrial, Marine and other Aquatic Ecosystems and the Ecological Complexes of which they are part; includes diversity within species, between species and of Ecosystems.

Diversity within species (or genetic diversity) refers to variability in the functional units of heredity present in any material of plant, animal, microbial or other origins. Species diversity is used to describe the variety of species-whether wild or domesticated) within a geographical area. Estimates of the total number of species (defined as a population of organisms which are able to interbreed freely under natural conditions) range from 2 to 100 million, though less than 1.5 million have actually been described. Ecosystem diversity refers to the enormous variety of plant, animal and micro-organism communities and ecological processes that make them function. In short, biodiversity refers to the variety of life on earth. This variety provides the building blocks to adapt to changing environmental conditions in the future.

### 1.2 WILDLIFE CONSERVATION

Wildlife Conservation is the practice of protecting animal species and their habitats. In order to survive, a species requires adequate food, water, shelter, space, and opportunities to reproduce. Wildlife conservation refers to the considered practice of ensuring protection for wild fauna species, their habitats, and plants. It has sustainable Effort to maintain and use natural resources including wildlife in ways they ensure that those resources will be available in the future.

“Wildlife Conservation is the application of ecological knowledge to populations of vertebrate animals and their plant and animal associates in a manner that strikes a balance between the needs of those populations and the needs of people” (*Robinson and Bolen 1999*).

Wildlife Conservation aims to stop the progress of the loss in the ecological biodiversity by taking into consideration ecological principles such as carrying capacity, disturbance and succession and environmental conditions such as food, water, shelter, space, and opportunities to reproduce with the aim of balancing the needs of wildlife with the needs of people. Wildlife is best preserved in their natural habitat. Wildlife wing of the forest department has adopted two-pronged strategies for the Wildlife Conservation: protection and awareness generation.

The government of Chhattisgarh has identified the state forest department as a nodal agency to prepare the Chhattisgarh Biodiversity Strategy and Action Plan i.e. CSBSAP.

Chhattisgarh state is identified as having one of the richest biodiversity habitats in the country; it has one of the densest forests in India, rich flora and fauna, several species of exotic flora and fauna and abundant non-timber forest products (NTFP's), with tremendous potential for value addition. Chhattisgarh state falls under the deccan biodiversity area. The forests of the state fall under two major forest types, i.e. Tropical Moist Deciduous forest and the Tropical Dry Deciduous forest.

Chhattisgarh has 55,674 sq km of forests, which is 41.18 percent of its geographical area. It has the third largest area under forest cover after Madhya Pradesh and Arunachal Pradesh. Of this, three percent is under very dense forest, 25.82 percent is moderately dense, 12.28 percent is open forest and 0.09 percent is scrub (Fig.1.1). The forest ecosystem of the state has very rich biodiversity comprises primarily with Sal dominated forests, followed by Teak forests and mixed forest ecosystem. As per the latest status of Chhattisgarh Forest policy report 2011, there has been a net decrease of 192 sq.km in the forest cover from 2009 (Forest Survey report 2013).

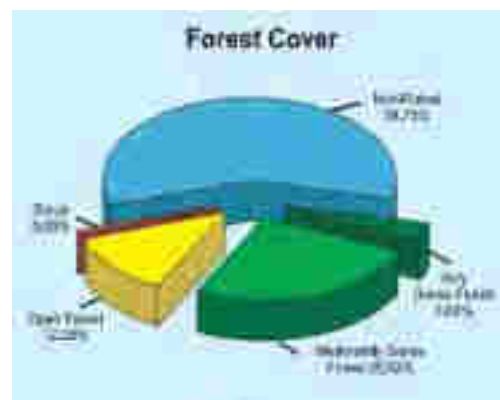


Fig.1.1 Forest cover in Chhattisgarh (State Action)

Chhattisgarh is among the richest Indian states in terms of mineral wealth, with 28 varieties of major minerals, including diamonds and ranks second in the country in mineral production. The state holds a major share of coal deposits in India, which has led to the state also being a major power producer and being power surplus. It is the only state in India to have tin ore reserves. About one-fifth of the iron-ore in the country is mined in the state and one of the best-quality, iron-ore deposits in the world is found at the Bailadila mines in the south of Chhattisgarh from where it is exported to Japan and other countries (table 1.1). Rich deposits of bauxite, limestone, dolomite, and corundum are also found in the state, making it the ideal location for low-cost of production of end products such as cement and aluminum. During 2009-10, the state had contributed 14.09 per cent in the national revenue from minerals (State Action Plan 2011).

**Table No1.1: Production of key minerals**

<b>Mineral</b>	<b>Production – 2008-09 (Million Tons)</b>
<b>Coal</b>	97.0
<b>Iron Ore</b>	32.9
<b>Limestone</b>	15.6
<b>Dolomite</b>	1.2
<b>Bauxite</b>	1.6
<b>Tin ore (Concentrate)</b>	57500*

\* In Kilogram

Chhattisgarh state has richest of energy resources such as Coal, Mineral this state is the second largest coal producing region after Jharkhand in India. The environmental impact of the coal industry includes issues such as land use, waste management, water, and air pollution, caused by coal mining, processing and the use of its products. In addition to atmospheric pollution, coal burning produces hundreds of millions of tons of solid waste products annually, including fly ash, bottom ash, and flue-gas desulfurization sludge, that contain mercury, uranium, thorium, arsenic, and other heavy metals.

Coal is the only natural energy resource and fossil fuel available in abundance in India. The major environmental challenges encountering the coal

industry are impacts of mine fires, dust suppression and control particularly haul road dust consolidation, treatment of mine waters containing heavy metals/acid mine drainage, restoration of water table and quality of ground and surface water, augmentation of pumped out mine water for drinking purpose, reclamation of mined out areas with pre-determined land use patterns conducive to the local populations etc. The biggest environmental challenge facing the coal industry is the issue of greenhouse gases and acid rain. Overall environmental management improvement has been taking place with the implementation of state of art environmental management schemes particularly under Environmental and Social Mitigation Project (ESMP) of (CIL) Coal India Limited (*Dr.Gurdeep Singh, June 2008*).

Chhattisgarh state is rich in energy resources. The main energy resource is coal. The state produces 15% of total coal of the country; the main coal-producing areas are: Korba - Produces 75% coal of the state and 11% of the country. The main coal producing areas are Hasdeo-Rampur Colliery, Mand-Raigarh Colliery, Vishrampur Colliery, Lakhanpur Colliery, Tatapani-Ramkola Colliery, Jhilmili Colliery, Sonhat Colliery, Jhagrakhand Colliery, Chirmiri-Kurasiya Colliery (*Chhattisgarh Biodiversity plan*).

The environmental impact of the coal industry includes issues such as land use, waste management, water, and air pollution, caused by coal mining, processing and the use of its products. In addition to atmospheric pollution, coal burning produces hundreds of millions of tons of solid waste products annually, including fly-ash, bottom-ash, and flue-gas de-sulfurization sludge, that contain mercury, uranium, thorium, arsenic, and other heavy metals.

The removal of vegetative cover and activities associated with the construction of haul roads, stockpiling of topsoil, displacement of overburden and hauling of soil and coal increase the quantity of dust around mining operations. Dust degrades air quality in the immediate area, has an adverse impact on vegetative life, and constitutes health and safety hazards for mine workers and nearby residents.

Surface mining of coal causes direct and indirect damage to wildlife. The impact on wildlife primarily from disturbing, removing and redistributing the land surface. Some impacts are short-term, and confined to the mine site; others have far-reaching, long-term effects. The most direct effect on wildlife is destruction or displacement of species in areas of excavation and spoils piling. Pit and spoil areas are not capable of providing food and cover for most species of wildlife. Mobile wildlife species like game animals, birds, and predators leave these areas. More sedentary animals like invertebrates, reptiles, burrowing rodents and small mammals may be destroyed (*Anurag et al. 2018*).

As per MoEF clearance regarding a condition (Clause 9) “The user agency in consultation with the state government, shall create and maintain alternate habitat/ home for avifauna, their nesting trees are to be cleared under this project. Birds nests will be artificially made out of eco-friendly material, placed in the area including the forest area and human settlements; adjoining the forest area being diverted for the project.”

To overcome the impact of mining activities on avifauna and wildlife found in Chhal Range, Dharamjaigarh Forest Division Chhattisgarh, SECL Raigarh had given an assignment to SFRTI, Raipur to prepare a Wildlife Conservation Plan including alternative habitat development plan for affected avifauna.

### **1.3 PROJECT BACKGROUND**

A Project Report for Chhal OCP in Chhal Geological block was prepared in March 2003, and was approved in May 2003 for a targeted capacity of 1.00 MTY at a capital expenditure of Rs.19.99 crores.

The proposed Chhal opencast falls under the administrative control of Raigarh area of SECL. The project report is based on the “Geological report on Chhal block” prepared by CMPDI in March 1991. Eight coal seams, namely, VI, V (T), V (B), Local, IV, III, II, II (A) and I occur within the block. Of these, older seams I, II and IIA are generally thin and impersistent. In Dharam and Chhal Underground Mines, Seam III is being exploited.



During the discussion of Planning Committee Meeting, it was decided that as no firm linkage is available for the coal from this project, a project report of annual production capacity (1.00 MTY) may be prepared. In future if demand arises and firm linkage is established, annual production capacity may be revised, considering remaining promising areas.

With an increased demand projected on SECL in XIth plan, Chhal OCP was proposed to expand from 1.0 MTY to 3.0 MTY.

Accordingly, an expansion PR of Chhal OCP (1.0 – 3.0 MTY) was prepared and approved in September 2007 within the sanctioned mine boundary with an initial capital requirement of Rs. 50.38 crores. This report was completed March 2010 at a completion cost of Rs. 46.95 crores.

Liberalization of power sector has resulted in a sharp increase in demand for power grade coal. Expansion of Chhal opencast is, again therefore, proposed with a view to fulfill the growth in demand. In this context, this project named Chhal OCP (Seam-III) Project (6.0 MTY) has been conceived.

## **1.4 HISTORY OF MINING**

The proposed area under consideration falls in Mand - Raigarh Coalfield of Raigarh district (Chhattisgarh). Mining activities in the area started long back in 1940 but remained confined to very small manual quarrying. The coalfield is almost virgin barring two small opencast mines i.e. Domnara in the south-west and barod in the north-east. Domnara opencast mine was closed due to lack of demand of grade 'G' coal produced by this mine. Baroud opencast mine is running.

## **1.5 PROJECT SITE INFORMATION OCP CHHAL**

### **1.5.1 LOCATION**

The project is located south of village Chhal at an approximate distance of 2.5 km on Kharsia - Dharamjaigarh State Highway and 16 km from Kharsia town. The block is bounded by latitude 22°04'40" and 22°06'27" and longitudes 83°06'10" and 83°09'10" and is included in the Survey of India Topo Sheet No. 64 N/4. It is situated in the Raigarh district of Chhattisgarh.

### **1.5.2 CLIMATE**

The area is characterized by tropical climate with well defined summer from April to June, rainy season from July to September and winter from November to February. May and up to mid June is the hottest month when the temperature rises to a maximum of 48<sup>0</sup>C. December and January are the coldest month, the temperature falls to a minimum of 7<sup>0</sup>C.

The average annual rainfall is about 1500 mm. The wind direction is generally westerly to north westerly. Relative humidity during monsoon ranges from 75% to 80% and in summer ranges from 18% to 60%.

### **1.5.3 PHYSIOGRAPHY**

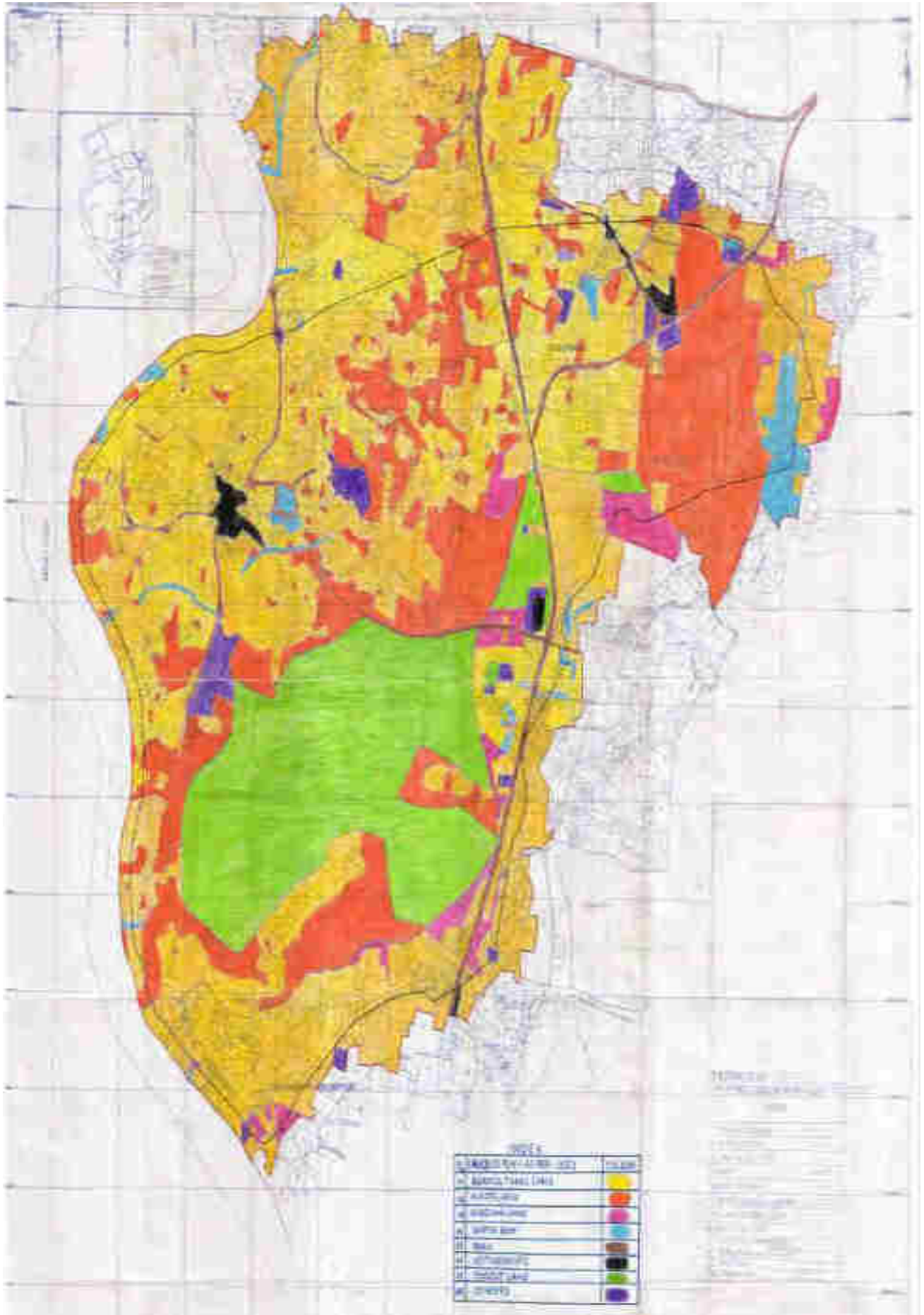
The Chhal Block is largely characterized by a plain country. The altitude varies between 231 m in the west to 267 m above MSL in the north eastern part of the block. The elevation of the ground varies between 255 m to 267 m along a linear patch running NE-SW in the central part of the property. The ground has a general slope towards NE, SE & SW. Most of the area is covered by soil and cultivate land. The southerly flowing Mand River and westerly flowing Kurket River with their tributaries form the main drainage of the Chhal Block. A small earthen dam has been constructed for the purpose of irrigation near village Khedapali in the eastern part of the block.

### **1.5.4 LAND USE PLAN**

The project envisages 1342.86 Ha of land for quarry, industrial and residential complex, safety zone and external dumps etc. This includes 516.59 Ha of land already acquired/under process and, 826.07Ha of land to be acquired. The break-up of the land is as follows:-

**Table No 1.2: Requirement of land in hec.**

REQUIREMENT OF LAND IN Ha							
Sl No.	Particulars	Land already acquired/u nder process	Land to be acquired				Total land requirement
			Tenancy / agricultur e land	Fore st land	Gov t. Lan d	Tota l	
1	Land for quarry	516.79	16.64	185. 155	156. 42	358. 22	875.00
2	For external dump	-	110.73		20.0 0	130. 73	130.73
3	Surface industrial developments rely. Siding, colony, approach road, etc.	-	50	-	-	50	50.00
4	Land for homestead/family	-	50	-	-	50	50
5	Land for environment and safety	-	92.65	-	-	92.6 5	92.65
6	Safety zone	-	144.47	-	-	144. 47	144.47
	<b>TOTAL LAND</b>	<b>516.79</b>	<b>464.49</b>	<b>185. 16</b>	<b>176. 42</b>	<b>826. 07</b>	<b>1342.86</b>



Land use plan of OCP Chhal

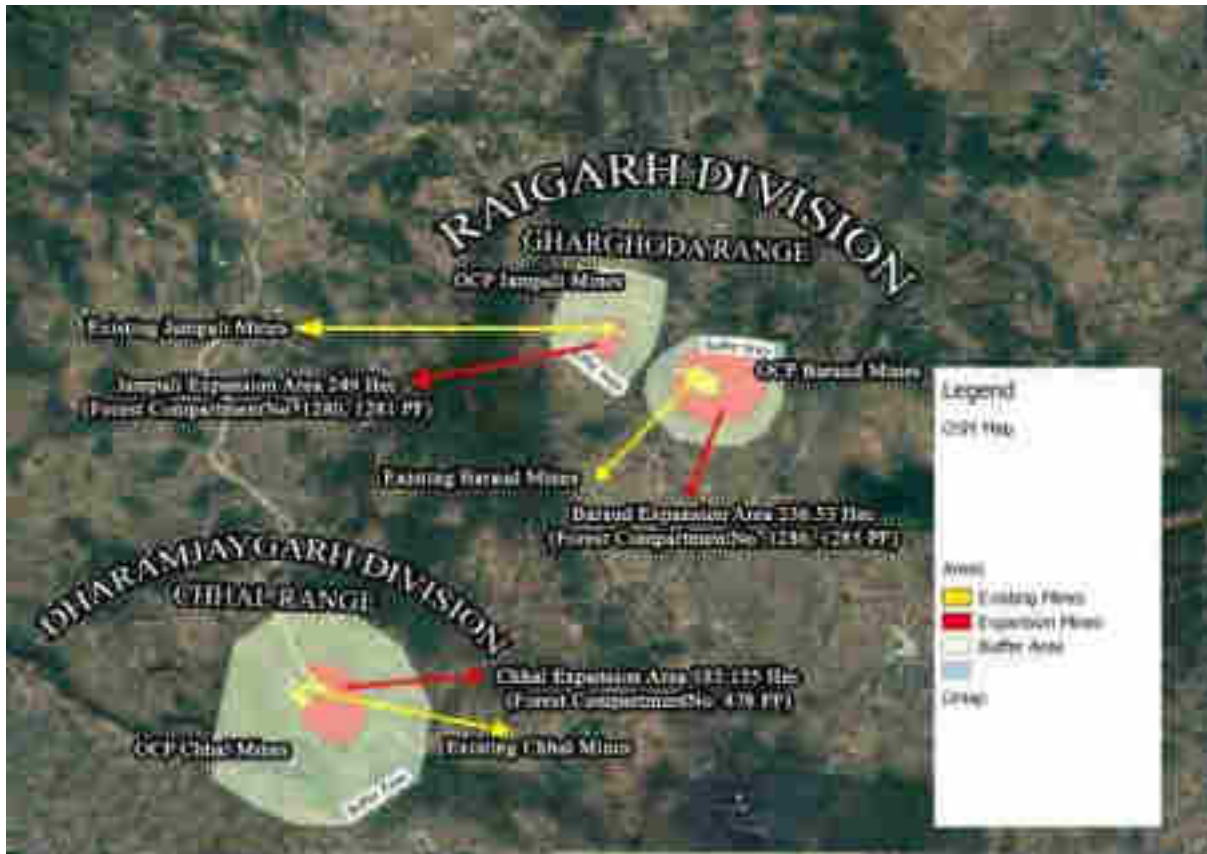


Fig 1.2: Google map of mining area of OCP Jampali, Bharaud & Chhal

#### 1.4.5 IMPACT ON LAND USE FOREST

There are about **826.07 ha** area land to be acquired out of which **185.155 ha. of forest land** in mining area will be proposed to acquire. Out of 185.155 ha land 176 ha land including the protected forest area and rest 9.155 ha area will be proposed from revenue forest area. Only one compartment should fall under proposed mining area namely comp. no. 478 PF.

The inventory of forest resource is made based on the guidelines of the forest department. The pilot survey is pre-requisite to finalized the most efficient survey design about 40 to 50 sample plot is lead out to cover up entire range variation existing within the forest population of the working plan area.

The earlier survey of flora & fauna in the proposed mining area was done by CMPDI and they adopted a similar methodology as applied in working plan therefore, the shape of the sampling unit is square. Sizes of the sampling selected are 0.1 ha. or 0.16 ha.

## CHAPTER 2

### REVIEW OF LITERATURE

---

The mining of coal in India has significant effects on wildlife populations and their habitats. The extraction of coal by various means (deep mining, long wall mining, contour mining, area mining or mountain top removal mining with valley fill) has a significant impact on terrestrial and aquatic ecosystems which can be felt for decades. Given the difficulty in extracting coal from geologic strata that are generally not readily accessible from the surface, it is inevitable that there will be some significant changes in the flora and fauna of the area within and surrounding the mine site.

The impacts of coal mining on wildlife populations occur at two primary levels:

- 1) Immediate, direct effects of mining in terms of direct mortality, disturbance and displacement of wildlife populations during mining activities, and
- 2) Changes in wildlife populations associated with long-term changes in land cover associated with mine sites and their reclamation.

#### **The goals of this literature review are to**

- 1) Review the extant literature on the effects of coal mining on aquatic and terrestrial Avifauna populations and habitat;
- 2) Review the literature relative to the effectiveness of reclamation practices in restoring conditions conducive for avifauna habitat; and
- 3) Identify areas where research is needed to further the science needed to better mitigate the impacts of mining on avian resources.

#### **2.1 DIRECT EFFECTS OF MINING ON WILDLIFE**

Very little literature exists on the direct effects of coal mining on wildlife. Mining certainly has direct effects as individuals and populations of species that occurred on the site pre-mining may sometimes be killed or displaced. Direct mortality will occur when the species in question is not mobile enough to avoid mining equipment, especially young ones. We did not find any literature that estimates the rate of direct mortality for any potentially affected species.

Displacement of wildlife populations from the mine site is another direct effect of mining. As mining proceeds on a site, wildlife moves to adjacent areas and establishes territories and home ranges. We were unable to locate any studies that documented the extent of this displacement and the implications in terms of survival and reproduction for coal mining in the Chhal. Some studies have been conducted on this topic in the Korba (C.G). In some species, reproduction is likely interrupted during the breeding season in which the displacement occurs. Survival of displaced individuals may be lower than survival would have been during the pre-mining period because displaced individuals may experience greater competition for resources in unfamiliar areas and may experience greater predation rates initially as they learn how to adjust to new surroundings.

## **2.2 WILDLIFE RESPONSE TO POST-MINING RECLAMATION**

Wildlife response to post-mining reclamation is based on the wildlife species in question, their habitat requirements, and presence of a source population to colonize the mine site, and the structure and composition of the vegetation on the mine site post-reclamation and in the surrounding landscape. Wildlife response can be characterized in a variety of ways, including relative abundance on the site, survival, reproduction, movements, foraging behavior, and other behavioural traits. The majority of studies on wildlife response focused simply on documenting the numerical response of species in question on the mine site during some time period post-reclamation. To understand the full implications of wildlife response and effects on habitat quality, more in-depth research is needed to document the demography (reproduction, survival, immigration, emigration) of the species that colonize mine sites post-reclamation.

## **2.3 AVIFAUNA**

Birds provide several ecological functions such as pest control, pollination, seed dispersal and plant reproduction in thousands of economically and culturally important plant species through its consumption of various terrestrial, aquatic and aerial resources (*Whelan et al., 2015*). Foraging ecology of birds contribute regulating services such as scavenging carcasses and nutrient

cycling (*Whelan et al., 2008*). Bird communities also provide a reliable ecological indicator of forest condition (*Canterbury et al., 2000*) due to their sensitivity to environmental perturbations, relevance to ecosystem functioning (e.g., in pollination and seed dispersal), and relative ease in sampling (*Brown, 1991*). Moreover, birds are associated with singular habitats, they are short-lived species so any change in the composition may manifest shortly after a disturbance. Hence, they can be used to develop habitat associations which are predictors of relative human disturbance levels and may be affected by some tourist activities (*Higginbottom et al., 2003; Newsome et al., 2004*). The bird population is an indication of environmental changes as they respond fast to threats and changing environment conditions (*Barov, 2011*).

As significant as being one of the mega diverse countries, Mining and mineral processing have the potential to be important sources of income and driving forces behind broader economic development (*Eggert, 2001*). With this, the country is faced with a great challenge in utilizing the rich available mineral resources for economic growth and development without compromising its ecological integrity and species diversity.

#### **2.4 AVIFAUNA RESPONSE TO POST-MINING RECLAMATION**

The vast majority of studies conducted on wildlife response have focused on birds in part because birds are easily monitored using various count-based surveys. The effects of mining on avian communities occur initially by the removal of vegetation in preparation for mining. If the site is forested, vegetation removal occurs through timber harvest or clearing. Although few studies have been done to specifically evaluate the changes associated with mine sites from pre-mining to post-mining land uses, there is substantial literature of the effects of timber harvest on avian communities and populations-see review in (*Sallabanks et al. 2000*). There are substantial differences in avian response to timber harvest for forest regeneration and avian response to timber harvest or clearing in preparation for mining because of the nature and timing of the re-vegetation that occurs. In timber harvest for forest management, tree regeneration begins within the first growing season post-harvest on the site and



birds respond relatively quickly to the vigorous flush of woody re-growth. On mine sites, the reclamation process takes more time, and the vegetation responds more slowly, especially if the site is being reclaimed with shrubs and trees for reforestation.

On reclaimed mine lands which were originally forested, avian communities shift from forest bird communities to communities associated with early succession habitats, grassland birds and scrub-shrub birds. These changes in bird communities have conservation implications because in some cases there are forest bird species present that have declining populations and are of high conservation concern, such as the Cerulean Warbler (*Setophaga cerulea*) in the Appalachian Mountains (Buehler et al. 2006). Negative impacts on forest bird populations have to be weighed against positive gains in early succession bird populations. Many species associated with early successional habitats, such as the Henslow's Sparrow (*Ammodramus henslowii*) and the Golden-winged Warbler (*Vermivora chrysoptera*) are also of high conservation priority (Hunter et al. 2001, Buehler et al. 2007).

Coal mining in the eastern United States seldom encounters bird species that are federally listed as threatened or endangered but most of the bird studies associated with mining have focused on characterizing songbird communities post-reclamation. Post-mining songbird studies have documented grassland bird response to reclamation when the reclamation has resulted in grassland cover. In general, grassland mine reclamation has been successful in creating habitat suitable for grassland bird's use. The grassland species attracted to reclaim mine lands include a diversity of songbirds and grassland raptors such as Northern Harriers (*Circus cyaneus*) and Short-eared Owls (*Asio flammeus*) (Rohrbaugh and Yahner 1996, Vukovich 2004, Vukovich et al. 2006).

Reclaimed mine sites in Pennsylvania, Kentucky, Illinois, Indiana, West Virginia, and Ohio are supporting breeding populations of Henslow's Sparrows (Bajema et al. 2001, Bajema and Lima 2001, DeVault et al. 2002, Scott et al. 2002, Mattice et al. 2005, Monroe and Ritchison 2005, Stauffer 2008, Stauffer et al. 2011) and/or Grasshopper Sparrows (*Ammodramus*

savannarum) (Whitmore 1979, Whitmore 1981, Wray et al. 1982, DeVault et al. 2002, Scott et al. 2002, Ammer 2003, Mattice et al. 2005, Galligan et al. 2006, Stauffer 2008, Stauffer et al. 2011), two grassland species of conservation concern. Reproductive rates by these species were comparable to reproduction in other settings (Ammer 2003, Monroe and Ritchison 2005, Galligan et al. 2006, Stauffer et al. 2011). No published survival data are available for grassland songbirds breeding on reclaimed mine lands. Adult and juvenile survival data are generally unavailable for most grassland songbirds (Perlut et al. 2008), because adult dispersal, depending on the species, may be high and return rates in ephemeral grassland habitats is often very poor (Jones et al. 2007). Without survival data, it is impossible to accurately determine whether reclaimed mine lands are providing conditions conducive for supporting source populations for priority species (Anders and Marshall 2005). Several authors have noted that reclaimed coal mine lands in the region were providing important grassland habitat contributing significantly to grassland bird conservation range-wide (Rohrbaugh and Yahner 1996, Bajema et al. 2001, Mattice et al. 2005, Monroe and Ritchison 2005, Stauffer et al. 2011).

Golden-winged Warbler populations have been declining precipitously in the Appalachian region (Buehler et al. 2007), and the species has been petitioned for listing under the Endangered Species Act in 2010 (USFWS 2011). Golden-winged populations occupy shrubby, early succession habitats often associated with reclamation of contour and area mines (Bulluck and Buehler 2008). Plant succession on mine lands is often slow, which provides for a prolonged period in which habitat conditions are conducive for Golden-winged Warblers.

Succession on mine lands post-reclamation can be successfully set back by prescribed burning to further prolong the period of suitability for Golden-winged (D. Buehler and K. Percy, unpubl. data). In some cases, however, recent coal mining may compromise Golden-winged habitat where remaining is occurring on old contour and area mine sites that are currently occupied by Golden-winged (D. Buehler, unpubl. data). A mine land reclamation

prescription is being developed for Golden-winged Warbler habitat restoration to address this issue (D. Buehler and K. Percy, unpubl. data).

Although grassland and scrub-shrub birds benefit from the early successional habitat developed from post-mining reclamation, forest-dwelling birds are adversely affected by land use change from forest to grassland, regardless of the origin of the change. Concern has been expressed related to habitat loss for Cerulean Warblers in the Appalachian Mountains associated with deforestation from coal mining (*Buehler et al. 2006, Wood et al. 2006, Bulluck 2007*).

Mining also affects forest songbirds in adjacent forested areas because of the creation of edge effects and because of forest fragmentation. Cerulean Warbler abundance, for example, was lower in forests adjacent to mountaintop removal mining with valley fill (*Wood et al. 2006*), although edges associated with contour mines in Tennessee were not associated with lower cerulean abundance (*Beachy 2008*). Cerulean Warbler reproduction was lower adjacent to forest disturbances from timber harvest than in undisturbed forest stands (*Boves 2011*). Similar relationships with cerulean reproduction and edges created by mining might be expected, although these relationships need to be documented.

Reclaimed coal mine lands can also provide habitat that supports upland game bird populations, including Northern Bobwhite (*Colinus virginiana*) (*Beckerle 2004*), American Woodcock (*Scolopax minor*) (*Gregg 1997*), Eastern Wild Turkey (*Meleagris gallopavo*) (*Rice 1986*), and Ruffed Grouse (*Bonasa umbellus*) (*Kimmel and Samuel 1984*). Although the potential for mine lands to contribute to Northern Bobwhite population recovery is cited in the National Bobwhite Conservation Initiative revised plan (*Palmer et al. 2011*), we were unable to locate any literature that demonstrated how this might be accomplished. Kentucky Department of Fish and Wildlife Resources (KDFWR), in

with the University of Tennessee, is conducting a northern bobwhite population ecology and habitat management project on Peabody Wildlife

Management area, a reclaimed coal mining area, which will generate information on how bobwhites are doing on reclaimed mine grasslands and how to enhance their habitat (J. Morgan, KDFWR, pers. comm.). Reclamation of mine lands in grasses and legumes provided poor quality grouse brood habitat, although later successional stages provided better brood habitat quality (*Kimmel and Samuel 1984*). Wild Turkeys used reclaimed mine lands extensively and densities on mine lands exceeded densities on nearby control areas (*Rice 1986*).

## 2.5 ECOLOGICAL EFFECTS OF PAVED ROADS INSIDE THE FOREST ON BIRDS

While the most obvious threat of paved roads to individual birds is injury or mortality due to vehicle collisions, this is often considered less compelling when compared to the more insidious effects of roads, such as behaviour modification or decreased population density, diversity, and/or breeding success (*Reijnen and Foppen 1994, Forman and Alexander 1998, Jacobson 2005, Ramp et al. 2006, Reijnen and Foppen 2006*). However, in some cases, direct road mortality is the major threat to a population (*Mumme et al. 2000, Ramsden 2003, Reijnen and Foppen 2006*). Given the vast network of roads in combination with other persistent anthropogenic factors at work (e.g., habitat loss, fragmentation, non-native species invasions, climate change), the potential impact of road mortality on specific wildlife populations should not be dismissed (*Erritzoe et al. 2003, Glista et al. 2008*).

Many studies report that certain species of birds avoid roads, paved or otherwise, when selecting habitat during some part of their life cycle (*Ferrer and Harte 1997, Parrish et al. 2001, Sara and DiVittorio 2003, Bollinger and Gavin 2004, Arcos and Salvadores 2005, Balbontin 2005, Carrascal et al. 2006, Gavashelishvili and McGrady 2006*). The risk of nest abandonment can also increase near roads (*Gorog et al. 2005*). In an extreme case, Great Bustard populations in Portugal appear to be concentrating themselves geographically, with new road building responsible for three of the local population declines (*Pinto et al. 2005*). Long-term trends suggest the Portuguese population may ultimately become confined to a single high-quality site, thereby increasing the probability of extinction (*Pinto et al. 2005*). For those species which use

roadways as habitat, maintenance activities to roads and ditches can inadvertently destroy nests, a particular concern for declining species such as the Burrowing Owl (*Catlin and Rosenberg 2006*).

Road-related threats to bird populations deserve more attention, however, conservation or mitigation action is often considered to be warranted only after a population-level decline can be demonstrated (*Reijnen and Foppen 2006*). Many road-related bird studies are conducted in or adjacent to protected areas, illustrating there may be no panacea that escapes road-related impacts (*Reijnen and Foppen 1994, Bard et al. 2002, Gutzwiller and Barrow 2003, Clevenger et al. 2003, Frey and Conover 2006, Ramp et al. 2006*).

## 2.6 RECLAMATION PRACTICES

Coal mining results in large landscape changes as soils and vegetation are removed. Changes to forested areas can shift habitat availability and bird communities (*James and Wamer, 1982; Hardt and Forman, 1989; Bolger et al., 1991; Winter et al., 2000; Herzog et al., 2001; Galligan et al., 2006; Wickham et al., 2007; and Loss et al., 2009*). Several bird species have benefited in recent decades from the reclamation of surface coal mines (*Bajema et al. 2001, DeVault et al. 2002, Ingold 2002*). Burger (2011) defined four periods of reclamation: tree-planting by hand, grassland, shrub/scrub, and the Forest Reclamation Approach (FRA) (*Angel et al., 2005*).

Managing and reclaiming land to establish vegetation patches (e.g., grasslands, forest, wetlands, early succession) of different stages can provide habitat for diverse wildlife and aquatic species. Restoring a diverse community of native and site-adapted vegetation that includes a variety of structural features is the first step to attract wildlife species (*Brenner and Kelly 1981; Camenzind 1984; Parmenter and MacMahon 1990*).

Birds are generally one of the first types of wildlife to visit a mine site following reclamation due to their mobility and active search for suitable habitat (*Brändle et al. 2003*). Many bird species are not restricted to a single vegetation type, but rather depend on some combination of early successional habitat, open

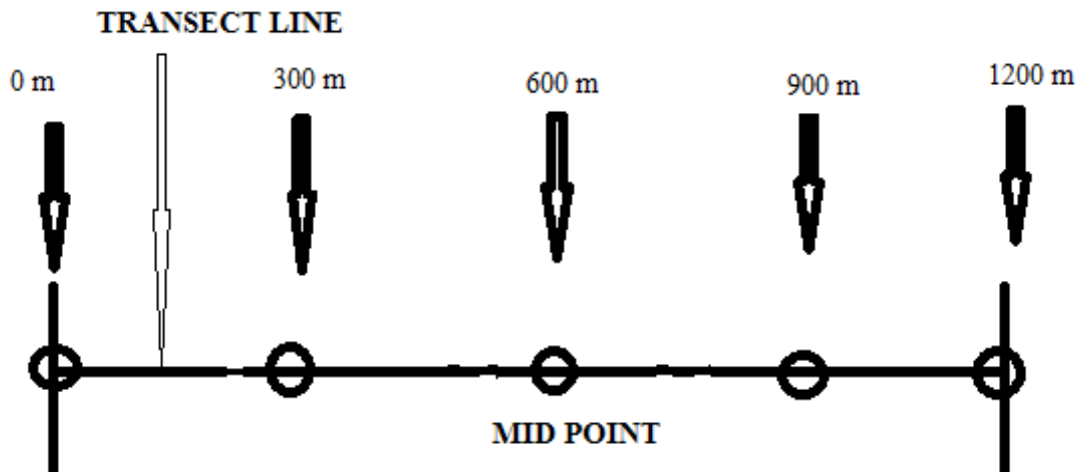
areas, and young and mature forests to find food and shelter and raise young (*Hunter et al. 2001*).

Although mining activities can have several negative impacts on wildlife populations, animals can return to reclaimed areas after mining if reclamation produces suitable habitat and individuals that can serve as colonists persist in the surrounding area. Site characteristics created by reclamation and the development of post-mining vegetation and habitat features influence the types of wildlife that use mined sites. The reclamation process provides habitat management opportunities for some species; through various reclamation techniques and procedures, mine lands can be manipulated to attract and support desired wildlife species (*Scott and Zimmerman 1984*).

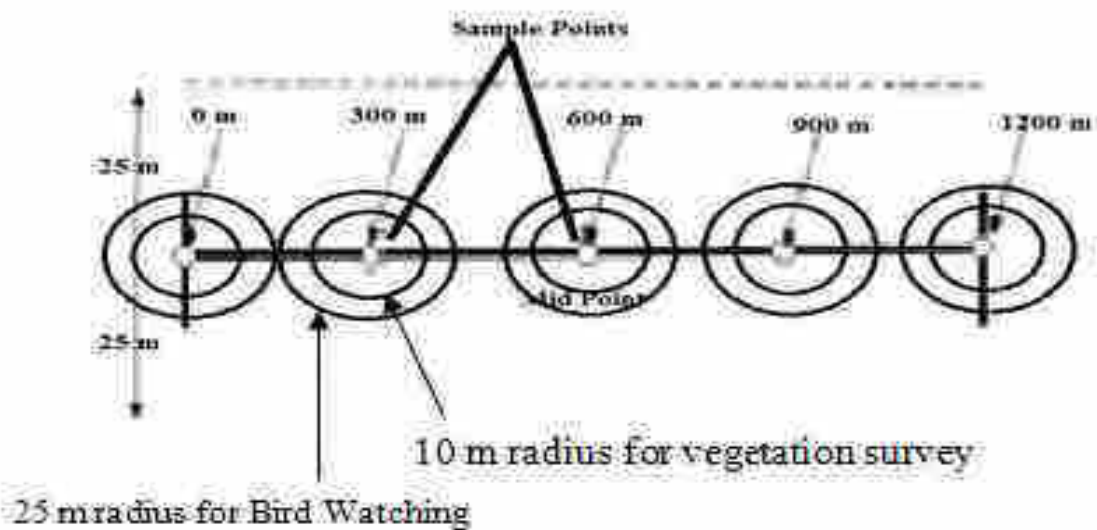
## CHAPTER 3

### METHODOLOGY

**3.1 Line Transect Methodology:** Line transects method had been applied for the bird count and their habitat survey. Line-transect distance sampling methods were also used to estimate the abundance of many biological populations such as animals, birds and plant species including nonliving things. In a line-transect survey method, an observer moves along a transect line and note the location of all birds detected to the line (*Bird census and survey techniques, Richard D. Gregory, David W. Gibbons, and Paul F. Donald, 2004*).



**Fig 3.1: Line Transect Methodology**



**Fig 3.2: Detail survey methodology of Line Transect Methodology**

### 3.2 Basic procedures in line transect sampling

Two types of data are recorded in line transect sampling, as shown in data collection point page no. 20. These are either (1) the perpendicular distances from the transect line  $x$  or (2) the sighting distances  $r$  and angles  $\theta$ . However, studies based on sighting distances and angles have been found to be subject to biases and are only discussed briefly here.

The usual assumptions made with line transect sampling are the following:

1. All objects on the transect line are detected.
2. Objects do not move in response to the observer before the detection is recorded.
3. Objects are only counted once.
4. Objects are recorded at the point of initial detection.
5. Distances are measured without errors.
6. Transect lines are randomly located in the study area.

A further assumption sometimes made for the estimation of standard errors is that

7. Sightings are independent events, and the number of objects detected follows a Poisson distribution.

### 3.3 Field survey

The field survey technique to observe the abundance of wildlife, avifauna, habitat, nesting pattern & surrounding vegetation in core zone applied seasonally; to estimate the current status of species diversity of avifauna & wildlife in the mining area. On the basis of species of wildlife & avifaunal diversity survey; it should be easy to determine the ecological behavior of each individual species and resulting to develop alternate habitat of affected avifauna & wildlife conservation plan at the 5-10 km periphery or buffer zone of the mining area.

Total 26 line transect was taken in the core and buffer zone during the first second and third seasonal survey i.e. summer, winter and autumn Season. During the field surveys, we made a line transect of 1200 m (mostly used a path



/ trail followed by the villagers to enter in the forest) in which distance sampling were taken in every 300 m in the transect to estimate the population of avifauna, its habit, habitat and nesting pattern including the floral diversity of the proposed mining area. A circular sample plot of 10 m radius had been taken in each transect at an interval of 300 m i.e. total 5 sample plots made in one transect namely 0m, 300m, 600m, 900m, 1200m in which vegetation composition (grass, herb, shrub and regeneration) and all tree species data had been taken including height and girth along with the counting of avifauna & wildlife. The data sheets used during the field survey are as follows:

**Table N0. 3.1: Datasheet for bird status survey**

Date: ----- Cell-ID: ----- Team: -----, Trail-length: -----

GPS at every 300 m			Sighting information					Remark	
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing			Observation
						A	T		

**Table No 3.2: Datasheet for habitat study at every 300 m on the transect line**

Date: ----- Cell-ID: ----- Team: -----, Trail-length: -----

S · N ·	GPS Location		Time (hrs.)	Land cover (100 m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)	
	Lat.	Long.			B / A / G / W / S	Tree spp.	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub		Regeneration

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

\* Land cover – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

\*\* Human structure – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

\*\*\* Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

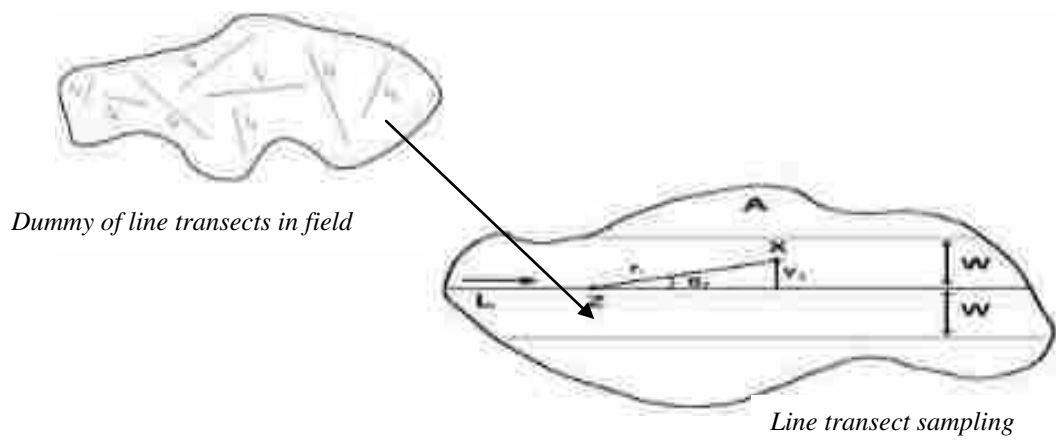
**Table No 3.3: Datasheet for wildlife study on transect line**

Date: \_\_\_\_\_ Cell-ID: \_\_\_\_\_ Team: \_\_\_\_\_ Trail-length: \_\_\_\_\_

GPS at every 300 m			Sighting information							
S. N.	Latitude	Longitude	Wildlife Species			Perp. Dist.	Bearing		Type of Species	Observation
			Direct Sighting	Indirect Sighting	Number		A	T		

**Basic concepts of line-transect sampling**

**a) Data collection (overview)**



**L** = transect line, **Z** = position of observer, **X** = position of object, **W** = strip width (1/2), **r<sub>i</sub>** = sighting distance (flushing distance), **θ<sub>i</sub>** (theta) = sighting angle, **y<sub>i</sub>** = perpendicular distance (note:  $y_i = r_i \sin \theta_i$ )

## CHAPTER 4

## OBSERVATIONS, DATA COLLECTION AND ANALYSIS

## 4.1 SUMMER SEASON SURVEY

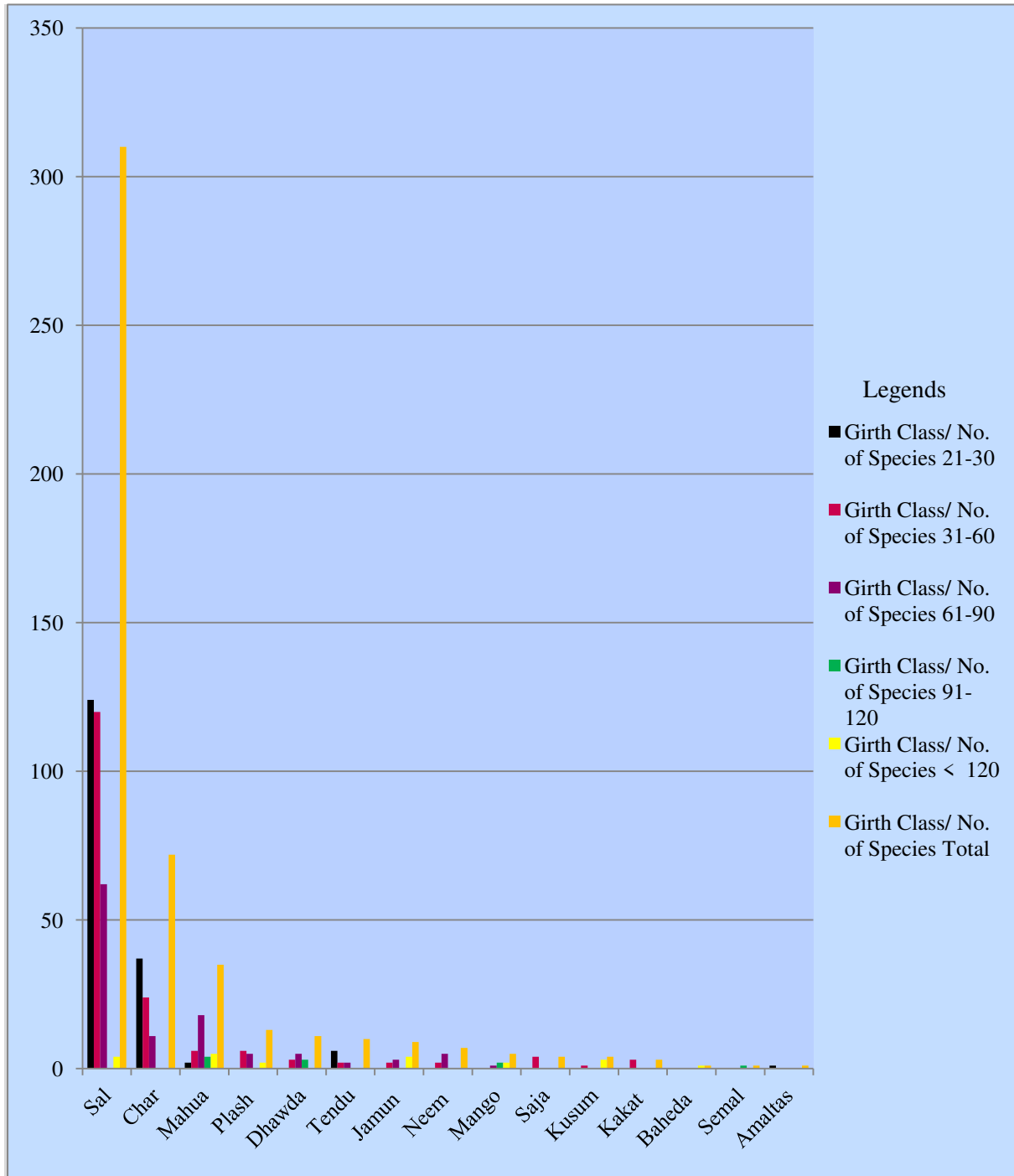
## 4.1.1 Floral diversity of study site

On the basis of the field survey, the data have been collected and analyzed. The core and buffer zone vegetation of study area are mainly surrounded by dominated tree species i.e. Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Palash (*Butea monosperma*), Dhawda (*Anogeissus latifolia*), Tendu (*Diospyros melanoxylon*), Jamun (*Syzygium cumini*), Neem (*Azadirachta indica*), Mango (*Mangifera indica*), Saja (*Terminalia tomentosa*), Kusum (*Schleichera oleosa*), Kekat (*Garuga pinnata*), Baheda (*Terminalia bellerica*), Semal (*Bombax ceiba*) and Amaltash (*Cassia fistula*) etc. Floral diversity data have been recorded and tabulated during the seasonal field survey of core and buffer zone of proposed mining site is given below in table no 4.1

Table No. 4.1: Floral diversity along with girth class of study site

Summary of available tree species in 35 sample plot (Total area = 10,995.6 m square)								
S. no.	Tree Species	Girth Class					Total	Regeneration Status
		21-30	31-60	61-90	91-120	< 120		Up to 20 cm
1	Sal	124	120	62	0	4	310	10
2	Char	37	24	11	0	0	72	47
3	Mahua	2	6	18	4	5	35	1
4	Palash	0	6	5		2	13	0
5	Dhawda	0	3	5	3	0	11	8
6	Tendu	6	2	2	0	0	10	4
7	Jamun	0	2	3	0	4	9	0
8	Neem	0	2	5	0	0	7	3
9	Mango	0	0	1	2	2	5	0
10	Saja	0	4	0	0	0	4	0
11	Kusum	0	1	0	0	3	4	0
12	Kakat	0	3	0	0	0	3	0
13	Baheda	0	0	0	0	1	1	0
14	Semal	0	0	0	1	0	1	0
15	Amaltas	1	0	0	0	0	1	0

**Area details : Total number of transect = 7; Total number of plots = 7x5 = 35; Area of one sample plot = 314.16 m Square**



**Graph 4.1: Floral diversity along with girth class of study site**

**Overall vegetation cover -** The data of all 7 transect have been recorded which is given in table no 4.2

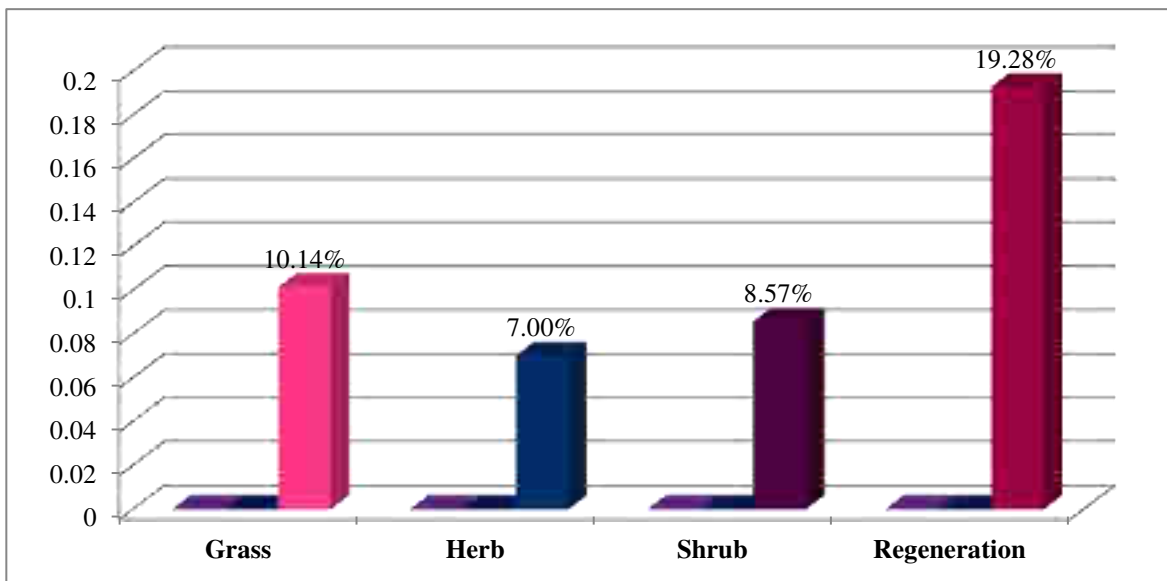
**Table No. 4.2: Average vegetation percentage of study site**

Transect No.	Grass	Herb	Shrub	Reg.
1	9%	9%	8%	25%
2	7%	8%	12%	31%
3	5%	9%	10%	28%
4	3%	5%	6%	2%
5	7%	13%	9%	19%
6	32%	10%	5%	15%

7	8%	11%	10%	14%
<b>Average</b>	<b>71%</b>	<b>65%</b>	<b>60%</b>	<b>135%</b>
<b>% (Total average divided by 7)</b>	<b>10.14%</b>	<b>7.00%</b>	<b>8.57%</b>	<b>19.28%</b>

**Table no. 4.3 Overall vegetation cover of study site**

<b>Vegetation</b>	<b>Average</b>
<b>Grass</b>	<b>10.14%</b>
<b>Herb</b>	<b>7.00%</b>
<b>Shrub</b>	<b>8.57%</b>
<b>Regeneration</b>	<b>19.28%</b>



**Graph 4.2: Overall status of vegetation average percentage**

According to vegetation survey, it has been analyzed that the diversity of tree species categorized under five girth classes i.e. 21-30 cm, 31-60 cm, 61-90 cm, 91-120 cm followed by <120 cm whereas the overall vegetation comparison of floral diversity other than tree species have been analyzed in average percent i.e. grassland 10.14 %, herbs 7.00 %, shrubs 8.57 % and the regeneration average percentage is 19.28% (Table no. 4.3 and Graph 4.2).

#### **4.1.2 Avifauna**

According to seasonal survey, 405 individual belongs to 61 different bird species has been recorded. As per recorded data, it has been analyzed that the population of avifauna dominated by Scaly Breasted Munia, Green Bee Eater, Rose Ringed Parakeet, Red Vented Bulbul, Indian Roller, Common Myna and Black Drongo etc. Mostly the birds found during the survey are endemic and

resident. The avifaunal diversity of study site have been tabulated in table no 4.4 and graph 4.3.

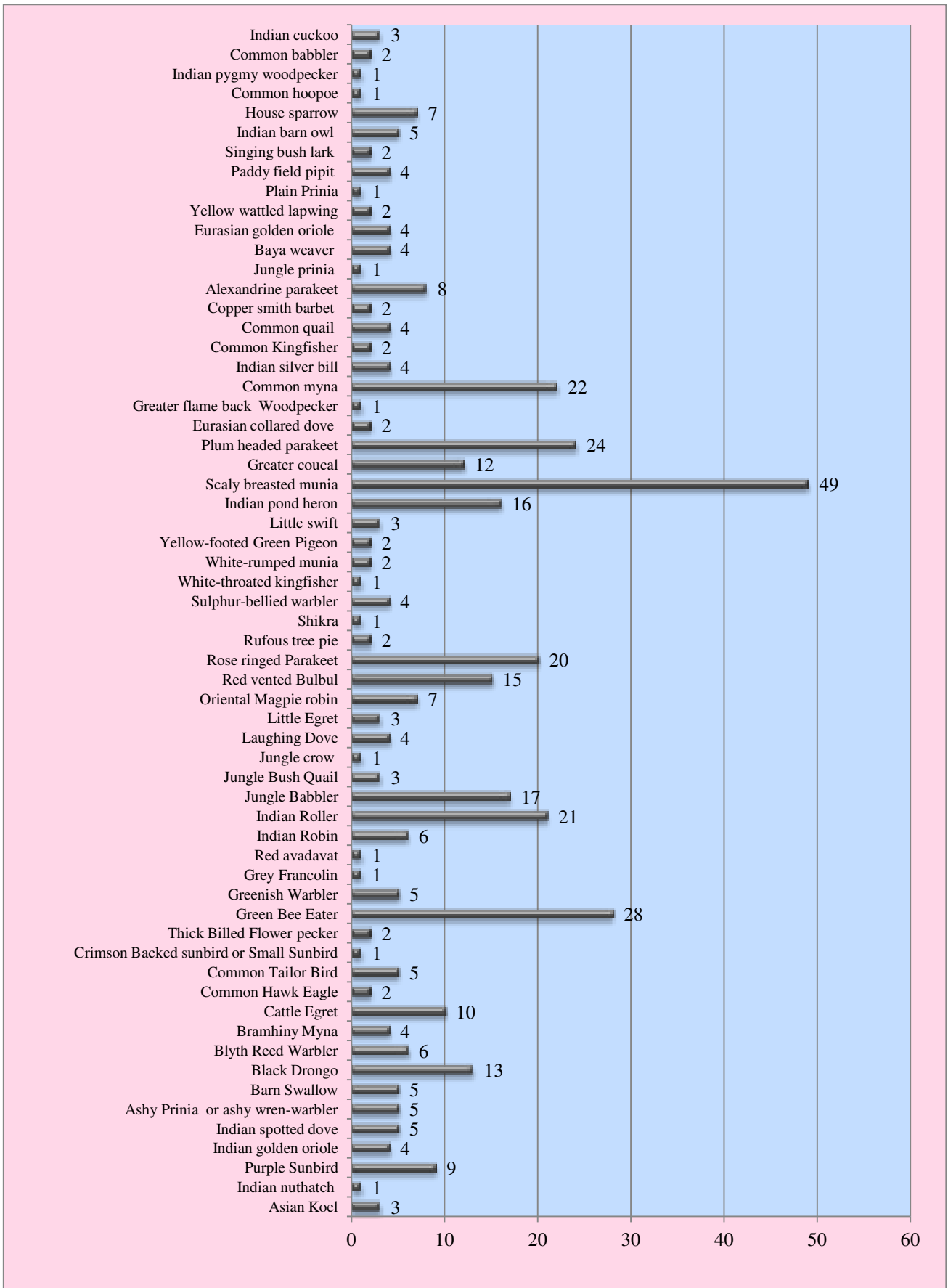
**Table No. 4.4: Check list of birds species in summer season**

S. No.	Common Name	Local Name	Zoological Name	Number of Birds	Family	IUCN Status
1	Asian Koel	Koel, Cuckoo	<i>Eudynamys scolopacea</i>	03	Cuculidae	LC
2	Indian Nuthatch	-	<i>Sitta casetana</i>	01	Sittidae	LC
3	Purple Sunbird	-	<i>Nectarania asiatica</i>	09	Nectariniini	LC
4	Indian Golden Oriole	-	<i>Oriolus oriolus kundoo</i>	04	Oriolidae	LC
5	Indian Spotted Dove	Padki	<i>Streptopelia chinensis</i>	05	Columbidae	LC
6	Ashy Prinia or Ashy Wren-warbler	-	<i>Prinia socialis</i>	05	Cisticolidae	LC
7	Barn Swallow	-	<i>Hirundo rustica</i>	05	Hirundinidae	LC
8	Black Drongo	Karrauna	<i>Dicrurus macrocercus</i>	13	Dicruridae	LC
9	Blyth Reed Warbler	-	<i>Acrocephalus dumetorum</i>	06	Acrocephalidae	LC
10	Bramhiny Myna	Maina	<i>Sturnia pagodarum</i>	04	Sturnidae	LC
11	Cattle Egret	Gay Bagula	<i>Bubulcus ibis</i>	10	Ardeidae	LC
12	Common Hawk Eagle	Cheel	<i>Hierococyx varius</i>	02	Cuculidae	LC
13	Common Tailor Bird	-	<i>Orthotomus sutorius</i>	05	Cisticolidae	LC
14	Crimson Backed Sunbird or Small Sunbird	-	<i>Leptocoma minima</i>	01	Nectariniidae	LC
15	Thick Billed Flower	-	<i>Dicaeum agile</i>	02	Dicaeidae	LC
16	Green Bee Eater	Patinga	<i>Merops orientalis</i>	28	Meropidae	LC
17	Greenish Warbler	-	<i>Phylloscopus trochiloides</i>	05	Phylloscopidae	LC
18	Grey Francolin	-	<i>Francolinus</i>	01	Phasianidae	LC
19	Red Avadavat	-	<i>Amandava amandava</i>	01	Estrildidae	LC
20	Indian Robin	Chirak	<i>Saxicoloides fulicatus</i>	06	Muscicapidae	LC
21	Indian Roller	Nilkanth/teohra	<i>Coracias benghalensis</i>	21	Coraciidae	LC
22	Jungle Babbler	Satbhaiya	<i>Turdoides striata</i>	17	Leiotherichidae	LC
23	Jungle Bush Quail	Titar	<i>Perdica asiatica</i>	03	Phasianidae	LC
24	Jungle Crow	Koua	<i>Corvus culminatus</i>	01	Corvidae	LC
25	Laughing Dove	Padki	<i>Spilopelia senegalensis</i>	04	Columbidae	LC
26	Little Egret	Kokda	<i>Egretta garzetta</i>	03	Ardeidae	LC
27	Oriental Magpie-robin	-	<i>Copsychus saularis</i>	07	Muscicapidae	LC
28	Red Vented Bulbul	Fikkadlow	<i>Pycnonotus cafer</i>	15	Pycnonotidae	LC
29	Rose Ringed Parakeet	Tota/Sua	<i>Psittacula krameri</i>	20	Psittaculidae	LC
30	Rufous Tree Pie	-	<i>Dendrocitta vagabunda</i>	02	Corvini	LC
31	Shikra	Cheel	<i>Accipiter badius</i>	01	Accipitridae	LC
32	Sulphur-Bellied Warbler	-	<i>Phylloscopus griseolus</i>	04	Acrocephalidae	LC
33	White-Throated Kingfisher	Kilkila	<i>Halcyon smyrnensis</i>	01	Alcedinidae	LC
34	White-Rumped Munia	-	<i>Lonchura striata</i>	02	Estrildidae	LC
35	Yellow-Footed Green	Kabootar	<i>Treron phoenicoptera</i>	02	Columbidae	LC
36	Little Swift	-	<i>Apus affinis</i>	03	Apodidae	LC
37	Indian Pond Heron	Khokho bakli	<i>Ardeola grayii</i>	16	Ardeidae	LC
38	Scaly Breasted Munia	-	<i>Lonchura punctulata</i>	49	Estrildidae	LC
39	Greater Coucal	Koyal	<i>Centropus sinensis</i>	12	Cuculidae	LC
40	Plum Headed Parakeet	Tota/Sua	<i>Psittacula cyanocephala</i>	24	Psittacidae	LC
41	Eurasian Collared Dove	Padki	<i>Streptopelia decaocto</i>	02	Columbidae	LC
42	Greater Flame Back	Katpodva	<i>Dryocopus martius</i>	01	Picidae	LC
43	Common Myna	Salhai/desimyna	<i>Acridotheres tristis</i>	22	Sturnidae	LC

**PROJECT REPORT ON WILDLIFE AND AVIFAUNA CONSERVATION PLAN FOR THE OCP CHAAL, DHARAMJAIGARH AREA**

44	Indian Silver Bill	-	<i>Euodice malabarica</i>	<b>04</b>	Estrildidae	LC
45	Common Kingfisher	Kilkila	<i>Alcedo atthis</i>	<b>02</b>	Alcedinidae	LC
46	Common Quail	Titar	<i>Coturnix coturnix</i>	<b>04</b>	Phasianidae	LC
47	Copper Smith Barbet	-	<i>Psilopogon</i>	<b>02</b>	Megalaimidae	LC
48	Alexandrine Parakeet	-	<i>Psittacula eupatria</i>	<b>08</b>	Psittacidae	LC
49	Jungle Prinia	-	<i>Prinia sylvatica</i>	<b>01</b>	Cisticolidae	LC
50	Baya Weaver	Gauraiya	<i>Ploceus philippinus</i>	<b>04</b>	Ploceidae	LC
51	Eurasian Golden Oriole	-	<i>Oriolus oriolus</i>	<b>04</b>	Oriolidae	LC
52	Yellow Wattled Lapwing	-	<i>Vanellus malabaricus</i>	<b>02</b>	Charadriidae	LC
53	Plain Prinia	-	<i>Prinia inornata</i>	<b>01</b>	Cisticolidae	LC
54	Paddy Field Pipit	-	<i>Anthus rufulus</i>	<b>04</b>	Motacillidae	LC
55	Singing Bush Lark	-	<i>Mirafra javanica</i>	<b>02</b>	Alaudidae	LC
56	Indian Barn Owl	-	<i>Tyto alba</i>	<b>05</b>	Tytonidae	LC
57	House Sparrow	Gouriaya	<i>Passer domesticus</i>	<b>07</b>	Passeridae	LC
58	Common Hoopoe		<i>Upupa epops</i>	<b>01</b>	Upupidae	LC
59	Indian Pygmy	-	<i>Yungipicus nanus</i>	<b>01</b>	Picidae	LC
60	Common Babbler	-	<i>Turdoides caudate</i>	<b>02</b>	Lieothrichidae	LC
61	Indian Cuckoo	-	<i>Cuculus micropterus</i>	<b>03</b>	cuculidae	LC
<b>Total</b>				<b>405</b>		





Graph No. 4.3: Status of individual avifauna species found in OCP Chhal

## 4.2 WINTER SEASON SURVEY

### 4.2.1 Floral diversity of study site

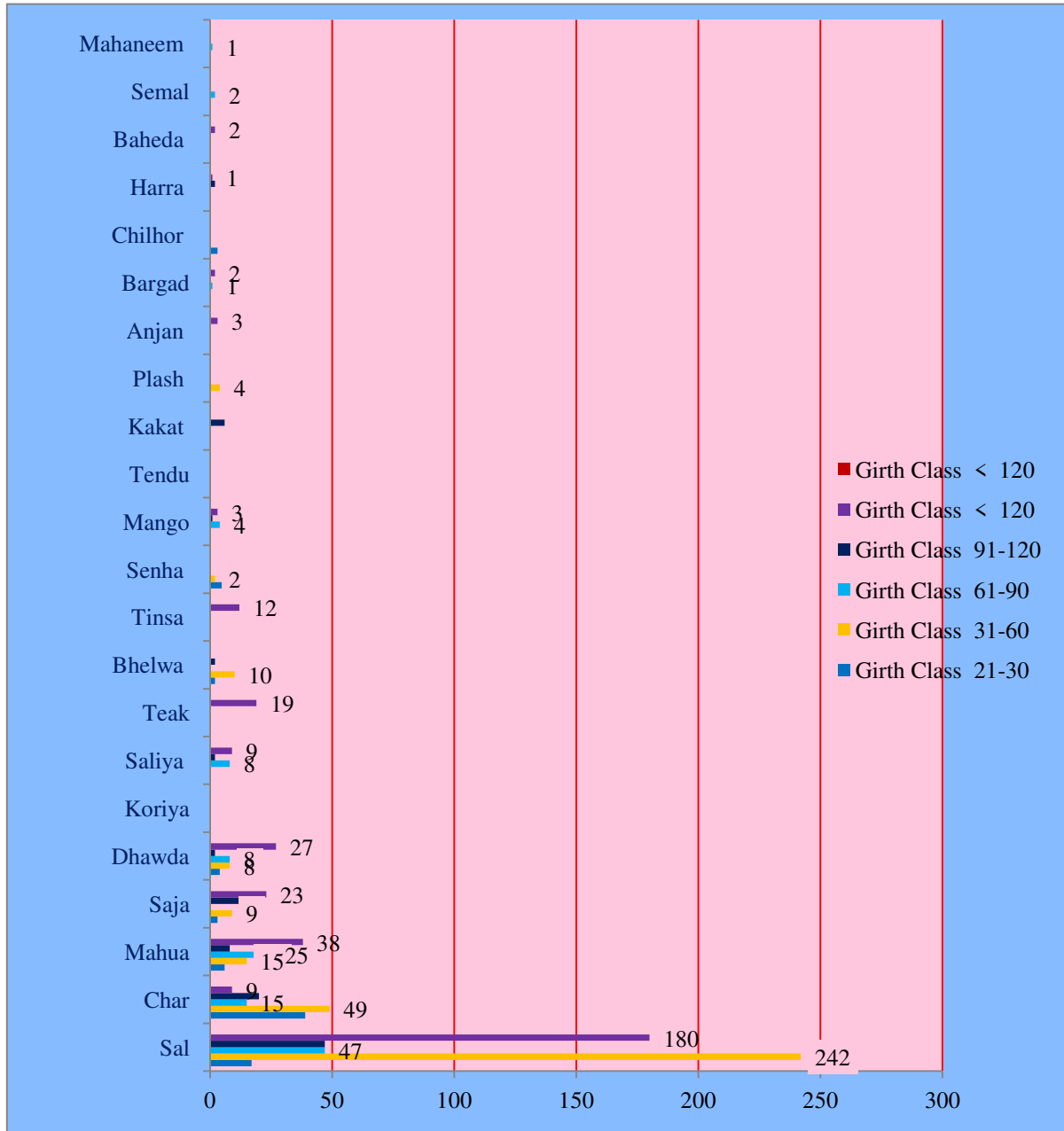
On the basis of the field survey, the data had been collected and analyzed. That the core and buffer zone vegetation of study area are mainly surrounded by dominated tree species i.e. Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Saja (*Terminalia tomentosa*), Dhawda (*Anogeissus latifolia*), Koriya (*Pinus koraiensi*), Teak (*Tectona grandis*), Bhelwa (*Semecarpus anacardium*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Tendu (*Diospyros melanoxylon*), Kekad (*Garuga pinnata*), Plash (*Butea monosperma*), Anjan (*Hardwickia binata*), Bargad (*Ficus bengalensis*), Harra (*Terminalia chebula*), Baheda (*Terminalia bellerica*), Semal (*Bombax ceiba*), Jamun (*Syzygium cumini*) and Mahaneem (*Ailanthus excelsa*) etc. Floral diversity data have been recorded and tabulated during the seasonal field surveys of core and buffer zone of proposed mining site given below in table no 4.5.

**Table No. 4.5: Floral diversity along with girth class in study site**

Summary of available tree species in 60 sample plot (Total area = 18,849.6 m square)								
S. no.	Tree Species	Girth class						Regeneration status
		21-30	31-60	61-90	91-120	< 120	Total	Up to 20 cm
1	Sal	17	242	47	47	180	533	17
2	Char	39	49	15	20	9	132	12
3	Mahua	06	15	25	08	38	92	0
4	Saja	03	09		16	23	51	0
5	Dhawda	04	08	08	02	27	49	0
6	Koriya	0	0	0	0	0	0	33
7	Saliya	0	0	08	02	09	19	0
8	Teak	0	0	0	0	19	19	0
9	Bhelwa	02	10	0	2		14	0
10	Tinsa	0	0	0	0	12	12	0
11	Senha	07	02	0	0	0	09	0
12	Mango	0	0	04	01	03	08	0
13	Tendu	0	0	0	0	0	0	08
14	Kakat	0	0	0	06	0	06	0
15	Plash	0	04	0	0	0	04	0
16	Anjan	0	0	0	0	03	03	0
17	Bargad	0	0	01	0	02	03	0
18	Chilhor	03	0	0	0	0	03	0

19	Harra	0	0	0	02	01	03	0
20	Baheda	0	0	0	0	02	02	0
21	Semal	0	0	02	0	0	02	0
22	Mahaneem	0	0	01	0	0	01	0

Area details : Total number of transect = 12; Total number of plots = 12x5 = 60; Area of one sample plot = 314.16 m Square

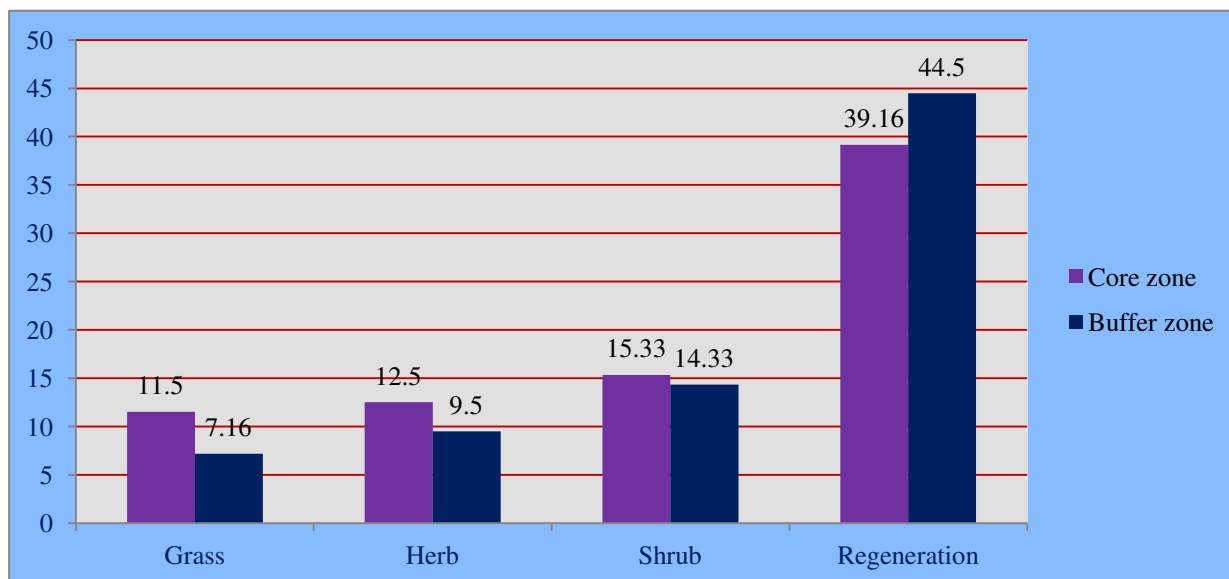


Graph 4.4: Floral diversity along with girth class in study site

4.2.2 Overall vegetation cover – The data of all 12 transect have been recorded which is given below in table no.4.6

Table No. 4.6: Average vegetation percentage of core and buffer zone

Vegetation	Core zone	Buffer zone
Grass	11.5%	7.16%
Herb	12.5%	9.5%
Shrub	15.33%	14.33%
Regeneration	39.16%	44.5%



Graph 4.5: Overall vegetation comparisons of core and buffer zone

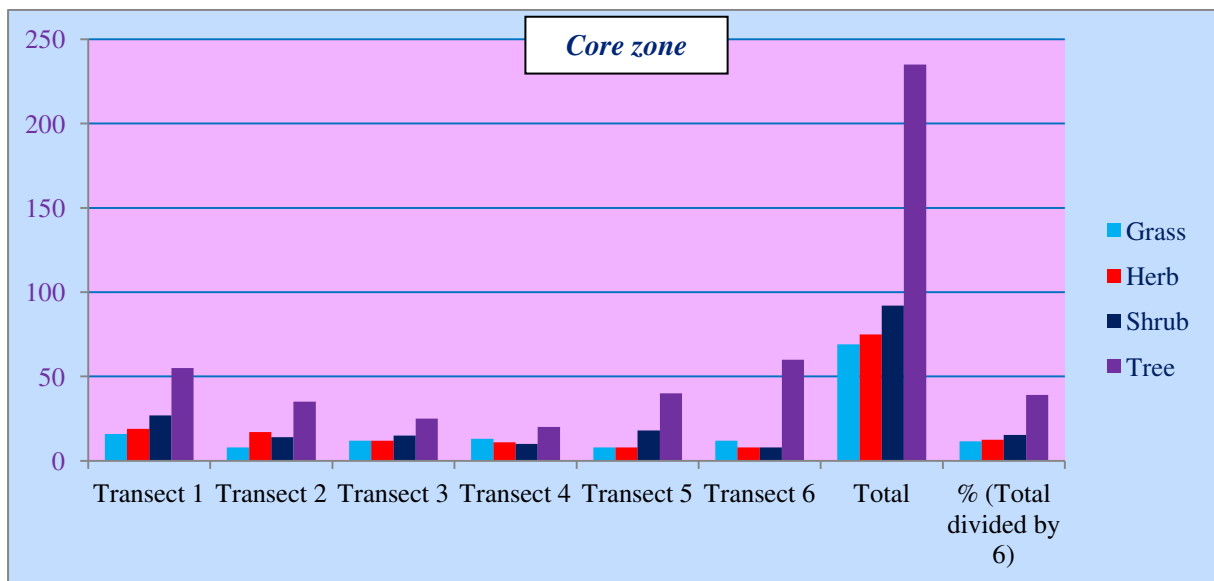
According to vegetation survey, it has been analyzed that the diversity of tree species categorized under five girth classes i.e. 21-30 cm, 31-60 cm, 61-90 cm, 91-120 cm followed by above 120 cm which shows in the table no 4.5 and graph 4.4 whereas the overall vegetation comparison of floral diversity other than tree species are recorded in percent i.e. grassland 11.5:7.16 %, herbs 12.5:9.5 %, shrubs 15.33:14.33 % and the regeneration percentage is 39.16:44.5 % (Table no 4.6 and Graph 4.5).

#### 4.2.3 Core zone

The core zone area comprises about 185.155 hectare. The winter seasonal field visits have been conducted in December 2018. The observation shows floral phenology of core zone in mining area is mostly dominated by Sal (*Shorea robusta*) species followed by Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Saja (*Terminalia tomentosa*), Dhawda (*Anogeissus latifolia*) etc.

**Table No. 4.7: Vegetation covers percentage of core mining area.**

S. No.	Grass	Herb	Shrub	Tree
1	16%	19%	27%	55%
2	8%	17%	14%	35%
3	12%	12%	15%	25%
4	13%	11%	10%	20%
5	8%	8%	18%	40%
6	12%	8%	8%	60%
<b>Average</b>	<b>69%</b>	<b>75%</b>	<b>92%</b>	<b>235%</b>
<b>% (Total average divided by 6)</b>	<b>11.5%</b>	<b>12.5%</b>	<b>15.33%</b>	<b>39.16%</b>



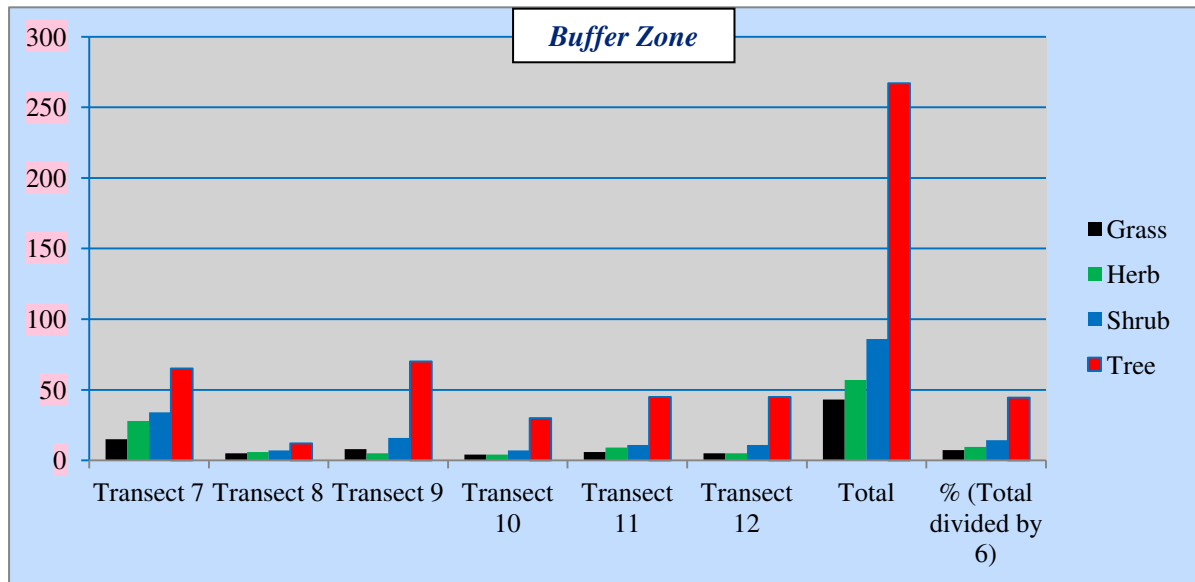
**Graph 4.6: Vegetation composition of core zone**

#### 4.2.3 Buffer zone:

The buffer zone of mining area is situated at 5-10 km distance from the core mining boundary. The floral vegetation diversity of buffer zone is illustrated in graph 4.7 and tabulated in table no 4.8.

**Table No 4.8: Vegetation percentage of buffer zone.**

S. No.	Grass	Herb	Shrub	Tree
1	15	28	34	65
2	5	6	7	12
3	8	5	16	70
4	4	4	7	30
5	6	9	11	45
6	5	5	11	45
<b>Average</b>	<b>43</b>	<b>57</b>	<b>86</b>	<b>267</b>
<b>% (Total average divided by 6)</b>	<b>7.16</b>	<b>9.5</b>	<b>14.33</b>	<b>44.5</b>



Graph 4.7: Vegetation composition of buffer zone

#### 4.2.4 Avifauna diversity

According to seasonal survey, 776 individual belongs to 89 different species has been recorded. As per recorded data, the population of avifauna dominated by Indian Pond Heron, Black Drongo, Red Vented bulbul, Indian Roller and Common Myna. Mostly the birds found during the survey are endemic and resident. The avifaunal diversity of mining area are tabulated in table no 4.9 and graph 4.8.

Table No 4.9: Checklist of avifauna recorded in the study site

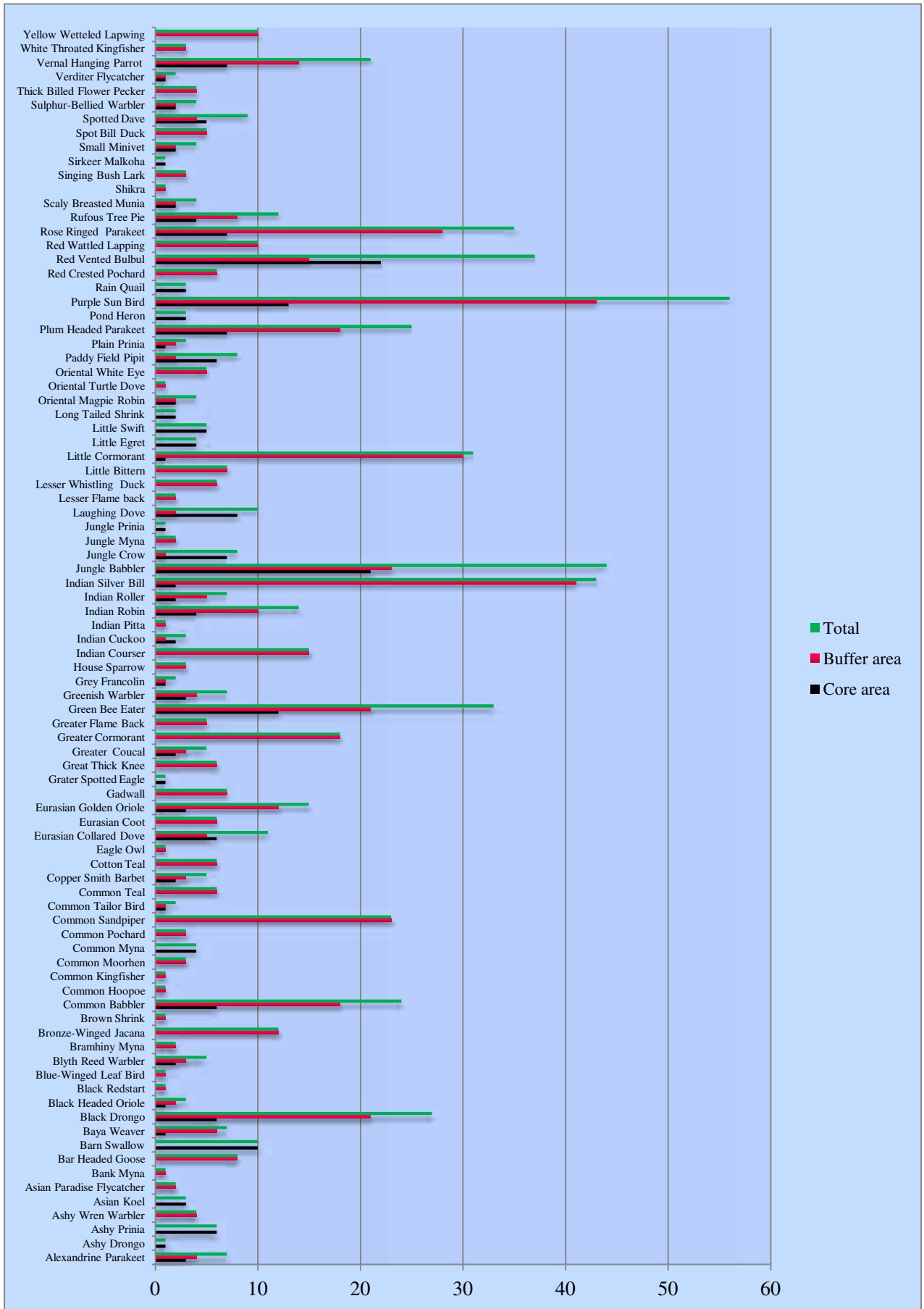
S. No	Common Name	Local Name	Scientific Name	Family	IUCN Status	Core zone	Buffer zone	No of birds
1	Alexandrine Parakeet	Parrot, Tota	<i>Psittacula eupatria</i>	Psittacidae	NT	3	4	7
2	Ashy Drongo	-----	<i>Dicrurus leucophaeus</i>	Dicruridae	LC	1		1
3	Ashy Prinia	-----	<i>Prinia socialis</i>	Cisticolidae	LC	6		6
4	Ashy Wren Warbler	-----	<i>Prinia socialis</i>	Cisticolidae	LC		4	4
5	Asian Koel	Koel, Cuckoo	<i>Eudynamys</i>	Cuculidae	LC	3		3
6	Asian Paradise Flycatcher	-----	<i>Terpsiphone paradisi</i>	Monarchidae	LC		2	2
7	Bank Myna	Myna	<i>Acridotheres ginginianus</i>	Sturnidae	LC		1	1
8	Bar Headed Goose	-----	<i>Anser indicus</i>	Anatidae	LC		8	8
9	Barn Swallow	-----	<i>Hirundo rustica</i>	Hirundinidae	LC	10		10
10	Baya Weaver	Gauraiya	<i>Ploceus philippinus</i>	Ploceidae	LC	1	6	7
11	Black Drongo	Karrauna	<i>Dicrurus macrocercus</i>	Dicruridae	LC	6	21	27

12	Black Headed Oriole	-----	<i>Oriolus larvatus</i>	Oriolidae	LC	1	2	3
13	Black Redstart	-----	<i>Phoenicurus ochruros</i>	Muscicapidae	LC		1	1
14	Blue-Winged Leaf Bird	-----	<i>Chloropsis cochinchinensis</i>	Chloropseidae	NT		1	1
15	Blyth Reed Warbler	-----	<i>Acrocephalus dumetorum</i>	Acrocephalidae	LC	2	3	5
16	Bramhiny Myna	Maina	<i>Sturnia pagodarum</i>	Sturnidae	LC		2	2
17	Bronze-Winged Jacana	-----	<i>Metopidius indicus</i>	Jacanidae	LC		12	12
18	Brown Shrink	-----	<i>Lanius cristatus</i>	Laniidae	LC		1	1
19	Common Babbler	-----	<i>Turdoides caudate</i>	Lieothrichidae	LC	6	18	24
20	Common Hoopoe	-----	<i>Upupa epops</i>	Upupidae	LC		1	1
21	Common Kingfisher	Kilkila	<i>Alcedo atthis</i>	Alcedinidae	LC		1	1
22	Common Moorhen	-----	<i>Gallinula chloropus</i>	Rallidae	LC		3	3
23	Common Myna	Salhai /desimyna	<i>Acridotheres tristis</i>	Sturnidae	LC	4		4
24	Common Pochard	-----	<i>Aythya ferina</i>	Anatidae	VU		3	3
25	Common Sandpiper	-----	<i>Actitis hypoleucos</i>	Scolopacidae	LC		23	23
26	Common Tailor Bird	-----	<i>Orthotomus sutorius</i>	Cisticolidae	LC	1	1	2
27	Common Teal	-----	<i>Anas crecca</i>	Anatidae	LC		6	6
28	Copper Smith Barbet	-----	<i>Psilopogon haemacephalus</i>	Megalaimidae	LC	2	3	5
29	Cotton Teal	-----	<i>Nettapus coromandelianus</i>	Anatidae	LC		6	6
30	Eagle Owl	Ullu	<i>Bubo bubo</i>	Strigidae	LC		1	1
31	Eurasian Collared Dove	Padki	<i>Streptopelia decaocto</i>	Columbidae	LC	6	5	11
32	Eurasian Coot	-----	<i>Fulica atra</i>	Rallidae	LC		6	6
33	Eurasian Golden Oriole	-----	<i>Oriolus oriolus</i>	Oriolidae	LC	3	12	15
35	Gadwall	-----	<i>Mareca strepera</i>	Anatidae	LC		7	7
36	Grater Spotted Eagle	-----	<i>Clanga clanga</i>	Accipitridae	VU	1		1
37	Great Thick Knee	-----	<i>Esacus recurvirostris</i>	Burhinidae	NT		6	6
38	Greater Coucal	Koyal	<i>Centropus sinensis</i>	Cuculidae	LC	2	3	5
39	Greater Cormorant	-----	<i>Phalacrocorax carbo</i>	Phalacrocoracidae	LC		18	18
40	Greater Flame Back	-----	<i>Chrysocolaptes guttacristatus</i>	Picidae	LC		5	5
41	Green Bee Eater	Patinga	<i>Merops orientalis</i>	Meropidae	LC	12	21	33
42	Greenish Warbler	-----	<i>Phylloscopus trochiloides</i>	Phylloscopidae	LC	3	4	7
43	Grey Francolin	-----	<i>Francolinus pondicerianus</i>	Phasianidae	LC	1	1	2
44	House Sparrow	Gouriaya	<i>Passer domesticus</i>	Passeridae	LC		3	3
45	Indian Courser	-----	<i>Cursorius coromandelicus</i>	Glareolidae	LC		15	15
46	Indian Cuckoo	-----	<i>Cuculus micropterus</i>	cuculidae	LC	2	1	3
47	Indian Pitta	-----	<i>Pitta brachyura</i>	Pittidae	LC		1	1

48	Indian Robin	Chirak	<i>Saxicoloides fulicatus</i>	Muscicapidae	LC	4	10	14
49	Indian Roller	Nilkanth/ teohra	<i>Coracias benghalensis</i>	Coraciidae	LC	2	5	7
50	Indian Silver Bill	-----	<i>Euodice malabarica</i>	Estrildidae	LC	2	41	43
51	Jungle Babbler	Satbhaiya	<i>Turdoides striata</i>	Leiothrichidae	LC	21	23	44
52	Jungle Crow	Koua	<i>Corvus culminatus</i>	Corvidae	LC	7	1	8
53	Jungle Myna	Maina	<i>Acridotheres fuscus</i>	Sturnidae	LC		2	2
54	Jungle Prinia	-----	<i>Prinia sylvatica</i>	Cisticolidae	LC	1		1
55	Laughing Dove	Padki	<i>Spilopelia senegalensis</i>	Columbidae	LC	8	2	10
56	Lesser Flame back	-----	<i>Dinopium benghalense</i>	Picidae	LC		2	2
57	Lesser Whistling Duck	-----	<i>Dendrocygna javanica</i>	Anatidae	LC		6	6
58	Little Bittern	-----	<i>Ixobrychus minutus</i>	Ardeidae	LC		7	7
59	Little Cormorant	-----	<i>Microcarbo niger</i>	Phalacrocoracidae	LC	1	30	31
60	Little Egret	Kokda	<i>Egretta garzetta</i>	Ardeidae	LC	4		4
61	Little Swift	-----	<i>Apus affinis</i>	Apodidae	LC	5		5
62	Long Tailed Shrink	-----	<i>Lanius schach</i>	Laniidae	LC	2		2
63	Oriental Magpie Robin	-----	<i>Copsychus saularis</i>	Muscicapidae	LC	2	2	4
64	Oriental Turtle Dove	-----	<i>Streptopelia orientalis</i>	Columbidae	LC		1	1
65	Oriental White Eye	-----	<i>Zosterops palpebrosus</i>	Zosteropidae	LC		5	5
66	Paddy Field Pipit	-----	<i>Anthus rufulus</i>	Motacillidae	LC	6	2	8
67	Plain Prinia	-----	<i>Prinia inornata</i>	Cisticolidae	LC	1	2	3
68	Plum Headed Parakeet	Tota/Sua	<i>Psittacula cyanocephala</i>	Psittacidae	LC	7	18	25
69	Pond Heron	Khokho bakli	<i>Ardeola grayii</i>	Ardeidae	LC	3		3
70	Purple Sun Bird	-----	<i>Nectarania asiatica asiatica</i>	Nectariniini	LC	13	43	56
71	Rain Quail	Quail	<i>Coturnix coromandelica</i>	Phasianidae	LC	3		3
72	Red Crested Pochard	-----	<i>Netta rufina</i>	Anatidae	LC		6	6
73	Red Vented Bulbul	Fikkadlow	<i>Pycnonotus cafer</i>	Pycnonotidae	LC	22	15	37
74	Red Wattled Lapping	-----	<i>Vanellus indicus</i>	Charadriidae			10	10
75	Rose Ringed Parakeet	Tota/Sua	<i>Psittacula krameri</i>	Psittaculidae	LC	7	28	35
76	Rufous Tree Pie	-----	<i>Dendrocitta vagabunda</i>	Corvini	LC	4	8	12
77	Scaly Breasted Munia	-----	<i>Lonchura punctulata</i>	Estrildidae	LC	2	2	4
78	Shikra	Cheel	<i>Accipiter badius</i>	Accipitridae	LC		1	1
79	Singing Bush Lark	-----	<i>Mirafra javanica</i>	Alaudidae	LC		3	3
80	Sirkeer Malkoha	-----	<i>Taccocua leschenaultii</i>	Cuculidae	LC	1		1



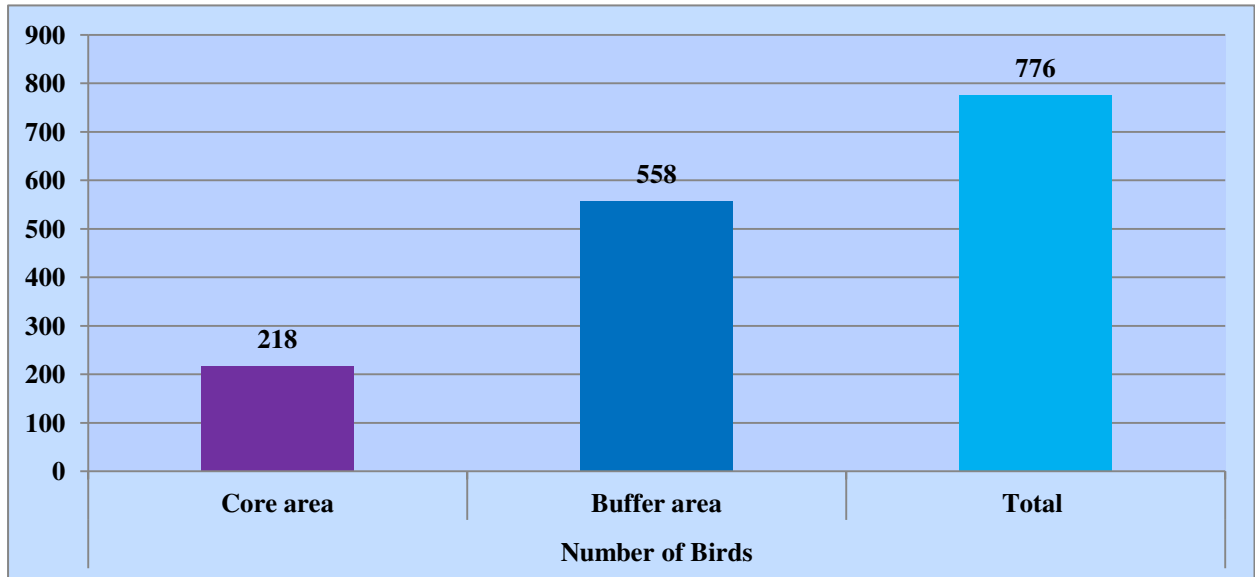
81	Small Minivet	-----	<i>Pericrocotus cinnamomeus</i>	Campephagidae	LC	2	2	4	
82	Spot Bill Duck	-----	<i>Anas poecilorhyncha</i>	Anatidae	LC		5	5	
83	Spotted Dave	-----	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC	5	4	9	
84	Sulphur-Bellied Warbler	-----	<i>Phylloscopus griseolus</i>	Acrocephalidae	LC	2	2	4	
85	Thick Billed Flower Pecker	-----	<i>Dicaeum agile</i>	Dicaeidae	LC		4	4	
86	Verditer Flycatcher	-----	<i>Eumyias thalassinus</i>	Muscicapidae	LC	1	1	2	
87	Vernal Hanging Parrot	-----	<i>Loriculus vernalis</i>	Psittaculidae	LC	7	14	21	
88	White Throated Kingfisher	Kilkila	<i>Halcyon smyrnensis</i>	Alcedinidae	LC		3	3	
89	Yellow Wetteled Lapwing		<i>Vanellus malabaricus</i>	Charadriidae	LC		10	10	
<b>Total</b>							<b>218</b>	<b>558</b>	<b>776</b>



Graph 4.8: Overview of recorded avifauna (2<sup>nd</sup> seasonal survey)

**Table No.4.10 Birds population difference between core and buffer zone**

S.No.	Number of birds		
	Core zone	Buffer zone	Total
2.	218	558	776



**Graph No.4.9 Birds population difference between core and buffer zone**

### 4.3 AUTUMN SEASON SURVEY

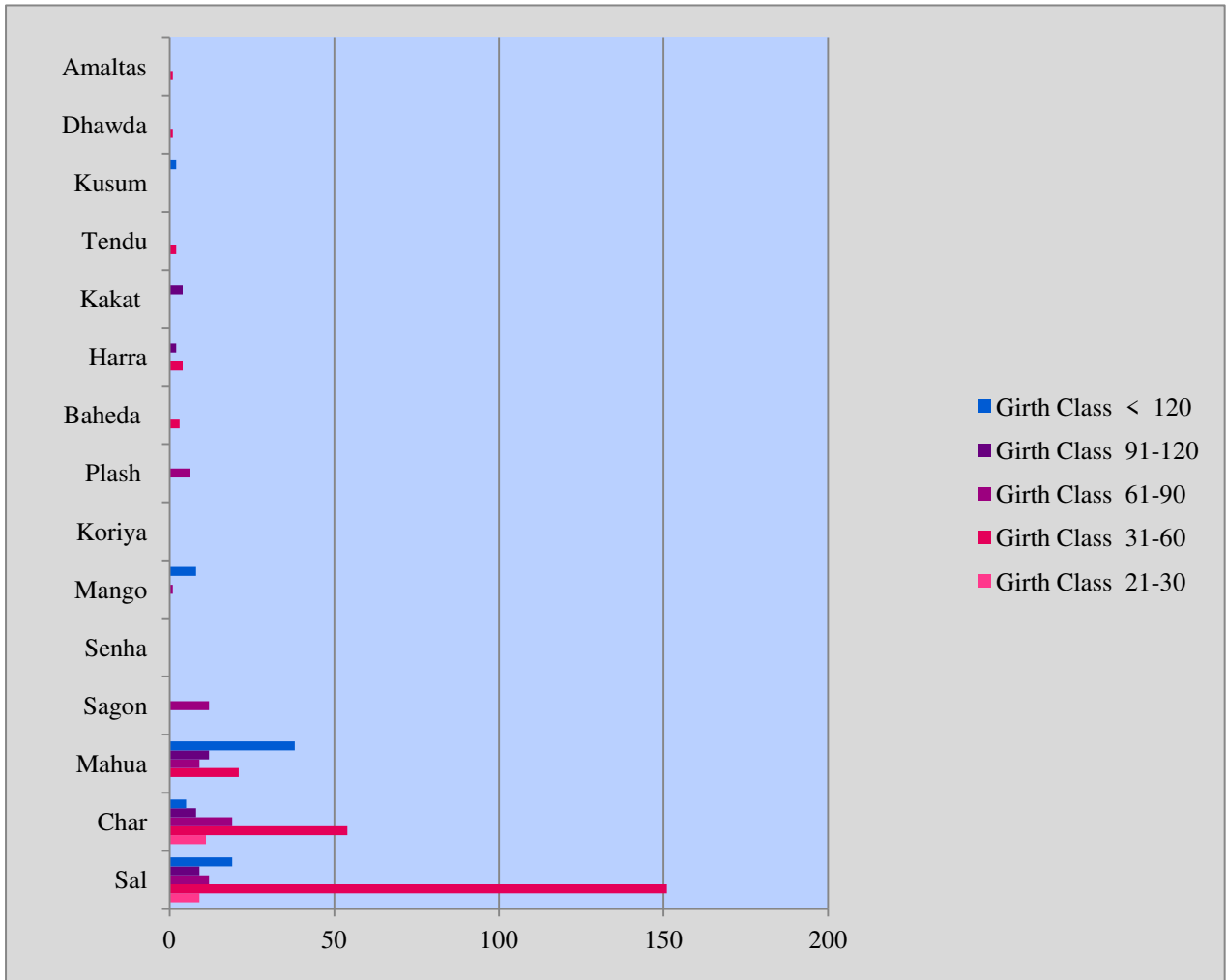
#### 4.3.1 Floral diversity of study site

On the basis of the field survey, the data had been collected and analyzed. That the core and buffer zone vegetation of study site are mainly surrounded by dominated tree species i.e. Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Teak (*Tectona grandis*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Koriya (*Pinus koraiensi*), Plash (*Butea monosperma*), Baheda (*Terminalia bellerica*), Harra (*Terminalia chebula*), Kekad (*Garuga pinnata*), Tendu (*Diospyros melanoxylon*), Dhawda (*Anogeissus latifolia*) and Amaltas (*Cassia fistula*) etc. Floral diversity data have been recorded and tabulated during the seasonal field surveys of core and buffer zone of proposed mining site is given below in table no 4.11

**Table No. 4.11: Floral diversity along with girth class in study site**

Summary of available tree species in 35 sample plot (Total area = 10,995.6 m square)								
S. no.	Tree species	Girth class						Regeneration status
		21-30	31-60	61-90	91-120	< 120	Total	Up to 20 cm
1	Sal	9	151	12	9	19	200	0
2	Char	11	54	19	8	5	97	7
3	Mahua	0	21	9	12	38	80	2
4	Sagon	0	0	12	0	0	12	3
5	Senha	0	0	0	0	0	0	12
6	Mango	0	0	1	0	8	9	0
7	Koriya	0	0	0	0	0	0	8
8	Plash	0	0	6	0	0	6	0
9	Baheda	0	3	0	0	0	3	3
10	Harra	0	4	0	2	0	6	0
11	Kakat	0	0	0	4	0	4	0
12	Tendu	0	2	0	0	0	2	0
13	Kusum	0	0	0	0	2	2	0
14	Dhawda	0	1	0	0	0	1	0
15	Amaltas	0	1	0	0	0	1	0

Area details : Total number of transect = 7; Total number of plots = 7x5 = 35 ; Area of one sample plot = 314.16 m square

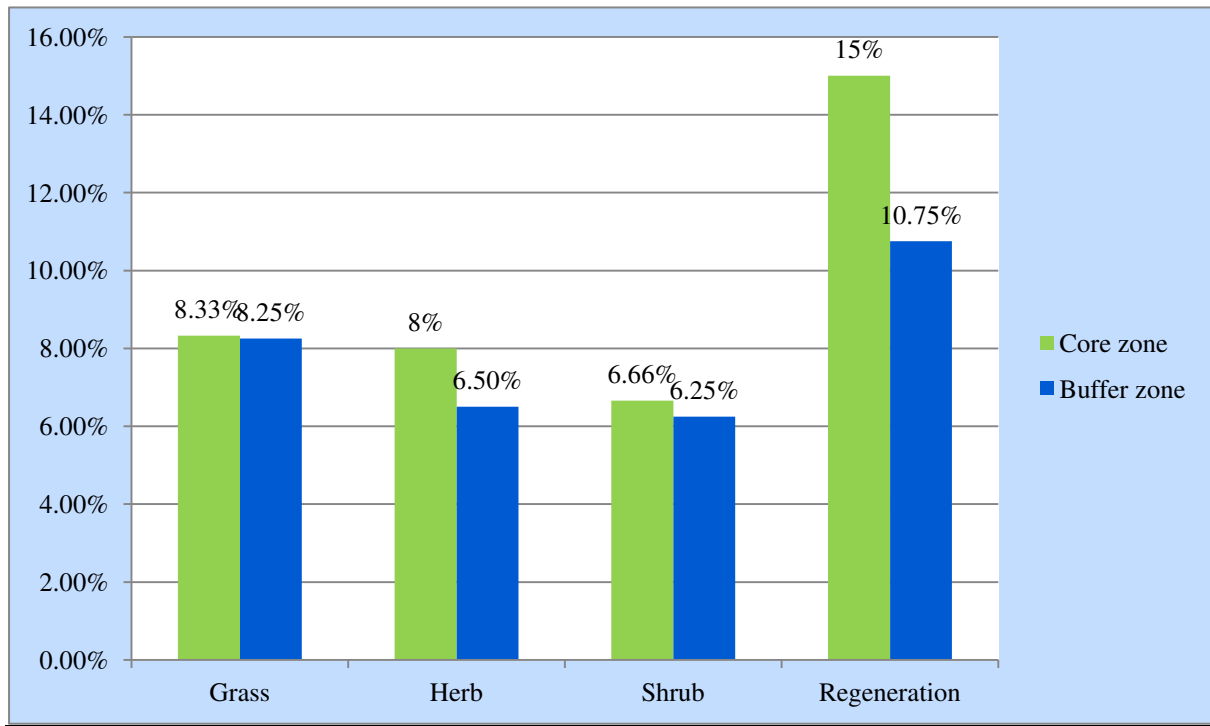


Graph 4.10: Floral diversity along with girth class in study site

**4.3.2 Overall vegetation cover** – The data of 7 transect have been recorded which is given below in table no 4.11

Table No. 4.12: Vegetation percentage of core and buffer zone

Vegetation	Core zone	Buffer zone
Grass	8.33%	8.25%
Herb	8%	6.50%
Shrub	6.66%	6.25%
Regeneration	15%	10.75%



**Graph 4.11: Vegetation comparisons of core and buffer zone**

According to vegetation survey, 7 transects with 5 intervals (7x5) in each sample plots have been drawn in the core and buffer zone respectively; in which the diversity of tree species categorized under five girth classes i.e. 21-30 cm, 31-60 cm, 61-90 cm, 91-120 cm followed by above 120 cm which shows in the table no 4.11 and graph 4.10 whereas the overall vegetation comparison of floral diversity other than tree species are recorded in percent i.e. grassland 8.33:8.25%, herbs 8:6.5%, shrubs 6.66:6.5% and the regeneration percentage is 15:10.75% (Table no 4.12 and Graph 4.11).

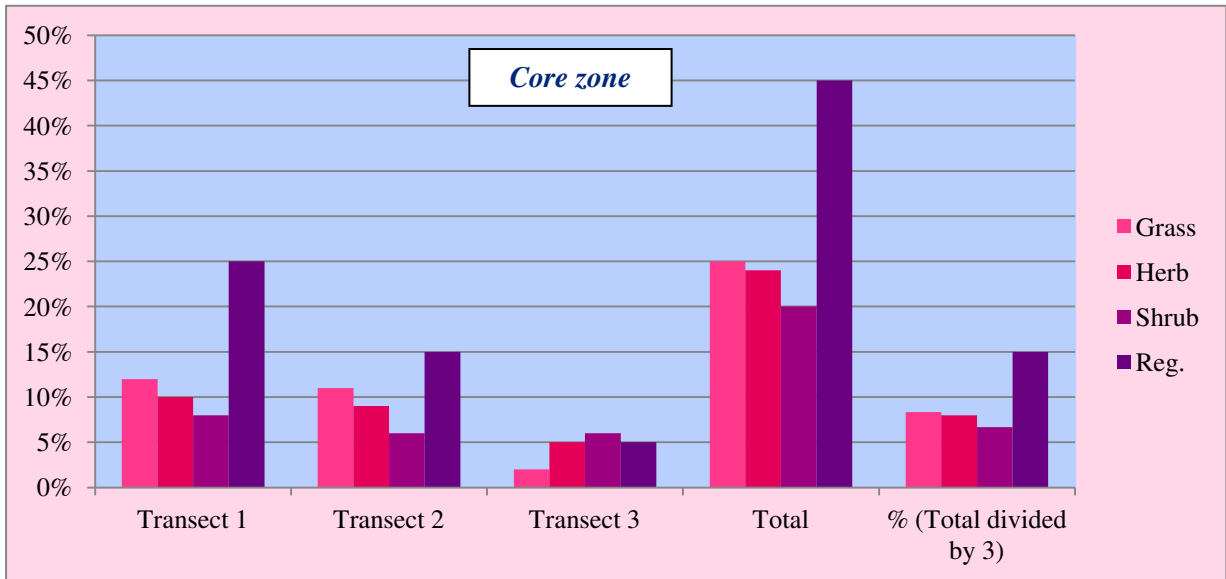
### 4.3.2 Core zone

The core zone comprises about 185.155 hectare. The third seasonal field visits were conducted in the month of March 2019. The observation shows the floral phenology of core zone in mining area is mostly dominated by Sal (*Shorea robusta*) species followed by Char (*Buchanania lanzan*)

**Table No. 4.13: Vegetation covers percentage of core mining area.**

Transect No.	Grass	Herb	Shrub	Reg.
1	12%	10%	8%	25%
2	11%	9%	6%	15%
3	2%	5%	6%	5%

<b>Average</b>	<b>25%</b>	<b>24%</b>	<b>20%</b>	<b>45%</b>
<b>% (Total average divided by 3)</b>	<b>8.33%</b>	<b>8%</b>	<b>6.66%</b>	<b>15%</b>



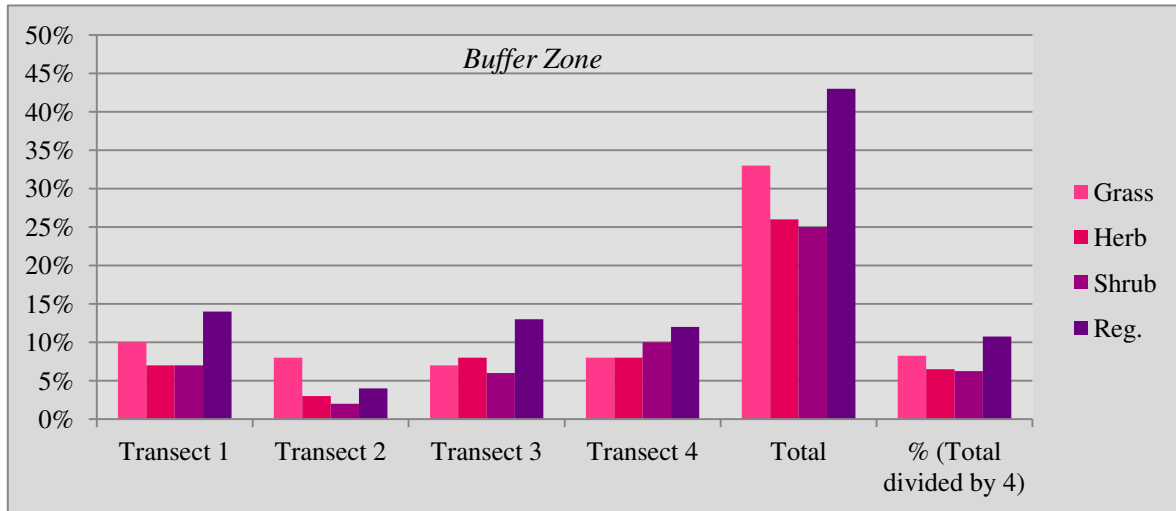
**Graph 4.12: Vegetation composition of core zone**

#### 4.3.3 Buffer zone:

The buffer zone of mining area is situated in 5-10 km distance from the core mining boundary. The floral vegetation diversity of buffer zone is illustrated in graph 4.13 and tabulated in table no 4.14.

**Table No 4.14: Vegetation percentage of buffer zone.**

<b>Transect No.</b>	<b>Grass</b>	<b>Herb</b>	<b>Shrub</b>	<b>Reg.</b>
<b>1</b>	10%	7%	7%	14%
<b>2</b>	8%	3%	2%	4%
<b>3</b>	7%	8%	6%	13%
<b>4</b>	8%	8%	10%	12%
<b>Average</b>	<b>33%</b>	<b>26%</b>	<b>25%</b>	<b>43%</b>
<b>% (Total average divided by 7)</b>	<b>8.25%</b>	<b>6.50%</b>	<b>6.25%</b>	<b>10.75%</b>



**Graph 4.13: Vegetation composition of buffer zone**

### 4.3.4 Avifauna

According to seasonal survey, 472 individual belongs to 50 different species has been recorded. As per recorded data, the population of avifauna dominated by Indian Pond Heron, Black Drongo, Red Vented Bulbul, Indian Roller and Common Myna etc. Mostly the birds found during the survey are endemic and resident. The avifaunal diversity of mining area are tabulated in table no 4.15 and graph 4.14.

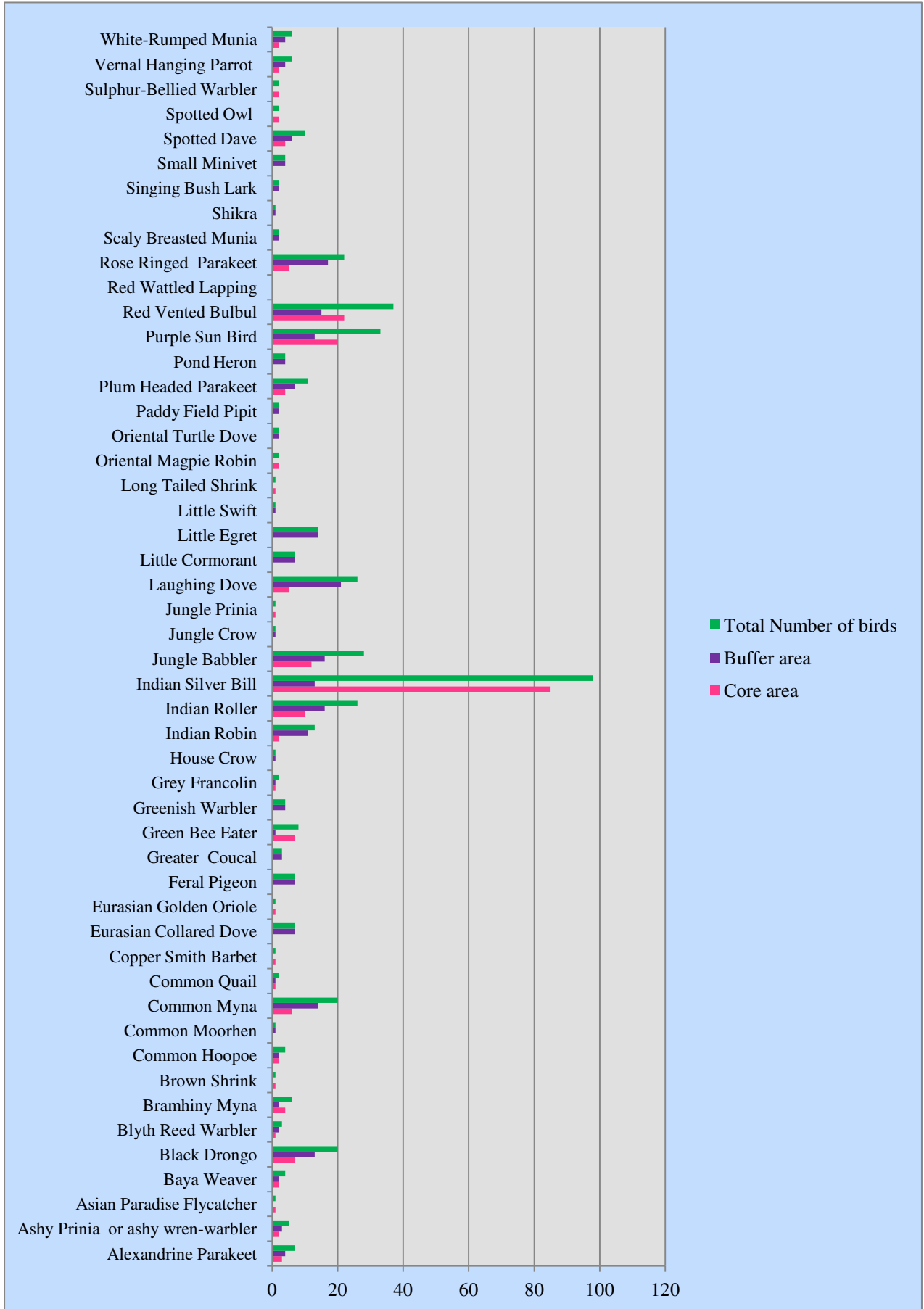
**Table No 4.15: Checklist of avifauna recorded in the mining area**

S. No	Common Name	Local Name	Scientific Name	Family	IUCN Status	Core zone	Buffer zone	No of birds
1	Alexandrine Parakeet	Parrot, Tota	<i>Psittacula eupatria</i>	Psittacidae	NT	3	4	7
2	Ashy Prinia or ashy wren-warbler	-----	<i>Prinia socialis</i>	Cisticolidae	LC	2	3	5
3	Asian Paradise Flycatcher	-----	<i>Terpsiphone paradisi</i>	Monarchidae	LC	1		1
4	Baya Weaver	Gauraiya	<i>Ploceus philippinus</i>	Ploceidae	LC	2	2	4
5	Black Drongo	Karrauna	<i>Dicrurus macrocercus</i>	Dicruridae	LC	7	13	20
6	Blyth Reed Warbler	-----	<i>Acrocephalus dumetorum</i>	Acrocephalidae	LC	1	2	3
7	Bramhiny Myna	Maina	<i>Sturnia pagodarum</i>	Sturnidae	LC	4	2	6
8	Brown Shrink	-----	<i>Lanius cristatus</i>	Laniidae	LC	1		1
9	Common Hoopoe	-----	<i>Upupa epops</i>	Upupidae	LC	2	2	4
10	Common Moorhen	-----	<i>Gallinula chloropus</i>	Rallidae	LC		1	1
11	Common Myna	Salhai /desimyna	<i>Acridotheres tristis</i>	Sturnidae	LC	6	14	20
12	Common Quail	Titar	<i>Coturnix coturnix</i>	Phasianidae	LC	1	1	2



13	Copper Smith Barbet	-----	<i>Psilopogon haemacephalus</i>	Megalaimidae	LC	1		1
14	Eurasian Collared Dove	Padki	<i>Streptopelia decaocto</i>	Columbidae	LC		7	7
15	Eurasian Golden Oriole	-----	<i>Oriolus oriolus</i>	Oriolidae	LC	1		1
16	Feral Pigeon	Kabutar	<i>Columba livia domestica</i>	Columbidae	LC		7	7
17	Greater Coucal	Koyal	<i>Centropus sinensis</i>	Cuculidae	LC		3	3
18	Green Bee Eater	Patinga	<i>Merops orientalis</i>	Meropidae	LC	7	1	8
19	Greenish Warbler	-----	<i>Phylloscopus trochiloides</i>	Phylloscopidae	LC		4	4
20	Grey Francolin	-----	<i>Francolinus pondicerianus</i>	Phasianidae	LC	1	1	2
21	House Crow	Kauaa	<i>Corvus splendens</i>	Corvidae	LC		1	1
22	Indian Robin	Chirak	<i>Saxicoloides fulicatus</i>	Muscicapidae	LC	2	11	13
23	Indian Roller	Nilkanth/teohra	<i>Coracias benghalensis</i>	Coraciidae	LC	10	16	26
24	Indian Silver Bill	-----	<i>Euodice malabarica</i>	Estrildidae	LC	85	13	98
25	Jungle Babbler	Satbhaya	<i>Turdoides striata</i>	Leiotherichidae	LC	12	16	28
26	Jungle Crow	Koua	<i>Corvus culminatus</i>	Corvidae	LC		1	1
27	Jungle Prinia	-----	<i>Prinia sylvatica</i>	Cistacolidae	LC	1		1
28	Laughing Dove	Padki	<i>Spilopelia senegalensis</i>	Columbidae	LC	5	21	26
29	Little Cormorant	-----	<i>Microcarbo niger</i>	Phalacrocoracidae	LC		7	7
30	Little Egret	Kokda	<i>Egretta garzetta</i>	Ardeidae	LC		14	14
31	Little Swift	-----	<i>Apus affinis</i>	Apodidae	LC		1	1
32	Long Tailed Shrike	-----	<i>Lanius schach</i>	Laniidae	LC	1		1
33	Oriental Magpie Robin	-----	<i>Copsychus saularis</i>	Muscicapidae	LC	2		2
34	Oriental Turtle Dove	-----	<i>Streptopelia orientalis</i>	Columbidae	LC		2	2
35	Paddy Field Pipit	-----	<i>Anthus rufulus</i>	Motacillidae	LC		2	2
36	Plum Headed Parakeet	Tota/Sua	<i>Psittacula cyanocephala</i>	Psittacidae	LC	4	7	11
37	Pond Heron	bagula	<i>Ardeola grayii</i>	Ardeidae	LC		4	4
38	Purple Sun Bird	-----	<i>Nectarania asiatica asiatica</i>	Nectariniini	LC	20	13	33
39	Red Vented Bulbul	Fikkadlow	<i>Pycnonotus cafer</i>	Pycnonotidae	LC	22	15	37
40	Red Wattled Lapping	-----	<i>Vanellus indicus</i>	Charadriidae				
41	Rose Ringed Parakeet	Tota/Sua	<i>Psittacula krameri</i>	Psittaculidae	LC	5	17	22
42	Scaly Breasted Munia	-----	<i>Lonchura punctulata</i>	Estrildidae	LC		2	2
43	Shikra	Cheel	<i>Accipiter badius</i>	Accipitridae	LC		1	1
44	Singing Bush Lark	-----	<i>Mirafra javanica</i>	Alaudidae	LC		2	2

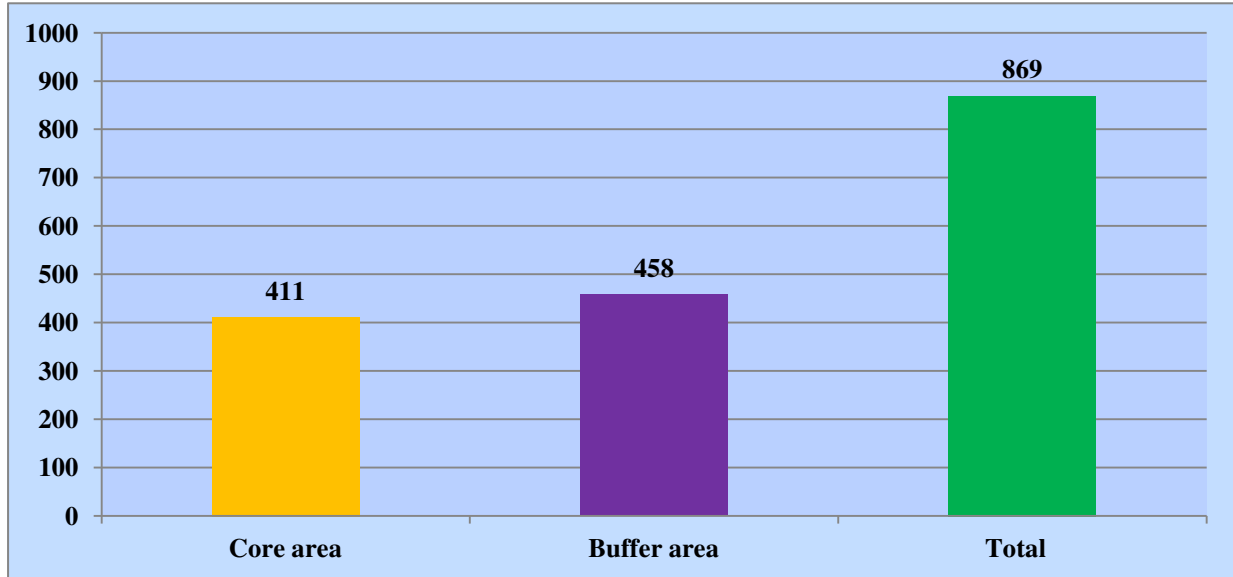
45	Small Minivet	-----	<i>Pericrocotus cinnamomeus</i>	Campephagidae	LC		4	4
46	Spotted Dove	Padki	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC	4	6	10
47	Spotted Owl	Ullu	<i>Strix occidentalis</i>	Strigidae	NT	2		2
48	Sulphur-Bellied Warbler	-----	<i>Phylloscopus griseolus</i>	Acrocephalidae	LC	2		2
49	Vernal Hanging Parrot	Tota	<i>Loriculus vernalis</i>	Psittaculidae	LC	2	4	6
50	White-Rumped Munia	-----	<i>Lonchura striata</i>	Estrildidae	LC	2	4	6
<b>Total</b>						<b>221</b>	<b>251</b>	<b>472</b>



Graph 4.14: Overview of recorded avifauna

**Table No.4.16 Birds population difference between core and buffer zone**

Number of birds		
Core zone	Buffer zone	Total
411	458	869



**Graph No.4.15 Birds population difference between core and buffer zone**

## CHAPTER 5

### RESULT AND DISCUSSION

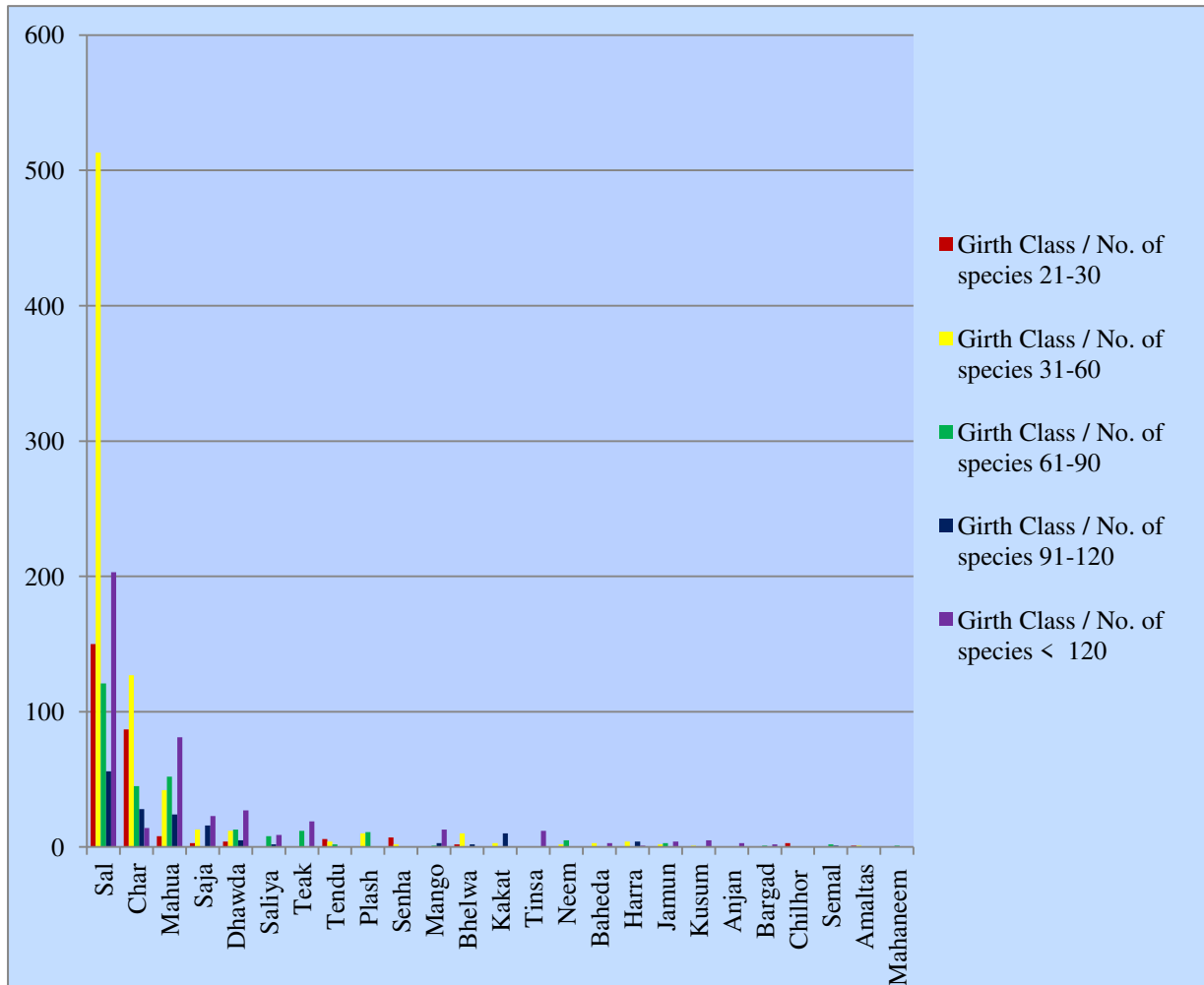
#### 5.1 Floral diversity of study site

On the basis of the field survey (as discussed above in chapter 4) the study have been revealed that the core and buffer zone vegetation of proposed area for excavation are mainly surrounded by dominated tree species i.e. Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Teak (*Tectona grandis*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Koriya (*Pinus koraiensi*), Plash (*Butea monosperma*), Baheda (*Terminalia bellerica*), Harra (*Terminalia chebula*), Kekad (*Garuga pinnata*), Tendu (*Diospyros melanoxylon*), Dhawda (*Anogeissus latifolia*) and Amaltas (*Cassia fistula*) etc. The floral diversity data have been recorded during the seasonal field survey of core and buffer zone have been tabulated in table no.5.1

**Table No 5.1. Floral diversity along with girth class in study site**

Summary of available tree species in 130 sample plot (Total area = 40480.8 m square)								
S. no.	Tree Species	Girth Class					Total	Regeneration Status
		21-30	31-60	61-90	91-120	< 120		Up to 20 cm
1	Sal	150	513	121	56	203	1043	27
2	Char	87	127	45	28	14	301	66
3	Mahua	8	42	52	24	81	207	4
4	Saja	3	13	0	16	23	55	0
5	Dhawda	4	12	13	5	27	61	8
6	Koriya	0	0	0	0	0	0	41
7	Saliya	0	0	8	2	9	19	0
8	Teak	0	0	12	0	19	31	3
9	Tendu	6	4	2	0	0	12	12
10	Plash	0	10	11	0	0	21	0
11	Senha	7	2	0	0	0	9	12
12	Mango	0	0	1	3	13	17	0
13	Bhelwa	2	10	0	2		14	0
14	Kakat	0	3	0	10	0	13	0
15	Tinsa	0	0	0	0	12	12	0
16	Neem	0	2	5	0	0	7	3
17	Baheda	0	3	0	0	3	6	3
18	Harra	0	4	0	4	1	9	0
19	Jamun	0	2	3	0	4	9	0
20	Kusum	0	1	0	0	5	6	0

21	Anjan	0	0	0	0	3	3	0
22	Bargad	0	0	1	0	2	3	0
23	Chilhor	3	0	0	0	0	3	0
24	Semal	0	0	2	1	0	3	0
25	Amaltas	1	1	0	0	0	2	0
26	Mahaneem	0	0	1	0	0	1	0
<b>Area details : Total number of transect = 26 ; Total number of plots = 26 x 5 = 130 ; Area of one sample plot = 314.16 m Square</b>								



**Graph No. 5.1 Floral diversity along with girth class of study site**

The table below shows the total numbers of 58 tree species which have been recorded through three seasonal surveys including Sal, Char, Mahua and Tendu which have been mostly found in the study area.

**Table No.5.2 Floral diversity of study site**

S. N	Local Name	Common Name	Botanical name	family
1.	Aam	Mango	<i>Mangifera indica</i>	Ancardiaceae
2.	Amaltash	amaltash	<i>Cassia fistula</i>	Fabaceae

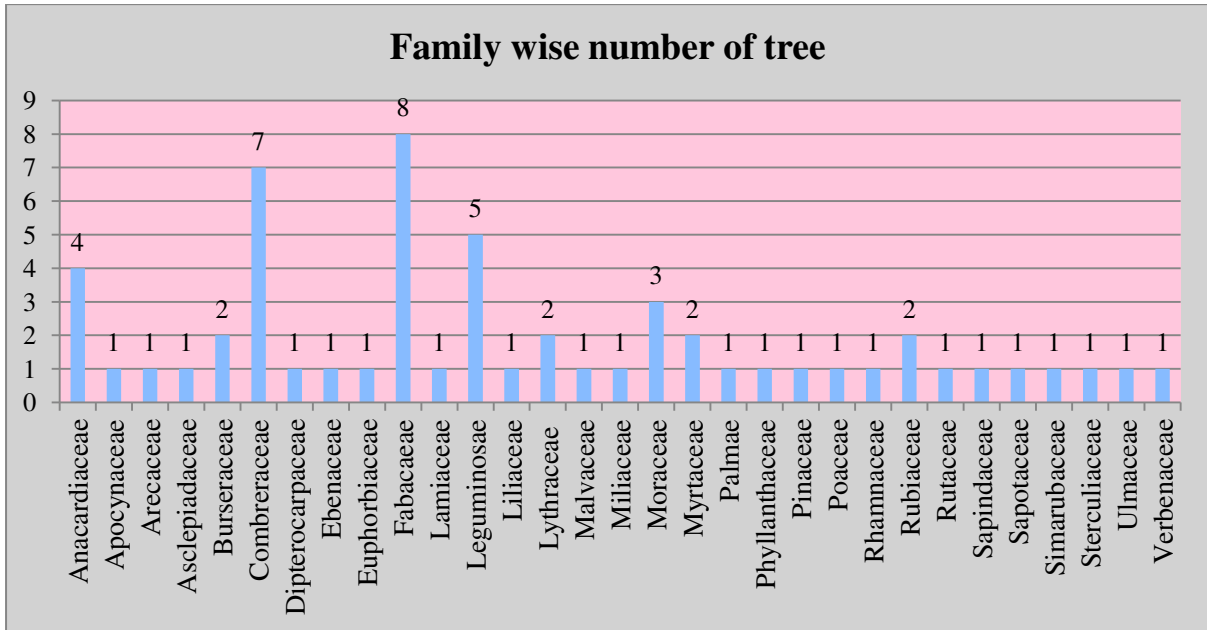
3.	Amla	Aonla	<i>Phyllanthus emblica</i>	Phyllanthaceae
4.	Arkasiya	Arkasiya	<i>acacia mangium</i>	Fabaceae
5.	Ashan	Saja	<i>Terminalia tomentosa</i>	Combretaceae
6.	Bad	Bargad	<i>Ficus benghalensis</i>	Moraceae
7.	Bahera	Bahera	<i>Terminalia bellerica</i>	Combretaceae
8.	Bakli, Dhau	Dhawra	<i>Anogiessus latifolia</i>	Combretaceae
9.	Bamoor/Bamri	Babul	<i>Acacia arabica</i>	Leguminosae
10.	Bel	Beal	<i>Aegle marmelos, correa.</i>	Rutaceae
11.	Ber	Ber	<i>Zizyphus mauritiana</i>	Rhamnaceae
12.	Bhelwa	Bhelwa	<i>Semecarpus anacardiam</i>	Anacardiaceae
13.	Bhirra	Bhirra	<i>Chloroxylon swietenia</i>	Miliaceae
14.	Bija	Bija	<i>Pterocarpus marsipium</i>	Fabaceae
15.	Chhind	Khajur	<i>Phoenix dactylifera</i>	Arecaceae
16.	Chirol	Chirol	<i>Holoptelea integrifolia</i>	Ulmaceae
17.	Chironji	Char	<i>Buchanania lanzan</i>	Anacardiaceae
18.	Chui	Chind	<i>Phoinex acaulis</i>	Palmae
19.	Dhawai	Dhawai	<i>Woodfordia fruticosa</i>	Lythraceae
20.	Dhawda	Dhawra	<i>Anogeissus latifolia</i>	Combretaceae
21.	Dumar	Gular	<i>Ficus glomerata</i>	Moraceae
22.	Gamari	Khamar	<i>Gmelina arborea</i>	Verbenaceae
23.	Harra	Harra	<i>Terminalia chebula</i>	Combretaceae
24.	Imli	Imli	<i>Tamarindus indica</i>	Fabaceae
25.	Jamun	Jamun	<i>Syzygium cumini</i>	Myrtaceae
26.	Kachnar	Kachnar	<i>Bauhinia variegata</i>	Leguminosae
27.	Kaju	Kaju	<i>Anacrdium occidentale</i>	Anacardiaceae
28.	Karam	Haldu	<i>Adina cordifolia</i>	Rubiaceae
29.	Karanj	Karanj	<i>Pongamia pinnata</i>	Fabaceae
30.	Kasai	Kashi	<i>Bridelia retusa</i>	Euphorbiaceae
31.	Kauha	Arjun	<i>Terminalia arjuna</i>	Combretaceae
32.	Kekad	Kekar	<i>Garuga pinnata</i>	Burseraceae
33.	Kem	Mundi	<i>Mitrangyna parviflora</i>	Rubiaceae
34.	Koriya	Koriya	<i>Pinus koraiensis</i>	Pinaceae
35.	Kossum	Kusum	<i>Schleichera oleosa</i>	Sapindaceae
36.	Kurru	kurru	<i>Sterculia urens</i>	Sterculiaceae
37.	Lathi Bans	Bamboo	<i>Dendrocalamus strictus</i>	Poaceae
38.	Madhar	Aak	<i>Calotropis gigantea</i>	Asclepiadaceae
39.	Mahaneem	Mahaneem	<i>Ailanthus excelsa</i>	Simarubaceae
40.	Mahua	Mahua	<i>Madhuca indica</i>	Sapotaceae
41.	Senha	Senha	<i>Lagerstoemia parviflora</i>	Lythraceae
42.	Neelgiri	Neelgiri	<i>Eucalyptus globulus</i>	Myrtaceae
43.	Neem	Neem	<i>Azadirachta indica</i>	Liliaceae
44.	Pakri	Pipal	<i>Ficus religiosa</i>	Moraceae
45.	Parsa	Palash	<i>Butea monosperma</i>	Fabaceae
46.	Pat koria, Kurchi	Koria	<i>Holarrhena antidysenterica</i>	Apocynaceae

47.	Safed Siris	Siris	<i>Albezia procera</i>	Fabaceae
48.	Kachnar	Kachnar	<i>Bauhinia variegata</i>	Fabaceae
49.	Sagaon	Teak	<i>Tectona grandis</i>	Lamiaceae
50.	Saja	Saja	<i>Terminallia tomentosa</i>	Combretaceae
51.	Salai	Salai	<i>Boswellia serrata</i>	Burseraceae
52.	Sarai	Sal	<i>Shorea robusta</i>	Dipterocarpaceae
53.	Semal	Semul	<i>Bombax ceiba</i>	Malvaceae
54.	Senha	Senha	<i>Lagerstoemia parviflora</i>	Lythraceae
55.	Shisham	Shisham	<i>Dalbergia latifolia</i>	Leguminosae
56.	Sissoo	Sissoo	<i>Dalbergia sissoo</i>	Leguminosae
57.	Tendu	Tendu	<i>Diospyros melanoxylon</i>	Ebenaceae
58.	Tilsa	Tilsa	<i>Ougeinia oojeinensis</i>	Leguminosae

Table No. 5.3 Family wise number of tree

S. No.	Name of family	Number of tree species
1.	Anacardiaceae	4
2.	Apocynaceae	1
3.	Arecaceae	1
4.	Asclepiadaceae	1
5.	Burseraceae	2
6.	Combreraceae	7
7.	Dipterocarpaceae	1
8.	Ebenaceae	1
9.	Euphorbiaceae	1
10.	Fabaceae	8
11.	Lamiaceae	1
12.	Leguminosae	5
13.	Liliaceae	1
14.	Lythraceae	2
15.	Malvaceae	1
16.	Miliaceae	1
17.	Moraceae	3
18.	Myrtaceae	2
19.	Palmae	1
20.	Phyllanthaceae	1
21.	Pinaceae	1
22.	Poaceae	1
23.	Rhamnaceae	1
24.	Rubiaceae	2
25.	Rutaceae	1
26.	Sapindaceae	1
27.	Sapotaceae	1
28.	Simarubaceae	1
29.	Sterculiaceae	1
30.	Ulmaceae	1
31.	Verbenaceae	1

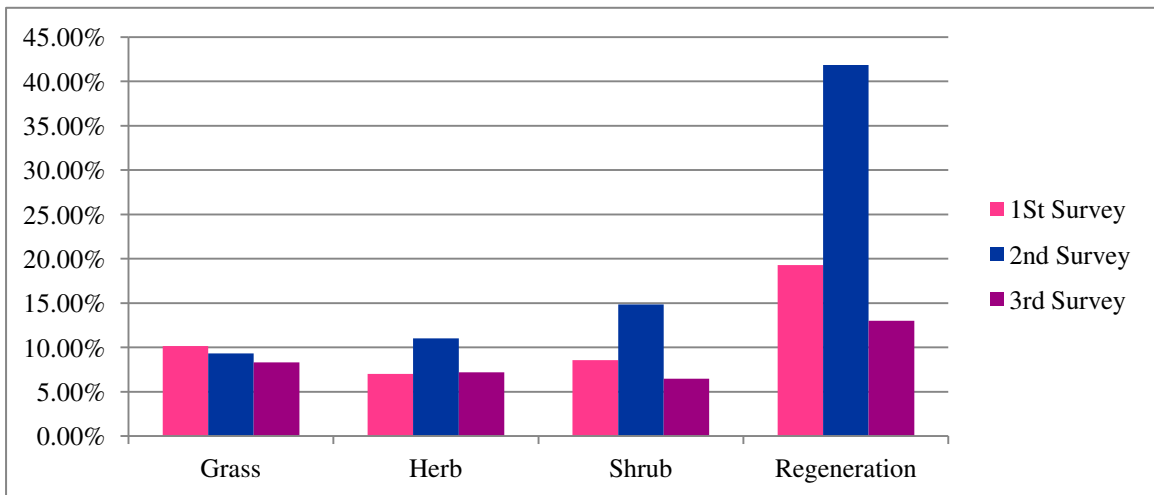




Graph No. 5.2 Family wise number of tree

Table no. 5.4 Seasonal vegetation covers at present in the study site

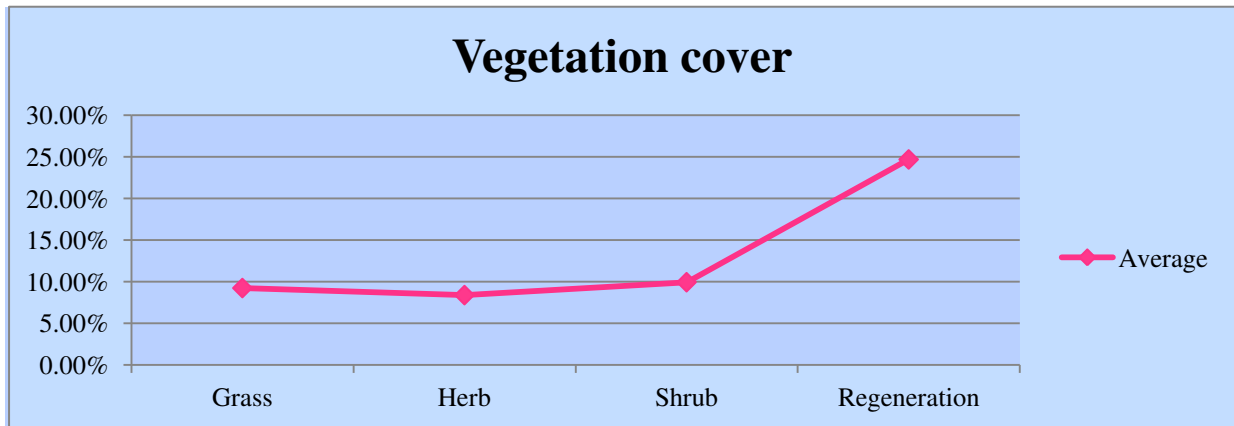
Vegetation	1st Survey	2nd Survey	3rd Survey
Grass	10.14%	9.33%	8.29%
Herb	7.00%	11.00%	7.20%
Shrub	8.57%	14.83%	6.45%
Regeneration	19.28%	41.83%	13.00%



Graph no. 5.3 Seasonal vegetation cover at present in the study site

Table no.5.5 Average vegetation at present in the study site

Vegetation	Average
Grass	9.25%
Herb	8.40%
Shrub	9.95%
Regeneration	24.70%



Graph No. 5.4 Average vegetation cover at present in the study site

## 5.2 Avifauna of OCP Chhal

According to three seasonal surveys, the avifauna populations have been recorded which are as, Summer season survey, total 405 individuals of 61 avifauna species, Winter season survey, total 776 individuals of 89 avifauna species and in Autumn season survey, 472 individuals of 50 avifauna species were recorded.

Overall from three seasonal surveys, total numbers of 1653 individual species of avifauna were recorded from 106 different species belongs to 32 families.

Table No.5.6 Checklist of availability of avifauna in the OCP Chhal

S. No.	Common Name	Local Name	Scientific Name	Family	IUCN Status
1.	Alexandrine Parakeet	Parrot, Tota	<i>Psittacula eupatria</i>	Psittacidae	NT
2.	Ashy Drongo	-----	<i>Dicrurus leucophaeus</i>	Dicruridae	LC
3.	Ashy Prinia or ashy wren-warbler	-	<i>Prinia socialis</i>	Cisticolidae	LC
4.	Asian Brown Flycatcher	--	<i>Muscicapa dauurica</i>	Muscicapidae	LC
5.	Asian Koel	Koel, Cuckoo	<i>Eudynamis scolopacea</i>	Cuculidae	LC
6.	Asian Paradise Flycatcher	-----	<i>Terpsiphone paradisi</i>	Monarchidae	LC
7.	Bank Myna	Myna	<i>Acridotheres ginginianus</i>	Sturnidae	LC
8.	Bar Headed Goose	-----	<i>Anser indicus</i>	Anatidae	LC
9.	Barn Swallow	-----	<i>Hirundo rustica</i>	Hirundinidae	LC
10.	Baya Weaver	Gauraiya	<i>Ploceus philippinus</i>	Ploceidae	LC
11.	Black Drongo	Karrauna	<i>Dicrurus macrocercus</i>	Dicruridae	LC

12.	Black Headed Oriole	-----	<i>Oriolus larvatus</i>	Oriolidae	LC
13.	Black Redstart	-----	<i>Phoenicurus ochruros</i>	Muscicapidae	LC
14.	Blue-Winged Leaf Bird	-----	<i>Chloropsis cochinchinensis</i>	Chloropseidae	NT
15.	Blyth Reed Warbler	-----	<i>Acrocephalus dumetorum</i>	Acrocephalidae	LC
16.	Bramhiny Myna	Maina	<i>Sturnia pagodarum</i>	Sturnidae	LC
17.	Bronze-Winged Jacana	-----	<i>Metopidius indicus</i>	Jacanidae	LC
18.	Brown Shrink	-----	<i>Lanius cristatus</i>	Laniidae	LC
19.	Cattle Egret	Gay Bagula	<i>Bubulcus ibis</i>	Ardeidae	LC
20.	Common Babbler	-----	<i>Turdoides caudate</i>	Lieothrichidae	LC
21.	Common Hawk Eagle	Cheel	<i>Hierococcyx varius</i>	Cuculidae	LC
22.	Common Hoopoe	-----	<i>Upupa epops</i>	Upupidae	LC
23.	Common Kingfisher	Kilkila	<i>Alcedo atthis</i>	Alcedinidae	LC
24.	Common Moorhen	-----	<i>Gallinula chloropus</i>	Rallidae	LC
25.	Common Myna	Salhai/ desimyna	<i>Acridotheres tristis</i>	Sturnidae	LC
26.	Common Pochard	-----	<i>Aythya ferina</i>	Anatidae	VU
27.	Common quail	Titar	<i>Coturnix coturnix</i>	Phasianidae	LC
28.	Common Sandpiper	-----	<i>Actitis hypoleucos</i>	Scolopacidae	LC
29.	Common Tailor Bird	-----	<i>Orthotomus sutorius</i>	Cisticolidae	LC
30.	Common Teal	-----	<i>Anas crecca</i>	Anatidae	LC
31.	Copper Smith Barbet	-----	<i>Psilopogon haemacephalus</i>	Megalaimidae	LC
32.	Cotton Teal	-----	<i>Nettapus coromandelianus</i>	Anatidae	LC
33.	Crimson Backed sunbird or Small Sunbird	-	<i>Leptocoma minima</i>	Nectariniidae	LC
34.	Eagle Owl	Ullu	<i>Bubo bubo</i>	Strigidae	LC
35.	Eurasian Collared Dove	Padki	<i>Streptopelia decaocto</i>	Columbidae	LC
36.	Eurasian Coot	-----	<i>Fulica atra</i>	Rallidae	LC
37.	Eurasian Golden Oriole	-----	<i>Oriolus oriolus</i>	Oriolidae	LC
38.	European Turtle Dove	Padki	<i>Streptopelia turtur</i>	Columbidae	VU
39.	Feral Pigeon	Kabutar	<i>Columba livia domestica</i>	Columbidae	LC
40.	Gadwall	-----	<i>Mareca strepera</i>	Anatidae	LC
41.	Grater Spotted Eagle	-----	<i>Clanga clanga</i>	Accipitridae	VU
42.	Great Thick Knee	-----	<i>Esacus recurvirostris</i>	Burhinidae	NT
43.	Greater Coucal	Koyal	<i>Centropus sinensis</i>	Cuculidae	LC
44.	Greater Cormorant	-----	<i>Phalacrocorax carbo</i>	Phalacrocoracidae	LC

45.	Greater Flame Back Woodpecker	Katpodva	<i>Dryocopus martius</i>	Picidae	LC
46.	Green Bee Eater	Patinga	<i>Merops orientalis</i>	Meropidae	LC
47.	Greenish Warbler	-----	<i>Phylloscopus trochiloides</i>	Phylloscopidae	LC
48.	Grey Francolin	-----	<i>Francolinus pondicerianus</i>	Phasianidae	LC
49.	House Crow	Kauaa	<i>Corvus splendens</i>	Corvidae	LC
50.	House Sparrow	Gouriaya	<i>Passer domesticus</i>	Passeridae	LC
51.	Indian Barn Owl	-	<i>Tyto alba</i>	Tytonidae	LC
52.	Indian Courser	-----	<i>Cursorius coromandelicus</i>	Glareolidae	LC
53.	Indian Cuckoo	-----	<i>Cuculus micropterus</i>	cuculidae	LC
54.	Indian Nuthatch	-	<i>Sitta castanea</i>	Sittidae	LC
55.	Indian Pitta	-----	<i>Pitta brachyura</i>	Pittidae	LC
56.	Indian Pond Heron	Khokho bakli	<i>Ardeola grayii</i>	Ardeidae	LC
57.	Indian Pygmy Woodpecker	-	<i>Yungipicus nanus</i>	Picidae	LC
58.	Indian Robin	Chirak	<i>Saxicoloides fulicatus</i>	Muscicapidae	LC
59.	Indian Roller	Nilkanth/teohra	<i>Coracias benghalensis</i>	Coraciidae	LC
60.	Indian Silver Bill	-----	<i>Euodice malabarica</i>	Estrildidae	LC
61.	Indian Spotted Dove	Padki	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC
62.	Jungle Babbler	Satbhaiya	<i>Turdoides striata</i>	Leiothrichidae	LC
63.	Jungle Bush Quail	Titar	<i>Perdica asiatica</i>	Phasianidae	LC
64.	Jungle Crow	Koua	<i>Corvus culminatus</i>	Corvidae	LC
65.	Jungle Myna	Maina	<i>Acridotheres fuscus</i>	Sturnidae	LC
66.	Jungle Prinia	-----	<i>Prinia sylvatica</i>	Cisticolidae	LC
67.	Laughing Dove	Padki	<i>Spilopelia senegalensis</i>	Columbidae	LC
68.	Lesser Flame Back	-----	<i>Dinopium benghalense</i>	Picidae	LC
69.	Lesser Whistling Duck	-----	<i>Dendrocygna javanica</i>	Anatidae	LC
70.	Little Bittern	-----	<i>Ixobrychus minutus</i>	Ardeidae	LC
71.	Little Cormorant	-----	<i>Microcarbo niger</i>	Phalacrocoracidae	LC
72.	Little Egret	Kokda	<i>Egretta garzetta</i>	Ardeidae	LC
73.	Little Swift	-----	<i>Apus affinis</i>	Apodidae	LC
74.	Long tailed Minivet		<i>Pericrocotus ethologus</i>	Campephagidae	LC
75.	Long Tailed Shrike	-----	<i>Lanius schach</i>	Laniidae	LC
76.	Oriental Magpie Robin	-----	<i>Copsychus saularis</i>	Muscicapidae	LC
77.	Oriental Turtle Dove	-----	<i>Streptopelia orientalis</i>	Columbidae	LC
78.	Oriental White Eye	-----	<i>Zosterops palpebrosus</i>	Zosteropidae	LC
79.	Paddy Field Pipit	-----	<i>Anthus rufulus</i>	Motacillidae	LC
80.	Plain Prinia	-----	<i>Prinia inornata</i>	Cisticolidae	LC

81.	Plum Headed Parakeet	Tota/Sua	<i>Psittacula cyanocephala</i>	Psittacidae	LC
82.	Purple Sun Bird	-----	<i>Nectarania asiatica asiatica (Latham)</i>	Nectariniini	LC
83.	Rain Quail	Quail	<i>Coturnix coromandelica</i>	Phasianidae	LC
84.	Red Avadavat	-	<i>Amandava amandava</i>	Estrildidae	LC
85.	Red Crested Pochard	-----	<i>Netta rufina</i>	Anatidae	LC
86.	Red Vented Bulbul	Fikkadlow	<i>Pycnonotus cafer</i>	Pycnonotidae	LC
87.	Red Wattled Lapping	-----	<i>Vanellus indicus</i>	Charadriidae	
88.	Rose Ringed Parakeet	Tota/Sua	<i>Psittacula krameri</i>	Psittaculidae	LC
89.	Rufous Tree Pie	-----	<i>Dendrocitta vagabunda</i>	Corvini	LC
90.	Scaly Breasted Munia	-----	<i>Lonchura punctulata</i>	Estrildidae	LC
91.	Shikra	Cheel	<i>Accipiter badius</i>	Accipitridae	LC
92.	Singing Bush Lark	-----	<i>Miraфра javanica</i>	Alaudidae	LC
93.	Singing Bush Lark	-	<i>Miraфра javanica</i>	Alaudidae	LC
94.	Sirkeer Malkoha	-----	<i>Taccocua leschenaultii</i>	Cuculidae	LC
95.	Small Minivet	-----	<i>Pericrocotus cinnamomeus</i>	Campephagidae	LC
96.	Spot Bill Duck	-----	<i>Anas poecilorhyncha</i>	Anatidae	LC
97.	Spotted Dave	-----	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC
98.	Spotted Owl	Ullu	<i>Strix occidentalis</i>	Strigidae	NT
99.	Sulphur-Bellied Warbler	-----	<i>Phylloscopus griseolus</i>	Acrocephalidae	LC
100.	Thick Billed Flower Pecker	-----	<i>Dicaeum agile</i>	Dicaeidae	LC
101.	Verditer Flycatcher	-----	<i>Eumyias thalassinus</i>	Muscicapidae	LC
102.	Vernal Hanging Parrot	-----	<i>Loriculus vernalis</i>	Psittaculidae	LC
103.	White Throated Kingfisher	Kilkila	<i>Halcyon smyrnensis</i>	Alcedinidae	LC
104.	White-Rumped Munia	-----	<i>Lonchura striata</i>	Estrildidae	LC
105.	Yellow Wattled lapwing	-	<i>Vanellus malabaricus</i>	Charadriidae	LC
106.	Yellow-Footed Green Pigeon	Kabootar	<i>Treron phoenicoptera</i>	Columbidae	LC

**Extinct (EX)** – Beyond reasonable doubt that the species is no longer extant.

**Extinct in the wild (EW)** – Survives only in captivity, cultivation and/or outside native range, as presumed after exhaustive surveys.

**Critically endangered (CR)** – In a particularly and extremely critical state.

**Endangered (EN)** – Very high risk of extinction in the wild, meets any of criteria A to E for Endangered.

**Vulnerable (VU)** – Meets one of the 5 red list criteria and thus considered to be at high risk of unnatural (human-caused) extinction without further human intervention.

**Near threatened (NT)** – Close to being at high risk of extinction in the near future.

**Least concern (LC)** – Unlikely to become extinct in the near future.

**Data deficient (DD)**

**Not evaluated (NE)**

Biodiversity is under threat worldwide and birds are the prime victim of the declining trend of biodiversity. It was observed that many of the birds recorded in OCP Chhal are enlisted in the threatened categories of IUCN as well as in the schedules of wild life (Protection) Act, 1972.

The conservation status of birds according to IUCN, and the wildlife (Protection) Act, 1972, along with their local status is presented in the table.

During field visit, total 106 bird species have been found in which 99 bird species are Least Concerned (LC), 3 birds species are Vulnerable (VU) and 4 bird species are Near threatened as per IUCN list (Table no-5.6).

**Table No. 5.7 Checklist of total no. of birds species at present in OCP Chhal**

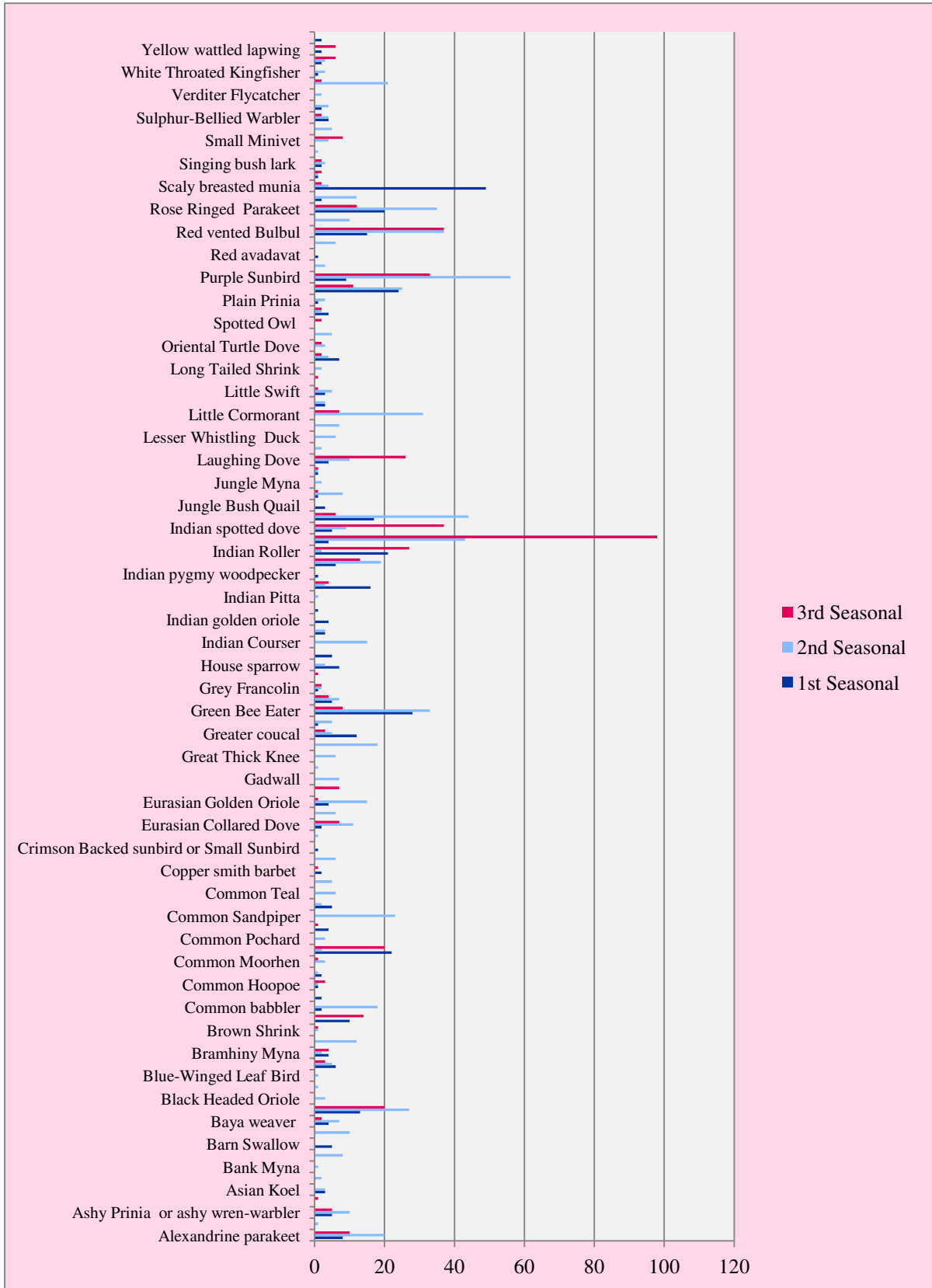
S.No.	Common Name	Number of birds			Total
		1 <sup>st</sup> Seasonal	2 <sup>nd</sup> Seasonal	3 <sup>rd</sup> Seasonal	
1	Alexandrine Parakeet	8	7	7	22
2	Ashy Drongo	-	1	-	1
3	Ashy Prinia or ashly wren-warbler	5	10	5	20
4	Asian Brown Flycatcher	-	-	1	1
5	Asian Koel	3	3	-	6
6	Asian Paradise Flycatcher	-	2	1	3
7	Bank Myna	-	1	-	1
8	Bar Headed Goose	-	8	-	8
9	Barn Swallow	5	-	-	5
10	Barn Swallow	-	10	-	10
11	Baya Weaver	4	7	4	15
12	Black Drongo	13	27	20	60

13	Black Headed Oriole	-	3	-	3
14	Black Redstart	-	1	-	1
15	Blue-Winged Leaf Bird	-	1	-	1
16	Blyth Reed Warbler	6	5	3	14
17	Bramhiny Myna	4	2	6	12
18	Bronze-Winged Jacana	-	12	-	12
19	Brown Shrink	-	1	1	2
20	Cattle Egret	10	-	0	10
21	Common Babbler	2	24	-	26
22	Common Hawk Eagle	2	-	-	2
23	Common Hoopoe	1	1	4	6
24	Common Kingfisher	2	1	-	3
25	Common Moorhen		3	1	4
26	Common Myna	22	4	20	46
27	Common Pochard	-	3	-	3
28	Common Quail	4	-	2	6
29	Common Sandpiper	-	23	-	23
30	Common Tailor Bird	5	2	-	7
31	Common Teal	-	6	-	6
32	Copper Smith Barbet	-	5		5
33	Copper Smith Barbet	2	-	1	3
34	Cotton Teal	-	6	-	6
35	Crimson Backed Sunbird or Small Sunbird	1	-	-	1
36	Eagle Owl	-	1	-	1
37	Eurasian Collared Dove	2	11	7	20
38	Eurasian Coot	-	6	-	6
39	Eurasian Golden Oriole	4	15	1	20
40	Feral Pigeon	-	-	7	7
41	Gadwall	-	7	-	7
42	Grater Spotted Eagle	-	1	-	1
43	Great Thick Knee	-	6	-	6
44	Greater Cormorant	-	18	-	18
45	Greater Coucal	12	5	3	20
46	Greater Flame Back Woodpecker	1	5	-	6
47	Green Bee Eater	28	33	8	69
48	Greenish Warbler	5	7	4	16
49	Grey Francolin	1	2	2	5
50	House Crow	-	-	1	1
51	House Sparrow	7	3	-	10
52	Indian Barn Owl	5	-	-	5
53	Indian Courser	-	15	-	15
54	Indian Cuckoo	3	3	-	6

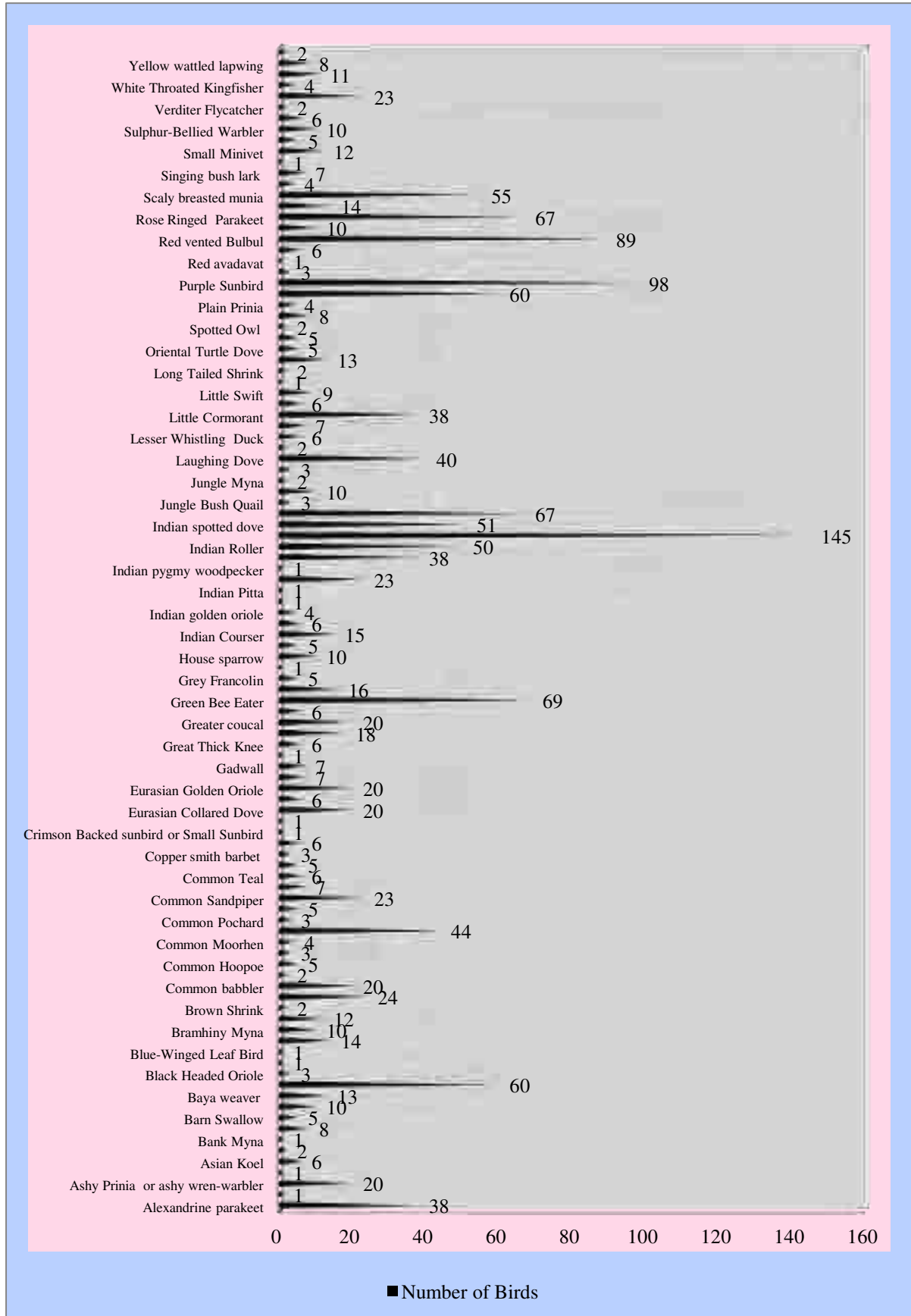
55	Indian Golden Oriole	4	-	-	4
56	Indian Nuthatch	1	-	-	1
57	Indian Pitta	-	1	-	1
58	Indian Pond Heron	16	3	4	23
59	Indian Pygmy Woodpecker	1	-	-	1
60	Indian Robin	6	19	13	38
61	Indian Roller	21	2	26	49
62	Indian Silver Bill	4	43	98	145
63	Indian Spotted Dove	5	9	10	24
64	Jungle Babbler	17	44	28	89
65	Jungle Bush Quail	3	-	-	3
66	Jungle Crow	1	8	1	10
67	Jungle Myna	-	2	-	2
68	Jungle Prinia	1	1	1	3
69	Laughing Dove	4	10	26	40
70	Lesser Flame Back	-	2	-	2
71	Lesser Whistling Duck	-	6	-	6
72	Little Bittern	-	7	-	7
73	Little Cormorant	-	31	7	38
74	Little Egret	3	3	14	20
75	Little Swift	3	5	1	9
76	Long Tailed Minivet	-	-	1	1
77	Long Tailed Shrike	-	2	1	3
78	Oriental Magpie Robin	7	4	2	13
79	Oriental Turtle Dove	-	3	2	5
80	Oriental White Eye	-	5	-	5
81	Spotted Owl	-	-	2	2
82	Paddy Field Pipit	4	2	2	8
83	Plain Prinia	1	3	-	4
84	Plum Headed parakeet	24	25	11	60
85	Purple Sunbird	9	56	33	98
86	Rain Quail	-	3	-	3
87	Red avadavat	1	-	-	1
88	Red Crested Pochard	-	6	-	6
89	Red vented Bulbul	15	37	37	89
90	Red Wattled Lapping	-	10	-	10
91	Rose Ringed Parakeet	20	35	22	77
92	Rufous Tree Pie	2	12	-	14
93	Scaly Breasted Munia	49	4	2	55
94	Shikra	1	1	1	3
95	Singing Bush Lark	2	3	2	7
96	Sirkeer Malkoha	-	1	-	1
97	Small Minivet	-	4	4	8
	Spotted Owl			2	2



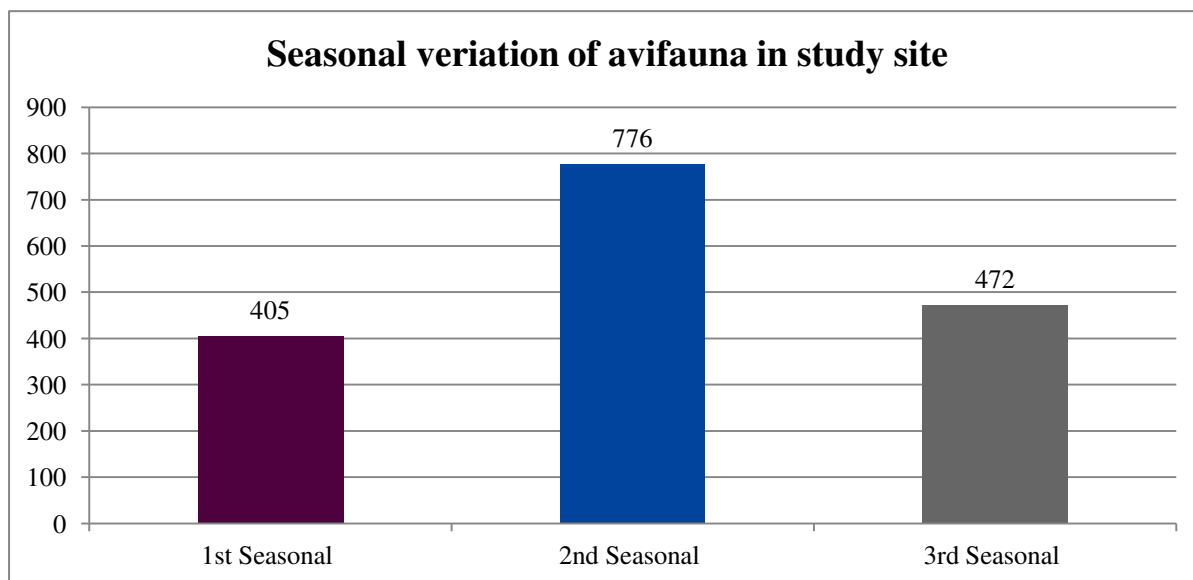
<b>98</b>	Spot Bill Duck	-	<b>5</b>	-	<b>5</b>
<b>99</b>	Sulphur-Bellied Warbler	<b>4</b>	<b>4</b>	<b>2</b>	<b>10</b>
<b>100</b>	Thick Billed Flower pecker	<b>2</b>	<b>4</b>	-	<b>6</b>
<b>101</b>	Verditer Flycatcher	-	<b>2</b>	-	<b>2</b>
<b>102</b>	Vernal Hanging Parrot	-	<b>21</b>	<b>2</b>	<b>23</b>
<b>103</b>	White Throated Kingfisher	<b>1</b>	<b>3</b>		<b>4</b>
<b>104</b>	White-Rumped Munia	<b>2</b>	<b>3</b>	<b>6</b>	<b>11</b>
<b>105</b>	Yellow Wattled Lapwing	<b>2</b>	-	<b>6</b>	<b>8</b>
<b>106</b>	Yellow-Footed Green Pigeon	<b>2</b>	-	-	<b>2</b>
<b>Total</b>		<b>405</b>	<b>776</b>	<b>472</b>	<b>1653</b>



Graph 5.5: Seasonal variation of individual birds species



Graph: 5.6 Species variation of avifauna

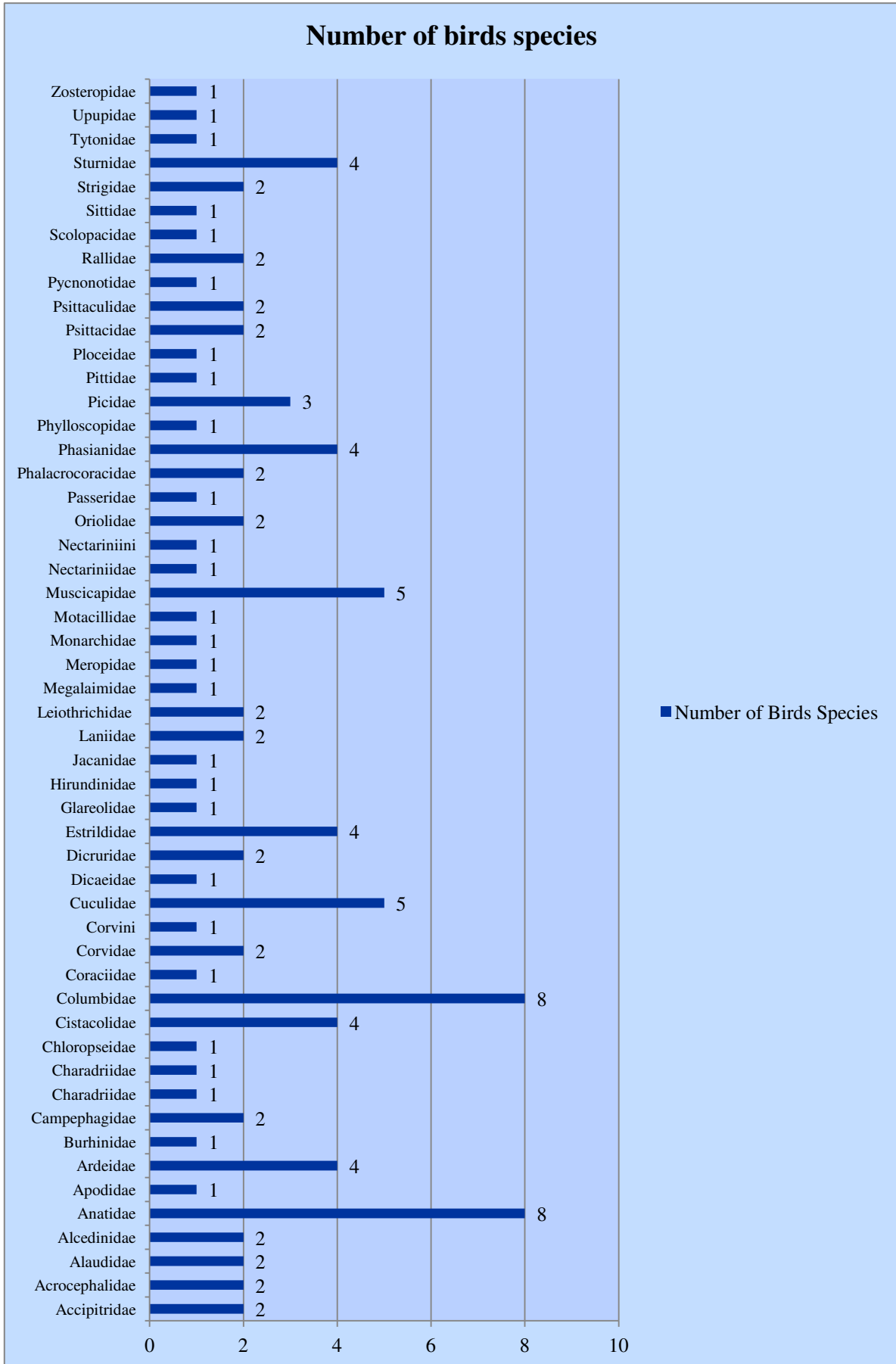


**Graph: 5.7 Seasonal variations of avifauna in study site**

**Table No. 5.8 Checklist of birds' species according to their family**

S.No.	Family name	Number of birds species
1	Accipitridae	2
2	Acrocephalidae	2
3	Alaudidae	2
4	Alcedinidae	2
5	Anatidae	8
6	Apodidae	1
7	Ardeidae	4
8	Burhinidae	1
9	Campephagidae	2
10	Charadriidae	1
11	Charadriidae	1
12	Chloropseidae	1
13	Cistacolidae	4
14	Columbidae	8
15	Coraciidae	1
16	Corvidae	2
17	Corvini	1
18	Cuculidae	5
19	Dicaeidae	1
20	Dicruridae	2
21	Estrildidae	4
22	Glareolidae	1
23	Hirundinidae	1
24	Jacaniidae	1
25	Laniidae	2
26	Leiothrichidae	2
27	Megalaimidae	1
28	Meropidae	1

29	Monarchidae	1
30	Motacillidae	1
31	Muscicapidae	5
32	Nectariniidae	1
33	Nectariniini	1
34	Oriolidae	2
35	Passeridae	1
36	Phalacrocoracidae	2
37	Phasianidae	4
38	Phylloscopidae	1
39	Picidae	3
40	Pittidae	1
41	Ploceidae	1
42	Psittacidae	2
43	Psittaculidae	2
44	Pycnonotidae	1
45	Rallidae	2
46	Scolopacidae	1
47	Sittidae	1
48	Strigidae	2
49	Sturnidae	4
50	Tytonidae	1
51	Upupidae	1
52	Zosteropidae	1



**Graph: No. 5.8 Checklist of birds species according to their family**

### 5.3 Discussion

During field visit, the area of Compartment number 477 (core zone) and 478 (buffer zone) have been surveyed in which total 26 transects were made to study the existing avifauna of the area and their habitat including wildlife and existing flora.

After three seasonal surveys, total 1653 individual species of avifauna were recorded from 106 different species belong to 32 families. (Table no.5.7 and graph 5.5).

According to three seasonal surveys, the avifauna populations have been recorded which are as; Summer season survey, total 405 individuals of 61 avifauna species; Winter season survey, total 776 individuals of 89 avifauna species; and in Autumn season survey, 472 individuals of 50 avifauna species were recorded.

It has been found that there are certain species of birds in the study area that have been classified under different threat categories by the IUCN status. Of these, *Clanga clanga*, *Streptopelia turtur* and *Aythya farina* was placed in the Vulnerable (VU) category, *Strix occidentalis*, *Esacus recurvirostris*, *Chloropsis cochinchinensis*, *Psittacula eupatria* were placed in the Near Threatened category and all the remaining species (n = 99) are placed in the Least concern category (Table no. 5.6)

Apart from the above survey technique, the study of working plan report of Raigarh - Dharamjaigarh Forest Division have been done in which total 86 tree species and 121 species of birds have been mentioned. Chhal Ranges under Dharamjaigarh Forest Division have been found dense forest with Sal dominated forest. During the field survey, most of the bird nests were found in Sal species followed by Char then Mahua and Saja. In each interval, observation of birds and its counting, vegetation study, dominating tree species, birds nest & its pattern were documented in this report.

The impact of noise, air and land disturbance on the study site, affecting the diversity of bird population can be understood as follows. It was observed

that the bird diversity of the core area is lesser than that of the buffer area. It was also observed that major disturbances produced by sound and noise pollution in the core area, which affect bird diversity, are caused due to blasting, vehicle movement and anthropogenic pressure. Other disturbances observed are caused due to air pollution by mining dust, and habitat degradation due to tree felling and ground digging. The above problems of noise and air pollution are directly related to mining activities and decreasing of forests, which destroy the habitat of avifauna. Buffer area is rich with agriculture land and forestland, which may provide suitable habitat for birds, and they may settle down there (*Vishwakarma, et. al 2018*).

It was also observed that vegetation cover and avifauna population were mainly occupying the buffer areas. This observation shows that the avifaunal population presence in thicker vegetative covered areas is more than the lesser ones. The direct impacts on the living organisms of the mining area include death of plants and animals due to mining activity or contact with toxic wastes and mine drainages, disturbance of wildlife habitat due to blasting and heavy machines. Indirect impacts may include changes in nutrient cycling, disruption of food chain and instability of ecosystem (*Gayatri et al 2010*). Therefore, it is accepted that biodiversity of flora and fauna needs essential amount of fresh atmosphere which is necessary for life.

Although grassland and scrub-species birds benefit from the early successive habitat development from post mining reclamation, forest-dwelling birds are adversely affected by land use change from forest to grassland, regardless of the origin of the changes. Concern has been expressed related to habitat loss for cerulean warblers in the Appalachian Mountains associated with deforestation from coal mining. (*Buechler et, al.2006, wood et al.2006, Bulluck 2007*),

Similar observations have been found in the study area, the diversity of birds, and in particular the native species, is positively correlated with increasing structural complexity of the vegetation. Also a seasonal change in



species diversity of birds occurs in forests due to their foraging behaviour (*Robertson and Hack well 1995*).

Forests attract a large number of avifauna because they provide suitable habitat for most birds, especially those birds that are associated with vegetation, and for most, the existence of tree is a vital component of their life cycle. The bird's level of interest on various forests depends on the age of the stands. The composition of bird species is highly related to the vegetation structure of forests (*Robertson and Hack well 1995*).

Accordingly, the alternative habitat development is proposed in the buffer zone for the conservation of avifauna. For better conservation measures artificial nesting trail is proposed for avifauna as per their habit, habitat, and behaviour and nesting pattern. The artificial nesting pattern and their designs are explained in the chapter 7.

The current status of avifauna as per their nesting pattern are categorized in eight parts which are Scrape nesting birds, Burrow nesting birds, Cavity nesting birds, Cup shaped nesting birds, Saucer/Plate form nesting birds, Platform nesting birds, Pendent nesting birds, Sphere shaped nesting birds found in the core zone of OCP Chhal. The data shows that the rich avifaunal diversity of OCP Chhal is good and alternative habitat is needed.

It is also observed that the vast majority of this studies conducted on wild life response have focused on birds and wildlife in part because birds are easily monitored using various count based survey. The effects of mining on avian communities occur initially by the removal of vegetation in preparation for mining. If the site is forested, vegetation removal occurs through timber harvest or clearing. Although few studies have been done specifically evaluate the changes associated with mine sites from pre-mining to post-mining land uses. (*Sallabanks et al. 2000.*)

This study also signifies that the seasonal variations in bird population were mostly found in winter season comparison to summer season and autumn seasons. The bird diversity is impacted by climate condition (Temperature)

*Waterhouse and Trapani, 2002*) According to *parsesan (2005)*, Weather conditions determine bird diversity by the spatial temporal shift of the species from one habitat to the other, seeking favourable condition. The highest diversity is in the forest due to the availability of food, water, breeding sites, breeding material and cover from predators. (*Hobson et al.2003*).

Therefore, the above discussion part shows the problems occurred in bird diversity and their habitat which were directly or indirectly affected from air, noise and land disturbance from mining activities. The whole reasonable parts should be solved from proper conservational practices attempted regarding biodiversity conservation of flora and fauna.

## CHAPTER 6

### RECOMMENDATIONS AND WILDLIFE CONSERVATION PLAN

#### 6.1 RECOMMENDATIONS

1. Green belts should be developed around the mining boundary, along the roads, lease periphery, benches and backfilled areas. The impact on the biological environment due to amount of dust generation is minimized by well-developed green belt in and around mining lease area.
2. The wastage coal dust particles in the dumping site of coal mine's should be managed properly to reduce air pollution and loss of avifaunal diversity & habitats.
3. Biological reclamation should be done to transform the degraded land and waste dump into a self - sustaining ecologically stable land form. Re-vegetation of waste dump is recommended to the slope stability, enhances the infiltration of rain water to increases the soil fertility.
4. Top soil management is needed to maintain the top soil stockpile to retain fertility. Excavated top soil can be dumped for future use such as meadow development and plantation purpose in order to further mitigation for habitat conservation of avifauna.
5. Fruit bearing and feeder tree species that are prefer by the birds available in the area, to be needed to plant in the buffer zone for plantation of avifauna conservation. Some of the tree species to be planted are: Sal (*Shorea robusta*), Char (*Buchanania lanzan*), Mahua (*Madhuca indica*), Pipal (*Ficus religiosa*), Bargad (*Ficus benghalensis*), Bhelwa (*Semecarpus anacardiam*), Gular (*Ficus glomerata*), Senha (*Lagerstoemia parviflora*), Mango (*Mangifera indica*), Baheda (*Terminalia bellerica*), Harra (*Terminalia chebula*), Tendu (*Diospyros melanoxylon*), Dhawda (*Anogeissus latifolia*) and Amaltas (*Cassia fistula*) etc.
6. Multiple water storage facilities are to be developed in the buffer boundaries to assure the water availability throughout the year. The existing ponds, river, dam and canals water resources recharge should be maintained.

7. The mining in the buffer zone along the river bank of Mand River must be avoided to insure of the river changing the path.
8. The social awareness program should be conducted among the local communities and villagers to provide information & awareness about birds and wild life their contribution in ecosystem and environment.
9. Artificial nest made up of local, light and fine wood materials. Nests will be prepared with the help of active JFM Committee and local forest staff and placed in the buffer area for the affected avifauna of core zone.
10. Assisted natural regeneration (ANR) should be done for the regeneration and reclamation, protection and preservation of natural tree seedlings in forest areas.
11. Best practices from forest department should be implemented for the prevention of forest fire.
12. Plantation and conservation efforts should be monitor regularly during various growth stages of site.
13. Establishment of artificial avifauna habitat “*Pakshi Vihar*” on dumping site.

## **6.2 CONSERVATION PLAN**

### **6.2.1 Plantation**

Plantation of the disturbed area will be undertaken simultaneously following mining. Plantation over undisturbed area including green belt will be carried out of the first five year itself. To reduce the impact of air pollution towards the habitation, forest, road etc, it has been proposed to create and maintain a green belt around the mine.

### **6.2.2 Green belt development**

A green belt of 7.5 m width will be proposed to be developed around the mining lease area. The green belt will consist mainly of the trees but will have shrubs, herbs and climbers also. The green belt vegetation, with respect to pollution, performs dual function:

1. Absorb some of the gaseous pollutants,
2. Prevent the escape of dust and noise.

So it is necessary to develop a greenbelt in and around the pollutant site with suitable, local species to combat the air pollution, effectively. The green belt function also as amalgamating the physical structures of the mines with surrounding environment greenbelt is developed primarily to absorb and to check the escape of pollutants. Although only local species will be used but the green belt may not have any relevance to biodiversity.

### **6.2.3 Plantation in the green belt**

Green belt plantation will be started with the start of the mining will be completed within the five years. Plant species will be selected with in following criteria thus tolerance to dust pollutions, evergreen trees, shad bearer fleshy leaf tree species shrubs and some herbs species combination will be planted in green belt area, Local source verity of plant species will be selected.

**List of recommended species for plantation**

S.No	Common Name	Tree (T)	Botanical Name
1.	Sal	T	<i>Shorea robusta</i>
2.	Pipal	T	<i>Ficus religiosa</i>
3.	Mahua	T	<i>Madhuca latifolia</i>
4.	Jamun	T	<i>Syzygium cumini</i>
5.	Tendu	T	<i>Diospyros melanxylon</i>
6.	Saja	T	<i>Terminalia tomentosa</i>
7.	Arjun	T	<i>Terminalia arjuna</i>
8.	Achar/Char	T	<i>Buchanania lanzan</i>
9.	Aonla	T	<i>Emblica officinatis</i>
10.	Kusum	T	<i>Schleichera oleosa</i>
11.	Khair	T	<i>Acacia catechu</i>
12.	Gular	T	<i>Ficus glomerata</i>
13.	Baheda	T	<i>Terminalia bellerica</i>
14.	Bhilwa	T	<i>Semecarpus anacardium</i>
15.	Harra	T	<i>Terminalia chebula</i>

**Shrubs (Sh) and Herbs (H)**

S.No	Common Name	Shrubs (Sh)/Herbs (H)	Botanical Name
1.	Dudhi	Sh.	<i>Wrightia tinctoria</i>
2.	Lantana	Sh.	<i>Lantana camara</i>
3.	Kaner	Sh.	<i>Nerium odoratum</i>
4.	Bhatkateya	H	<i>Solanum trilobatum</i>
5.	Chhind	Sh	<i>Phoenix acaulis</i>
6.	Kathjamun	Sh.	<i>Eugenia heyneana</i>
7.	Chhoti Lajwanti	H	<i>Hemigraphis indica</i>
8.	Katma, Amti	Sh.	<i>Antidesma ghaesembilla</i>
9.	Khirni	Sh.	<i>Mimusops hexandra</i>
10.	Charota	H	<i>Cassia tora</i>
11.	Phetoa	Sh.	<i>Gardenia turgid</i>
12.	Marodphal	Sh.	<i>Helicteres isora</i>
13.	Gokhuru (bada)	H	<i>Acanthospermum hirsutum</i>

**Bamboo and grasses**

S.No	Common Name	Botanical Name
1	Bans Bamboo	<i>Dendrocalamus strictus</i>
2	Bhurbhusi Grass	<i>Eragostis tenella</i>
3	Doob ghas Dag grass	<i>Cynodon dactylon</i>
4	Kans Dag grass	<i>Saccharum spontaneum</i>
5	Phulbahari Dag grass	<i>Arundinella setosa</i>
6	Sukla	<i>Heteropogon contortus</i>
7	Kanta bahari Dag grass	<i>Aristida setacea</i>
8	Kanta bahiri	<i>Aristida adscensionis</i>
9	Ghas	<i>Eleusine indica</i>

10	Ghas	<i>Eragrostiell sp.</i>
11	Ghas	<i>Bothriochloa pertusa</i>
12	Ghas	<i>Themeda quadrivalvis</i>
13	Ghas	<i>Iselema laxum</i>

#### 6.2.4 Over burden dump management

The overburden soil will be first be dumped, temporarily and then later on it will be used for filling the void. The overburden consists of two type of soil

- ❖ The top lower soil about 0.5 meter average thickness. It is rich in nutrient and suitable for plant growth, and
- ❖ The lower soil, which in true sense is not a soil but is earth, because in this soil organic matter is totally absent and is generally poor in nutrients required for plant growth.
- ❖ These two types of soil will be dumped separately. After dumping the soil for 2-3 years the top soil, dumped separately, will then be used as the top layer over the lower soil.

#### 6.2.5 Backfill dump

Backfill dump will start from 3<sup>rd</sup> year. Backfill will continue till this quarry is completely worked out. For backfilling and reclamation, part of the waste will be available. Part of the OB waste will have to be dumped in outside dump.

#### 6.2.6 Top soil dump

The total top soil generated during the life of mine will be stacked separately in a soil stock pile. It will be used for growing plant along the fingers of the site roads and reclamation of external dump and back filled area. The top soil stockpile will be of low height not exceeding 6m and will be grassed to retain fertility.

#### 6.2.7 Reclamation of backfill area

The soil used for backfilling will be a better soil than the original soil because during dumping some leaf litter will be added to it and some grasses will be promoted to grow on it through seed sowing.

## 1. Bio-Reclamation

Biological reclamation will be done to transform the degraded land and waste dump into a self - sustaining ecologically stable land form. This will prevent soil erosion, dust pollution and will create aesthetic beauty. Re-vegetation of waste dump through systematic means, increases the slope stability, enhances the infiltration of rain water and its availability, increases the soil fertility and promotes natural regeneration of native plant species.

## 2. Species selection for reclamation of the area

Successful bio-reclamation would largely depend on the selection of appropriate species for re-vegetation. While selecting plant species following parameters will be considered.

- Local and native to the soil
- Nitrogen fixing leguminous species will form at least 30% of the total plantation.
- Shrubs, herbs and grasses to check soil erosion and development of fertile soil.

Apart from above top Soil management will be done to ensure the inoculation of Microorganism, seed, organic matter etc.

## 3. Tree plantation

Criteria for the selection of plants:

**Plant species selected for plantation in the backfilled, overburden soil should possess any or more of the following properties.**

- a. Have soil binding property.
- b. Be a nitrogen fixer.
- c. Be able to tolerate, at least to some extent, the crack formation in the soil.
- d. Have drought tolerance ability.
- e. Be able to grow in a slope.
- f. Be able to grow in nutrient and organic matter poor soil.
- g. Be a local species.



**Plantation of trees will be done at the rate of 1000 seedlings per ha of the area.**

Plantation of the overburden soil will be taken up in two phases.

### **Plantation in the buffer zone**

Trees will be planted in the buffer zone as well. This plantation will be done at selected places only and only local species will be used in the plantation. Some of the tree species included will be: Mahua (*Madhuca latifolia*), Sal (*Shorea robusta*), Bargad (*Ficus benghalensis*), Peepal (*Ficus religiosa*), Dhawda (*Anogeissus latifolia*), Tendu (*Diospyros melanoxylon*), Char (*Buchanania lanzan*), Khair (*Acacia catechu*), Aonla (*Phyllanthus emblica*), Arjun (*Terminalia arjuna*), Saja (*Terminalia tomentosa*), Baheda (*Terminalia bellerica*) etc.

- Care will be taken to include some fruit bearing trees like Gular (*Ficus glomerata*), Char (*Buchanania lanzan*), Aonla (*Phyllanthus emblica*) Aam (*Mangifera indica*) and such trees to provide food to the herbivores which in turn will be the food source of the carnivores.
- Water, particularly during drier seasons, becomes the most important factor to all types of wild animals including the mammals, birds and reptiles. If water is available safely, then all other factors become secondary for the presence and survival of the wild life in any forested area.
- Places suitable for mini watersheds will be identified in the core as well as in the buffer zone to store rainwater. Further, to make water available at all the times, throughout the year, some of these water holes will be recharged through artificial means. Proper slope will be given to approach these water sources so that the wild animals will be able to drink water without any difficulty.
- Proper cover through vegetation or any other type of even artificial cover will be developed near to these water sources so that the prey species will be able to hide themselves from the predators, at the time of approaching the water sources.

- To attract the birds, plants yielding food to the birds will be planted on priority basis. If water and food are available to the birds without any anthropogenic disturbances the area can become an ideal place for bird watching.
- Execution of the above works is proposed to be taken by the forest department of Chhattisgarh financed by the company.

The different species that have history of good survival and growth under similar site conditions shall be planted. The suggested species for plantation are given below:

**Fruit bearing trees**

- Jamun
- Mango
- Imli
- Sitaphal
- Bel
- Char
- Tendu
- Gular
- Bargad etc.

**Medicinal trees**

- Neem
- Karanj
- Harra
- Behara
- Aonla
- Arjun
- Shikakai
- Mahua etc.

**Timber value trees**

- Teak
- Shivan
- Ghamar
- Sisham
- Safed Sirus
- Bamboo
- Sal
- Bija etc.

**Ornamental trees**

- Amaltas
- Gulmohar
- Kapok etc.

### 6.3 CONSERVATION PLAN FOR FAUNA

Several reasons for the decline of wildlife and methods for their conservation are practiced. However the best method for the conservation of wild life is related directly to the maintenance of ecosystems in their natural condition, allowing their natural development and degree of protection afforded to the wildlife and their habitat. Both these phenomena (ecosystem development and habitat protection) are related to anthropogenic factors. Some of the important anthropogenic factors are listed below:

- ❖ Habitat fragmentation and destruction
- ❖ Man-animal conflict
- ❖ Forest fire
- ❖ Poaching
- ❖ Stake holders dependence on forest resources
- ❖ Creating awareness amongst forest stake holders
- ❖ Water scarcity

The plan for wild life conservation, with respect to above situations, is detailed as under:

#### 6.3.1 Habitat improvement

Some of the common trees to be planted for habitat improvement will include: *Terminalia tomentosa*, *Anogeissus latifolia*, *Madhuca latifolia*, *Buchanania lanzan*. Together with these some fruit yielding species should also be planted e.g. Mango, Tendu and Gular etc. *Ficus benghalensis* is also encountered in the forests but with a very low frequency, but is a flagship species and should be planted with similar frequency. To this it is important to add the plantation of aonla, which has almost disappeared from the area. The area vegetated with the local species will provide natural environment, food and shelter to the wild life attracting them more to the

area. Some hideouts, suitable to different wildlife species, should also be created at suitable places.

### **6.3.2 Elimination of Man-animal conflict**

Man-animal conflict is a difficult problem to be eliminated. The conflict is both deliberate as well as inadvertent. However, conflict can be minimized through employing local persons to form anti-depredation team. The conflict can be minimized also through protecting the area, preventing the entry of human beings or the cattle in the area. First aid facilities should be provided in the villages to meet exigencies in case of any conflict.

### **6.3.3 Prevention of forest fire**

Forest fire is caused both naturally as well as by the human beings. Anthropogenic causes will be minimized through forming a fire line around the forest area. To add to the prevention of fire local persons will be employed as fire guards, during the fire prone season. The team will be instructed to fight the fire as soon as it is detected. Watch towers will also be constructed to detect forest fire. Awareness program against forest fire will also be run in adjoining villages.

### **6.3.4 Prevention of poaching**

Poaching is undoubtedly a serious problem in the conservation of wild life. Several methods are employed by the poachers, to kill or trap the wild life, of which poisoning and traps of different types are more common. A proper vigilance will be maintained to check such menace. Poaching menace will be eliminated seriously neither all the efforts to promote wild life survival in the area will go in to waste.

### **6.3.5 Creating awareness amongst forest stake holders**

Awareness about the environment and wild life will be created amongst the adjoining villages. They will be informed about the importance of a good environment, a healthy ecosystem and more importantly about the wild life. Through slide and film shows they will be convinced about the sustenance of natural

ecosystems. They will be convinced that their own survival depends upon the survival of a healthy ecosystem, to which a wide variety of wild life is an essential component. To develop affection of the people towards the wild life some of them will be taken to some zoos and wild life sanctuaries. Awareness programmers will be run with the help of Forest Officers and more importantly some national experts will be invited to deliver talk's awareness, related to wildlife conservation.

### **6.3.6 Water availability**

Rainfall in the area is about 1300 mm, sufficiently to be categorized as a wet area. However, due to lack of proper storage, severe water scarcity develops during the summer months. To make the water available throughout the year it is essential to create water storage facility. Multiple water storage places will be created in the Buffer zone through improving the existing ponds, constructing stop dams in the water channels and through creating water holes. Also, camouflage and hiding places should be created. Some wildlife species fulfill their salt requirement through licking the soil. Salt deposits will be arranged for such species adjacent to the water holes. These water holes will also be helpful in recharging the ground water and thus will be supporting good growth of the vegetation.

### **6.3.7 Restriction of grazing and creation of waterholes**

Waterholes will be constructed outside the plain area for exclusive use of wildlife. This will reduce direct conflict between the wild animals and cattle. Patrolling parties will check and stop the entry and illegal grazing of cattle in the area. Heavy grazing not only reduces the herbaceous cover but brings about compaction of the soil also. It also favours the growth of non-palatable, unwanted weeds like *Lantana camara*, *Hyptis suaveolens*, *Plectranthus incanus*, and *Ageratum conyzoides* and so on. Such weeds will be uprooted and eradicated, preferably before their flowering and fruiting, to promote the growth of fodder grasses.

### **6.3.8 Training and awareness programme**

This is the most important aspect of wild life conservation. People will be educated regarding the importance of wild life conservation through mass publicity by installing sign-boards, conducting audio visual classes and distributing literature in respective villages in the buffer zone. Experts in the field of wild life conservation will also be invited to deliver talks through slides.

### **6.3.9 Encourage local villagers to grow trees on their own on field bunds/court yards etc.**

In consultation with Forest Department the company will provide some finance, to grow saplings of tree species, having importance for wood, small timber and fuel wood to distribute to the villagers. Bamboo will be another important species with a lot of environmental and economic value. This will, no doubt, will help reduce dependence of people on RF forest; as a result the ecological condition of the area will improve so the wild life will be attracted to this area.

### **6.3.10 Creation of conservation awareness**

What if a few species of wildlife become endangered or extinct? How are we concerned if the Indian Cheetah has been lost forever or the Asiatic lion is precariously perched on the verge of extinction? Why should we spend corer of rupees to protect the tiger? The answers to these questions of “what”, “how” and “why” should form the basis for creating conservation awareness among the public- an understanding of the importance of biological diversity of inter-relationships in nature, of the sustenance and stability of ecosystems and of man’s impact on the natural world.

## 6.4 CONSERVATION PLAN FOR AVIFAUNA

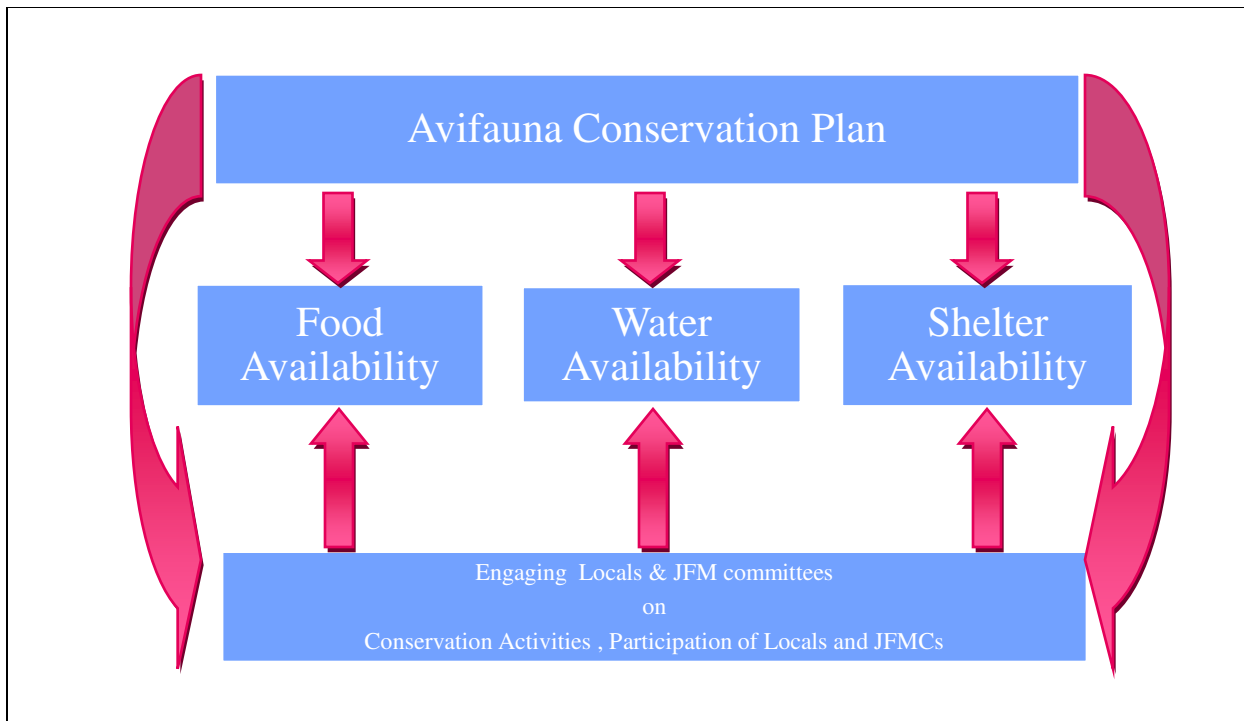
India is rich in Biodiversity with two global Hotspots. The avifauna of India includes around 1301 species, (Clements & James, 2000). Birds are the indicators of the health of an ecosystem as they indicate its needs and diversity. However, detailed study, exclusively on birds of Raigarh district has been carried out. According to working plan, Raigarh forest Division shows diversity of habitat like barren, woodland, shrub land, agricultural and grassland etc. This diversity of topography and habitat offers suitable environment and opportunities for the bird population for breeding, feeding, resting and nesting. Beside this, some of natural habitats of avifauna were disturbed by mining of coal production expansion. From growth of mining, the natural habitat of birds are getting affected which results decreased population of avifauna in other manner. To conserve affected avifauna, it is most important to conserve the species of birds and their habitat.

The avifauna conservation plan should be planned in such a manner that habitat, water and food availability were naturally surrounded in newest location. The conservation plan for avifauna is detailed as below:

### 6.4.1 MAJOR STRUCTURES FOR ALTERNATE HABITAT DEVELOPMENT

Species diversity has often been the prime attribute in conservation strategies. Sites have been evaluated merely by the number of species they contain (Ranjit.R.J, Daniels; A landscape approach to conservation of birds). The major structures for alternate habitat development of avifauna conservation should be focused on food, water and shelter availability. The conservation plan consist the food, water and shelter availability considered with scientific recommendations. The avifauna conservation plan is based majorly on availability of following points:

- (i) Food availability**
- (ii) Water availability**
- (iii) Shelter availability**



**Figure 6.1: Conceptual model for improving Avifauna Conservation Plan.**

### **(I) Food availability**

For every living creature, food is important need to survive and to live. In line with previous studies in pied flycatchers (Verhulst 1994; Siikamäki 1998), our food supplementation was successful at increasing nestling survival until fledging. In supplemented nests, the effect of breeding density on adult body mass and fledging probability was cancelled out. The decrease in provisioning rate with increasing density in control nests, independently of dispersal status, also disappeared in supplemented nests, mainly because of an increase in provisioning rate in high-density habitats. Food availability thus played a role in mediating the density-dependence of these traits and in particular the differences between dispersing and philopatric individuals in patterns of density-dependence on adult body mass and fledging probability, although the last result remains to be confirmed with more statistical power.

**(a) Bird feeder:** Bird feeders are artificial structures for feeding birds in proper medium. The structure is made such a manner that a hollow container for foods, seeds



etc and consist of holes through which grains or seeds were feed by birds. Bird feeders are available in different models such as crop feeders, seed feeders etc. These feeders can also be constructed by wood logs or bamboos. This structure can be made by local peoples by proper instructions and demonstration.

**(b) Plantation of fruit tree species:** To promote people for planting fruit yielding tree species such as jamun, ficus spps, anjeer etc.

**(c) Encouraging locals for cereal crop cultivation:** Promoting locals for cultivation of crops like bajra, kodo, kutki, tilhan etc. They are also encouraged for growing green vegetables like bitter ground (kheera), green vegetables etc.

## **(II) Water availability**

**(a) Selecting habitat in water available location:** The Annual Rainfall in Raigarh district is about 1300 mm and is sufficient to be categorized as a wet area. However, selection of alternate habitat in buffer zone for nest placement will be chosen nearby the natural water bodies like naala, ponds or rivers. Due to lack of proper storage, severe water scarcity develops during the summer months.

**(b) Construction of water structures:** Secondly, to make the water available throughout the year it is essential to create water storage facility. Multiple water storage places will be created in the Buffer zone through improving the existing ponds, constructing stop dams in the water channels and through creating water holes. Moreover, permanent water sources are important to foster bird diversity (Tilghman 1987; Jokimäki 1992).

**(c) Mud pot or ‘Sapore’ made by locals:** The next structure is ‘mud pot’ or ‘sakore’ which is also effective model for conservation of avifauna for the purpose of water and food storage. The plate like mud pots can be easily made by ‘potter’ and can be constructed by local villagers. Involving local villagers or local potter will be helpful for this purpose and for rise of their participation awareness. These mud pots can be easily placed in anywhere and also in branches of trees.

### (III) Shelter availability

Birds are generally one of the first types of wildlife to visit a mine site following reclamation due to their mobility and active search for suitable habitat (Brändle et al. 2003). The availability of different kinds of nest-boxes may increase the colonization of urban parks by a great variety of cavity-nesting birds (Jokimäki 1999). Many bird species are not restricted to a single vegetation type, but rather depend on some combination of early successional habitat, open areas, and young and mature forests to find food and shelter and raise young (Hunter et al. 2001). For providing the shelter to avifauna will be based on nesting patterns of bird species found in raigarh district. Internationally recommended artificial nests will be constructed by the help of local communities / Joint forest management. Detailed nest designs are mentioned below.

**6.4.2 Artificial nesting:** Before the artificial nesting trail we had surveyed the avifauna species of mining site and categorized them according to their habit, habitat and nesting pattern through which artificial nesting is being proposed.

Artificial nesting structures can be used to increase avifauna reproductive success in buffer zones where natural nest site are unavailable or unsuitable. While artificial nesting structure cannot replace natural nesting habitats, they can increase the number of nesting site available in an area. Many types of avifauna use artificial nesting structures including song birds, woodpecker, waterfowl, and raptors. While structures are generally designed to meet the nesting requirements of certain species, they may also be used by none target animals and provide roosting and winter cover for variety of birds. Nest boxes, nesting platform or shelves, and nesting baskets, culverts, and cylinders are some of the common types of artificial nesting structures. The most effective artificial nesting structures are those installed enclose proximity to brood-rearing habitat, adequate escape/concealment cover, a reliable source of food and water and other element of the habitat of target species. Predators, competitors and

territory sizes for individual species also influence the usefulness of nesting structures. Nest monitoring and maintenance actions can be taken to limit competing or undesirable species access reproduction success, and provide an opportunity for landowners and managers to observe avifauna. Cavity nesting birds which mainly nests in tree cavities are likely to use nest box. Primary cavity nesting species, such as members of the woodpecker family, excavate nesting cavity in live / standing dead tree (snags); Secondary cavity nesters (e.g. some passerine or perching birds, owls, and waterfowl) use cavities abandoned by primary excavators and those formed by fungus, knots, and tree subject to decay. The presence of snags in forested areas is directly related to the quality and quantity of nesting habitat for many cavities nesting species.

**6.4.3 Construction material:** structures made of wood are relatively inexpensive and easy to build. Wood seems to be the most weather resistant, insulating material, and most avifauna species prefer wood to metal or plastic structures. For most nest boxes, ¾ inch rough-cut borders are best used for construction. Since cavity nesting waterfowl do not carry nesting material to the nest, 3-4 inches of coarse sawdust or woodchips should be placed inside the nest box. Nest boxes intended for use by woodpeckers can be tightly packed with sawdust to resemble decaying woody material. Old nesting material should be removed at the start of each nesting season and replaced with fresh material. While many artificial nesting structures are designed for cavity nesters, some provide nesting sites for other avifauna. Nesting platforms, baskets and cylinders are used by waterfowl, raptors and other species. If wire mesh is used as nest support material, the weave must be tight enough to prevent eggs and young from falling.

Designs range from simple platforms to complex, multi-compartment structures some of these design are more successful than others, and most can built or acquired from a variety of suppliers. Basic nest box designs can be modified to accommodate

various species by altering dimensions or entrance hole sizes. The size of the entrance hole also influences the internal temperature of the box, predator accessibility, and use by competing non-target species.

#### 6.4.4 Basic nest box characteristic

1. Should be made of wood; Sal (*Shorea robusta*), Sisoo (*Dalbergia sisoo*), Babool (*Acacia nilotica*) etc (preferred, most weather resistant).
2. Box should open from the side or top for maintenance and cleaning.
3. Sides of nest box should enclose the floorboard (recessed ¼ inch) to prevent rain seepage.
4. Nails, woodscrews, and hinges should be rust proof.
5. Entrance hole dimensions should accommodate the desired bird species; hole should not be large enough to allow competitors and predators access.
6. A double thick entrance and extended roof to deter predators like squirrels and raccoons.
7. Ventilation holes or slits at the top of both sides, just beneath the roof of the box.
8. Drainage holes (four or five) drilled into the bottom of the nest box to allow for drainage.
9. Song bird nest box should not have a perch, which increases predator access; native song birds do not use perches.
10. Nest box should not be treated with green preservative, it is poisonous to birds.
11. Nest box should not be painted on the inside or painted bright, unnatural colours on the outside (may attract predators or exotic species) (Avifauna survey 2013).

### Artificial nest designs

#### Design I

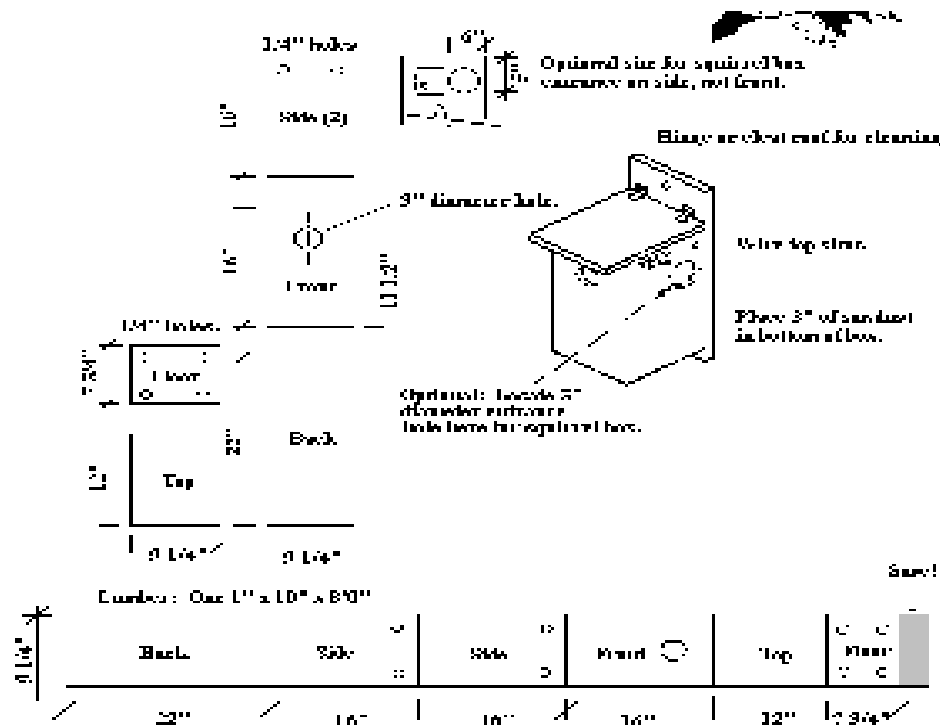


Fig 6.2: Ideal nest design for Doves, Parakeets, and Orioles

#### Design II

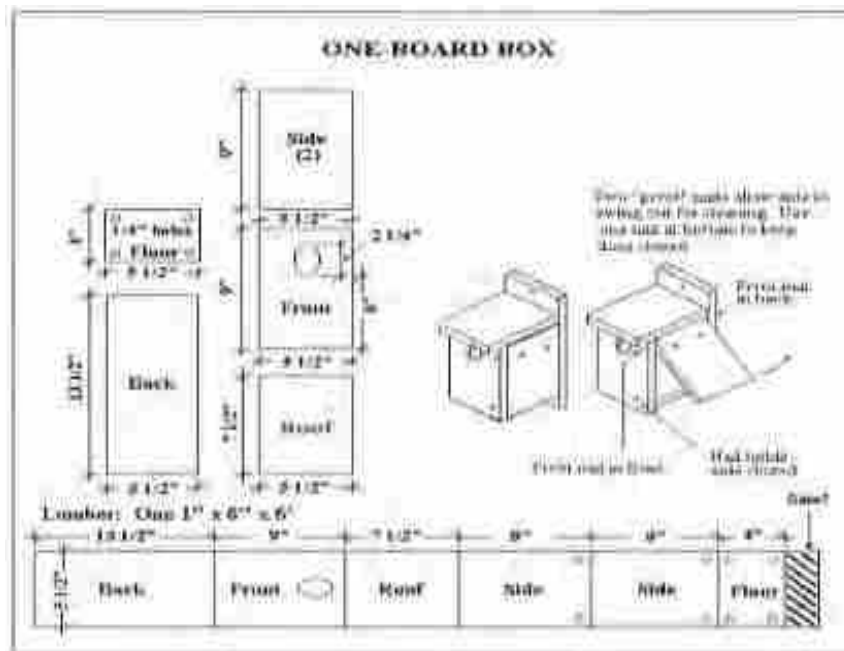


Fig 6.3: Ideal nest design for Yellow Throated Sparrow, Mynas, Parakeets, and Indian Rollers etc.

Design III

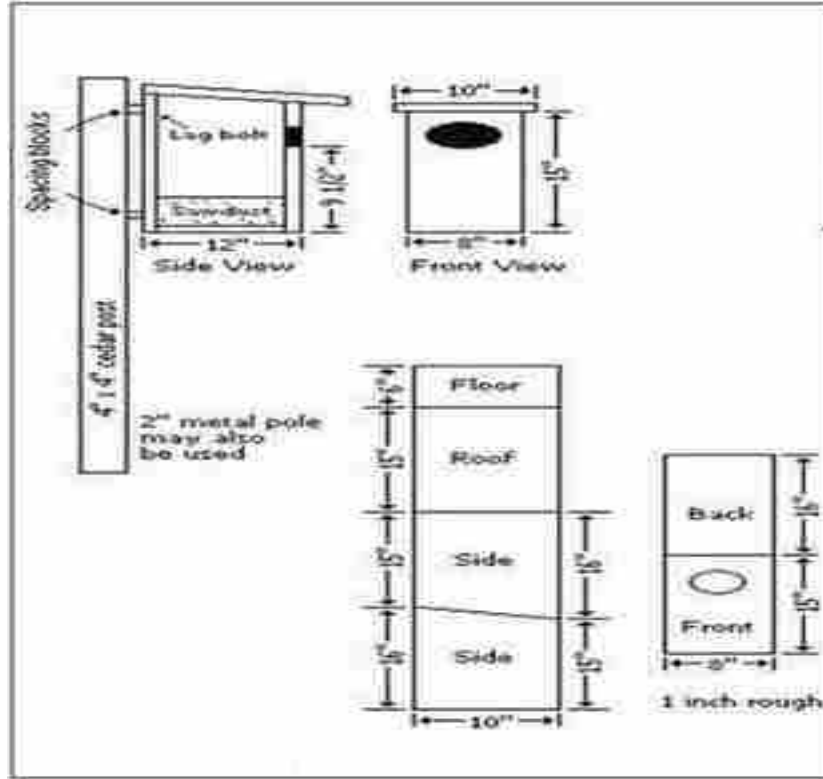


Fig 6.4: Ideal nest design for Shrikes, Indian Robin, Magpie Robin, etc.

Design IV

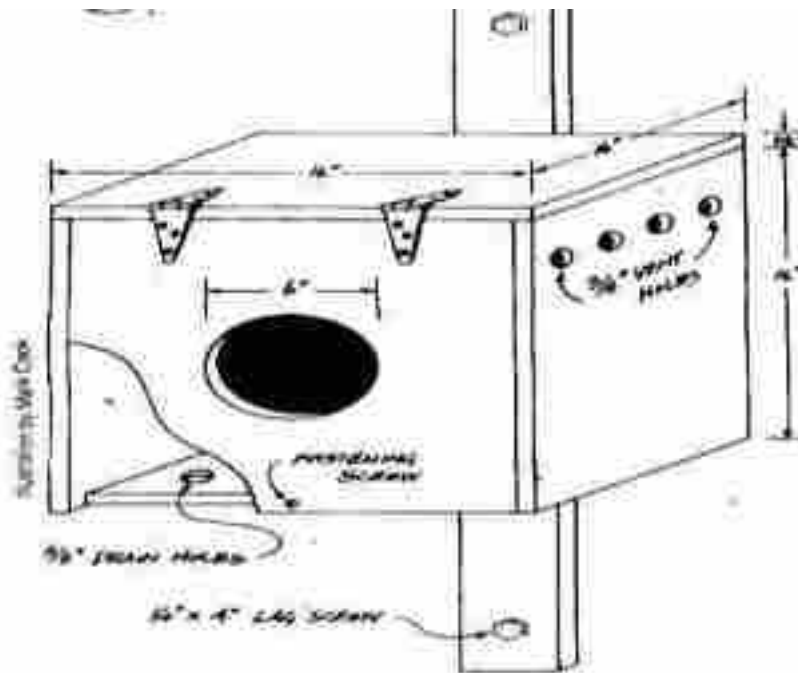


Fig 6.5: Ideal nest design for Owl and Owlets.

Design V

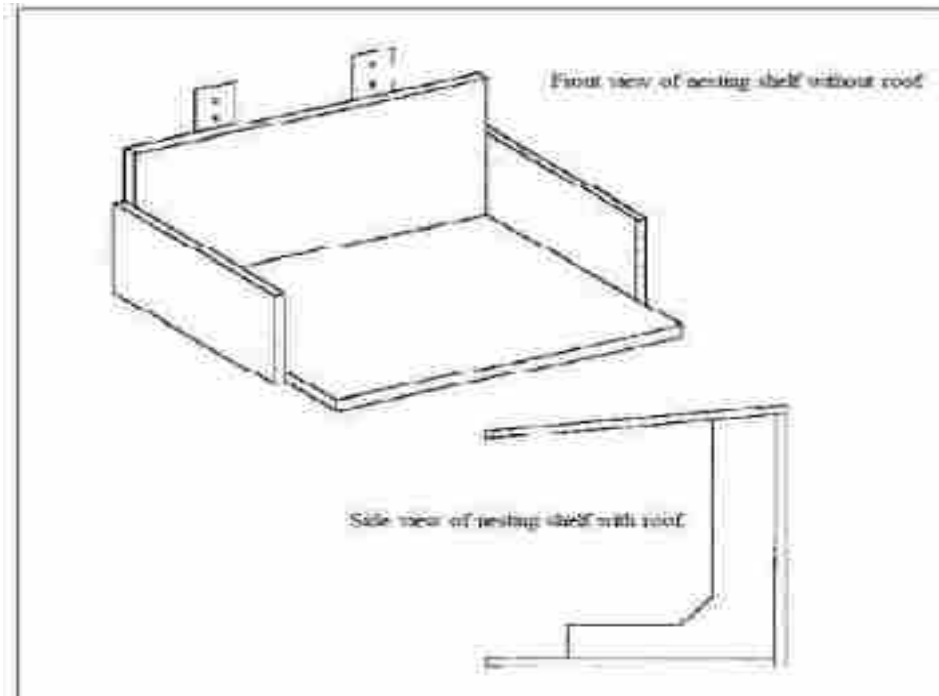


Fig-6.6: Ideal nest design for Platform and Twig nesting birds.

Design VI

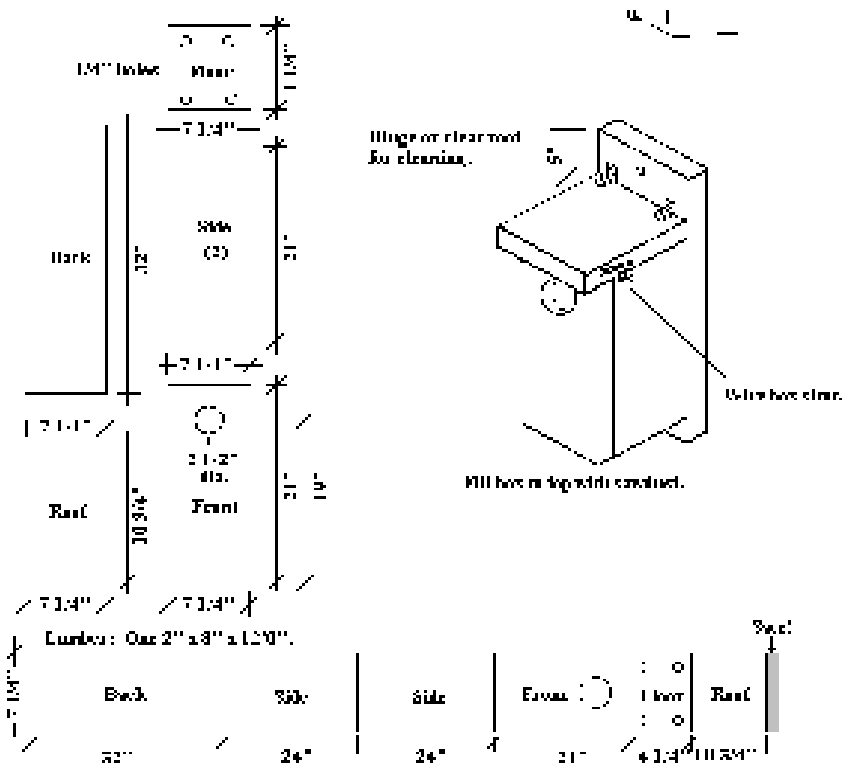


Fig 6.7: Ideal Nest design for excavators having yellow tail and red patch on the back of head and neck

Design VII

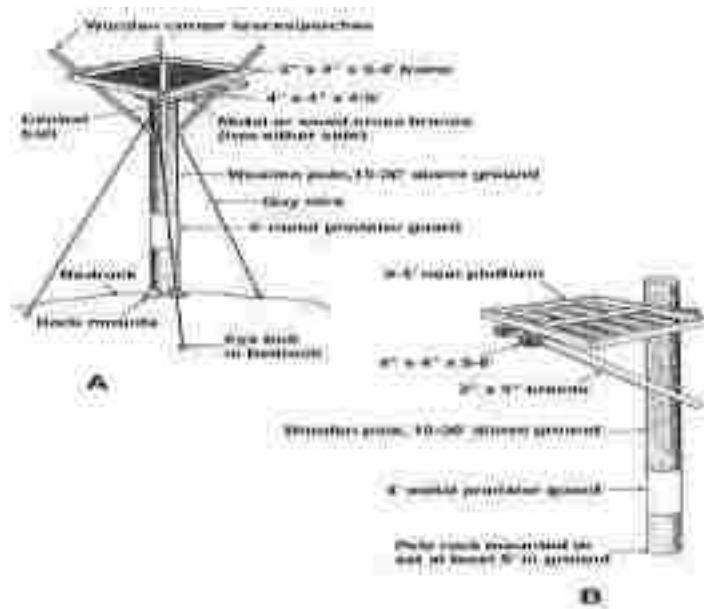


Fig 6.8: Ideal nest design for Raptors.

Design VIII

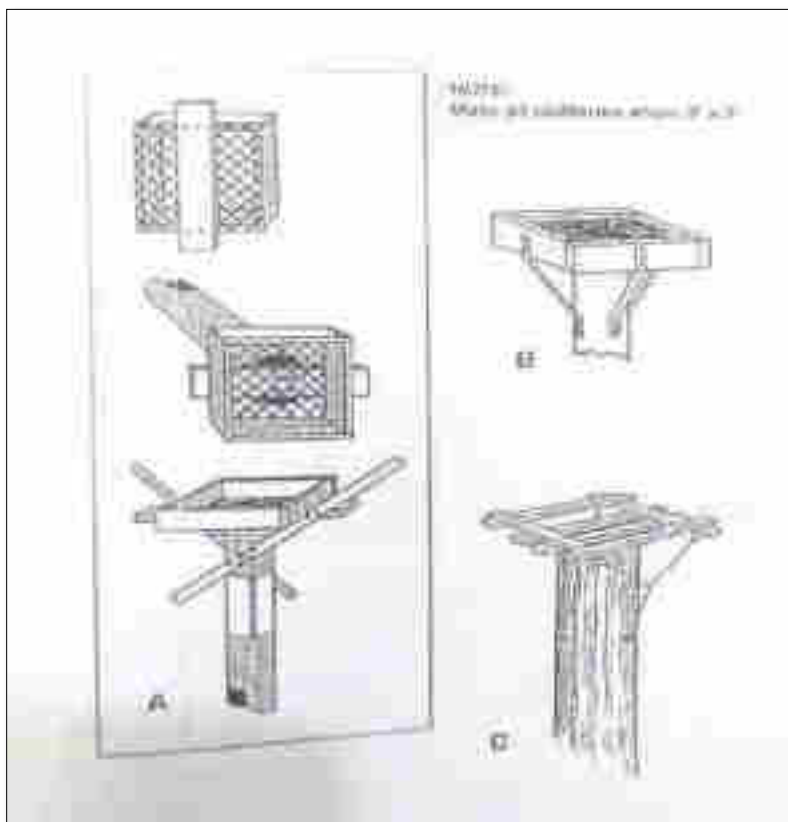


Fig 6.9: Ideal nest design for Raptors.



## Design IX



**Fig 6.10: Ideal nest design for grassland birds and Cup nesting birds.**

As per the above cited figures for all the birds found in the mining area of OCP Chhal. The artificial nesting design proposed for all birds characterized on their habit, habitat and nesting patterns (Fig 6.1- 6.8).

## 6.5 CONSERVATION PLAN FOR ELEPHANT

Elephants are major agents of change and are often indicated as those large herbivores possessing the ability of changing entire ecosystems in terms of vegetation structure and composition, thereby affecting a whole series of other ecosystem components as well. The exclusive role of elephants as agents of change could thus far not be completely isolated from the multitude of factors involved in ecosystem dynamics.

Globally, wild elephants are present in 50 countries, 13 of which are in Asia and 37 in Africa. At present the number of wild Asian elephants (*Elephas maximus*) is between 35,000 and 50,000 ([www.elephantcare.org](http://www.elephantcare.org)), while the number in captivity is around 16,000. The trend in almost all Asian range states has been a drastic decline in wild elephant numbers, due to a range of anthropogenic factors related to increasing human population, loss and degradation of forest habitat, fragmentation of breeding populations and increasing human-elephant conflict (HEC).

The Asian elephant is categorized as an ‘endangered’ species in the red list of the World Conservation Union ([www.iucnredlist.org](http://www.iucnredlist.org)) and is classified with the Convention for International Trade of Endangered Species ([www.cites.org](http://www.cites.org)). They have declined from over 5 million animals located throughout the continent 100 years ago, to the current number confined to fragmented habitats in sub-Saharan regions. Whereas poaching for ivory and meat was a major reason for the decline in the past, loss of habitat is the biggest threat to their continued survival at present. Paradoxically, though, elephant numbers are increasing in some countries and may need to be controlled in order to prevent degradation of their habitats.

India holds by far the largest number of wild Asian elephants, estimated at about 26,000 to 28,000 or nearly 60% of the population of the species (*Bist 2002*). *Elephas maximus* is placed in Schedule I and Part I of Indian Wildlife Protection Act (1972)

conferring it the highest level of protection. Wild elephants are presently distributed over an area of about 109,500 km<sup>2</sup> (*Santiapillai and Sukumar, 2006*); this is approximately 3% of India's geographical area. Adjacent to some of these areas, a segment of the elephant population killed an average of 350 people annually over the last five years (2005-2006 to 2009-2010) (Project Elephant), and damaged an average of 330 km<sup>2</sup> of crops every year for the last three years (2007-2008 to 2009-2010) (Project Elephant).

Northern Chhattisgarh in Central India has been home of Asian elephants since historical times. However, in the early part of the 20th century they became locally extinct (*Singh, 2002*). In 1988 elephants migrated from the prime elephant habitat of Jharkhand into Chhattisgarh and caused extensive damage to life and property. Since then, HEC cases have been increasing due to straying of migratory elephants in the state (*Singh, 2002*). The number of wild elephants in the year 2007-08 in the state estimated to be 122 (*Moe, 2008*). Major reason for prolonged stay of elephants in the state could be better forest cover (44 %), heavy mining, habitat degradation and deforestation in the states of Jharkhand and Orissa (*Singh, 2002; Earth Matters Foundation, 2008*). Even the state of Chhattisgarh is primarily inhabited by tribal communities dependent largely on agriculture and minor forest produce. Increasing human pressure on forested areas is resulting in increased incidences of human-elephant conflicts. This necessitated a detailed assessment of habitat suitability and dispersal corridor for elephants in the area.

### **6.5.1 Records of the Elephant's movement in Raigarh District**

During 19th century and earlier elephants were, recorded only from the northern part (Raigarh district) of the state but for unknown reasons the species left the area in the beginning of the 20th century. During this time the species was recorded from Raigarh District. However, the species re-entered the area of Chhattisgarh state, in

1980s, around the year 1986. The elephants then entered the area of Raigarh district, from Orissa state. In the beginning their entry was occasional, coming and going in to and out of the area. However, in later years their entry as well as their residence time, within the area of the state, has increased.

**At present, the study area of Chhal Range under Dharamjaigarh Forest Division has been observed the elephant movement**

**1. Important points in the conservation of elephants:** Following are some key points in the conservation of elephants:

- ❖ Require 150-250 kg of plant food every day, with preference for grasses.
- ❖ Evolved to a large size, with black color. The black color absorbs more heat.
- ❖ Lack sweat gland to dissipate the body heat, hence, require a shade in sunny days, or require frequent cooling through wallowing or spreading water over the body.
- ❖ Have very poor visibility particularly during night. Their eyes do not shine in the night, because of reduced number of cones, unlike the canines like tiger, leopard and even bovid like the cow.
- ❖ A good source of water is required also for drinking.
- ❖ Frequent dusting of the body or mud cover over the body is required to protect the body from the biting insects.
- ❖ Change in cropping pattern by introducing crops disliked by elephant or the plant which act as elephant repellent (e.g. Patchouli, (Pachouli) *Helianthus annuus* (Sunflower) *Capsicum annum* (Chilli) *Sesamum indicum* (Til) and Citrus should be promoted.

### **6.5.2 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<sup>2</sup>.

### 6.5.2 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.

### 6.5.3 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.

### 6.5.4 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.

SN	Botanical Name	Local Name
1.	<i>Acacia catechu</i>	Khair
2.	<i>Acacia nilotica</i>	Babool
3.	<i>Aegle marmelos</i>	Bel
4.	<i>Albizia lebbek</i>	Kala siris

5.	<i>Bambusa arundinacea</i>	Bans
6.	<i>Albizzia procera</i>	Safed siris
7.	<i>Bauhinia variegata</i>	Kachnar
8.	<i>Bauhinia vahlii</i>	Mahul
9.	<i>Bauhinia malabarica</i>	Khatua
10.	<i>Bombax ceiba</i>	Semal
11.	<i>Brachiaria sp.</i>	Ghas
12.	<i>Bridelia retusa</i>	Kasai
13.	<i>Careya arborea</i>	Kumhi
14.	<i>Cordia myxa</i>	Lassora
15.	<i>Cymbopogon flexuosus</i>	Ghas
16.	<i>Cynodon dactylon Doob</i>	Grass
17.	<i>Dalbergia sissoo</i>	Shisham
18.	<i>Dendrocalamus strictus</i>	Bans/ Bamboo
19.	<i>Desmostachya bipinnata</i>	Urai/Khus
20.	<i>Eleusine sp.</i>	Ghas
21.	<i>Emblica officinalis</i>	Amla
22.	<i>Eucalyptus spp</i>	Nilgiri
23.	<i>Eulaliopsis binata</i>	Bagai Ghas
24.	<i>Feronia elephantum</i>	Kaith
25.	<i>Ficus bengalensis</i>	Bargad/Bar
26.	<i>Ficus glomerata</i>	Dumar/Gular
27.	<i>Ficus religiosa</i>	Pipal
28.	<i>Ficus rumphii</i>	Duranga-hesa
29.	<i>Ficus infectoria</i>	Pakar
30.	<i>Flacourtia indica</i>	Kandai
31.	<i>Garuga pinnata</i>	Kekad
32.	<i>Grewia elastica</i>	Dhaman
33.	<i>Helicteres isora</i>	Ainthe
34.	<i>Holarrhena antidysenterica</i>	Korea
35.	<i>Ipomoea spp.</i>	Karmata
36.	<i>Imperata arundinacea</i>	Ulu
37.	<i>Kydia calycina</i>	Baranga/Pula
38.	<i>Lagerstroemia parviflora</i>	Senha/Sidha
39.	<i>Limonia acidissima</i>	Kaith
40.	<i>Mallotus philippinensis</i>	Sinduri/Rohini
41.	<i>Mimosa pudica</i>	Lajwanti
42.	<i>Mitragyna parvifolia</i>	Mudhi
43.	<i>Musa paradisiaca</i>	Banana
44.	<i>Neyraudia arundinacea</i>	Bichhloo
45.	<i>Oryza sativa</i>	Dhan
46.	<i>Ougeinia oojeinensis</i>	Tinsa
47.	<i>Phoenix humilis</i>	Buta Chhind
48.	<i>Pithecellobium dulce</i>	Jangal Jalebi

49.	<i>Randia dumetorium</i>	Mainphal
50.	<i>Saccharum munja</i>	Kandi-khar
51.	<i>Saccharum officinarum</i>	Ganna
52.	<i>Saccharum spontaneum</i>	Kans
53.	<i>Sansevieria sp.</i>	Sisal
54.	<i>Schleichera oleosa</i>	Kosam/Kusum
55.	<i>Shorea robusta</i>	Sarai/Sal
56.	<i>Syzygium cumini</i>	Jamun
57.	<i>Tamarindus indica</i>	Amlı / Imli
58.	<i>Terminalia tomentosa</i>	Saja
59.	<i>Tectona grandis</i>	Sagaun / Teak
60.	<i>Tinospora cordifolia</i>	Giloe / Gurch
61.	<i>Thysanolaena agrostis</i>	Hathi ghas / Pirlu
62.	<i>Zizyphus mauritiana</i>	Bhander
63.	<i>Zizyphus xylopyra</i>	Ghont

The most commonly consumed species belong to family *Poaceae* and *Fabaceae* (17.65%) followed by *Moraceae* (14.71%). Elephants extensively feed on *Artocarpus heterophyllus*, *Syzygium cumini*, *Acacia nilotica*, *A. catechu*, *Dalbergia sissoo*, *Zizyphus mauritiana*, *Aegle marmelos* and *Ficus* species, besides various grasses and shrubs (Bhagat et al, 2017). *Saccharum spontaneum*, *Thysanolaena maxima* and fruit parts of *Dillenia indica*, are some of the other species recorded to be preferred by elephants. Some other food plants have been reported by the villagers of elephant moving areas of Chhattisgarh state. The list includes:

<i>Musa paradisiaca</i>	Kela	All the parts are edible.
<i>Oryza sativa</i>	rice	Eat very cleverly the fruiting part, only, in the barn yard they dismantle the heap of gathered rice.
<i>Saccharum officinarum</i>	Ganna	One of the most preferred food item.
<i>Dendrocalamus strictus</i>	Bamboo	All the parts are edible.
<i>Ficus benghalensis</i>	Bargad	Leaves and barks were eaten mostly.
<i>Ficus religiosa</i>	peepal	Leaves and barks were eaten mostly.
<i>Artocarpus heterophyllus</i>	Kathal	Fruits, leaves and barks were eaten mostly.
<i>Miliusa velutina</i>	Bhilwa	Leaves and barks were eaten mostly.
<i>Pterocarpus marsupium</i>	Bija	Barks were eaten mostly.
<i>Zea mays</i>	Makka	Whole plant's parts are eaten.

<i>Phoenix sylvestris</i>	Chhind	Rhizomes are edible.
<i>Phoenix acaulis</i>	Buta chhind	Rhizomes are edible.
<i>Buchanania lanzan</i>	Char	The saplings are up-rooted; the root is thrashed clean of soil and is then eaten.
<i>Goruga pinnata</i>	Kekad	Barks were eaten mostly.
<i>Carica papaya</i>	Papita	Whole plant's parts are eaten.

Some of the elephants develop fascination for country made alcoholic drinks called “*Handia*”.

### 6.5.5 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.

### 6.5.6 Solution

Habitat destruction by man has threatened the survival of the Asian Elephant. Therefore; maintenance of the habitat is the first requirement in the conservation of the elephants. If proper habitat is absent or is below the desirable standard, then it may be developed. Elephants require, simultaneously, two types of habitats:

#### a. Dense forest with tall trees and

#### b. Scrub jungle and grasslands dense forest is required as refuge and protection from intense sun rays

Scrub and grasslands are required as a better feeding area. Tall trees are not a good source of food because their foliage and tender twigs are beyond the reach of elephant's trunk. It is only the fallen fruit and bark of such trees which can be eaten. It is generally difficult to peel off the bark from trees. In a scrub or grassland, it is easy to feed. The food item may be foliage, tender shoot, entire plant or even the root; all are within their easy reach. With respect to the area, there are two options for the conservation of the elephants:



- **Restrict the elephants in a defined area**
- **Develop a corridor for long, may be interstate, migration route.**

Development of a corridor far beyond the OCP Chhal Dharamjaigah mining lease area will be the best choice for the conservation of the species. The corridor, to be developed, must have both the dense forest with tall trees as well as shrubby areas. Now it depends upon the condition of the area to decide that the shrubby areas should be forming outer fringe to the tall tree area or should be in the middle or should be in patches in between the tall trees. The corridor belt should be of sufficient width and should be planned either away from the village settlements or the isolated houses near to their path should be shifted. Elephants require 150-200kg of food per head, per day. Habitat planning should include provisions to yield sufficient food. It is important now to decide about the plant species. The food plants should be of more liking type to the elephants. To keep the food plants within easy reach of the elephants, regular planting of new plants or pruning to stimulate coppicing, should be made. Some of the food plant species suggested to be planted in the area are:

*Dendrocalamus strictus*, (Bans) *D. Rhedii* (Bans), *Bambusa arundinacea* (Bans), *Ficus benghalensis* (Bargad), *F. religiosa* (peepal), *F. glomerata* (Gular), *F. rumphii* (Jangali Bargad), *F. infectoria* (Pakar), *Artocarpus heterophyllus* (Kathal), *Milium velutinum* (Bhilwa), *Pterocarpus marsupium* (Bija), *Phoenix sylvestris* (Chhind), *Phoenix acaulis* (Buta chhind), *Buchanania lanzan* (Char), *Feronia elephantum* (Kaith), *Goruga pinnata* (Kekad), *Thysanolaena agrostis* (Hathi ghas), *Cymbopogon flexuosus* (ghas), *Themeda quadrivalvis* (Ghas), *Iseilema laxum* (Ghas), *Bothriochloa pertusa* (Ghas), *Apluda mutica* (Ghas) etc. Bamboos (*Dendrocalamus strictus*, *Bambusa arundinacea*) are one group of fast growing plants which can form a good proportion of diet to the elephants. Another bamboo species *Dendrocalamus rhedii* will be an exotic species to the area but is common in Western Ghats. It has a thin stem. Elephants have special liking for the bamboo plant and it is easy to grow

the plant in sufficient quantity in short time. However, it is not a species which can create any problem. The villagers in OCP Chhal area have informed that the elephants have special liking for *Buchanania lanzan*. The saplings of the plant are uprooted and the root thrashed clean and eaten. With the vegetation it is essential to develop perennial sources of water with some salt ponds, within the conservation area.

### 6.5.7 ELEPHANT CORRIDOR

There is a need to establish an elephant corridor, combining the Tamor-Pingla and Semarsot wildlife sanctuaries in Sarguja district and Badalkhol wildlife sanctuary in Jashpur district. Corridor will be developed to join these three wildlife sanctuaries. However, still no notification has been issued so far.

### 6.5.8 SOME SUGGESTIONS TO ESCAPE ELEPHANT DAMAGE

Methods adopted to escape elephant damage may be categorized as

#### ❖ Active and passive methods

##### Active methods

- Noise-making like shouting, drum beating, bursting fire crackers, firing gun shots into the air (by forest officials only),
- Using elephant torch light
- Pelting stones and lighted fuel-woods.
- Loudspeaker broadcasting of tiger roaring sound However, the major drawback of using all these methods is that these may provoke the raiding elephants increasing the possibility of more damage to the crops and other properties as well as higher risk to the farmer's life. Further, if the active methods fail to be effective, singly, then combined effort should be made.

##### Passive methods

- Change in cropping pattern by introducing some elephant repellent alternative cash crops (e.g. Patchouli, *Helianthus annuus*, *Capsicum annum* and Citrus).
- Digging trenches around village area.

- Planting sisal (*Agave americana*) around village boundary.
- Solar fencing.
- Improvement of water sources.
- Raise/improve fodder resources.
- Fencing houses with GI wires.

Elephants avoid shining objects. GI wires are cheapest, shining objects to distract the elephants. Barbed wire fencing is gradually proving ineffective in preventing the movement of elephants. In the buffer zone of the presently applied mining lease area also the elephant have broken barbed wire fencing and entered a nursery. Crops of elephant liking should be avoided, as far as possible. Some of the crops, listed above, should be used to replace the more traditional crops like the sugarcane and rice. In Karnataka elephant proof trenches are being dig around the village area, but I have observed in Raigarh district in Chhattisgarh state that the elephants can move down and up in trenches of good depth. Sisal has been found to be good to prevent the elephants to cross the sisal planted area. The plant yields a good quality fiber. Electric fencing has also been suggested as one of the methods but in Assam it has been found to be a failure as the elephant have discovered techniques to break such fences, safely. In areas like Kamakshyanagar in Dhenkanal division in Orissa improvement of fodder resources in the forest has shown promising result of restricting the elephants more in the forest area. Passive methods are always better to avoid man-elephant conflicts. More important are the selection of plants as alternative crop as well as plants to check the entry of elephants in to the settlement areas. A good amount of researches and suggestions on the conservation and reducing its conflicts with human being is going on, resulting in suggestions coming frequently on these aspects. With the above, some more, methods are being suggested for affected region:

- **Two doors in a house:** Most of the houses in villages have only one door or exit. In case the elephant enters the house through the door, the occupants can escape through another door.
- **Timely information:** Timely information to the helping person about the approach of elephants can reduce the conflicts as well as loss of human life. For this a network should be formed with the villages and the forest officers.
- **Elephant torch:** The elephant torch should be provided to each of the vulnerable villages. Presently the torch is only with the forest officer, one torch for several villages.

**Some more suggestions to avoid conflicts:**

- Do not make crowd near elephant.
- Maintain at least 300 meter distance from the elephant.
- Do not wear red, white or colorful clothes.
- Day time is their resting time; do not disturb them during day time.
- Do not injure them neither they become more violent.
- Do not allow children, ladies and aged persons to go near the elephants.
- Do not prepare liquor or “handia” (country liquor) in the elephant movement area, because elephants like it and can smell it from distance. Do not go near the elephant after taking alcoholic drink.
- Elephants have good smelling power so keep in mind the direction of the wind.
- Elephant can run at a speed of 30-40km per hour, so do not run straight instead make zig-zag running.
- While running throw towel, handkerchief, cap or any other cloth so that they will get attracted to that and will get engaged with that.
- In a hilly terrain run towards the slope.
- While running away from an elephant do not hide behind a tree nor climb up a tree in the evening.

- To prevent the entry of elephants in a village burn wood and “Masal”. Collect in a group and make noise by beating drum, tin etc. Try to drive them towards non in habituated area.
- Make the payment for compensation of elephant loss, early.
- Inform loss of human life or property, within 24 hours to the Patwari or the nearest forest employee.

#### **Steps taken in Africa, to escape elephant damage**

- Elephant area is fenced with ropes. Fencing ropes are smeared with a mixture of chilli + tobacco powder in engine oil. Disagreeable smell of the mixture helps to some extent, to ward off the elephants
- Honey bee combs are promoted on the elephant corridor boundary. Honey bees ward off the elephants.
- Electronic tracking devices are attached to the elephants to track their movements. This helps in timely information to the villagers.

## CHAPTER 8

### ENVIRONMENTAL MITIGATION MEASURES

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#### Environmental mitigation measures

##### 7.1 Mitigation measures of air pollution

- Dust cannot be avoided completely due to the nature of the activities during mining operation. However it can be managed by regularly water spraying (particularly during the dry season) on haul roads, transfer points of conveyors and crushers.
- A fleet of sprinkler vehicles with adequate water spray systems will be made available and would be operational at all times.
- The novel enclosures method for control of fugitive particulate emission involves the application of porous wind fences (also referred to as wind screens).
- OB dumps areas will be isolated and re-vegetated.
- Plantation along coal transportation roads, infrastructures etc.
- Stabilization of unpaved surfaces.
- Tarpaulin covers shall be used over the beds of the trucks employed for transportation of overburden and coal, which are prone to fugitive dust emission.
- Idling of delivery trucks/equipment should not be permitted.

##### 7.2 Mitigation measures of water pollution

The impact on water quality will be due to mine discharge. There will not be any impact on nearby water body as there isn't any surface water body in the vicinity of the mines. The change in the ground and surface water quality will be more pronounced mainly due to population increase by setting of new townships and influx of population from other areas.

- The surface water from the mining area will be regulated in such a manner so as to cause minimum contamination and alteration to the natural drainage system.

- The storm water will be diverted from the mining areas through a series of diversion banks intercept drains to either the natural drainage channels or to water storage reservoirs.
- All drain channels will provide with small stone/rock barriers across drain to water current and to arrest solid particles. This will also be cleaned periodically.
- Sewage treatment plan is proposed for sewage from office and colony.
- The mine water will be collected in setting tanks after sedimentation clear water will be discharged in natural stream.
- A network of drains, sedimentation control dams and sumps will be provided in the in-pit drainage so that maximum quantity of water will be reused to store in the water reservoirs.

### **7.3 Mitigation measures of noise pollution**

- Acoustic treatment of rotating equipments.
- Compulsory use of personnel protective equipment (PPE) such as ear plugs for water workers.
- All machine mountings will have in their foundations anti vibration pads / sheets for reducing the vibration and nearby noise.
- Installation of noise generating machinery, strictly in-compliance with the recommendation of the manufactures. This would ensure an installation free from vibration and exhaust leaks which are also measure contributors to increased noise levels.
- Use of dumping materials such as thin rubber sheet for wrapping the worn places of compressors, generators etc.
- Shock absorbing techniques to reduce impact.
- Use of physical barriers and green belt development around the mine to restrict the noise from going outside the proposed mine boundary during operation.

#### **7.4 Mitigation measures of land use**

- Design the mining and associated activities for the minimum possible forest land requirement.
- Design the mining activities in such a manner that the changes in the surface drainage pattern are minimum.
- In case of opencast mines plan the mine with decommissioning, closure, reclamation and rehabilitation so that the land after mining can be brought in economic uses.

#### **7.5 Mitigation measures for soil profile**

- Provisions should be made in opencast mining for separate removal and handling of top and sub-soils so that these can be re-laid at the time of reclamation for developing the land uses of the reclaimed surface.
- River bank and their stability plan for soil conservation.

#### **7.6 Mitigation measures for vegetation**

- The vegetation cover will be improved by scientific green belt development as per MoEF guidelines 2006.
- The plantation should be made 4 times the number of existing plants before the mine is started.
- The plantation will be done as per the approved mining plan and Environmental Management Plan.
- Using advanced technologies such as remote sensing and Geographic Information Systems for planning, monitoring and evaluating forest cover.

#### **7.7 Mitigation measures for wildlife**

- Development of alternate habitat for affected avifauna of core zone to buffer zone.
- Artificial nesting placement, trails and their regular monitoring by coordination with the forest department.



- Development of migratory corridors for wild animals.
- Check the natural streams to restore the water banks.

## CHAPTER 8

### PROPOSED BUDGET FOR ALTERNATIVE HABITAT MANAGEMENT PLAN OF OCP CHHAL

#### 8.1 Proposed budget for alternative habitat management plan

S. No.	Activities	Site specific activity	1 <sup>st</sup> Year		2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	Total	Remark	Nodal agency
			No. of plants / Nests/ Area/	Amount in Rs.	Amount in Rs.	Amount in Rs.	Amount in Rs.		
1.	Habitat improvement	Mixed plantation in revenue forest (Refer Chapter 7.2 S. No. 1)	10 hec.	16,17,990	--	--	16,17,990	Plantation of ecosystem improvement in revenue forest of Compartment no 477 (Khedapali). First year for plantation and next 5 years for maintenance.	Forest Dept.
		RDF plantation (Refer Chapter 7.2 S. No. 2)	100 hec.	29,42,200	--	--	29,42,200		
			50 hec.	14,71,100	--	--	14,71,100		
		Big tree plantation in School /Aaganbadi/ SECL office and another govt. office (Refers to Chapter 7.2 S. No. 3)	2535 Plants	63,37,500	--	--	63,37,500	Plantation of ecosystem improvement should be done in the Schools, Aanganbadi, SECL Office and other Govt. buildings/ lands with suitable tree species. First year for plantation and next 5 years for maintenance.	Forest Dept.
		Grasslands developed on proposed sites (Refer to Chapter 7.2 S. No. 4)	5 hec.	39,27,000	--	--	39,27,000	Establishment of Grassland on Compartment no 477 Khedapali area. First year for plantation and next 5 years maintenance.	Forest Dept.
		Placement of artificial nest, bird feeder and water pot 'Sapora' (Refer to Chapter 7.2 S. No. 5)	1000 Nest, 250 Sapora, 250 Birds feeder	5,00,000	--	--	5,00,000	Artificial nest box placement and two years for monitoring and evaluation.	Forest Dept.

	<b>Biodiversity improvement</b>	<b>Establishment of artificial avifauna habitat “Pakshi Vihar” on dumping site.</b>	L.S.	55,00,000	--	--	55,00,000	Creation of avifauna habitat “pakshi Vihar” in dumping sites available on OCP Chhal. (Included 10% for monitoring & evaluation)	SECL/SFRTI, Raipur
	<b>River bank &amp; pond restoration/ plantation activity and maintenance</b>	<b>Pond site plantation (Refer to Chapter 7.2 S. No. 6)</b>	890 Plants	6,20,330	--	--	6,20,330	Plantation of ecosystem improvement should be proposed nearby river, road side and local pond’s bund with suitable tree species. First year plantation and next 5 years for maintenance.	Forest Dept.
		<b>River bank plantation (Refer to Chapter 7.2 S. No. 6)</b>	5 hec.	9,93,980			9,93,980		Forest Dept.
		<b>Road side plantation (Both side)</b>	5 hec.	70,85,185	--	--	70,85,185		Forest Dept.
		<b>Pond restoration (Refer to Chapter 7.2 S. No. 7)</b>	1 Nos	2,50,000	--	--	2,50,000	Pond renovation activity should be done in 1 pond	Forest Dept.
		<b>River bank restoration works in Mand river (Refer to Chapter 7.2 S. No. 8)</b>	L.S.	10,00,000	--	--	10,00,000	Restoration activity proposed on Mand River approx 3 km (Both side)	Forest Dept.
	<b>(SMC) Soil &amp; Moisture Conservation work</b>	<b>Soil &amp; Moisture Conservation (SMC) works (Refer to Chapter 7.2 S. No. 9)</b>	50 hec.	1,51,250	--	--	1,51,250	Treatment for up-gradation of degraded area to normal forest. First year for SMC activity and next 2 years for maintenance.	Forest Dept.
	<b>Training &amp; workshops / Awareness Program</b>	<b>Creation of social awareness program for conservation of avifauna and wildlife.</b>	L.S.	2,00,000	2,00,000	2,00,000	6,00,000	Awareness and Education Training program, empowering and sensitizing villagers should be conducted for local community on nearby villages for avifauna and wildlife conservation.	Forest Dept.

		<b>Awareness and education program for wildlife (Elephant) Conservation and management</b>	L.S.	5,00,000	5,00,000	5,00,000	15,00,000	Awareness and Education program should be conducted for affected area/villages under buffer zone of OCP Chhal.	Forest Dept.
	<b>Fire Protection</b>	<b>Fire protection and construction of watch towers</b>	L.S.	5,00,000	5,00,000	5,00,000	15,00,000	Monitoring through satellite imagery and construction of watch tower on buffer zone.	Forest Dept./ FMIS / FSI
	<b>Monitoring and Evaluation.</b>	<b>Monitoring and Evaluation.</b>	L.S.	15,00,000	--	--	15,00,000	Monitoring & Evaluation of all proposed activities will be carried out by the SFRTI, Raipur for next five years.	SFRTI, Raipur
<b>Grand total</b>				<b>3,50,96,535</b>	<b>12,00,000</b>	<b>12,00,000</b>	<b>3,74,96,535</b>		
<b>Total amount in words- - Three Crore, Seventy Four Lakhs, Ninety Six Thousand, Five hundred Thirty Five Rupees only/-</b>									

**Note:-**

- Budget for plantation of safety zone is imposed earlier under condition of EIA report by the SECL and this report only recommends the favourable plant species which provides food, shelter and alternate habitat for avifauna and wildlife.
- All the proposed activities in the budget were taken under **CAMPA norms**.
- The total cost of the proposed budget is **Rs. 3,74,96,535**. Out of this 50,00,000 will be utilized for the development of artificial bird habitat (pakshi vihar) by OCP Chhal through its own agency in the dumping area and 10% of Rs 50,00,000 i.e. Rs. 5,00,000 will be given to SFRTI, Raipur for the execution of monitoring and evaluation activity.

## 8.2 SITE SPECIFIC ACTION PLAN OF OCP CHHAL, DHARAMJAIGARH FOREST DIVISION

### Proposed activity sites with location for development of site specific plan

Sr. No.	Range	Proposed activity	Name of village	Name of activity Area/ Location/ Building/ Compartment. No.	GPS location	Area/ No. of plants/ No. of Nest	Recommended tree species	Required amount in Rs.
1.	Chhal	<b>Mixed plantation</b> (As per CAMPA Norms @1,61,799/hac.)	Khedapali	Compartment No. 477 RF	22°05'34.94''N 83°08'48.27''E	10 hec.	Plantation of ecosystem improvement with Fruit bearing and suitable tree species.	<b>16,17,990</b>
2.	Chhal	<b>RDF plantation</b> (As per CAMPA Norms @29,422/hect.)	Khedapali	Compartment No. 477 RF	--	100 hec.		<b>29,42,200</b>
			Rilo Kurru area	Compartment No. 1130 PF	22°05'08.61''N 83°05'11.45''E	50 hec.		<b>14,71,100</b>
3.	Chhal	<b>Big tree plantation in School /Aaganbadi/ SECL Office and another govt. office</b> (As per CAMPA Norms @2500/plants with tree guard)	Navapara	Primary School, Navapara	22°07'03.16''N 83°08'37.85''E	180 Plants	Shady, ornamental & Fruit bearing Tree species	<b>4,50,000</b>
			Puslada	Govt. Higher Secondary School, Pusalda	22°05'30.02''N 83°08'59.03''E	700 Plants	Shady, ornamental & Fruit bearing Tree species	<b>17,50,000</b>
				Primary School, Pusalda	22°05'24.12''N 83°08'59.10''E	180 Plants	Shady, ornamental & Fruit bearing Tree species	<b>4,50,000</b>
				Govt. High School, Pusalda	22°05'25.71''N 83°09'05.77''E	180 Plants	Shady, ornamental & Fruit bearing Tree species	<b>4,50,000</b>
	Chhal		Bojiya	Govt. High School, Bojiya	22°07'24.79''N 83°09'16.00''E	110 Plants	Shady, ornamental & Fruit bearing Tree species	<b>2,75,000</b>
				Primary School Bojiya	22°07'33.62''N 83°09'26.34''E	130 Plants	Shady, ornamental & Fruit bearing Tree species	<b>3,25,000</b>
				Gram Panchyat , Bojiya	22°07'35.47''N 83°09'20.86''E	25 Plants	Shady, ornamental & Fruit bearing Tree	<b>62,500</b>

							species	
	Chhal		Chitapalli	Primary School, Chitapalli	22°06'15.59''N 83°10'04.92''E	30 Plants	Shady, ornamental & Fruit bearing Tree species	75,000
			Chhal	SECL office	22°06'40.11''N 83°08'27.23''E	1000 Plants	Shady, ornamental & Fruit bearing Tree species	25,00,000
4.	Chhal	<b>Grass land development</b> (As per CA Norms @7,85,400/hect.)	Khedapali	Compartment No. 477 RF	--	5 hec.	Grass Species	39,27,000
5.	Chhal	<b>1000 Nest 250 Water pots 'sapora' 250 bird feeder</b>	Khedapali	Compartment No. 477 RF	22°05'34.94''N 83°08'48.27''E	500 Nest 125 Sapora 125 Birds feeder	--	2,50,000
			Pusalda	Compartment No. 479 PF	22°06'12.45''N 83°08'46.05''E	100 Nest 25 Sapora 25 Birds feeder	--	50,000
			Sarasmar	Compartment No. 510 RF	22°09'50.63''N 83°06'53.76''E	100 Nest 25 Sapora 25 Birds feeder	--	50,000
			Rilo Kurru area	Compartment No. 1130 PF	22°05'08.61''N 83°05'11.45''E	100 Nest 25 Sapora 25 Birds feeder	--	50,000
	Kharsia		Domnara	Compartment No. 1151 RF	22°0'40.52'' N 83°06'00.35''E	100 Nest 25 Sapora 25 Birds feeder	--	50,000
	Chhal		Kansbahar Aurananra	Compartment No. 506, 511	22°08'22.36''N 83°09'53.64''E	100 Nest 25 Sapora 25 Birds feeder	--	50,000

6.	Chhal	<b>River site plantation</b> (As per CAMPA Norms @1,98,796/hect.)	Kurket river	Kurket river	22°05'37.40''N 83°08'22.14''E	5 hac.	<i>Terminalia Arjuna,</i> <i>kahua, Jamun, ficus</i> <i>species and fruit bearing</i> <i>Tree species</i>	<b>9,93,980</b>
		<b>Pond site plantation</b> (As per CAMPA Norms @697/plants)	Khedapalli	Dam	22°05'37.40''N 83°08'22.14''E	200 Plants		<b>1,39,400</b>
			Pusalda	Pond	22°05'22.93''N 83°09'14.05''E	50 Plants		<b>34,850</b>
			Sarasmar	Pond	22°08'52.45''N 83°07'15.78''E	200 Plants		<b>1,39,400</b>
			Bokramuda Pond	Pond	22°08'52.73''N 83°07'15.78''E	200 Plants		<b>1,39,400</b>
			Sokhiya Nala, Chitaplli	Nala	22°06'00.37''N 83°10'10.69''E	200 Plants		<b>1,39,400</b>
			Domnara	Pond	22°04'40.49''N 83°06'00.34''E	20 Plants		<b>13,940</b>
	Kurru		Pond	22°08'48.39''N 83°05'30.39''E	20 Plants	<b>13,940</b>		
Kharsia								
Chhal								
7.		<b>Pond renovation</b>	Pusalda	Pond	22°05'22.93''N 83°09'14.05''E	1Pond	--	<b>2,50,000</b>
8.		<b>River bank restoration work</b>	Mand river	River	--	L.S	--	<b>10,00,000</b>
9.	Chhal	<b>Soil &amp; Moisture Conservation</b> (As per CAMPA Norms @3025/hac.)	Sarasmar	Compartment No. 510 RF	22°09'50.63''N 83°06'53.76''E	50 hac.	--	<b>1,51,250</b>
<b>Total amount</b>								<b>1,98,11,350</b>



Fig 7.1 Site specific plan for OCP Chhal



## PHOTO PLATES



*Cup Shaped Nest*



*Cup Shaped Nest*



*Platform Nest*



*Platform Nest*



*Sphere Shaped Nest*



*Pendent Nest*

### Glimpses of birds nest found in study area during the transect line



*Sphere Shaped Nest*



*Sphere Shaped Nest*



*Cup shaped nest*



*Platform Nest*



*Saucer Plate Nest*



*Platform Nest*

### Glimpses of birds nest found in study area during the transect line



*Platform Nest*



*Platform Nest*



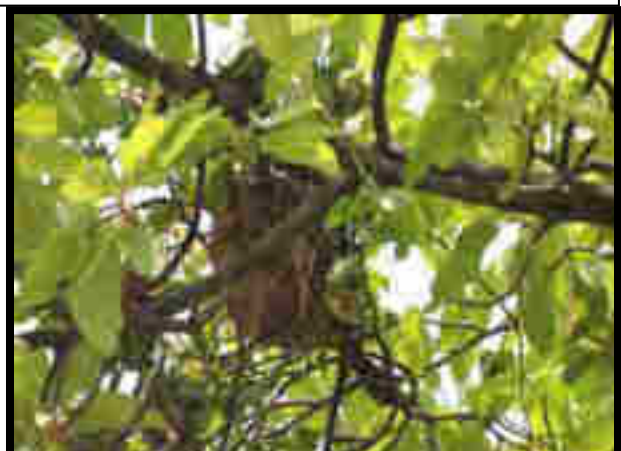
*Cup Shape Nest*



*Platform Nest*



*Sphere Shaped nest*



*Pendent Nest*

### Glimpses of birds nest found in study area during the transect lines



*Cavity Shaped Nest*



*Cavity Shaped Nest*



*Cup Shaped Nest*



*Pendulum Shaped Nest*



*Cup Shaped Nest*



*Platform Shaped Nest*

Glimpses of avifauna species found in study area during the transect line



*Indian Pond Heron*



*Cattle egret*



*Indian Roller*



*House Sparrow*



*Black Drongo*



*Yellow Wattled Lapwing*



*Pond Heron*



*Rose Ringed Parakeet*



*Scaly Brested Munia*



*Eurasian Collared Dove & Plum Headed Parakeet*



*Baya Weaver*



*Spotted Dove*



*Greater Coucal*



*Red Vented Bulbul*



*Jungle Prinia*



*Indian Robin*



*Common Myna*



*Pond Heron*



*House Sparrow*



*Green Bee Eater*



*Purple Sun Bird*



*Purple Sun Bird female*





*Asian Koel*



*Indian Pond Heron*



*Common Pigeon*



*Jungle Bush Quail*



*Indian Roller*



*Cattle Egret*

### ARTIFICIAL NEST IMAGES



*Design for Sparrow, Myna etc*



*Design for Indian Robin, Roller etc*



*Design for Doves, Parakeets etc*



*Design for Cavity Nesters*



*Design for Owls & Owlets*



*Design for Platform Nesters*

## BIRD FEEDER



*Construction of bamboo based bird feeder in SFRTI*

## CHAPTER 9

### REFERENCES

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- ❖ Ammer, F. K. (2003). *Population level dynamics of grasshopper sparrow populations breeding on reclaimed mountaintop mines in West Virginia*. Ph.D. dissertation, West Virginia University, Morgantown.
- ❖ Anders, A. D. and Marshall, M. R. (2005). *Increasing the accuracy of productivity and survival estimates in assessing landbird population status*. *Conservation Biology* 19:66-74.
- ❖ Angel, P., V. Davis, J. Burger, D. Graves, and C. Zipper. (2005). *The Appalachian Regional Reforestation Initiative (ARRI)*. *Forest Reclamation Advisory*, 1, 1-2.
- ❖ Arcos, F., and Salvadores, R. (2005). *Habitat selection by territorial males of Little Bustard *Tetrax tetrax* in a NW Iberian population*. *Ardeola* 52:151–157.
- ❖ *Avifauna survey report for Power Grid Corporation, 765 KV D/C Jharsuguda-Dharamjaigarh (Korba), Transmission line, prepared by Conservation core Society and Bilaspur State University, 2013.*
- ❖ Bajema, R. A., Devault T.L., Scott P.E., and Lima S.L. (2001). *Large reclaimed coal mine grasslands and their significance for Henslow's Sparrows in the American Midwest*. *Auk* 118:422–431.
- ❖ Balbontin, J. (2005). *Identifying suitable habitat for dispersal in Bonelli's eagle: An important issue in halting its decline in Europe*. *Biological Conservation* 126:74–83.
- ❖ Bard, A. M., Smith, H.T., Egensteiner, E. D., Mulholland, R., Harber, T. V., Heath, G. W., Miller, W. J. B. and Weske, J. S. (2002). *A simple structural method to reduce road-kills of royal terns at bridge sites*. *Wildlife Society Bulletin* 30:603–605.
- ❖ *Best Management Practices Manual, Ministry of Environment and Forests, Government of India, February (2003).*
- ❖ Beachy, T. A. (2008). *Cerulean warbler (*Dendroica cerulea*) breeding ecology and habitat selection, initial response to forest management, and association with anthropogenic disturbances in the Cumberland Mountains of Tennessee*. M.S. thesis, University of Tennessee, Knoxville.

- ❖ *Beckerle, L. T. (2004). Techniques for encouraging native plants and creating bobwhite quail habitat on drastically disturbed land. Proceedings of the National Meeting of the American Society of Mining and Reclamation 21:127.*
- ❖ *Bhushan, Chandra Rich Lands, Poor People: The Socio-Environmental Challenges of Mining in India. Rich, Lands, Poor People: The Socio-Environmental Challenges of Mining in India.*
- ❖ *Boaz A.A. et al., Birds of Chhattisgarh (2012), First edition published by Ela Foundation and Forest Department Chhattisgarh.*
- ❖ *Bolger, D.T., A.C. Alberts, and M.E. Soule. (1991). Occurrence patterns of bird species in habitat fragments: Sampling, extinction, and nested species subsets. The American Naturalist, 137, 155-166.*
- ❖ *Bollinger, E. K., and Gavin, T. A. (2004). Responses of nesting bobolinks *Dolichonyx oryzivorus* to habitat edges. Auk 121:767–776.*
- ❖ *Boves, T. A. (2011). Multiple responses by Cerulean Warblers to experimental forest disturbance in the Appalachian Mountains. Ph. D. dissertation, University of Tennessee, Knoxville.*
- ❖ *Brändle, M., Durka, W., Krug, H. and Brandl, R. (2003). The assembly of local flora and fauna: Plants and birds in non-reclaimed mining sites. Ecography 26:652-60.*
- ❖ *Brenner, F. J., and Kelly, J. (1981). Characteristics of bird communities on surface mined lands in Pennsylvania. Environmental Management 5:441-49.*
- ❖ *Brown, K.S. jr. (1991). Conservation of Neotropical environments: insects as indicators. In: Collins, N.M., Thomas, J.A. (Eds.), The conservation of insects and their habitats. Academic Press, London, pp. 449–504.*
- ❖ *Buehler, D. A., Welton, M. J. and Beachy, T. A. (2006). Predicting cerulean warbler habitat use in the Cumberland Mountains of Tennessee. Journal of Wildlife Management 70:1763-1769.*
- ❖ *Buehler, D. A., Roth, A. M., Vallender, R., Will, T. C., Confer, J. L., Canterbury, R. A., Swarthout, S. B., Rosenberg, K. V. and Bulluck, L. P. (2007). Status and conservation priorities of Golden-Winged Warbler (*Vermivora chrysoptera*) in North America. The Auk 124:1439-1445.*
- ❖ *Bulluck, L. P. and Buehler, D. A. (2008). Factors influencing golden-winged warbler (*Vermivora chrysoptera*) nest-site selection and nest survival in the Cumberland Mountains of Tennessee. Auk 125:551-559.*

- ❖ *Burger, J.A. (2011). Sustainable mine land reclamation in the eastern U.S. coalfields: A case for an ecosystem reclamation approach. Paper presented at the 2011 National Meeting of the American Society of mining and Reclamation, Bismarck, ND.*
- ❖ *Camenzind, F. J. (1984). Wildlife and coal development: An overview. Minerals and the Environment 6:94-100.*
- ❖ *Canterbury, G.E., T.E. Martin, D.R. Petit, L.J. Petit and D.F. Bradford (2000). Bird communities and habitat as ecological indicators of forest condition in regional monitoring. Conservation Biology, 14, 544–558.*
- ❖ *Carrascal, L. M., Seoane, J., Palomino, D. and Alonso, C. L. (2006). Habitat preferences, population size and demographic trends of Houbara Bustard *Chlamydotis undulata* in Lanzarote and La Graciosa (Canary Islands). *Ardeola* 53:251–269.*
- ❖ *Catlin, D. H., and Rosenberg, D.K. (2006). Nest destruction associated with mortality and dispersal of burrowing owls in the Imperial Valley, California. *Southwestern Naturalist* 51:406–409.*
- ❖ *Clevenger, A. P., Chruszcz, B. and Gunson, K. E. (2003). Spatial patterns and factors influencing small vertebrate fauna road-kill aggregations. *Biological Conservation* 109:15–26.*
- ❖ *Devault, T. L., Scott, P.E., Bajema R.A., and Lima, S.L. (2002). Breeding bird communities of reclaimed coal-mine grasslands in the American Midwest. *Journal of Field Ornithology* 73:268–275.*
- ❖ *Dutta, P., Mahatha, S. and De, P. (2004). Opencast mining impact. A methodology for cumulative impact assessment of opencast mining projects with special reference to air quality assessment. *Impact Assessment and Project Appraisal*, volume 22, number 3, September 2004, pages 235–250, Beech Tree Publishing, 10 Watford Close, Guildford, Surrey GU1 2EP, UK.*
- ❖ *EIA Guidance Manual - Ministry of Minerals, Ministry of Environment and Forest, Government of India, New Delhi, February 2010.*
- ❖ *Erritzoe, J., Mazgajski, T. D. and Rejt, L. (2003). Bird casualties on European roads—a review. *Acta Ornithologica* 38:77–93.*
- ❖ *Ferrer, M., and Harte, M. (1997). Habitat selection by immature Spanish Imperial Eagles during the dispersal period. *Journal of Applied Ecology* 34:1359–1364.*

- ❖ Forman, R. T. T., and Alexander, L. E. (1998). Roads and their major ecological effects. *Annual Review of Ecological Systems* 29:207–231.
- ❖ Frey, S. N., and Conover, M. R. (2006). Habitat use by meso-predators in a corridor environment. *Journal of Wildlife Management* 70:1111–1118.
- ❖ Gavashelishvili, A., and McGrady, M. J. (2006). Breeding site selection by Bearded Vulture *Gypaetus barbatus* and Eurasian Griffon *Gyps fulvus* in the Caucasus. *Animal Conservation* 9:159–170.
- ❖ Galligan, E.W., T.L. DeVault, and S. Lima. (2006). Nesting success of grassland and savanna birds on reclaimed surface coal mines of the Midwestern United States. *The Wilson Journal of Ornithology*, 118, 537-546.
- ❖ Glista, D. J., DeVault, T. L. and DeWoody, J. A. (2008). Vertebrate road mortality predominantly impacts amphibians. *Herpetological Conservation and Biology* 3(1):77–87.
- ❖ Gorog, A. J., Pamungkas, B. and Lee, R.J. (2005). Nesting ground abandonment by the Maleo *Macrocephalon maleo* in North Sulawesi: identifying conservation priorities for Indonesia's endemic megapode. *Biological Conservation* 126:548–555.
- ❖ Gregg, I. D. (1997). American Woodcock use of reclaimed surface mines in West Virginia. M. S. thesis, West Virginia University, Morgantown.
- ❖ Gutzwiller, K. J., and Barrow, W.C. (2003). Influences of roads and development on bird communities in protected Chihuahuan Desert landscapes. *Biological Conservation* 113:225–237.
- ❖ Hardt, R.A. and R.T.T Forman. (1989). Boundary form effects on woody colonization of reclaimed surface mines. *Ecology*, 70, 1252-1260.
- ❖ Herzog, F., A. Lausch, E. Muller, H. Thulke, U. Steinhardt, and S. Lehmann. (2001). Landscape Metrics for Assessment of Landscape destruction and Rehabilitation. *Environmental Management* 27, 91-107.
- ❖ Hunter, W. C., D. A. Buehler, R. A. Canterbury, J. L. Confer, and P. B. Hamel. (2001). Conservation of disturbance-dependent birds in eastern North America. *The Wildlife Society Bulletin* 29:440-55.
- ❖ Ingold, D. J. (2002). Use of reclaimed stripmine by grassland nesting birds in east-central Ohio. *Ohio Journal of Science* 102:56–62.
- ❖ Jacobson, S. L. (2005). Mitigation measures for highway-caused impacts to birds. In C. J. Ralph and T. D. Rich (eds.). *USDA Forest Service General*

- Technical Report PSWGTR- 191, Volume I and II, 1043–1050. Forest Service, U.S. Department of Agriculture. 1294pp.*
- ❖ *James, F.C. and N.O. Wamer. (1982). Relationships between temperate forest bird communities and vegetation structure. Ecology, 63, 159-171.*
  - ❖ *Jones, S. L., Dieni, J. S., Green, M. T. and Gouse, P. J. (2007). Annual return rates of breeding grassland songbirds. Wilson Journal of Ornithology 119:89-94.*
  - ❖ *Kadekodi, Gopal K. (2010). The Health of Mining and Wealth of Miners July 24, Economic & Political Weekly XIV (30): 14-15.*
  - ❖ *Kimmel, R. O. and Samuel, D. E. (1984). Ruffed grouse brood habitat on reclaimed surface mines in West Virginia. Environmental Geochemistry and Health 6:150-153.*
  - ❖ *Loss, S.R., M.O. Ruiz, and J.D. Brawn. (2009). Relationships between avian diversity, neighborhood age, income, and environmental characteristics of an urban landscape. Biological Conservation, 142, 2578-2585.*
  - ❖ *Mattice, J. A., Brauning, D. W. and Diefenbach, D. R. (2005). Abundance of grassland sparrows on reclaimed surface mines in western Pennsylvania. Pages Pages 504-510 in C. J. Ralph and T. D. Rich, editors. Bird conservation implementation and integration in the Americas: Proceedings of the Third International Partners in Flight Conference, USDA Forest Service General Technical Report PSW-GTR-191.*
  - ❖ *Ministry of Mines (2008). National Mineral Policy (For non - fuel and non - coal minerals), Government of India*
  - ❖ *Ministry of Mines (2011). Mining Policy and Legislation, Annual Report 2010-2011*
  - ❖ *Monroe, M. S. and Ritchison, G. (2005). Breeding biology of Henslow's Sparrows on reclaimed coal mine grasslands in Kentucky Journal of Field Ornithology 76:143-149.*
  - ❖ *Mumme, R. L., Schoech, S. J., Woolfenden, G. E. and Fitzpatrick, J. W. (2000). Life and death in the fast lane: demographic consequences of road mortality in the Florida Scrub-Jay. Conservation Biology 14:501–512.*
  - ❖ *Palmer, W. E., Terhune, T. M. and McKenzie, D. F. (2011). The National Bobwhite Conservation Initiative: A range-wide plan for recovering bobwhites. National Bobwhite Technical Committee Technical Publication, ver. 2.0.*



- ❖ *Parmenter, R. R., and J. A. MacMahon. (1992). faunal community development on disturbed lands: An indicator of reclamation succession. In Evaluating Reclamation Success: The Ecological Consideration— Proceedings of a Symposium, ed. J. C. Chambers and G. L. Wade, 73-89. (Contains selected papers from the 1990 Mining and Reclamation Conference and Exhibition of the American Society for Surface Mining and Reclamation, held April 23-26, 1990, in Charleston, W.Va.) U.S. Department of Agriculture. U.S. Forest Service. Northeast Forest Experiment Station General Technical Report NE-164. Radnor, Pa.: Northeastern Forest Experiment Station.*
- ❖ *Parrish, T. L., Hubert, W. A., Anderson, S. H., Purcherelli, M. J. and Mangus, W. (2001). Distributions of roosting Sandhill Cranes as identified by aerial thermography. Prairie Naturalist 33:93–100.*
- ❖ *Perlut, N. G., A. M. Strong, T. M. Donovan, and N. J. Buckley. (2008). Grassland songbird survival and recruitment in agricultural landscapes: implications for source-sink demography. Ecology 89:1941-1952.*
- ❖ *Pinto, M., Rocha, P. and Moreira, F. (2005). Long-term trends in Great Bustard *Otis tarda* populations in Portugal suggest concentration in single high quality area. Biological Conservation 124:415–423.*
- ❖ *Ramp, D., Wilson, V. K., and Croft, D. B. (2006). Assessing the impacts of roads in peri-urban reserves: road-based fatalities and road usage by wildlife in the Royal National Park, New South Wales, Australia. Biological Conservation 129:348–359.*
- ❖ *Ramsden, D. J. (2003). Barn owls and major roads: results and recommendations from a 15-year research project. Barn Owl Trust, Ashburton, Devon, UK.*
- ❖ *Reijnen, R., and Foppen, R. (1994). The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for Willow Warblers *Phylloscopus trochilus* breeding close to a highway. Journal of Applied Ecology 31:85–94.*
- ❖ *Reijnen R., and Foppen, R. (2006). Chapter 12: Impact of road traffic on breeding bird populations. In Davenport, J. and J. L. Davenport (eds.). The ecology of transportation: managing mobility for the environment, 255–274. Springer, the Netherlands.*

- ❖ *Rice, F. H. (1986). Response of wild turkeys to surface coal mining in north central Pennsylvania. M. S. thesis, Pennsylvania State University, University Park, Pennsylvania.*
- ❖ *Rohrbaugh, R. W., Jr. and Yahner, R. H. (1996). Reclaimed surface mines: an important nesting habitat for northern harriers in Pennsylvania. Pages 307-314 in D. Bird, D. Varland, and J. Negro, editors. Raptors in human landscapes. Adaptations to built and cultivated environments. Academic Press.*
- ❖ *Sara, M., and Di Vittori, M. (2003). Factors influencing the distribution, abundance and nest-site selection of an endangered Egyptian vulture *Neophron percnopterus* population in Sicily. *Animal Conservation* 6:317–328.*
- ❖ *Scott, M. D., and G. M. Zimmerman. (1984). Wildlife management at surface coal mines in the Northwest. *Wildlife Society Bulletin* 12:364-70.*
- ❖ *Scott, P. E., Devault, T.L., Bajema, R. A., and Lima, S. L. (2002). Grassland vegetation and bird abundances on reclaimed midwestern coal mines. *Wildlife Society Bulletin* 30:1006–1014.*
- ❖ *Standard terms of reference [TOR] for EIA / EMP report for Projects / activities requiring Environment clearance under EIA Notification, 2006, Ministry of Environment, Forest and Climate Change, April 2015.*
- ❖ *Singh, Dr. Gurdeep,(2008). Mitigating environmental and social impacts of Coal mining in India. 1st International Conference on “Managing the Social & Environmental Consequences of Coal Mining in India’ during November 19-21, 2007 at New Delhi, Mining Engineer Journal,*
- ❖ *Singh, Gurdeep, (2005). Regional Environmental and Social Challenges facing the Coal Industry. The Coal Summit Organised the India Energy Forum, Indian Coal Forum and MGMI, 19-20 October.*
- ❖ *Singh, Gurdeep and Gupta, R. K. (2005).Water Pollution from Coal Washeries and its Impact on Damodar River. *The Indian Mining & Engg. J.* 44 (3)*
- ❖ *Singh, A. N., Raghubanshi, A. S. and. Singh, J. S. (2002). Plantations as a tool for mine spoil restoration, *Current Science*, 82:12.*
- ❖ *Singh, Gurdeep and Puri, S. K, (2004). Air quality assessment in Korba Coalfield *Indian Journal of Air Pollution Control*, IV (2) 31-41.*
- ❖ *Singh, Gurdeep, (1999). Water pollution issues and control strategies in mining areas, *Minetech*, 20:1 pp45-53.*

- ❖ Singh, Gurdeep, (2005). *Water sustainability through Augmentation of Underground Pumped out Water for Potable Purpose from Coal Mines of Eastern India. Environmental Geochemistry, Vol8, No. 1 & 2, pp.89-94.*
- ❖ Singh, Arun P. (2010). *Butterfly diversity in tropical moist deciduous sal forests of Ankua Reserve Forest, Koina Range, Saranda Division, West Singhbhum District, Jharkhand, India. Journal of Threatened Taxa 2(9): 1130-1139.*
- ❖ Singh, R. K. (2000). *Impact of Iron ore mining on the elephant habitat of Singhbhum forests, Bihar. Thesis presented to the Saurashtra University, Rajkot, India for the degree of Doctor of Philosophy in Wildlife Science.*
- ❖ Stauffer, G. E. (2008). *Nesting ecology and site fidelity of grassland sparrows on reclaimed surface mines in Pennsylvania. M. S. thesis, Pennsylvania State University, University Park.*
- ❖ Stauffer, G. E., Diefenbach, D. R., Marshall, M. R. and Brauning, D. W. (2011). *Nest success of grassland sparrows on reclaimed surface mines. Journal of Wildlife Management 75:548-557.*
- ❖ Tripathy, D. P., Panigrahi, D. C. and Singh, Gurdeep (1997). *Environmental Impacts of Mine Fires - A Case Study of a Part of Jharia Coalfield, 2nd WOMEC, Katowice, Poland.*
- ❖ Whelan, C.J., C.H. Sekercioglu and D.G. Wenny (2015). *Why bird matter from economic ornithology to ecosystem services. J. Ornithol., 156, 227-238.*
- ❖ Whelan, C.J., D.G. Wenny and R.J. Marquis (2008). *Ecosystem services provided by birds. Annals of the New York Academy of Sci., 1134, 25-60.*
- ❖ Wickham, J.D., K. Riitters K., Wade, T.G., Coan, M., and Homer, C. (2007). *The effect of Appalachian mountaintop mining on interior forest. Landscape Ecology, 22, 179-187.*
- ❖ Winter, M., Johnson, D.J., and Faaborg, J. (2000). *Evidence for edge effects on multiple levels in tallgrass prairie. The Condor, 102, 256-266.*
- ❖ Wood, P. B., Bosworth, S. B. and Dettmers, R. (2006). *Cerulean warbler abundance and occurrence relative to large-scale edge and habitat characteristics. Condor 108:154-165.*
- ❖ [https://en.wikipedia.org/wiki/Waste\\_management](https://en.wikipedia.org/wiki/Waste_management)
- ❖ <https://en.wikipedia.org/wiki/Ecology>

## ANNEXURE I (SUMMAR SEASON)

## Datasheet for Bird status survey

Cell-ID T1 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal and Kamesh Kumar Sahu. Trail-length:  
1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
0 M	22°05'38.24"	83°06'49.07"	Common Myna	03	-	-	-	By Flying
			Greater Coucal	01	-	-	-	Noted Through Chirping
			Indian Robin	01	-	-	-	Noted Through Chirping
300 M	22°05'28.83"	83°06'47.56"	Plum Headed Parakeet	02	-	-	-	Noted Through Chirping
			Common Myna	04	-	-	-	Noted Through Chirping
600 M	22°05'18.80"	83°06'49.30"	Common Myna	02	-	-	-	Noted Through Chirping
			Plum Headed Parakeet	01	-	-	-	By flying
			Indian Robin	01	-	-	-	By flying
			Red Vented Bulbul	01	13.71m	31°	340°	Perching
900 M	22°05'09.17"	83°06'51.36"	Common Hawk Eagle	02	-	-	-	By flying
			Rose Ringed Parakeet	01	-	-	-	Noted Through Chirping
			Indian Roller	01	29.26m	340°	340°	Perching
1200 M	22°04'59.19"	83°06'50.07"	Red Vented Bulbul	01	18.28m	90°	20°	Perching
			Common Myna	02	-	-	-	Noted Through Chirping
			Indian Roller	02	-	-	-	By flying

## Datasheet for Bird status survey

Cell-ID: T2 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length:  
1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
0 M	22°05'18.92"	83°07'36.25"	Indian Roller	01	-	-	-	Noted Through Chirping
			Greenish Warbler	01	7.31m	145°	90°	Perching
			Blyth's Reed Warbler	01	-	-	-	Noted Through Chirping
300 M	22°05'16.54"	83°07'25.64"	Little Swift	01	-	-	-	Noted Through Chirping
			Indian Pygmy Woodpecker	01	-	-	-	Noted Through Chirping

			Indian Pond Heron	01	-	-	-	By flying
			Indian Roller	01	5.48m	170	90	Perching
			Purple Sun Bird	01	9.14m	170	90	Perching
600 M	22°05'17.94"	83°07'16.54"	Spotted Dove	01	10.05m	60°	90°	Perching
			Plum Headed	06	10.05m	125°	90°	Perching
			Greater Coucal	02	-	-	-	Noted Through Chirping
			Eurasian collared	02	10.05m	125°	90°	Perching
			Yellow Footed	02	10.05m	125°	90°	Perching
			Jungle Babbler	05	53.94m	350°	90°	Perching
			Baya Weaver	01	8.22m	160°	90°	Perching
			Rufous Tree Pie	01	-	-	-	By flying
			900 M	22°05'19.20"	83°07'07.46"	Rose Ringed	06	-
Green Bee Eater	05	-				-	-	By flying
Jungle Babbler	01	-				-	-	Noted Through Chirping
Indian Roller	02	-				-	-	Noted Through Chirping
1200 M	22°05'20.01"	83°06'59.10"	Red Vented Bulbul	01	-	-	-	Noted Through Chirping
			Southern Coucal	06	-	-	-	By flying
			Greater Coucal	05	-	-	-	Noted Through Chirping
			Oriental Magpie Robin	04	-	-	-	Noted Through Chirping
			Purple Sun Bird	01	-	-	-	Noted Through Chirping
			Baya Weaver	01	-	-	-	Noted Through Chirping

### Datasheet for Bird status survey

Cell-ID: T3 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
0 M	22°05'05.16"	83°07'08.53"	Blyth's Reed Warbler	01	21.94	200°	270°	Perching
			Indian Roller	02	38.40	200°	270°	Perching
			Common Myna	02	-	-	-	By flying
			Purple Sun Bird	01	-	-	-	By flying
			Black Drongo	02	-	-	-	By flying
300 M	22°05'04.57"	83°07'11.89"	Green Bee Eater	01	-	-	-	By flying
			Indian Pond Heron	07	-	-	-	By flying
			Red Vented Bulbul	01	7.31m	301°	240°	Perching
			Aisy Prinia	01	-	-	-	By flying
			Laughing Dove	01	-	-	-	By flying
600	22°05'08.17"	83°07'22.21"	Indian Roller	01	-	-	-	By flying

<b>M</b>			Common Myna	01	-	-	-	Noted Through Chirping
			Aisy Prinia	01	-	-	-	By flying
			Green Bee Eater	01	-	-	-	Noted Through Chirping
			Laughing Dove	01	-	-	-	By flying
			Plum Headed Parakeet	02	-	-	-	By flying
			Indian Robin	01	-	-	-	By flying
			Greenish Warbler	01	-	-	-	Perching
			Oriental Magpie Robin	01	-	-	-	By flying
			Red Avadavat	01	-	-	-	By flying
			Indian Silverbill	01	20.11	210 <sup>0</sup>	270 <sup>0</sup>	Perching
<b>900 M</b>	22 <sup>0</sup> 05' 11.84"	83 <sup>0</sup> 07' 28.60"	Rufuos Tree Pie	01	-	-	-	By flying
			Green Bee Eater	01	-	-	-	By flying
			Black Drongo	01	-	-	-	By flying
			Cattle Egret	04	-	-	-	By flying
			Rose Ringed Parakeet	02	-	-	-	By flying
			Indian Roller	01	-	-	-	By flying
<b>1100 M</b>	22 <sup>0</sup> 05' 12.80"	83 <sup>0</sup> 07' 39.29"	Common Myna	01	-	-	-	By flying

### Datasheet for Bird status survey

Cell-ID: T4 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
<b>0 M</b>	22 <sup>0</sup> 05' 00.42"	83 <sup>0</sup> 07' 10.85"	Red Vented Bulbul	01	-	-	-	By Flying
			Ashy Prinia	01	-	-	-	By Flying
			Scaly Breasted Prinia	01	-	-	-	By Flying
			Indian Roller	01	-	-	-	Noted Through Chirping
			Indian Cuckoo	01	-	-	-	Noted Through Chirping
			Black Drongo	01	-	-	-	By flying
			Asian Koel	01	-	-	-	Noted Through Chirping
<b>300 M</b>	22 <sup>0</sup> 05' 00.29"	83 <sup>0</sup> 07' 00.28"	Red Vented Bulbul	01	-	-	-	Noted Through Chirping
			Plain Prinia	01	-	-	-	By flying
			Indian Cuckoo	01	-	-	-	Noted Through Chirping
			Black Drongo	01	-	-	-	Noted Through Chirping
			White Rumped Munia	01	20.12m	330 <sup>0</sup>	370 <sup>0</sup>	Perching
<b>600 M</b>	22 <sup>0</sup> 04' 56.87"	83 <sup>0</sup> 04' 49.85"	Rose Ringed Parakeet	02	-	-	-	By flying
			Indian Pond Heron	03	-	-	-	By flying

900 M	22°04'55.99"	83°06'42.75"	Indian Roller	01	-	-	-	By flying
			Common Kingfisher	01	-	-	-	By flying
			Greater Coucal	02	-	-	-	By flying
			Cattle Egret	02	-	-	-	By flying
			Indian Roller	01	-	-	-	Noted Through Chirping
			Purple Sun Bird	01	22.86m	340 <sup>0</sup>	340 <sup>0</sup>	Perching
			Red Vented Bulbul	01	22.86m	340 <sup>0</sup>	340 <sup>0</sup>	Perching
			Plum Headed Parakeet	02	-	-	-	By flying
1200 M	22°04'53.75"	83°06'34.19"	Scaly Brested Munia	04	18.28m	90 <sup>0</sup>	75 <sup>0</sup>	Perching
			Red Vented Bulbul	02	-	-	-	By flying
			Indian Roller	01	-	-	-	By calling
			Jungle Bush Quail	01	9.14m	345 <sup>0</sup>	75 <sup>0</sup>	Perching
			Yellow Wattled	01	10.97m	310 <sup>0</sup>	75 <sup>0</sup>	Perching
			Jungle Crow	01	-	-	-	By flying
			Green Bee Eater	01	19.20m	210 <sup>0</sup>	75 <sup>0</sup>	Perching
			Black Drongo	02	15.54m	222 <sup>0</sup>	75 <sup>0</sup>	Perching
			Paddy Field Pipit	02	10.97m	140 <sup>0</sup>	75 <sup>0</sup>	Perching
			Singing Bush Lark	02	12.80m	145 <sup>0</sup>	75 <sup>0</sup>	Perching
			Thick Bellied Flower	01	-	-	-	By flying
			Common Tailor Bird	05	20.11m	163 <sup>0</sup>	75 <sup>0</sup>	Perching

### Datasheet for Bird status survey

Cell-ID: T5 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
0 M	22°05'38.90"	83°07'41.06"	Red Vented	02	13.71m	80 <sup>0</sup>	150 <sup>0</sup>	Perching
			Indian Robin	02	19.20m	110 <sup>0</sup>	150 <sup>0</sup>	Perching
			Green Bee	03	-	-	-	By flying
			Indian Cuckoo	01	-	-	-	By flying
			Black Drongo	01	-	-	-	Noted Through Chirping
			Indian hawk	01	20.11m	115 <sup>0</sup>	150 <sup>0</sup>	Perching
			Shikara	01	20.11m	115 <sup>0</sup>	150 <sup>0</sup>	Perching
			Blyth reed	01	-	-	-	Noted Through Chirping
300 M	22°05'40.52"	83°07'30.65"	Oriental	01	13.72m	80 <sup>0</sup>	80 <sup>0</sup>	Perching
			Black drongo	01	9.14m	190 <sup>0</sup>	80 <sup>0</sup>	Perching
			Common quail	01	-	-	-	Noted Through Chirping
			Bramhiny	02	-	-	-	By flying
			Bayar weaver	02	32.01m	35 <sup>0</sup>	80 <sup>0</sup>	Perching
			Indian silver	01	19.20m	72 <sup>0</sup>	80 <sup>0</sup>	Perching
			Thick bellied	01	-	-	-	By flying
600 M	22°05'34.53"	83°07'20.50"	Indian nuthatch	01	14.63m	310 <sup>0</sup>	50 <sup>0</sup>	Perching
			sulphur-bellied	02	15.54m	215 <sup>0</sup>	50 <sup>0</sup>	Perching

			Blyth reed	01	15.54m	170 <sup>0</sup>	50 <sup>0</sup>	Perching
			Red Vented	01	-	-	-	By flying
			Alexandrine	04	31.09m	237 <sup>0</sup>	50 <sup>0</sup>	Perching
			Plum headed	03	31.09m	237 <sup>0</sup>	50 <sup>0</sup>	Perching
			Jungle prinia	01	-	-	-	By flying
			Jungle babbler	01	28.35m	256 <sup>0</sup>	50 <sup>0</sup>	Perching
			Common	02	28.35m	256 <sup>0</sup>	50 <sup>0</sup>	Perching
<b>900 M</b>	22 <sup>0</sup> 05'26.03"	83 <sup>0</sup> 07'12.54"	Red Vented	01	24.68m	310 <sup>0</sup>	60 <sup>0</sup>	Perching
			Common myna	04	-	-	-	By flying
			Bramhiny	02	-	-	-	By flying
			Cattle egret	06	15.54m	117 <sup>0</sup>	60 <sup>0</sup>	Perching
			Indian pond	02	13.71m	215 <sup>0</sup>	60 <sup>0</sup>	Perching
			Ashy Prinia	01	20.11m	220 <sup>0</sup>	60 <sup>0</sup>	Perching
			Paddy Field	02	6.40m	290 <sup>0</sup>	60 <sup>0</sup>	Perching
Shikra	01	24.68m	275 <sup>0</sup>	60 <sup>0</sup>	Perching			
<b>1200 M</b>	22 <sup>0</sup> 05'26.54"	83 <sup>0</sup> 06'00.64"	Indian Roller	01	-	-	-	Noted Through Chirping
			Indian robin	01	-	-	-	Noted Through Chirping
			Purple sun bird	02	10.97m	215 <sup>0</sup>	90 <sup>0</sup>	Perching
			Greater flame back	01	-	-	-	Noted Through Chirping
			Common	01	9.14m	210 <sup>0</sup>	90 <sup>0</sup>	Perching
			Alexandrine	03	15.54m	310 <sup>0</sup>	90 <sup>0</sup>	Perching

### Datasheet for Bird status survey

Cell-ID: T6 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
<b>0 M</b>	22 <sup>0</sup> 05'48.12"	83 <sup>0</sup> 07'29.38"	Jungle babbler	02	19.20m	135 <sup>0</sup>	190 <sup>0</sup>	Perching
			Sulphur-bellied warbler	01	22.86m	264 <sup>0</sup>	190 <sup>0</sup>	Perching
			Crimson backed sun bird	01	22.86m	264 <sup>0</sup>	190 <sup>0</sup>	Perching
			Asian koel	02	-	-	-	By flying
			Spotted dove	02	15.54m	111 <sup>0</sup>	190 <sup>0</sup>	Perching
			Green bee eater	04	-	-	-	By flying
			Red vented bulbul	01	-	-	-	Noted Through Chirping
<b>300 M</b>	22 <sup>0</sup> 05'57.00"	83 <sup>0</sup> 07'37.40"	Ashy prinia	01	19.21m	112 <sup>0</sup>	195 <sup>0</sup>	Perching
			Indian silverbill	01	16.45m	136 <sup>0</sup>	195 <sup>0</sup>	Perching
			Blyth reed warbler	02	16.45m	136 <sup>0</sup>	195 <sup>0</sup>	Perching
			Green bee eater	08	-	-	-	By flying
			White rumped munia	01	10.05m	290 <sup>0</sup>	195 <sup>0</sup>	Perching
			Cattle egret	04	-	-	-	By flying
<b>600 M</b>	22 <sup>0</sup> 06'06.30"	83 <sup>0</sup> 07'36.63"	Black drongo	01	65.83m	270 <sup>0</sup>	195 <sup>0</sup>	Perching
			Green bee eater	04	-	-	-	By flying
			Spotted dove	02	55.77m	97 <sup>0</sup>	195 <sup>0</sup>	Perching



			Loughing dove	01	55.77m	97 <sup>0</sup>	195 <sup>0</sup>	Perching
			Greater coucal	01	20.11m	111 <sup>0</sup>	195 <sup>0</sup>	Perching
			Purple sun bird	01	20.11m	111 <sup>0</sup>	195 <sup>0</sup>	Perching
			Indian pond heron	01	-	-	-	By flying
			Rose ringed parakeet	04	11.88m	250 <sup>0</sup>	195 <sup>0</sup>	Perching
900 M	22°06'11.93"	83°07'34.57"	Indian silverbill	01	10.97m	134 <sup>0</sup>	170 <sup>0</sup>	Perching
			Black drongo	01	-	-	-	Noted Through Chirping
			Jangle babbler	01	-	-	-	By flying
			Rose ringed parakeet	02	19.20m	117 <sup>0</sup>	170 <sup>0</sup>	Perching
			Jungle Bush Quail	02	23.77m	210 <sup>0</sup>	170 <sup>0</sup>	Perching
			Green bee eater	01	-	-	-	By flying
			Indian roller	01	-	-	-	Noted Through Chirping
			Indian pond heron	01	-	-	-	By flying
1200 M	22°06'26.83"	83°07'31.12"	Plum headed parakeet	02	-	-	-	Noted Through Chirping
			Golden oriole	01	-	-	-	Noted Through Chirping
			Cattle egret	01	-	-	-	By flying
			Scaly Bressted Munia	01	9.14m	95 <sup>0</sup>	160 <sup>0</sup>	Perching
			Common quail	01	32.91m	217 <sup>0</sup>	160 <sup>0</sup>	Perching
			Purple sun bird	01	-	-	-	By flying
			Green bee eater	25	-	-	-	By flying
			Indian robin	01	-	-	-	By flying
			Oriental magpie robin	01	10.97m	123 <sup>0</sup>	160 <sup>0</sup>	Perching
			Alexandrian parakeet	01	24.68m	136 <sup>0</sup>	160 <sup>0</sup>	Perching
			Laughing dove	01	6.40m	90 <sup>0</sup>	160 <sup>0</sup>	Perching

### Datasheet for Bird status survey

Cell-ID: T7 Team: Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal And Kamesh Kumar Sahu. Trail-length: 1.2 (Km)

GPS at every 300 m			Sighting information					
S.N.	Latitude	Longitude	Species	Num ber	Perp. Dist.	Bearing		Observation
						A	T	
0 M	22°04'44.28"	83°07'37.23"	Common myna	03	13.76m	10 <sup>0</sup>	277 <sup>0</sup>	Perching
			Rose ringed parakeet	02	12.80m	0 <sup>0</sup>	277 <sup>0</sup>	Perching
			Indian roller	01	-	-	-	Noted Through Chirping
			White throated kingfisher	01	10.05m	180 <sup>0</sup>	277 <sup>0</sup>	Perching
			Sulphur bellied warbler	01	-	-	-	By flying
			Red vented bulbul	01	6.40m	0 <sup>0</sup>	277 <sup>0</sup>	Perching
			Little swift	01	-	-	-	By flying
			Indian pond heron	01	-	-	-	By flying
			Scaly breasted munia	>45	10.97m	315 <sup>0</sup>	277 <sup>0</sup>	Perching
300 M	22°04'45.09"	83°07'47.78"	Red vented bulbul	01	-	-	-	By flying
			Purple sunbird	01	-	-	-	Noted Through

								Chirping
			Green bee eater	01	-	-	-	By flying
			Indian roller	01	15.54m	351 <sup>0</sup>	268 <sup>0</sup>	Perching
			Greater coucal	01	-	-	-	Noted Through Chirping
			Plum headed parakeet	02	29.26m	295 <sup>0</sup>	268 <sup>0</sup>	Perching
<b>600 M</b>	22 <sup>0</sup> 04'44.50" <sup>N</sup>	83 <sup>0</sup> 07'57.25" <sup>E</sup>	Eurasian golden oriole	03	9.14m	170 <sup>0</sup>	250 <sup>0</sup>	Perching
			Greenish warbler	02	9.14m	170 <sup>0</sup>	250 <sup>0</sup>	Perching
			Indian roller	01	11.88m	340 <sup>0</sup>	250 <sup>0</sup>	Perching
			Plum headed parakeet	04	15.54m	348 <sup>0</sup>	250 <sup>0</sup>	Perching
			Black drongo	01	-	-	-	By flying
			Jungle babbler	03	-	-	-	By flying
<b>900 M</b>	22 <sup>0</sup> 04'40.40" <sup>N</sup>	83 <sup>0</sup> 08'08.70" <sup>E</sup>	Barn swallow	05	9.14m	165 <sup>0</sup>	262 <sup>0</sup>	Perching
			Little swift	01	-	-	-	By flying
			Rose ringed parakeet	01	-	-	-	Noted Through Chirping
			Alexandrine parakeet	02	10.97m	365 <sup>0</sup>	262 <sup>0</sup>	Perching
			Ashy prinia	01	10.97m	365 <sup>0</sup>	262 <sup>0</sup>	Perching
			Jungle babbler	>12	-	-	-	By flying
<b>1200 M</b>	22 <sup>0</sup> 04'48.24" <sup>N</sup>	83 <sup>0</sup> 08'18.80" <sup>E</sup>	Green bee eater	02	-	-	-	By flying
			Indian roller	01	-	-	-	By flying
			Greenish warbler	01	-	-	-	Noted Through Chirping
			Gray Francolin	01	21.94m	190 <sup>0</sup>	260 <sup>0</sup>	Perching
			Common kingfisher	01	12.80m	201 <sup>0</sup>	260 <sup>0</sup>	Perching
			Blyth's reed warbler	01	4.57m	330 <sup>0</sup>	260 <sup>0</sup>	Perching

### ANNEXURE I (WINTER SEASON)

#### Datasheet for Bird status survey

Cell-ID: T1 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 6:00 AM

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
<b>0 M</b>	22 <sup>0</sup> 05'35.19" <sup>N</sup>	83 <sup>0</sup> 06'45.69" <sup>E</sup>	6:32 AM	Ashy Wren Warbler	02	-	-	-	By Flying
<b>300 M</b>	22 <sup>0</sup> 05'27.50" <sup>N</sup>	83 <sup>0</sup> 06'53.18" <sup>E</sup>	6:40 AM	Indian Silverbil	01	-	-	-	Noted Through chirping
				Purple Sun Bird	01	-	-	-	Noted Through chirping
				Green Bee Eater	05	12M	230 <sup>0</sup>	231 <sup>0</sup>	Perching
				Ashy Prinia	02	-	-	-	By Flying
				Greenish Warbler	01				By Flying
<b>600 M</b>	22 <sup>0</sup> 05'22.51" <sup>N</sup>	83 <sup>0</sup> 07'00.80" <sup>E</sup>	6:55 AM	Small Parakeet	01	-	-	-	Noted Through chirping
				Purple Sun Bird	01	-	-	-	Noted Through chirping
				Sulphur-Bellied	01	-	-	-	By flying

				Warbler					
				Rose Ringed Parakeet	02	-	-	-	Noted Through chirping
				Ashy Drongo	01	-	-	-	By flying
<b>900 M</b>	22°05' 19.45"	83°07' 05.06"	7:05 AM	Jungle Prinia	01	-	-	-	By flying
				Common Myna	01	-	-	-	Noted Through chirping
				Jungle Babbler	01	-	-	-	Noted Through chirping
				White-Rumped Munia	01	-	-	-	By flying
				Indian Robin	01	-	-	-	By flying
<b>1200 M</b>	22°05' 14.34"	83°07' 11.52"	7:13 AM	Alexandrine Parakeet	01	-	-	-	By flying
				Asian Koel	01	-	-	-	Noted Through chirping
				Jungle Babbler	03	-	-	-	Noted Through chirping
				Purple Sun Bird	02	-	-	-	By flying
				Rufous Tree Pie	02	-	-	-	By flying
				Black Drongo	01	-	-	-	By flying
				Green Bee Eater	01	-	-	-	Noted Through chirping
				Eurasian Golden Oriole	01	-	-	-	By flying

### Datasheet for Bird status survey

Cell-ID: T2 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.0 (Km). Season: winter. Time: 7:30 AM

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
<b>0 M</b>	22°05' 15.17"	83°07' 21.33"	7:35 AM	Laughing Dove	02	-	-	-	Noted Through chirping
				Jungle Crow	07	-	-	-	By Flying
				Purple Sun Bird	01	-	-	-	By Flying
				Red Vented Bulbul	01	-	-	-	Noted Through chirping
<b>300 M</b>	22°05' 24.71"	83°07' 20.42"	7:47 AM	Rose Ringed Parakeet	01	-	-	-	Noted Through chirping
				Purple Sun Bird	01	-	-	-	Noted Through chirping
				Indian Robin	01	-	-	-	Preaching
				Indian Roller	01	-	-	-	By Flying

				Black Drongo	01	-	-	-	By Flying
				Asian Koel	01	-	-	-	By Flying
				Eurasian Collared Dove	01	-	-	-	By Flying
				Red Vented Bulbul	01	-	-	-	Noted Through chirping
<b>600 M</b>	22°05'32.45"	83°07'22.60"	8:00 AM	Plum Headed Parakeet	03	-	-	-	By Flying
				Small Parakeet	03	-	-	-	By Flying
				Purple Sun Bird	01	-	-	-	Noted Through chirping
				Green Bee Eater	01	-	-	-	Noted Through chirping
				Red Vented Bulbul	01	-	-	-	Noted Through chirping
				Eurasian Collared Dove	02	-	-	-	By Flying
				Grater Spotted Eagle	01	-	-	-	By Flying
<b>900 M</b>	22°05'40.75"	83°07'26.24"	8:10 AM	Black Drongo	01	-	-	-	By flying
				Rufous Tree Pie	01	15 M	170°	200°	Preaching
				Eurasian Collared Dove	01	17 M	170°	200°	Preaching
				Red Vented Bulbul	01	15 M	160°	200°	Noted Through chirping
				Alexandrine Parakeet	01	-	-	-	Noted Through chirping
				Spotted Dove	02	12 M	160°	200°	Preaching

**Datasheet for Bird status survey**

**Cell-ID: T3 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 9:00 AM**

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
<b>0 M</b>	22°05'17.18"	83°07'34.30"	9:00 AM	Indian Silverbil	01	-	-	-	Noted Through chirping
				Purple Sunbird	01	-	-	-	Noted Through chirping
				Red Vented Bulbul	01	-	-	-	By Flying
<b>300 M</b>	22°05'13.21"	83°07'25.26"	9:15 AM	Green Bee Eater	01	-	-	-	By Flying
				Rufous Tree Pie	01	-	-	-	By Flying
				Plum Headed Parakeet	02	20 M	70°	70°	Perching
				Red Vented Bulbul	05	13 M	140°	70°	Perching
				Indian Robin	01	-	-	-	By Flying

600 M	22°05'09.38"	83°07'16.70"	9:22 AM	Green Bee Eater	01	-	-	-	By Flying
				Black Drongo	01	-	-	-	By Flying
				Laughing Dove	02	-	-	-	Noted Through chirping
				Indian Cuckoo	01	-	-	-	Noted Through chirping
				Capper Smith Babbler	01	-	-	-	By flying
				Spotted Dave	01	-	-	-	Noted Through chirping
900 M	22°05'04.08"	83°07'08.54"	9:33 AM	Red Vented Bulbul	01	-	-	-	Noted Through chirping
				Purple Sunbird	01	-	-	-	Noted Through chirping
				Ashy Prinia	01	-	-	-	By flying
				Scaly Breasted Munia	01	-	-	-	Noted Through chirping
				White Rumped Munia	01	-	-	-	By flying
				Common Tailorbird	01	11 M	330 <sup>0</sup>	50 <sup>0</sup>	Perching
1200 M	22°05'00.12"	83°07'01.95"	9:45 AM	Rose Ringed Parakeet	02	-	-	-	By flying
				Small Parakeet	01	-	-	-	By flying
				Eurasian Collared Dove	02	15 M	130 <sup>0</sup>	70 <sup>0</sup>	Perching
				Red Vented Bulbul	01	-	-	-	By flying
				Sirkeer Malkoha	01	17 M	150 <sup>0</sup>	70 <sup>0</sup>	Perching
				Green Bee Eater	01	-	-	-	By flying
				Black Drongo	01	-	-	-	By flying
				Scaly Breasted Munia	01	19 M	1350 <sup>0</sup>	70 <sup>0</sup>	Perching
				Little Swift	01	-	-	-	By flying

### Datasheet for Bird status survey

Cell-ID: T4 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 10:05 AM

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
0 M	22°05'03.40"	83°06'54.64"	10:05AM	Jungle Babbler	07	10 M	180 <sup>0</sup>	90 <sup>0</sup>	Perching
				Greenish Warbler	02	-	-	-	By Flying
				Asian Koel	01	-	-	-	By Flying
				Laughing Dove	01	-	-	-	Noted Through chirping
				Indian Roller	01	-	-	-	By Flying
300 M	22°05'58.77"	83°07'45.39"	10:20AM	Red Vented Bulbul	01	-	-	-	By Flying
				Sulphur-	01	-	-	-	By Flying

				Bellied Warbler					
				Laughing Dove	01	-	-	-	Noted Through chirping
				Indian Roller	01	-	-	-	Noted Through chirping
				Purple Sunbird	01	-	-	-	Noted Through chirping
				Oriental Magpie Robin	01	17 M	135 <sup>0</sup>	90 <sup>0</sup>	Perching
<b>600 M</b>	22 <sup>0</sup> 05'01.01	83 <sup>0</sup> 06'33.82	10:30AM	Barn Swallow	09	27 M	40 <sup>0</sup>	120 <sup>0</sup>	Perching
				Golden Oriole	01	12 M	70 <sup>0</sup>	120 <sup>0</sup>	Perching
				Laughing Dove	01	-	-	-	By flying
				Little Swift	01	-	-	-	By flying
				Small Parakeet	01	-	-	-	By flying
				Greater Coucal	01	18 M	90 <sup>0</sup>	120 <sup>0</sup>	Perching
<b>900 M</b>	22 <sup>0</sup> 05'06.29	83 <sup>0</sup> 06'28.92	10:40AM	Laughing Dove	01	-	-	-	Noted Through chirping
				Purple Sunbird	01	-	-	-	Noted Through chirping
				Indian Robin	01	-	-	-	By flying
				Green Bee Eater	02	11 M	330 <sup>0</sup>	50 <sup>0</sup>	Perching
				Plum Headed Parakeet	01	-	-	-	By flying
				Plum Headed Parakeet	01	-	-	-	By flying
				Black Drongo	01	11 M	330 <sup>0</sup>	50 <sup>0</sup>	Perching
				Copper Smith Barbet	01	-	-	-	By flying
				Little Swift	01	-	-	-	By flying
				Red Vented Bulbul	01	-	-	-	Noted Through chirping
Little Cormorant	01	-	-	-	By flying				
<b>1200 M</b>	22 <sup>0</sup> 05'09.56	83 <sup>0</sup> 06'24.12	10:55AM	Purple Sunbird	01	-	-	-	Noted Through chirping
				Indian Robin	02	-	-	-	Noted Through chirping
				Little Egret	03	-	-	-	By flying
				Little Swift	01	-	-	-	By flying
				Barn Swallow	01	-	-	-	By flying
				Pond Heron	03	15 M	130 <sup>0</sup>	70 <sup>0</sup>	Perching

**Datasheet for Bird status survey**

Cell-ID: T5 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 0.9 (Km). Season: winter. Time: 3:25PM

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
0 M	22°05'48.32"	83°07'28.90"	3:25PM	Red Vented Bulbul	01	-	-	-	By Flying
				Jungle Babbler	04	-	-	-	By Flying
				Indian Roller	01	-	-	-	By Flying
				Indian Silver Bill	01	10 M	180°	180°	Perching
300 M	22°05'57.68"	83°07'31.08"	3:37PM	Laughing Dove	01	35 M	290°	200°	Perching
				Red Vented Bulbul	01	-	-	-	By Flying
				Ashy Prinia	01	-	-	-	By Flying
				Plain Prinia	01	-	-	-	By Flying
				Sulphur-Bellied Warbler	01	-	-	-	By Flying
				Blyth Reed Warbler	01	-	-	-	By Flying
600 M	22°06'05.21"	83°07'34.13"	3:45PM	Greater Coucal	01	-	-	-	By Flying
				Grey Francolin	01	-	-	-	By Flying
				Raqin Quail	03	-	-	-	By flying
				Purple Sunbird	01	-	-	-	Noted Through chirping
				Red Vented Bulbul	02	-	-	-	By flying
				Spotted Dave	01	35 M	190°	190°	Perching
900 M	22°06'13.27"	83°07'38.04"	3:55PM	European Turtle Dove	01	35 M	190°	190°	Perching

**Datasheet for Bird status survey**

Cell-ID: T6 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 0.9 (Km). Season: winter. Time: 4:25 PM

GPS at every 300 m			Sighting information						
S.N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
0 M	22°05'33.17"	83°08'13.63"	4:25 PM	Spotted Dave	01	20 M	0°	320°	Perching
				Long Tailed Shrike	01	17M	120°	320°	Perching
				Rose Ringed Parakeet	01	-	-	-	By Flying
				Little Swift	01	-	-	-	By Flying
				Common	01	-	-	-	By Flying

300 M	22°05'26.51"	83°08'18.95"	4:33PM	Myna					
				Baya Weaver	01	-	-	-	By Flying
				Red Vented Bulbul	03	-	-	-	Noted Through chirping
				Blyth Reed Warbler	01	-	-	-	By Flying
				Oriental Magpie Robin	01	-	-	-	By Flying
Golden Oriole	01	-	-	-	Noted Through chirping				
600 M	22°05'18.32"	83°08'22.65"	4:42PM	Black Leaded Oriole	01	22 M	180°	320°	Perching
				Alexandrine Parakeet	04				
				Europium Turtle Dave	01	15 M	30°	320°	Perching
				Red Vented Bulbul	01	-	-	-	By flying
				Long Tailed Shrink	01	-	-	-	By flying
				Indian Cuckoo	02	25 M	40°	320°	Perching
				Jungle Babbler	07	-	-	-	By flying
900 M	22°05'11.03"	83°08'26.36"	4:52PM	Jungle Babbler	01	-	-	-	Noted Through chirping
				Small Parakeet	01	-	-	-	Noted Through chirping
				Verditer Flycatcher	01	5 M	210°	320°	Perching

### Datasheet for Bird status survey

Cell-ID: T7 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 6:53 AM

GPS at every 300 m			Sighting information						
S. N.	Latitude	Longit ude	Time	Species	Numb er	Perp. Dist.	Bearing		Observation
							A	T	
0 M	22°05'42.72"	83°08'26.85"	6:53 AM	Indian Roller	01	-	-	-	Noted Through chirping
				Common Moorhen	03	-	-	-	By Flying
				Lesser Whistling Duck	01	-	-	-	By Flying
				Shikra	01	30M	140°	250°	Perching
				Indian Robin	01	15M	140°	250°	Perching
300 M	22°05'43.35"	83°08'36.54"	7:05 AM	Greenish Warbler	01	-	-	-	By Flying
				Indian Silver Bill	02	-	-	-	By Flying
				Scaly Breasted Munia	02	12M	290°	260°	Perching
				Asian Paradise Flycatcher	02	17M	320°	260°	Perching
				Baya Weaver	01	12M	290°	260°	Perching
600 M	22°05'42.84"	83°08'46.12"	7:15 AM	Grey Francolin	01	13M	180°	280°	Perching
				Plum Headed Parakeet	01	-	-	-	By flying



				Red Vented Bulbul	02	-	-	-	Noted Through chirping
				Green Bee Eater	16	-	-	-	By flying
				Oriental Turtle Dove	01	-	-	-	By flying
				Blyth Reed Warbler	02	27M	160 <sup>0</sup>	280 <sup>0</sup>	Perching
				Jungle Babbler	06	-	-	-	By flying
900 M	22 <sup>0</sup> 05'42.58"	83 <sup>0</sup> 08'55.34"	7:27 AM	Jungle Crow	01	-	-	-	By flying
				Sulphur-Bellied Warbler	01	-	-	-	By flying
				Spotted Dave	02	-	-	-	Noted Through chirping
				Red Vented Bulbul	01	-	-	-	Noted Through chirping
				Paddy Field Pipit	02	-	-	-	By flying
				Black Drongo	01	-	-	-	By flying
1200 M	22 <sup>0</sup> 05'42.33"	83 <sup>0</sup> 09'03.88"	7:41 AM	Red Vented Bulbul	02	-	-	-	By flying
				Laughing Dove	01	-	-	-	Noted Through chirping
				Indian Roller	01	-	-	-	Noted Through chirping
				Indian Silver Bill	02	-	-	-	By flying
				Purple Sunbird	01	24 M	0 <sup>0</sup>	280 <sup>0</sup>	Perching
				Common Babbler	04	12 M	190 <sup>0</sup>	280 <sup>0</sup>	Perching
Verditer Flycatcher	01	32 M	190 <sup>0</sup>	280 <sup>0</sup>	Perching				

### Datasheet for Bird status survey

Cell-ID: T8 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:02 AM

GPS at every 300 M			Sighting Information						
S. N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
00 M	22 <sup>0</sup> 05'58.62"	83 <sup>0</sup> 09'13.18"	8:02 AM	Indian Roller	01	-	-	-	Noted Through Chirping
				Golden Oriole	01	25M	150 <sup>0</sup>	100 <sup>0</sup>	Perching
				Purple Sunbird	01	-	-	-	By Flying
				Indian Robin	01	-	-	-	By Flying
				Indian Silver Bill	02	-	-	-	By Flying
300 M	22 <sup>0</sup> 06'00.55"	83 <sup>0</sup> 09'03.81"	8:12 AM	Purple Sunbird	01	-	-	-	By Flying
				Red Vented Bulbul	02	-	-	-	Noted Through Chirping
				Spotted Dave	02	-	-	-	Noted Through Chirping
600 M	22 <sup>0</sup> 06'00.19"	83 <sup>0</sup> 08'55.28"	8:20 AM	Common Tailor Bird	01	7 M	30 <sup>0</sup>	80 <sup>0</sup>	Perching
				Common Babbler	01	-	-	-	By Flying
				Purple Sunbird	02	-	-	-	Noted Through Chirping
				Indian Silver Bill	16	-	-	-	By Flying
				Greenish Warbler	01	-	-	-	By Flying
Green Bee Eater	02	12 M	40 <sup>0</sup>	80 <sup>0</sup>	Perching				

90 0 M	22 <sup>0</sup> 06'01. 42"	83 <sup>0</sup> 08'45. 36"	8:32 AM	Alexandrine Parakeet	01	-	-	-	By Flying
				Eurasian Collared Dove	01	-	-	-	Noted Through Chirping
				Indian Silver Bill	01	-	-	-	By Flying
				Plum Headed Parakeet	01	-	-	-	By Flying
				Blue-Winged Leaf Bird	01	12 M	20 <sup>0</sup>	90 <sup>0</sup>	Perching
				Black Redstart	01	25 M	180 <sup>0</sup>	90 <sup>0</sup>	Perching
12 00 M	22 <sup>0</sup> 05'42. 33"	83 <sup>0</sup> 09'03. 88"	8:40 AM	Eagle Owl	01	-	-	-	By Flying
				Indian Roller	01	-	-	-	By Flying
				Black Drongo	06	25 M	200 <sup>0</sup>	90 <sup>0</sup>	Perching
				Little Cormorant	30	35 M	90 <sup>0</sup>	90 <sup>0</sup>	Perching
				Eurasian Collared Dove	02	12 M	210 <sup>0</sup>	90 <sup>0</sup>	Perching
				Common Kingfisher	01	24 M	80 <sup>0</sup>	90 <sup>0</sup>	Perching
				White Throated Kingfisher	02	24 M	70 <sup>0</sup>	90 <sup>0</sup>	Perching
				Bronze-Winged Jacana	12	45 M	130 <sup>0</sup>	90 <sup>0</sup>	Perching
				Indian Courser	15	14 M	130 <sup>0</sup>	90 <sup>0</sup>	Perching
				Great Thick Knee	06	32M	110 <sup>0</sup>	90 <sup>0</sup>	Perching
				Gadwall	07	30 M	40 <sup>0</sup>	90 <sup>0</sup>	Perching
				Spot Bill Duck	05	15 M	90 <sup>0</sup>	90 <sup>0</sup>	Perching
				Cotton Teal	06	20 M	80 <sup>0</sup>	90 <sup>0</sup>	Perching
				Common Teal	06	24 M	80 <sup>0</sup>	90 <sup>0</sup>	Perching
				Red Wattled Lapping	10	30M	60 <sup>0</sup>	90 <sup>0</sup>	Perching
				Common Sandpiper	23	24 M	70 <sup>0</sup>	90 <sup>0</sup>	Perching
				Singing Bush Lark	3	13 M	100 <sup>0</sup>	90 <sup>0</sup>	Perching
				Greater Cormorant	18	18 M	120 <sup>0</sup>	90 <sup>0</sup>	Perching
				Lesser Whistling Duck	05	20 M	190 <sup>0</sup>	90 <sup>0</sup>	Perching
				Little Bittern	07	19 M	130 <sup>0</sup>	90 <sup>0</sup>	Perching
Eurasian Coot	06	11 M	160 <sup>0</sup>	90 <sup>0</sup>	Perching				
Red Crested Pochard	06	21 M	90 <sup>0</sup>	90 <sup>0</sup>	Perching				
Common Pochard	03	22 M	140 <sup>0</sup>	90 <sup>0</sup>	Perching				
Bar Headed Goose	08	32 M	90 <sup>0</sup>	90 <sup>0</sup>	Perching				

### Datasheet for Bird status survey

Cell-ID: T9 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:00 AM

GPS at every 300 M			Sighting Information						
S. N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
0	22 <sup>0</sup> 09'44.	83 <sup>0</sup> 10'02	8:00	Jungle Babbler	02	-	-	-	By Flying

M	00"	.25"	AM	Rufous tree pie	01	25M	0 <sup>0</sup>	290 <sup>0</sup>	Perching
				Plum headed parakeet	01	-	-	-	By Flying
				Indian Silver Bill	01	-	-	-	By Flying
				Small Parakeet	02	-	-	-	By Flying
30 0 M	22 <sup>0</sup> 09'44. 02"	83 <sup>0</sup> 10'08 .74"	8:25 AM	Indian Pitta	01	21 M	200 <sup>0</sup>	290 <sup>0</sup>	Perching
				Brown Shrink	01	18 M	200 <sup>0</sup>	290 <sup>0</sup>	Perching
				Small Parakeet	01	-	-	-	By Flying
				Indian Silver Bill	01	-	-	-	By Flying
				Black Drongo	01	-	-	-	Noted Through Chirping
				Lesser Flame Back	01	-	-	-	Noted Through Chirping
60 0 M	22 <sup>0</sup> 09'44. 56"	83 <sup>0</sup> 10'17 .23"	8:35 AM	Indian Silver Bill	01	-	-	-	By Flying
				Purple Sunbird	01	-	-	-	Noted Through Chirping
				Red vented Bulbul	01	-	-	-	Noted Through Chirping
				Rose ringed Parakeet	04	-	-	-	By Flying
90 0 M	22 <sup>0</sup> 09'44. 86"	83 <sup>0</sup> 10'25 .67"	8:45 AM	Rose ringed Parakeet	01	-	-	-	Noted Through Chirping
				Eurasian Collared Dove	01	-	-	-	Noted Through Chirping
				Purple Sunbird	01	-	-	-	Noted Through Chirping
				Common Babbler	03	-	-	-	By Flying
12 00 M	22 <sup>0</sup> 09'46. 54"	83 <sup>0</sup> 10'35 .42"	9:00 AM	Alexandrine Parakeet	01	-	-	-	By Flying
				Indian Robin	01	-	-	-	By Flying
				Rufous tree pie	06	-	-	-	Noted Through Chirping
				Purple Sunbird	30	-	-	-	Noted Through Chirping
				Eurasian Collared Dove	01	-	-	-	By Flying
				House Sparrow	03	-	-	-	By Flying
				Small Parakeet	01	-	-	-	Noted Through Chirping
				Eurasian golden oriole	04	-	-	-	By Flying
Rose ringed Parakeet	02	-	-	-	By Flying				

### Datasheet for Bird status survey

Cell-ID: T10 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 9:27 AM

GPS at every 300 M			Sighting Information						
S. N.	Latitude	Longitude	Time	Species	Number	Perp. Dist.	Bearing		Observation
							A	T	
0 M	22 <sup>0</sup> 09'59. 09"	83 <sup>0</sup> 10'35 .11"	9:27 AM	Plum headed parakeet	06	-	-	-	By Flying

				Rose ringed Parakeet	03	-	-	-	By Flying
				Alexandrine Parakeet	03	-	-	-	By Flying
				Black Drongo	02	-	-	-	By Flying
				Greater Flame Back	02	-	-	-	Noted Through Chirping
300 M	22°09'58.18"	83°10'24.76"	9:35 AM	Rose ringed Parakeet	01	22 M	160°	80°	Perching
				Black Drongo	02	-	-	-	Noted Through Chirping
				Black Headed Oriole	01	-	-	-	By Flying
				Green Bee Eater	01	-	-	-	By Flying
				Greater Coucal	01	-	-	-	By Flying
600 M	22°09'57.36"	83°10'15.20"	9:45 AM	Jungle Babbler	03	-	-	-	By Flying
				Ashy Prinia	02	-	-	-	By Flying
				Black Drongo	02	-	-	-	By Flying
				Blyth Reed Warbler	01	-	-	-	By Flying
				Rose ringed Parakeet	02	-	-	-	By Flying
				Small Parakeet	02	12 M	20°	80°	Perching
				Common Hoopoe	01	20 M	120°	80°	Perching
Indian Roller	01	-	-	-	By Flying				
900 M	22°09'57.62"	83°10'05.26"	9:50 AM	Indian Silver Bill	01	-	-	-	By Flying
				Plain Prinia	02	-	-	-	By Flying
				Common Babbler	04	-	-	-	By Flying
				Rose ringed Parakeet	02	-	-	-	By Flying
				Purple Sunbird	01	-	-	-	By Flying
				White-throated kingfisher	01	20 M	120°	80°	Perching
				Greater Coucal	01	-	-	-	By Flying

### Datasheet for Bird status survey

Cell-ID: T11 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 9:27 AM

GPS At Every 300 M			Sighting Information					
S.N.	Latitude	Longitude	Species	Number	Perp. Dist.	Bearing		Observation
						A	T	
0m	22°09'57.59"	83°10'47.98"	Greater Flameback	01	-	-	-	Noted Through Chirping
			Jungle Myna	02	-	-	-	Flying
			Black Drongo	01	-	-	-	Flying
			Indian Roller	01	-	-	-	Noted Through Chirping
300 m	22°09'54.40"	83°10'39.14"	Alexandrine Parakeet	03	-	-	-	Flying
			Rose Ringed Parakeet	05	12	340°	50°	Perching

			Plum Headed Parakeet	04	-	-	-	Noted Through Chirping
			Small Parakeet	06	-	-	-	Flying
			Golden Oriole	02	-	-	-	Noted Through Chirping
			Jungle Babbler	08	17	120°	50°	Perching
<b>600 m</b>	22°09'51.67	83°10'30.07	Rose Ringed Parakeet	05	-	-	-	Flying
			Copper Smith Barbet	03	10	350°	50°	Perching
			Rufus Tree Pie	01	14	110°	50°	Perching
			Black Drongo	02	-	-	-	Flying
<b>900 m</b>	22°09'47.40	83°10'21.18	Indian Silverbil	05	22	130°	50°	Perching
			Black Myna	01	-	-	-	Flying
			Golden Oriole	01	-	-	-	Noted Through Chirping
<b>1200 m</b>	22°09'44.08	83°10'13.70	Alexandrine Parakeet	02	-	-	-	Flying
			Plumheaded Parakeet	02	-	-	-	Flying
			Purple Sunbird	01	-	-	-	Noted Through Chirping
			Black Hooded Oriole	01	17	140°	70°	Perching

**Datasheet for Bird status survey**

Cell-ID: T12 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 9:27 AM

GPS At Every 300 M			Sighting Information					
S.N.	Latitude	Longitude	Species	Number	Per p. Dist.	Bearing		Observation
						A	T	
<b>0m</b>	22°09'12.70	83°10'37.34	Greater Flameback	2	-	-	-	Flying
			Greater Cauca	1	-	-	-	Flying
			Rose Ringed Parakeet	3	-	-	-	Flying
			Indian Silverbil	2	-	-	-	Noted Through Chirping
<b>300 m</b>	22°09'12.70	83°10'26.53	Thick Blid Flower Peacker	2	35	170°	90°	Perching
			White Rumped Munia	1	30	40°	90°	Perching
			Alexandrine Parakeet	4	-	-	-	Flying
			Black Drongo	2	-	-	-	Flying
<b>600 m</b>	22°09'12.45	83°10'16.57	Oriental White Eye	2	32	10°	90°	Perching
			Indian Silverbil	4	-	-	-	Flying
			Green Bee Eater	12	-	-	-	Flying
			Ashy Prinia	2	29	160°	90°	Perching
			Purple Sunbird	2	-	-	-	Flying
<b>900 m</b>	22°09'12.54	83°10'07.44	Red Vented Bulbul	5	25	20°	90°	Perching
			Baya Weaver	2	35	150°	90°	Perching
			Golden Oriole	2	-	-	-	Noted Through

								Chirping
			Lesser Flamback	1	-	-	-	Noted Through Chirping
			Common Babbler	6	-	-	-	Flying
			Greenish Warbler	2	-	-	-	Flying
			Oriental Magpie Robin	2	35	120°	90°	Perching
			Small Minivet	2	40	40°	90°	Perching
1200 m	22°09'12. 59	83°10'01 .34	Small Minivet	2	32	130°	90°	Perching
			Plum Headed Parakeet	3	-	-	-	Flying
			Jungle Babbler	6	-	-	-	Flying
			Purple Sunbird	1	-	-	-	Noted Through Chirping
			Small Parakeet	2	-	-	-	Noted Through Chirping
			Thick Billed Flower Pecker	2	12	107°	90°	Perching
			Golden Oriole	2	17	30°	90°	Perching
			Oriental White Eye	3	28	50°	90°	Perching
			Black Drongo	2	-	-	-	Noted Through Chirping
			Red Vented Bulbul	2	-	-	-	Noted Through Chirping
			Indian Silverbil	3	-	-	-	Flying
			Baya Weaver	3	-	-	-	Flying

**ANNEXURE II (SUMMER SEASON)**

**Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T1 Team:** Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)	
				B / A / G / W / S	Tree species	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub		Regeneration
<b>0 M</b>	22 <sup>0</sup> 05' 38.24"	83 <sup>0</sup> 06' 49.07"	W/S	Sal	G 0.20 m	4	2%	1%	5 %	30 %	Nil	
				Char	G 0.18 m							
<b>300 M</b>	22 <sup>0</sup> 05' 28.83"	83 <sup>0</sup> 06' 47.56"	W/S	Sal	G 0.35m	1,4	1%	2%	3%	25%	Nil	
				Char	G 0.15m							
				Mahua	G 0.19m							
<b>600 M</b>	22 <sup>0</sup> 05' 18.80"	83 <sup>0</sup> 06' 49.30"	W/S	Jamun	G 0.10m	1,4	2%	3%	4%	35%	Nil	
				Sal	G 0.22m							
				Char	G 0.20m							
<b>900 M</b>	22 <sup>0</sup> 05' 09.17"	83 <sup>0</sup> 06' 51.36"	W/S	Sal	G 0.35m	1,4	3%	1%	5%	20%	Nil	
				Char	G 0.20m							
<b>1200 M</b>	22 <sup>0</sup> 04' 59.19"	83 <sup>0</sup> 06' 50.07"	W/A	Mango	G 0.95m	1,4	1%	2 %	5 %	15%	Nil	
				Amaltash	G 0.20 m							
				Mahua	G 0.65m							

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T2 Team:** Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)	
				B / A / G / W / S	Tree species	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub		Regeneration

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<b>0 M</b>	22°05'18.92"	83°07'36.25"	W	Sal	G 0.65 m	1,4	1%	1%	1%	15%	R/E/S
				Char	G 0.15 m						
				Mahua	G 0.90m						
<b>300 M</b>	22°05'16.54"	83°07'25.64"	W	Sal	G 0.35m	1,4	1%	1%	2%	30%	Nil
				Char	G 0.22m						
				Mahua	G 0.18m						
<b>600 M</b>	22°05'17.94"	83°07'16.54"	W	Neem	G 0.20m	1,4	1%	2%	5%	35%	Nil
				Sal	G 0.50m						
				Char	G 0.20m						
<b>900 M</b>	22°05'19.20"	83°07'07.46"	W	Sal	G 0.35m	1,4	2%	3%	5%	40%	Nil
				Char	G 0.18m						
				Mahua	G 0.36m						
<b>1200 M</b>	22°05'20.01"	83°06'59.10"	W	Sal	G 0.30m	1,4	2%	1%	5%	35%	Nil
				Char	G 0.20 m						
				Dhawda	G 0.15m						

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T3 Team:** Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)	
					B / A / G / W / S	Tree species	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub		Regeneration
<b>0 M</b>	22°05'05.16"	83°07'08.53"		W/A	Kusum (01)	G 3.00 m	1,4	1%	2%	7%	30%	E/S/P	
					Jamun (02)	G 0.50m							
					Char (02)	G 0.60 m							
<b>300 M</b>	22°05'04.57"	83°07'11.89"		W	Sal (35)	G 0.22m	1,4	1%	2%	5%	50%	Nil	
					Char (06)	G 0.40m							
					Kekat (01)	G 0.40m							
<b>600 M</b>	22°05'08.17"	83°07'22.21"		W	Senha (02)	G 0.16m	1,4	1%	1%	5%	50%	Nil	
					Sal (10)	G 0.80m							



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900 M	22°05'11.84"	83°07'28.60"	W	Char (5)	G 0.15m	1,4	2%	3%	3%	40%	Nil
				Sal (15)	G 0.50m						
				Char (03) Dhawda (03)	G 0.20m G 0.35m						
1100 M	22°05'12.80"	83°07'39.29"	W	Sal (15)	G 0.50m	1,4	1%	2%	2%	20%	E/S/R/W
				Char (12)	G 0.17m						
				Senha (3)	G 0.15m						

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T4 Team:** Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)
				B / A / G / W / S	Tree species	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub	
0 M	22°05'00.42"	83°07'10.85"	W/A	Mahua (01)	G 0.60m	1,4	1%	1%	1%	2%	S/E/W
				Char (02)	G 0.55m						
300 M	22°05'00.29"	83°07'00.28"	W/S	Mahua (02)	G 0.75m	1,4	1%	1%	1%	2%	S/W
				Char(04)	G 0.75m						
				Mango (02)	G 0.60m						
600 M	22°04'56.87"	83°04'49.85"	A/S	Jamun(02)	G 1.30m	1,4	0%	1%	1%	2%	E
				Mango(02)	G 2.10m						
				Palash (02)	G 2.30m						
900 M	22°04'55.99"	83°06'42.75"	A/S	Jamun(02)	G 2.30m	1,4	3%	1%	1%	5%	Nil
				Mango(03)	G 2.10m						
				Bahera (01)	G 1.20m						
1200 M	22°04'53.75"	83°06'34.19"	A/W/S	Palash (05)	G 0.67m	1,4	1%	1%	2%	6%	E/P
				Jamun (03)	G 0.74 m						
				Mahua (04)	G 0.55m						

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T5 Team:** Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)
				B / A / G / W / S	Tree species	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub	
			S/H/R/E/W/P								
0 M	22°05'38.90"	83°07'41.06"	W/S	Sal (02)	G 0.80 m	1,4	2%	3%	5 %	20 %	Nil
				Mahua (02)	G 0.60m						
				Char (03)	G 0.35 m						
300 M	22°05'40.52"	83°07'30.65"	W/S	Tendu(02)	G 0.50m	1,4	1%	2%	3%	25%	Nil
				Saja (02)	G 0.60m						
				Dhawda (3)	G 0.65m						
600 M	22°05'34.53"	83°07'20.50"	W	Mahua (03)	G 0.65m	1,4	2%	3%	5%	30%	Nil
				Sal (05)	G 0.45m						
				Char(05)	G 0.40m						
900 M	22°05'26.03"	83°07'12.54"	W/A	Tendu (02)	G 0.90m	1,4	1%	2%	3%	40%	Nil
				Sal(03)	G 0.90m						
				Char (05)	G 0.50m						
1200 M	22°05'26.54"	83°06'00.64"	W/A	Char (03)	G 0.55m	1,4	1%	3%	2%	20%	Nil
				Sal (02)	G 0.75 m						
				Mahua (02)	G 0.95m						

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T6 Team:** Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)
				B / A / G / W / S	Tree species	Parameter s	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub	
			S/H/R/E/W/P								

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<b>0 M</b>	22°05'48.12"	83°07'29.38"	W/S	Sal (25)	G 0.55 m	1,4	1%	1%	2 %	20 %	R/E
				Char (02)	G 0.12 m						
<b>300 M</b>	22°05'57.00"	83°07'37.40"	W/S	Tendu(06)	G 0.25m	1,4	>1%	>1%	1 %	20 %	R/E
				Sal (35)	G 0.26m						
				Dhawda (4)	G 0.10m						
<b>600 M</b>	22°06'06.30"	83°07'36.63"	S/G	Tendu (04)	G >0.10m	1,4	10%	1%	1%	35%	Nil
				Sal (10)	G >0.10m						
				Neem(01)	G 0.60m						
<b>900 M</b>	22°06'11.93"	83°07'34.57"	B/A	Nil	Nil	-	20%	0%	0%	0%	Nil
<b>1200 M</b>	22°06'26.83"	83°07'31.12"	W	Palash(06)	G 0.40m	1,4	5%	1%	1%	20%	E/P/S
				Neem (05)	G 0.70 m						
				Mahua (02)	G 1.20m						

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T7 Team:** Ashutosh Pandey, Vijay Kumar Bhagat, Ashish Rawal, Kamesh Kumar Sahu.

S.N.	Latitude	Longitude	Land-cover (100m radius)	Vegetation (3 dominant species)			Vegetation composition				Human structure (500m radius)
				B / A / G / W / S	Tree species	Parameters	Observation 1 / 2 / 3 / 4 / 5	Grass	Herb	Shrub	
			S/H/R/E/W/P								
<b>0 M</b>	22°04'44.28"	83°07'37.23"	A	Mahua (02)	G 1.55 m	1,4	2%	1%	2 %	25 %	Nil
				Char (02)	G 0.75 m						
				Semul (01)	G 1.19 m						
<b>300 M</b>	22°04'45.09"	83°07'47.78"	W/A	Char(04)	G 0.80m	1,4	1%	2%	3 %	15 %	Nil
				Sal (7)	G 0.80m						
				Neem (1)	G 0.55m						
<b>600 M</b>	22°04'44.50"	83°07'57.25"	W/S	dhawda (02)	G 0.90m	1,4	2%	2%	3%	20%	Nil
				Kusum(01)	G 0.60m						
				kekat(02)	G 0.45m						

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<b>900 M</b>	22°04'40.40"	83°08'08.70"	W/S	Dhawda (3)	G 1.20m	1,4	1%	3%	5%	35%	Nil
				Sal (04)	G 1.30m						
				Saja (02)	G 0.60m						
<b>1200 M</b>	22°04'48.24"	83°08'18.80"	W/A	kusum(02)	G 2.10m	1,4	2%	3%	6%	5%	Nil
				Char (01)	G 0.80 m						
				Mahua (07)	G 1.80m						

Abbreviation: **Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**ANNEXURE II (WINTER SEASON)**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

Cell-ID: T1 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 6:00 AM

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb		Shrub	Regeneration
								H	G						
<b>0 M</b>	22°05'35.19"	83°06'45.69"	6:32 AM	S/G	Mahua	06	7m	0.33m	4	5%	5%	10 %	10 %	E,W,H	
					Char	04	3m	0.25m							
					Mango	01	12m	1.12m							
<b>300 M</b>	22°05'27.50"	83°06'53.18"	6:40 AM	W/S	Sal	07	11m	0.47m	4,5	5%	3%	5%	10%	Nil	
					Senha	03	5m	0.28m							
					Char	03	7m	0.45m							
<b>600 M</b>	22°05'22.51"	83°07'00.80"	6:55 AM	W/S	Char	05	11m	0.32m	4,5	2%	4%	5%	20%	Nil	
					Sal	04	6m	0.27m							
					Dhaoda	23	8m	0.45m							
<b>900 M</b>	22°05'19.45"	83°07'05.06"	7:05 AM	W	Char	09	7m	0.25m	4,5	2%	5%	5%	10%	Nil	
					Mahua	02	9m	0.45m							
					Sal	15	10m	0.35m							
<b>1200 M</b>	22°05'14.34"	83°07'11.52"	7:13 AM	W/A	Mango	02	12m	3.00m	4	2%	2%	2%	5%	Nil	
					Mahua	04	3m	0.35m							
					Koria	09	3m	0.42m							

**Abbreviation: Land cover – B** (barren) / **A** (Agriculture) / **G** (Grassland) / **W** (Woodland) / **S** (Scrubland)

**Human structure – S** (Settlement) / **R** (Metal road) / **E** (Electricity) / **P** (Pond) / **W** (Well / tube well)

**Observation – 1.** Illicit felling **2.** Girdling **3.** Dead tree **4.** Living / Healthy **5.** Diseased

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T2 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.0 (Km). Season: winter. Time: 7:35 AM**

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)					Vegetation composition				Human structure (500m radius)
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb	Shrub	
								H	G					S/H/R/E/W/P
0 M	22°05'15.17"	83°07'21.33"	7:35 AM	W	Sal	06	10m	0.90m	4	2%	5%	5%	10 %	E,W,H
					Baheda	05	3m	0.35m						
					Koriya	06	4m	0.28m						
300 M	22°05'24.71"	83°07'20.42"	7:47 AM	G/S	Sal	06	10m	0.45m	4	2%	2%	2%	10%	Nil
					Mahua	06	5m	0.26m						
					Chironji	03	3m	0.28m						
600 M	22°05'32.45"	83°07'22.60"	8:00 AM	W	Sal	17	7m	0.42m	4	2%	5%	2%	20%	Nil
					Char	04	5m	0.35m						
					Dhaoda	04	3m	0.35m						
900 M	22°05'40.75"	83°07'26.24"	8:10 AM	W	Sal	17	3m	0.25m	4	2%	5%	5%	5%	Nil
					Senha	04	3m	0.25m						
					Dhaoda	02	5m	0.35m						

**Abbreviation: Land cover – B** (barren) / **A** (Agriculture) / **G** (Grassland) / **W** (Woodland) / **S** (Scrubland)

**Human structure – S** (Settlement) / **R** (Metal road) / **E** (Electricity) / **P** (Pond) / **W** (Well / tube well)

**Observation – 1.** Illicit felling **2.** Girdling **3.** Dead tree **4.** Living / Healthy **5.** Diseased

**ANNEXURE II (WINTER SEASON)**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T3 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 9:00 AM**

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition	Human structure (500m radius)
					B / A / G /	Tree	Number	Parameters		

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				W / S	species	of Tree	H	G	n 1/2/3/4/5	Grass	Herb	Shrub	Regeneration	S/H/R/E/W/P
0 M	22°05'17.18"	83°07'34.30"	9:00 AM	W	Sal	17	10m	0.95m	4	2%	2%	3%	10 %	R,H,E
					Saja	06	6m	0.35m						
					Dhaoda	03	5m	0.40m						
300 M	22°05'13.21"	83°07'25.26"	9:15 AM	W	Sal	05	8m	0.65m	4	2%	3%	5%	10%	Nil
					Baheda	03	5m	0.45m						
					Char	03	4m	0.42m						
600 M	22°05'09.38"	83°07'16.70"	9:22 AM	W	Sal	07	10m	0.60m	1,4	3%	2%	5%	20%	Nil
					Mahua	03	10m	1.50m						
					Char	05	8m	0.35m						
900 M	22°05'04.08"	83°07'08.54"	9:33 AM	W, S	Mahua	02	5m	0.25m	1,4	2%	2%	5%	10%	Nil
					Char	05	5m	0.35m						
					Sal	06	7m	0.45m						
22°05'00.12"	83°07'01.95"	22°05'00.12"	9:45 AM	W/G	Mahua	01	8m	1.20m	1,4	3%	3%	2%	5%	Nil
					Char	01	6m	0.42m						
					Baheda	02	12m	1.00m						

Abbreviation: Land cover – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

Human structure – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

ANNEXURE II

Appendix 2: Datasheet for habitat characterization at every 300 m along transect route

Cell-ID: T4 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 10:05 AM

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)					Vegetation composition				Human structure (500m radius)	
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb	Shrub		Regeneration
								H	G						
0 M	22°05'03.40"	83°06'54.64"	10:05 AM	W	Mahua	02	10m	2.60m	1,4	2%	2%	2%	3 %	S,E	
					Mango	03	11m	0.75m							
					Char	01	7m	0.45m							
300	22°05'58.77"	83°07'45.39"	10:20	W	Mahua	05	12m	1.25m	1,4	3%	2%	2%	5%	E	

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M			AM		Palash	04	7m	0.40m						
					Char	02	3m	0.20m						
600 M	22°05'01.01"	83°06'33.82"	10:30 AM	W	Char	02	10m	0.95m	1,4	2%	3%	2%	5%	E
					Mango	03	10m	2.20m						
					Mahua	01	8m	1.65m						
900 M	22°05'06.29"	83°06'28.92"	10:40 AM	W/S	Mahua	04	10m	1.25m	1,4	2%	2%	2%	5%	S,E
					Baheda	01	9m	1.70m						
					Chhar	04	7m	0.35m						
1200 M	22°05'09.56"	83°06'24.12"	10:55 AM	W/G	Mahua	05	12m	0.55m	1,4	2%	2%	2%	2%	P,S,E
					Baheda	01	10m	0.42m						
					Semal	02	16m	0.75m						

**Abbreviation: Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

Cell-ID: T5 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.0 (Km). Season: winter. Time: 3:25 PM

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)					Vegetation composition				Human structure (500m radius)
				B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb	Shrub	Regeneration	S/H/R/E/W/P
							H	G						
0 M	22°05'48.32"	83°07'28.90"	3:25PM	S	Sal	15	9m	1.20m	1,4	0%	1%	2%	3%	S,R,E
					Chilho	02	3m	0.25m						
					Char	06	3m	0.30m						
300 M	22°05'57.68"	83°07'31.08"	3:37PM	S,W	Sal	17	3m	0.20m	4	5%	2%	10%	25%	E
					Koria	20	7m	0.40m						
					Tendu	08	6m	0.60m						
600 M	22°06'05.21"	83°07'34.13"	3:45PM	S,G	Baheda	01	11m	0.35m	2,4	2%	4%	5%	10%	E
					Mahaneem	02	4m	0.35m						
					Sal	01	15m	0.95m						

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<b>900 M</b>	22°06'13.27"	83°07'38.04"	3:55PM	B	Mango	02	8m	0.65m	4	1%	1%	1%	2%	R,E,S
					Mahaneem	01	10m	1.70m						
					Mahua	03	10m	0.98m						

**Abbreviation: Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T6 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.0 (Km). Season: winter. Time: 10:05 AM**

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)					Vegetation composition				Human structure (500m radius)	
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb	Shrub		Regeneration
								H	G						
<b>0 M</b>	22°05'33.17"	83°08'13.63"	4:25 PM	W	Bargad	01	5m	0.75m	4	2%	1%	2%	20 %	R,E	
					Sal	25	5m	0.35m							
					Char	06	3m	0.30m							
<b>300 M</b>	22°05'26.51"	83°08'18.95"	4:33PM	S,W	Sal	26	6m	0.50m	1,2,4	5%	3%	2%	20 %	Nil	
					Saja	03	4m	0.45m							
					Char	04	4m	0.35m							
<b>600 M</b>	22°05'18.32"	83°08'22.65"	4:42PM	W	Sal	35	6m	0.40m	1,2,4	3%	2%	2%	10%	Nil	
					Char	08	5m	0.55m							
					Baheda	02	4m	0.25m							
<b>900 M</b>	22°05'11.03"	83°08'26.36"	4:52PM	W	Sal	11	5m	0.80m	1,4	2%	2%	2%	10%	Nil	
					Char	05	4m	0.45m							
					Mahua	03	5m	0.75m							

**Abbreviation: Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T7 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 6:53 AM**



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S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb		Shrub	Regeneration
								H	G						
0 M	22°05'42.72"	83°08'26.85"	6:53AM	W	Sal	16	7m	0.45m	1,4	5%	2%	10%	15%	P,S,R,E	
					Char	06	5m	0.55m							
					Mahua	03	4m	0.35m							
300 M	22°05'43.35"	83°08'36.54"	7:05AM	W,S	Sal	21	5m	0.60m	1,2,4	2%	5%	5%	5%	P	
					Mahua	03	3m	0.35m							
					Char	04	3m	0.25m							
600 M	22°05'42.84"	83°08'46.12"	7:15AM	W,S	Sal	08	5m	0.40m	1,2,4	5%	10%	15%	25%	Nil	
					Char	10	4m	0.25m							
					Baheda	03	5m	0.45m							
900 M	22°05'42.58"	83°08'55.34"	7:27AM	A,W	Chhar	05	5m	0.50m	2,4	2%	10%	2%	10%	Nil	
					Mahua	07	7m	0.70m							
1200 M	22°05'42.33"	83°09'03.88"	7:41AM	A,W	Mango	01	8m	0.90m	1,4	1%	1%	2%	5%	Nil	
					Sal	06	6m	0.95m							
					Mahua	01	5m	0.70m							

**Abbreviation: Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

Cell-ID: T8 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:02 AM

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb		Shrub	Regeneration
								H	G						
0 M	22°05'58.62"	83°09'13.18"	8:02AM	A,W	Mahua	08	7m	0.85m	1,4	1%	2%	2%	5%	Nil	
					Char	07	6m	0.65m							

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<b>300 M</b>	22°06'00.55"	83°09'03.81"	8:12AM	W	Sal	15	6m	0.55m	1,4	1%	1%	2%	3%	Nil
					Sal	35	7m	0.55m						
					Saja	03	3m	0.30m						
					Senha	02	4m	0.35m						
<b>600 M</b>	22°06'00.19"	83°08'55.28"	8:20AM	W	Mahua	06	8m	0.75m	4	1%	1%	1%	2%	Nil
					Sal	07	9m	0.80m						
					Chhar	05	4m	0.55m						
<b>900 M</b>	22°06'01.42"	83°08'45.36"	8:32AM	W	Harra	01	9m	1.20m	4	1%	1%	1%	1%	P
					Mahua	03	12m	1.45m						
					Chhar	04	4m	0.45m						
<b>1200 M</b>	22°05'42.33"	83°09'03.88"	8:40AM	B,P	Harra	01	8m	1.20m	4	1%	1%	1%	1%	Wetland
					Mahua	02	15m	1.55m						
					Bargad	01	10m	1.35m						

**Abbreviation: Land cover** – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

**Human structure** – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

**Observation** – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T9 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:00 AM**

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb	Shrub	Regeneration	S/H/R/E/W/P
								H	G						
<b>0 M</b>	22°09'44.00"	83°10'02.25"	8:00AM	W	Sal	18	30m	1.55m	4	1%	2%	2%	10%	H,S	
					Char	03	12m	1.35m							
					Saja	01	22m	1.44m							
<b>300 M</b>	22°09'44.02"	83°10'08.74"	8:25AM	W	Sal	13	30m	130m	4	1%	1%	2%	10%	Nil	
					Char	04	25m	110m							
					Saliya	06	30m	130m							
<b>600 M</b>	22°09'44.56"	83°10'17.23"	8:35AM	W	Sal	29	32m	1.65m	4	2%	1%	5%	75%	Nil	
					Dhawda	05	25m	1.40m							
					Saja	03	22m	0.95m							

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<b>900 M</b>	22°09'44.86"	83°10'25.67"	8:45AM	W	Sal	08	33m	1.20m	4	2%	1%	2%	70%	Nil
					Dhawda	04	35m	1.10m						
					Chhar	02	30m	1.09m						
<b>1200 M</b>	22°09'46.54"	83°10'35.42"	9:00AM	W	Sal	19	35m	1.45m	4	2%	1%	5%	25%	Nil
					Saliya	08	25m	0.80m						
					Saja	05	28m	1.20m						

**Abbreviation: Land cover – B** (barren) / **A** (Agriculture) / **G** (Grassland) / **W** (Woodland) / **S** (Scrubland)

**Human structure – S** (Settlement) / **R** (Metal road) / **E** (Electricity) / **P** (Pond) / **W** (Well / tube well)

**Observation – 1.** Illicit felling **2.** Girdling **3.** Dead tree **4.** Living / Healthy **5.** Diseased

**ANNEXURE II**

**Appendix 2: Datasheet for habitat characterization at every 300 m along transect route**

**Cell-ID: T10 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.0 (Km). Season: winter. Time: 8:00 AM**

S.N.	Latitude	Longitude	Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
					B / A / G / W / S	Tree species	Number of Tree	Parameters		Observation 1/2/3/4/5	Grass	Herb		Shrub	Regeneration
								H	G						
<b>0 M</b>	22°09'59.09"	83°10'35.11"	9:27AM	W	Sal	15	30m	1.55m	4	1%	2%	2%	10%	H,S	
					Saja	04	12m	1.35m							
					Tilisa	02	22m	1.44m							
<b>300 M</b>	22°09'58.18"	83°10'24.76"	9:35AM	W	Sal	16	30m	130m	4	1%	1%	2%	10%	Nil	
					Dhawda	02	25m	110m							
					Anjan	03	30m	130m							
<b>600 M</b>	22°09'57.36"	83°10'15.20"	9:45AM	W	Sal	08	32m	1.65m	4	2%	1%	5%	75%	Nil	
					Dhawda	06	25m	1.40m							
					Saja	03	22m	0.95m							
<b>900 M</b>	22°09'57.62"	83°10'05.26"	9:50AM	W	Teak	19	33m	1.20m	4	2%	1%	2%	70%	Nil	
					Harra	01	35m	1.10m							
					Mahua	07	30m	1.09m							

**Abbreviation: Land cover – B** (barren) / **A** (Agriculture) / **G** (Grassland) / **W** (Woodland) / **S** (Scrubland)

**Human structure – S** (Settlement) / **R** (Metal road) / **E** (Electricity) / **P** (Pond) / **W** (Well / tube well)

Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

ANNEXURE II

Appendix 2: Datasheet for habitat characterization at every 300 m along transect route

Cell-ID: T11 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:45 AM

S.N.	GPS Location		Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)				Vegetation composition				Human structure (500m radius)		
	Lat.	Long.			B / A / G / W / S	Tree spp.	Number of tree	Parameters		Observation 1 / 2 / 3 / 4 / 5	Grass (%)	Herb (%)		Shrub (%)	Regeneration (%)
								H	G						
0m	22°09'57.59	83°10'47.98	11:35 am	W	Sal	08	25m	1.40m	4	1%	2%	2%	5%	E	
					Mahua	05	30m	1.70m							
					Char	02	35m	1.65m							
300m	22°09'54.40	83°10'39.14	11:55 am	W	Sal	12	17m	0.95m	4,5	1%	1%	3%	5%	E	
					Char	04	40m	1.55m							
					Saja	04	30m	1.35m							
600m	22°09'51.67	83°10'30.07	12:03 am	W	Sal	08	17m	0.70m	4,5	1%	2%	2%	15%	E	
					Char	08	17m	0.75m							
					Mahua	03	30m	1.35m							
900m	22°09'47.40	83°10'21.18	12:16 am	W	Sal	08	28m	1.25m	3,4,5	2%	3%	2%	10%	E	
					Saja	04	26m	1.10m							
					Saliha	02	26m	1.15m							
1200m	22°09'44.08	83°10'13.70	12:27 am	W	Sal	08	35m	1.65m	4	1%	1%	2%	10%	E	
					Saliha	03	28m	1.40m							
					char	06	25m	1.10m							

Abbreviation: Land cover – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

Human structure – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

ANNEXURE II

Appendix 2: Datasheet for habitat characterization at every 300 m along transect route

Cell-ID: T12 Team: Ashutosh Pandey, Vijay Kumar Bhagat & Amit Baghel. Trail-length: 1.2 (Km). Season: winter. Time: 8:00 AM

S.N.	GPS Location		Time (hrs.)	Land-cover (100m radius)	Vegetation (3 dominant species)					Vegetation composition				Human structure (500m radius)	
	Lat.	Long.			B / A / G / W / S	Tree spp.	Number of tree	Parameters		Observation 1 / 2 / 3/ 4/ 5	Grass (%)	Herb (%)	Shrub (%)		Regeneration (%)
								H	G						
0m	22 <sup>0</sup> 09'12.70	83 <sup>0</sup> 10'37.34	7:45am	W	Dhawda	08	35m	0.85m	4	1%	1%	2%	5%	R	
					Sal	11	35m	1.55m							
					Saja	07	25m	1.10m							
300m	22 <sup>0</sup> 09'12.70	83 <sup>0</sup> 10'26.53	7:50 am	W	Dhawda	06	40m	1.40m	1,4	1%	1%	3%	5%	R	
					Sal	12	40m	1.20m							
					Tinsa	04	30m	1.25m							
600m	22 <sup>0</sup> 09'12.45	83 <sup>0</sup> 10'16.57	8:02 am	W	Sal	10	40m	1.55m	1,4	1%	1%	2%	15%	R	
					Tinsa	05	35m	1.35m							
					dhawda	06	32m	1.25m							
900m	22 <sup>0</sup> 09'12.54	83 <sup>0</sup> 10'07.44	8:17 am	W	sal	08	45m	1.65m	1,4	1%	1%	2%	10%	R	
					Kekat	02	15m	0.95m							
					Saja	04	28m	1.20m							
1200m	22 <sup>0</sup> 09'12.59	83 <sup>0</sup> 10'01.34	8:25 am	W	Sal	11	50m	2.10m	1,4	1%	1%	2%	10%	R	
					Saja	04	32m	1.20m							
					Kekat	04	25m	1.10m							

Abbreviation: Land cover – B (barren) / A (Agriculture) / G (Grassland) / W (Woodland) / S (Scrubland)

Human structure – S (Settlement) / R (Metal road) / E (Electricity) / P (Pond) / W (Well / tube well)

Observation – 1. Illicit felling 2. Girdling 3. Dead tree 4. Living / Healthy 5. Diseased

## ANNEXURE 3

## Avifauna checklist of seasonal survey 2018 of OCP Chhal by SFRTI

S. No.	Common Name	Local Name	Scientific Name	Family	IUCN Status
1.	Alexandrine Parakeet	Parrot, Tota	<i>Psittacula eupatria</i>	Psittacidae	NT
2.	Ashy Drongo	-----	<i>Dicrurus leucophaeus</i>	Dicruridae	LC
3.	Ashy Prinia or ashy wren-warbler	-	<i>Prinia socialis</i>	Cisticolidae	LC
4.	Asian Brown Flycatcher	--	<i>Muscicapa dauurica</i>	Muscicapidae	LC
5.	Asian Koel	Koel, Cuckoo	<i>Eudynamis scolopacea</i>	Cuculidae	LC
6.	Asian Paradise Flycatcher	-----	<i>Terpsiphone paradisi</i>	Monarchidae	LC
7.	Bank Myna	Myna	<i>Acridotheres ginginianus</i>	Sturnidae	LC
8.	Bar Headed Goose	-----	<i>Anser indicus</i>	Anatidae	LC
9.	Barn Swallow	-----	<i>Hirundo rustica</i>	Hirundinidae	LC
10.	Baya Weaver	Gauraiya	<i>Ploceus philippinus</i>	Ploceidae	LC
11.	Black Drongo	Karrauna	<i>Dicrurus macrocercus</i>	Dicruridae	LC
12.	Black Headed Oriole	-----	<i>Oriolus larvatus</i>	Oriolidae	LC
13.	Black Redstart	-----	<i>Phoenicurus ochruros</i>	Muscicapidae	LC
14.	Blue-Winged Leaf Bird	-----	<i>Chloropsis cochinchinensis</i>	Chloropseidae	NT
15.	Blyth Reed Warbler	-----	<i>Acrocephalus dumetorum</i>	Acrocephalidae	LC
16.	Bramhiny Myna	Maina	<i>Sturnia pagodarum</i>	Sturnidae	LC
17.	Bronze-Winged Jacana	-----	<i>Metopidius indicus</i>	Jacanidae	LC
18.	Brown Shrink	-----	<i>Lanius cristatus</i>	Laniidae	LC
19.	Cattle Egret	Gay Bagula	<i>Bubulcus ibis</i>	Ardeidae	LC
20.	Common Babbler	-----	<i>Turdoides caudate</i>	Lieothrachidae	LC
21.	Common Hawk Eagle	Cheel	<i>Hierococyx varius</i>	Cuculidae	LC
22.	Common Hoopoe	-----	<i>Upupa epops</i>	Upupidae	LC
23.	Common Kingfisher	Kilkila	<i>Alcedo atthis</i>	Alcedinidae	LC
24.	Common Moorhen	-----	<i>Gallinula chloropus</i>	Rallidae	LC
25.	Common Myna	Salhai/ desimyna	<i>Acridotheres tristis</i>	Sturnidae	LC
26.	Common Pochard	-----	<i>Aythya ferina</i>	Anatidae	VU
27.	Common quail	Titar	<i>Coturnix coturnix</i>	Phasianidae	LC
28.	Common	-----	<i>Actitis hypoleucos</i>	Scolopacidae	LC

	Sandpiper				
29.	Common Tailor Bird	-----	<i>Orthotomus sutorius</i>	Cisticolidae	LC
30.	Common Teal	-----	<i>Anas crecca</i>	Anatidae	LC
31.	Copper Smith Barbet	-----	<i>Psilopogon haemacephalus</i>	Megalaimidae	LC
32.	Cotton Teal	-----	<i>Nettapus coromandelianus</i>	Anatidae	LC
33.	Crimson Backed sunbird or Small Sunbird	-	<i>Leptocoma minima</i>	Nectariniidae	LC
34.	Eagle Owl	Ullu	<i>Bubo bubo</i>	Strigidae	LC
35.	Eurasian Collared Dove	Padki	<i>Streptopelia decaocto</i>	Columbidae	LC
36.	Eurasian Coot	-----	<i>Fulica atra</i>	Rallidae	LC
37.	Eurasian Golden Oriole	-----	<i>Oriolus oriolus</i>	Oriolidae	LC
38.	European Turtle Dove	Padki	<i>Streptopelia turtur</i>	Columbidae	VU
39.	Feral Pigeon	Kabutar	<i>Columba livia domestica</i>	Columbidae	LC
40.	Gadwall	-----	<i>Mareca strepera</i>	Anatidae	LC
41.	Grater Spotted Eagle	-----	<i>Clanga clanga</i>	Accipitridae	VU
42.	Great Thick Knee	-----	<i>Esacus recurvirostris</i>	Burhinidae	NT
43.	Greater Coucal	Koyal	<i>Centropus sinensis</i>	Cuculidae	LC
44.	Greater Cormorant	-----	<i>Phalacrocorax carbo</i>	Phalacrocoracidae	LC
45.	Greater flame back Woodpecker	Katpodva	<i>Dryocopus martius</i>	Picidae	LC
46.	Green Bee Eater	Patinga	<i>Merops orientalis</i>	Meropidae	LC
47.	Greenish Warbler	-----	<i>Phylloscopus trochiloides</i>	Phylloscopidae	LC
48.	Grey Francolin	-----	<i>Francolinus pondicerianus</i>	Phasianidae	LC
49.	House Crow	Kauaa	<i>Corvus splendens</i>	Corvidae	LC
50.	House Sparrow	Gouriaya	<i>Passer domesticus</i>	Passeridae	LC
51.	Indian barn owl	-	<i>Tyto alba</i>	Tytonidae	LC
52.	Indian Courser	-----	<i>Cursorius coromandelicus</i>	Glareolidae	LC
53.	Indian Cuckoo	-----	<i>Cuculus micropterus</i>	cuculidae	LC
54.	Indian nuthatch	-	<i>Sitta castanea</i>	Sittidae	LC
55.	Indian Pitta	-----	<i>Pitta brachyura</i>	Pittidae	LC
56.	Indian pond heron	Khokho bakli	<i>Ardeola grayii</i>	Ardeidae	LC
57.	Indian pygmy woodpecker	-	<i>Yungipicus nanus</i>	Picidae	LC
58.	Indian Robin	Chirak	<i>Saxicoloides fulicatus</i>	Muscicapidae	LC
59.	Indian Roller	Nilkanth/teohra	<i>Coracias benghalensis</i>	Coraciidae	LC

60.	Indian Silver Bill	-----	<i>Euodice malabarica</i>	Estrildidae	LC
61.	Indian spotted dove	Padki	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC
62.	Jungle Babbler	Satbhaiya	<i>Turdoides striata</i>	Leiothrichidae	LC
63.	Jungle Bush Quail	Titar	<i>Perdica asiatica</i>	Phasianidae	LC
64.	Jungle Crow	Koua	<i>Corvus culminatus</i>	Corvidae	LC
65.	Jungle Myna	Maina	<i>Acridotheres fuscus</i>	Sturnidae	LC
66.	Jungle Prinia	-----	<i>Prinia sylvatica</i>	Cistacolidae	LC
67.	Laughing Dove	Padki	<i>Spilopelia senegalensis</i>	Columbidae	LC
68.	Lesser Flame back	-----	<i>Dinopium benghalense</i>	Picidae	LC
69.	Lesser Whistling Duck	-----	<i>Dendrocygna javanica</i>	Anatidae	LC
70.	Little Bittern	-----	<i>Ixobrychus minutus</i>	Ardeidae	LC
71.	Little Cormorant	-----	<i>Microcarbo niger</i>	Phalacrocoracidae	LC
72.	Little Egret	Kokda	<i>Egretta garzetta</i>	Ardeidae	LC
73.	Little Swift	-----	<i>Apus affinis</i>	Apodidae	LC
74.	Long tailed Minivet		<i>Pericrocotus ethologus</i>	Campephagidae	LC
75.	Long Tailed Shrink	-----	<i>Lanius schach</i>	Laniidae	LC
76.	Oriental Magpie Robin	-----	<i>Copsychus saularis</i>	Muscicapidae	LC
77.	Oriental Turtle Dove	-----	<i>Streptopelia orientalis</i>	Columbidae	LC
78.	Oriental White Eye	-----	<i>Zosterops palpebrosus</i>	Zosteropidae	LC
79.	Paddy Field Pipit	-----	<i>Anthus rufulus</i>	Motacillidae	LC
80.	Plain Prinia	-----	<i>Prinia inornata</i>	Cisticolidae	LC
81.	Plum Headed Parakeet	Tota/Sua	<i>Psittacula cyanocephala</i>	Psittacidae	LC
82.	Purple Sun Bird	-----	<i>Nectarania asiatica asiatica (Latham)</i>	Nectariniini	LC
83.	Rain Quail	Quail	<i>Coturnix coromandelica</i>	Phasianidae	LC
84.	Red avadavat	-	<i>Amandava amandava</i>	Estrildidae	LC
85.	Red Crested Pochard	-----	<i>Netta rufina</i>	Anatidae	LC
86.	Red Vented Bulbul	Fikkadlow	<i>Pycnonotus cafer</i>	Pycnonotidae	LC
87.	Red Wattled Lapping	-----	<i>Vanellus indicus</i>	Charadriidae	
88.	Rose Ringed Parakeet	Tota/Sua	<i>Psittacula krameri</i>	Psittaculidae	LC
89.	Rufous Tree Pie	-----	<i>Dendrocitta vagabunda</i>	Corvini	LC
90.	Scaly Breasted Munia	-----	<i>Lonchura punctulata</i>	Estrildidae	LC
91.	Shikra	Cheel	<i>Accipiter badius</i>	Accipitridae	LC



92.	Singing Bush Lark	-----	<i>Mirafra javanica</i>	Alaudidae	LC
93.	Singing bush lark	-	<i>Mirafra javanica</i>	Alaudidae	LC
94.	Sirkeer Malkoha	-----	<i>Taccocua leschenaultii</i>	Cuculidae	LC
95.	Small Minivet	-----	<i>Pericrocotus cinnamomeus</i>	Campephagidae	LC
96.	Spot Bill Duck	-----	<i>Anas poecilorhyncha</i>	Anatidae	LC
97.	Spotted Dave	-----	<i>Streptopelia chinensis suratensis</i>	Columbidae	LC
98.	Spotted Owl	Ullu	<i>Strix occidentalis</i>	Strigidae	NT
99.	Sulphur-Bellied Warbler	-----	<i>Phylloscopus griseolus</i>	Acrocephalidae	LC
100.	Thick Billed Flower Pecker	-----	<i>Dicaeum agile</i>	Dicaeidae	LC
101.	Verditer Flycatcher	-----	<i>Eumyias thalassinus</i>	Muscicapidae	LC
102.	Vernal Hanging Parrot	-----	<i>Loriculus vernalis</i>	Psittaculidae	LC
103.	White Throated Kingfisher	Kilkila	<i>Halcyon smyrnensis</i>	Alcedinidae	LC
104.	White-Rumped Munia	-----	<i>Lonchura striata</i>	Estrildidae	LC
105.	Yellow wattled lapwing	-	<i>Vanellus malabaricus</i>	Charadriidae	LC
106.	Yellow-footed Green Pigeon	Kabootar	<i>Treron phoenicoptera</i>	Columbidae	LC

### Characterization of bird species according to their nesting pattern

1. **Scrape nesting birds:** - The simplest nest construction is the Scrape, which merely a shallow depression in soil or vegetation.

#### Bird species found in OCP Chhal area:

- a) Common Quail
  - b) Rain Quail
  - c) Jungle Bush Quail
  - d) Gray Francolin
  - e) Yellow Wattled Lapwing
2. **Burrow nesting birds:** - Soil plays a different role in the burrow nest: the eggs and young in most cases the incubating parent birds are sheltered under the earth.

#### Bird species found in OCP Chhal area:

- a) Little Swift
- b) Barn Swallow

- c) Green Bee Eater
  - d) White Throated Kingfisher
3. **Cavity nesting birds:** - The cavity nest is a chamber, typically in living or dead wood, but sometimes in the trunks of tree ferns or large cacti, including saguaro. In tropical areas, cavities are sometimes excavated in arboreal insect nests.

**Bird species found in OCP Chhal area:**

- a) Common Myna (Secondary cavity nester)
  - b) Copper Smith Barbet (Primary cavity nester)
  - c) House Sparrow (Secondary cavity nester)
  - d) Bramhiny Myna (Secondary cavity nester)
  - e) Indian Robin (Secondary cavity nester)
  - f) Indian Roller (Secondary cavity nester)
  - g) Oriental Magpie Robin (Secondary cavity nester)
  - h) Rose Ringed Parakeet (Secondary cavity nester)
  - i) Indian Nuthatch Barbet (Primary cavity nester)
  - j) Plum Headed Parakeet (Secondary cavity nester)
  - k) Alexandrine Parakeet (Secondary cavity nester)
  - l) Indian Barn Owl (Secondary cavity nester)
  - m) Lesser Golden Backed Woodpecker (Primary cavity nester)
4. **Cup shaped nesting birds:** - The cup nest is smoothly hemispherical inside, with a deep depression to house the eggs. Most are made of pliable materials including grasses though a small number are made of mud or saliva.

**Bird species found in OCP Chhal area:**

- a) Sulphur Bellied Warbler
- b) Indian Spotted Dove
- c) Black Drongo
- d) Common Hawk Cuckoo
- e) Common Tailor Bird
- f) White Rumped Munia
- g) Ashy Prinia or Ashy Wren Warbler
- h) Blyth Reed Warbler
- i) Greenish Warbler
- j) Jungle Babbler

- k) Laughing Dove
  - l) Indian Cuckoo (Mostly use a nest of crows and drongos House Crow)
  - m) Eurasian Collared Dove
  - n) Asian Koel (Brood parasite lays egg on different birds nest)
  - o) Eurasian Golden oriole
  - p) Paddy Field Pipit
  - q) Singing Bush lark
5. **Saucer or plate form nest:** - The saucer or plate nest, though superficially similar to a cup nest, has at most only a shallow depression to house the eggs.
- Bird species found in OCP Chhal area:**
- a) Greater Coucal
6. **Platform nesting birds:** - The platform nest is a large structure, often many times the size of the (typically large) bird which has built it. Depending on the species, these nests can be on the ground or elevated.
- Bird species found in OCP Chhal area:**
- a) Indian Pond Heron
  - b) Cattle Egret
  - c) Little Egret
  - d) Rufous Tree pie
  - e) Shikra
  - f) Yellow Footed Green Pigeon
  - g) Jungle Crow
  - h) Little Cormorant
  - i) Buzzard
  - j) Great Egret
7. **Pendant nesting birds:** - The pendant nest is an elongated sac woven of pliable materials such as grasses and plant fibers and suspended from a branch.
- Bird species found in OCP Chhal area:**
- a) Common Kingfisher
  - b) Purple Sunbird
  - c) Indian Golden Oriole
  - d) Crimson Backed Sunbird
  - e) Thick Billed Flower-pecker
  - f) Baya Weaver

g) Indian Silverbill

8. **Sphere shaped nesting birds:** - The Sphere nest is roundish structure; it is completely enclosed, except for a small opening which allows access.

**Bird species found in OCP Chhal area:**

- a) Red Vented Bulbul
- b) Scaly Breasted Munia
- c) Jungle Prinia
- d) Plain Prinia
- e) Red Avadavat

**Detailed description of birds including habit habitat and nesting pattern**

**1. Scrape nesting bird species found in OCP Chhal area:**

**a) Common Name: Common Quail**

**Zoological Name:** *Coturnix coturnix coturnix (Linnaeus)*

**Family:** Phasianidae

**Conservation Status:** Least Concern

**Voice Call:** The only indication of its presence is the distinctive "wet-my- lips" repetitive song of the male. The call is uttered mostly in the mornings, evenings and sometimes at night.

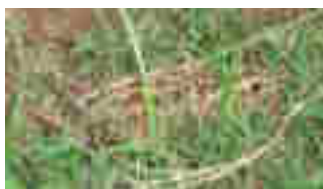
**Habitat:** Grassland, cropped fields, and scrubs

**Feeding:** The rain quail feeds on seeds of grasses and other plants, insect Larvae and small invertebrates.

**Breeding Season:** Breeding takes place between March and October.

**Nesting Pattern:** 6-12 eggs in a ground nest.

**Economic Importance:** Common Quail and their eggs provide food for humans. They are also common, well-liked birds of aviaries.



**Nesting of Common Quail**



**Male Bird**



**Female Bird**

**b) Common Name: Jungle Bush Quail**

**Zoological Name:** *Perdicula asiatica*

**Family:** Phasianidae

**Conservation Status:** Least Concern

**Voice Call:** Advertising call is a rhythmic, harsh, slightly grating “chee- chee-chuck, chee-chee-chuck

**Habitat:** Dry scrub and brush habitats, often stony, ranging from thin grass to fairly dense deciduous.

**Feeding:** The diet of the jungle bush quail consists mainly of seeds. Particularly of grasses, although it also takes insects.

**Breeding Season:** Breeding takes place after the rains and lasts until the onset of colder weather.

**Nesting Pattern:** their housing is, they need to be provided with plenty of green branches to provide sheltered and a place for the hens to lay.

**Economic Importance:** Sometimes, these quail are kept in aviaries. They have a pet trade.



Nesting of Rain Quail



Male Bird



Female Bird

### c) Common Name: Gray Francolin

**Zoological Name:** *Francolinus pondicerianus*

**Family:** Phasianidae

**Conservation Status:** Least Concern

**Voice Call:** loud and repeated *Ka-tee-tar... tee-tar*. The female call is *a tee... tee... tee* repeated and sometimes *a kila.. kila.. kila* and the challenge call *kateela.. kateela.. kateela* is a duet.

**Habitat:** They are found in open cultivated lands as well as scrub forest and their local name of teetar.

**Feeding:** Food includes seeds, grains as well as insects, particularly termites and Beetels.

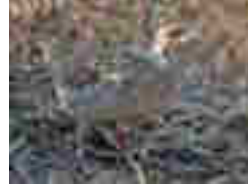
**Breeding Season:** April to September

**Nesting Pattern:** The nest is a hidden scrape on the ground.

**Economic Status:** They are hunted illegally in much of their range using low nets and easily caught using calling decoy birds.



Male Bird



Female Bird

**D) Common Name: Yellow-wattled Lapwing**

**Zoological Name:** *Vanellus malabaricus*

**Family:** Charadriidae

**Conservation Status:** Least Concern

**Voice Call:** The call is a sharp tchee-it call

**Habitat:** This species is common in much of India, being seen in a variety of open lowland habitats. It tends to be seen in drier habitats than the red-wattled lapwing, *Vanellus indicus*.

**Feeding:** The food of the yellow-wattled lapwing is beetles, termites and other invertebrates, which are picked from the ground

**Breeding Season:** These lapwings breed in the dry season with peak breeding in March to May ahead of the monsoons.

**Nesting Pattern:** A nest in a clump of grass has been noted as exceptional.



Nesting of Yellow-wettled Lapwing



Male female birds is alike

**E) Common Name: Rain Quail**

**Zoological Name:** *Coturnix coromandelica* (Gmelin)

**Family:** Phasianidae

**Conservation Status:** Least Concern

**Voice Call:** The call is a metallic chrink-chrink, constantly repeated mornings and evenings, and in the breeding season also during the night.

**Habitat:** Grassland, cropped fields, and scrubs

**Feeding:** The rain quail feeds on seeds of grasses and other plants, insect Larvae and small invertebrates.

**Breeding Season:** Breeding occurs during the wet season and depends on local rainfall patterns. Generally, rain quail breed from March to October. Their nests are constructed in standing crops or thin grasses in the ground and are sometimes hidden in scrub, low bush or grass.

**Nesting Pattern:** The quail nest usually on the ground contains six to eight eggs and the female incubate the eggs.

**Economic Importance:** Sometimes, these quail are kept in aviaries. They have a pet trade.



**Nesting of Rain Quail**



**Male Bird**



**Female Bird**

**F) Common Name:** Common Teal

**Zoological Name:** *Anas crecca*

**Family:** Anatidae

**Conservation Status:** Least Concern

**Voice Call:** The female has a feeble *keh* or *neeh*

**Habitat:** Common inhabitant of sheltered freshwater wetlands with some tall vegetation, such as taiga bogs or small lakes and ponds with extensive reed beds.

**Feeding:** Feeding on seeds of aquatic plants and grasses, including sedges and grains.

**Breeding Season:** Starts Mar/May

**Nesting Pattern:** The nest is a scrape or a natural depression on the ground.



**Nesting of Common Teal**



**Male female birds a like**

**G) Common Name: Red-wattled Lapwing**

**Zoological Name:** *Vanellus indicus*

**Family:** Charadriidae

**Conservation Status:** Least Concern

**Voice Call:** The call is a sharp “did he do it or pity to do it”

**Habitat:** It usually keeps in pairs or trios in well-watered open country, ploughed fields, grazing land, and margins and dry beds of tanks and puddles. They occasionally form large flocks, ranging from 26 to 200 birds. It is also found in forest clearings around rain-filled depressions. It runs about in short spurts and dips forward obliquely (with unflexed legs) to pick up food in a typical plover manner.

**Feeding:** The diet of the lapwing includes a range of insects, snails and other invertebrates, mostly picked from the ground. They may also feed on some grains. They feed mainly during the day but they may also feed at night. They may sometimes make use of the legs to disturb insect prey from soft soil.

**Breeding Season:** The breeding season is mainly March to August.

**Nesting Pattern:** Nests are difficult to find since the eggs are cryptically coloured and usually matches the ground pattern.



Nesting of Red- wattled lapwing



Male female birds is alike

**2. Burrow nesting bird species found in OCP Chhal area:**

**a) Common Name: Little Swift**

**Zoological Name:** *Apus affinis*

**Family:** Apodidae

**Conservation Status:** Least Concern

**Voice Call:** Tirr-Tirr



**Habitat:** Occurs over a wide range of habitats and latitudes, though less frequently in truly arid regions. Little swifts spend most of their lives in the air, living on the insects they catch in their beaks.

**Feeding:** Flies, termites, ants, beetles, grasshoppers and a dragonfly. They drink on the wing, but roost on vertical cliffs or walls.

**Breeding Season:** Winter

**Nesting Pattern:** Little swifts build their nests in hole in buildings or sometimes on cliffs, laying 1-4 eggs

**Predators:** Common buzzards (*Buteo buteo*)



Nesting of Little Swift



Male Female bird is alike

#### b) Common Name: Barn Swallow

**Zoological Name:** *Hirundo rustica*

**Family:** Hirundinidae

**Conservation Status:** Least Concern

**Voice Call:** The song of the barn swallow is a cheerful warble, often ending with su-seer with the second note higher than the first but falling in pitch. Calls include witt or witt-witt and a loud splee-plink when excited.

**Habitat:** Low vegetation, such as pasture, meadows and farmland, preferably with nearby water. The presence of accessible open structures such as barns, stables, or culverts to provide nesting sites, and exposed locations such as wires, roof ridges or bare branches for perching, are also important in the bird's selection of its breeding range.

**Feeding:** The barn swallow typically feeds 7–8 m (23–26 ft) above Shallow water or the ground, often following animals, humans or farm machinery to catch disturbed insects, but it will occasionally pick prey items from the water surface, walls and plants.

**Breeding Season:** November- February

**Nesting Pattern:** It builds a cup nest from mud pellets in barns or similar structures and feeds on insects caught in flight.

**Predators:** Hawks, owls, Rats, Squirrels, Racoons, Domestic Cats, Snakes etc are predators of Barn Swallow. Barn swallows usually give alarm calls when predators come near. Most predators of barn swallows attack the nestlings, but hawks, falcons, and owls tend to hunt adults.



**Nesting of Barn Swallow**



**Male Bird**



**Female Bird**

**c) Common Name: Green Bee Eater**

**Zoological Name:** *Merops orientalis*

**Family:** Meropidae

**Conservation Status:** Least Concern

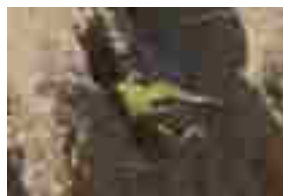
**Voice Call:** The calls are a nasal trill tree-tree-tree-tree, usually given in flight. Commonest call is a rolling or burry “trrrr...trrrr...” or a similar “trip..trip..trrrrr...trrrrr.”

**Habitat:** They are mainly insect eaters and they are found in grassland, thin scrub and forest often quite far from water.

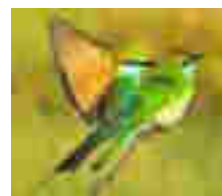
**Feeding:** bee-eaters pre-dominantly eat insects, especially bees, wasps and ants, which are caught in the air by sorties from an open perch

**Breeding Season:** The breeding season is from March to June.

**Nesting Pattern:** These are often solitary nesters, making a tunnel in a sandy bank. They nest in hollows in vertical mud banks.



**Nesting of Green Bee Eater**



**Male female bird is alike**

**d) Common Name: White Throated Kingfisher**

**Zoological Name:** *Halcyon smyrnensis*

**Family:** Alcedinidae

**Conservation Status:** Least Concern

**Voice Call:** chake-ake-ake-ake-ake

**Habitat:** White-throated kingfisher is a common species of a variety of habitats, mostly in the trees, wires or other perches.

**Feeding:** This species mainly hunts large crustaceans, insects, earth-worms, rodents, snakes, fish and frogs. Predation of small birds such as the Oriental white-eye, chick of a Red-wattled Lapwing, sparrows and Munias have been reported.

**Breeding Season:** Monsoon

**Nesting Pattern:** The nest is a tunnel (50 cm long, but a nest with a 3-foot tunnel has been noted) in an earth bank.

**Predators:** With a powerful bill and rapid flight, these kingfishers have few predators when healthy and rare cases of predation by a black kite and a jungle crow may be of sick or injured birds.

**Economic Importance:** White-throated kingfishers eat domestic and agricultural pests, including both mammalian and insect pests. Like many generalists, these birds help to control the populations of small vertebrates and invertebrates that might otherwise do costly damage to human works and food supplies. (Ali and Ripley, 1983)



Nesting of White Throated Kingfisher      Male female bird is alike

### 3. Cavity nesting bird species found in OCP Chhal area:

#### a) Common Name: Common Myna

**Zoological Name:** *Acridotheres tristis*

**Family:** Sturnidae

**Conservation Status:** Least Concern

**Voice Call:** The calls includes croaks, squawks, chirps, clicks, whistles and 'growls', and the bird often fluffs its feathers and bobs its head in singing.

**Habitat:** Common Myna nests in commercial, Residential and bushland habitats.

**Feeding:** Like most starlings, the common myna is omnivorous. It feeds on insects, crustaceans, reptiles, small mammals, seeds, grain and fruits and discarded waste from human habitation.

**Breeding Season:** Depending on geographical location, common mynas have been reported to breed anywhere from 1-3 times yearly. In their native range, common mynas begin nesting in March and breeding lasts through September.

**Nesting Pattern:** Nest in a hole in a tree or wall

**Predators:** Common nest predators of common mynas are house crows (*Corvus splendens*) and house cats (*Felis silvestris*). Javan mongooses (*Herpestes javanicus*) raid nests to take nestlings and eggs. Common mynas roost together for predator defense and often mob predators in flocks.

**Economic Importance:** Common mynas may be helpful in reducing insect populations in agricultural areas. Common mynas also pollinate and disperse the seeds of economically important trees. Common mynas are often sold as pets for their intelligence and ability to mimic human speech.



Nesting of Common Myna

Male female birds is alike

#### b) Common Name: Copper Smith Barbet

**Zoological Name:** *Psilopogon haemacephalus*

**Family:** Megalaimidae

**Conservation Status:** Least Concern

**Voice Call:** tuk...tuk...tuk

**Habitat:** Throughout their wide range they are found in gardens, groves and sparse woodland. Habitats with trees having dead wood suitable for excavation is said to be important.

**Feeding:** Prefers Banyan, Peepal, and etc and the occasional insect, caught in aerial sallies. Flower petals may also be included in their diet.

**Breeding Season:** The breeding season is mainly February to April in India.

**Nesting Pattern:** Birds nest and roost in cavities.

**Mortality Factor:** Adult birds are sometimes taken by predatory species. In urban areas, there are records of collisions with structures including white walls. Pesticide poisoning has also been noted.



Nesting of Copper Smith Barbet



Male Bird



Female Bird

c) **Common Name: House Sparrow**

**Zoological Name:** *Passer domesticus*

**Family:** Passeridae

**Conservation Status:** Least Concern

**Voice Call:** chirr up, tschilp, or Philip, "chur-chur-r-r-it-it-it-it", House sparrows give a nasal alarm call, the basic sound of which is transcribed as quer, and a shrill chree call in great distress.

**Habitat:** The house sparrow is closely associated with human habitation and cultivation. Primarily associated with man, living around buildings from isolated farms to urban centres.

**Feeding:** As an adult, the house sparrow mostly feeds on the seeds of grains and weeds, but it is opportunistic and adaptable, and eats whatever foods are available.

**Breeding Season:** Feb–Sept, varying with latitude, but can be interrupted by high temperature and monsoon rains; up to three broods.

**Nesting Pattern:** Holes in cliffs and banks, or tree hollows, are also used. A sparrow sometimes excavates its own nests in sandy banks or rotten branches, but more frequently uses the nests of other birds such as those of swallows in banks and cliffs, and old tree cavity nests.

**Predators:** Many hawks and owls hunt and feed on house sparrows. Known predators of nesting young or eggs include cats, domestic dogs, raccoons, and many snakes. House sparrows avoid predation by foraging in small flocks so that there are many eyes watching out for potential predators.

**Parasite and Disease:** The commonly recorded bacterial pathogens of the house sparrow are often those common in humans, and include Salmonella and Escherichia coli.



Nesting of House Sparrow



Male bird



Female bird

**d) Common Name: Bramhiny Starling**

**Zoological Name:** *Sturnia pagodarum*

**Family:** Sturnidae

**Conservation Status:** Least Concern

**Voice Call:** They have musical call notes that are long made up of a series of slurred notes that ends abruptly.

**Habitat:** found in dry forest, scrub jungle and cultivation and is often found close to human habitations. The especially favour areas with waterlogged or marshy lands.

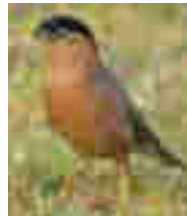
**Feeding:** The brahminy starling is omnivorous, eating fruit and insects.

**Breeding Season:** March to September

**Nesting Pattern:** It builds its nest in tree holes or artificial cavities. The nest is lined with grass, feathers and rags.



Nesting of Bramhiny Myna



Male bird



Female bird

**e) Common Name: Indian Robin**

**Zoological Name:** *Saxicoloides fulicatus*

**Family:** Muscicapidae

**Conservation Status:** Least Concern

**Voice Call:** Song a very short, high-pitched, creaky squeaky jumble of 4–5 notes in minor key.

**Habitat:** This bird is found in open stony, grassy and scrub forest habitats. They are mainly found in dry habitats and are mostly absent from the thicker forest regions and high rainfall areas. The species is often found close to human habitation and will frequently perch on rooftops.

**Feeding:** They feed mostly on insects but are known to take frogs and lizards especially when feeding young at the nest. Individuals may forage late in the evening to capture insects attracted to lights.

**Breeding Season:** December to September

**Nesting Pattern:** Nests are built between rocks, in holes in walls or in a tree hollow. Nests are lined with animal hair and it has been noted that many nests have pieces of snake sloughs.

**Predators:** Nestlings may be preyed on by the Rufous treepie.



**Nesting of Indian Robin**



**Male Bird**



**Female Bird**

**f) Common Name: Indian Roller**

**Zoological Name:** *Coracias benghalensis*

**Family:** Coraciidae

**Conservation Status:** Least Concern

**Voice Call:** The call of the Indian roller is a harsh crow-like chack sound. It also makes a variety of other sounds, including metallic boink calls.

**Habitat:** They are very commonly seen perched along roadside trees and wires and are commonly seen in open grassland and scrub forest

**Feeding:** They descend to the ground to capture their prey which may include insects, arachnids, small reptiles (including Calotes versicolor (changeable lizard) ) and small snakes and amphibians.

**Breeding Season:** March to June

**Nesting Pattern:** Holes created by woodpeckers or wood boring insects in trees such as Sal favored for nesting. Nest cavities may also be made by tearing open rotten tree trunks or in cavities in building.



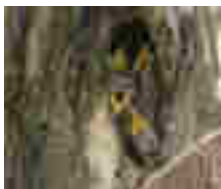
**Nesting of Indian Roller**



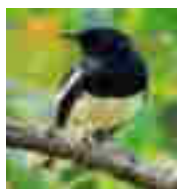
**Male bird**



**Female bird**

**g) Common Name: Oriental Magpie Robin****Zoological Name:** *Copsychus saularis***Family:** Muscicapidae**Conservation Status:** Least Concern**Voice Call:** Harsh hissing krshhh**Habitat:** They are common birds in urban gardens as well as forests. The oriental magpie-robin is found in open woodland and cultivated areas often close to human habitations.**Feeding:** The diet of magpie robins includes mainly insects and other invertebrates. Although mainly insectivorous, they are known to occasionally take flower nectar, leeches, centipedes and even fish.**Breeding Season:** March to July**Nesting Pattern:** They nest in tree hollows or niches in walls or building, often adopting nest boxes.

Nesting of Oriental Magpie Robin



Male bird



Female bird

**h) Common Name: Rose Ringed Parakeet****Zoological Name:** *Psittacula krameri***Family:** Psittaculidae**Conservation Status:** Least Concern**Voice Call:** “kii-a” or “kii-ak”**Habitat:** Rose-ringed Parakeet is common in cultivated areas, urban parks and gardens, dry and open forests.**Feeding:** In the wild, rose-ringed parakeets usually feed on buds, fruits, vegetables, nuts, berries, and seeds.**Breeding Season:** September to December**Nesting Pattern:** They built nest in the hollow of trees.**Aviculture:** Rose-ringed parakeets are popular as pets and they had a long History in aviculture.**Economic Status:** Populations of these birds are decreasing due to trapping for the pet trade. Despite some people's attempts to revive their population by freeing these birds from local markets, the rose-ringed parakeet's population has dropped drastically in many areas of the Indian subcontinent.





**Nesting of Rose Ringed Parakeet**



**Male bird**



**Female bird**

**i) Common Name: Indian Nuthatch**

**Zoological Name:** *Sitta castanea*

**Family:** Sittace

**Conservation Status:** Least Concern

**Voice Call:** Nuthatch calls and sounds and behavior around a forest suet feeding location consist of aggressive displays of flared wings sometimes with a rattle-snake like rattle or Brrrr.... and a lot of calls that might be called "quank" or "yank" or "hit" calls that a pair of Nuthatches might use to keep in contact or let their other forest mates - mostly Chickadees and Titmice know that they are coming or in the area and maybe get out of the way.

**Habitat:** Indian nuthatch (*Sitta castanea*) is a species of bird in the Sittidae family. It is found in Bangladesh, India and Nepal. Its natural habitats are subtropical or tropical dry forests, subtropical or tropical moist lowland forests, and subtropical or tropical moist montane forests

**Feeding:** Nuthatches forage along tree trunks and branches and are members of the same feeding guild as woodpeckers

**Breeding Season:** Late Feb to May.

**Nesting Pattern:** Tree holes.



**Nesting pattern**



**Female birds**



**Male birds**

**J) Common Name: Plum Headed Parakeet**

**Zoological Name:** *Psittacula cyanocephala*

**Family:** Psittacidae

**Conservation Status:** Least Concern

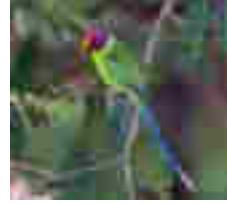
**Voice Call:** The usual flight and contact call is tink

**Habitat:** The plum-headed parakeet is a bird of forest and open woodland, even in city gardens

**Feeding:** They feed on grains, fruits, the fleshy petals of flowers (*Salmalia*, *Butea*) and sometimes raid agricultural fields and orchards.

**Breeding Season:** The breeding season in India is mainly from December to April and July to August in Sri Lanka.

**Nesting Pattern:** Nests in tree holes.



Nesting of Plum Headed Parakeet

Male female birds is alike

**K) Common Name: Alexandrine Parakeet**

**Zoological Name:** *Psittacula eupatria*

**Family:** Psittacidae

**Conservation Status:** Near Threatened

**Voice Call:** The usual flight and contact call is tuink.

**Habitat:** The Alexandrine Parakeet lives in forests, woodlands, agricultural lands and mangrove forests at elevations of up to 900 m (3000 ft).

**Feeding:** It eats a variety of wild and cultivated seeds, buds, flowers, fruits and nuts.

**Breeding Season:** November to April.

**Nesting Pattern:** They usually nest in tree hollows.



Nesting of Alexandrine Parakeet

Male female birds is alike

**L) Common Name: Indian Barn Owl**

**Zoological Name:** *Tyto alba*

**Family:** Tytonidae

**Conservation Status:** Least Concern

**Voice Call:** Their calls include screeches, wheeze, purrs and snoring sounds.

**Habitat:** The barn owl is a bird of open country such as farmland or grassland with some interspersed woodland, this owl prefers to hunt along the edges of woods or in rough grass strips adjoining pasture.

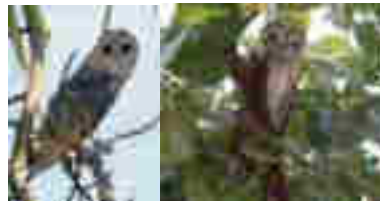
**Feeding:** The common barn owl ecosystem includes tropical and temperate deciduous or evergreen forests, taiga, arid and semi arid deserts and grasslands. They inhabit riparian woodlands, swamp forests, deciduous jungles, light secondary forest, thick scrub jungle urban areas of cities savanna and prairies.

**Breeding Season:** Barn owls living in tropical regions can breed at any time of year, but some seasonality in nesting is still evident. Where there are distinct wet and dry seasons, egg-laying usually takes place during the dry season, with increased rodent prey becoming available to the birds as the vegetation dies off.

**Nesting Pattern:** Barn Owls put their nests in holes in trees, cliff ledges and crevices, caves, burrows in river banks, and in many kinds of human structures, including barn lofts, church steeples, houses, nest boxes, haystacks, and even drive-in movie screens.



Nesting of Indian Barn Owl



Male female birds is alike

**j) Common Name: Lesser Golden Backed Woodpecker**

**Zoological Name:** *Dinopium benghalense* (Linnaeus)

**Family:** Picidae

**Conservation Status:** Least Concern

**Voice Call:** Klikir-r-r-r

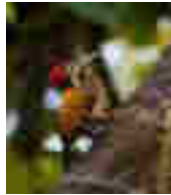
**Habitat:** 1. it is associated with open forest and cultivation lands.  
2. They are often seen in urban areas with wooded avenues.  
3. It is somewhat rare in the Kutch and desert region of Rajasthan

**Feeding:** They feed on insects mainly beetle larvae from under the bark, Visit Termite mounds and sometimes feed on nectar.

**Breeding Season:** February and July

**Nesting Pattern:** The nest hole is usually excavated by the birds and has a horizontal entrance and descends into a cavity. Nests have also been noted in

mud embankments. They adapt well in human-modified habitats making use of artificial constructions.



Nesting of Lesser Golden Back



Male Bbird



Female bird

**k) Common Name:** Jungle Myna

**Zoological Name:** *Acridotheres fuscus*

**Family:** Sturnidae

**Conservation Status:** Least Concern

**Voice Call:** Song a loud, hoarse "screeow" repeated in short series.

**Habitat:** This common passerine is typically found in forest and cultivation and often close to open water. They may disperse outside their range particularly after the breeding season.

**Feeding:** Diet includes insects, fruit, seeds and nectar. Insect food comprises grasshoppers, mole-crickets and crickets (Orthoptera), termites Etc.

**Breeding Season:** Season Jan–Jul; in India.

**Nesting Pattern:** The Jungle Myna, one nest was in a tree hole.



Nesting of Jungle Myna



Male Female Birds are alike

**l) Common Name:** Bank Myna

**Zoological Name:** *Acridotheres ginginianus*

**Family:** Sturnidae

**Conservation Status:** Least Concern

**Voice Call:** Song of male includes low croaks, high-pitched whistles and warbles, also some mimicry.

**Distribution:** The distribution was formerly noted to be restricted north roughly of a line between Bombay and Balasore in Orissa, but the species may be expanding its range.

**Habitat:** They are found mainly in the vicinity of open water and their usual habitat is cultivated farmland and open country but flocks will often live within cities, in markets and railway stations.

**Feeding:** Diet includes insects, fruit, seeds and nectar. Insect food comprises grasshoppers, mole-crickets and crickets (Orthoptera), termites Etc.

**Breeding Season:** Season Mar–Aug, primarily Apr–Jun.

**Nesting Pattern:** the Jungle Myna, one nest was in a tree hole.



Nesting of Bank Myna



Male female birds is alike

M) **Common Name:** Common Hoopoe

**Zoological Name:** *Upupa epops*

**Family:** Upupidae

**Conservation Status:** Least Concern

**Voice Call:** pleasant, mellow hoo...po... po..., sometimes only first two notes; calls have a slightly ventriloquistic quality; calls frequently when breeding.

**Habitat:** These requirements can be provided in a wide range of ecosystems, and as a consequence the hoopoe inhabits a wide range of habitats such as heath land, wooded steppes, savannas and grasslands, as well as forest glades.

**Feeding:** The diet of the hoopoe is mostly composed of insects, although small reptiles, frogs and plant matter such as seeds and berries are sometimes taken as well.

**Breeding Season:** The breeding season in India is spread from March to September.

**Nesting Pattern:** Vertical surfaces with cavities (such as trees, cliffs or even walls, nest boxes, haystacks, and abandoned burrows) in which to nest.



**Nest and adult**



**Male female alike**

#### **4. Cup shaped nesting bird species found in OCP Chhal area:**

##### **a) Common Name: Sulphur Bellied Warbler**

**Zoological Name:** *Phylloscopus griseolus*

**Family:** Phylloscopidae

**Conservation Status:** Least Concern

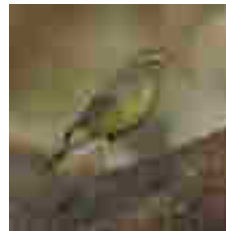
**Voice Call:** They have a single note cheep call.

**Habitat:** They are found on rocky hill and scrub forest habitats.

**Feeding:** Like other leaf-warblers it gleans insects from small branches and leaves.

**Breeding Season:** End-April to early August

**Nesting Pattern:** Nest, built entirely by female over 4–10 days, a ball of dry grasses.



**Nesting of Sulphur Bellied Warbler    Male female birds is alike**

##### **b) Common Name: Indian Spotted Dove**

**Zoological Name:** *Streptopelia chinensis suratensis*

**Family:** Columbidae

**Conservation Status:** Least Concern

**Voice Call:** Krookruk-krukroo... kroo kroo kroo

**Habitat:** Woodland, scrub, farmland and ground.

**Feeding:** They forage on the ground for grass seeds, grains, fallen fruits and seeds of other plants.

**Breeding Season:** Summer

**Nesting Pattern:** They nest mainly in low vegetation, building a flimsy cup of twigs in which two whitish eggs are laid. Nests are sometimes placed on the ground or on buildings and other structures.



Nesting of Indian Spotted Dove



Male bird



Female bird

**c) Common Name: Black Drongo**

**Zoological Name:** *Dicrurus macrocercus*

**Family:** Dicruridae

**Conservation Status:** Least Concern

**Voice Call:** It is said that they imitate the call of the Shikra so as to put mynas to flight and then to steal prey. False alarm calls has also been noted.

**Habitat:** The black drongo is found predominantly in open forests and usually perches and hunts close to the ground. They are mostly aerial predators of insects but also glean from the ground or off vegetation. The black drongo can be found in savannas, fields, and urban habitats.

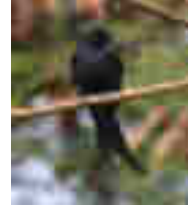
**Feeding:** They feed mainly on insects such as grasshoppers, cicadas, termites, wasps, bees, ants, moths, beetles and dragonflies.

**Breeding Season:** Black drongos breed mainly in February and March in southern India and until August in other parts of the country.

**Nesting Pattern:** The nest is a cup made with a thin layer of sticks placed in the fork of branch, and is built in a week by both the male and female. The usual clutch is three or rarely four eggs laid in a cup nest placed in the fork of an outer branch of tree. Large leafy tree such as the jackfruit are preferred.

**Predators:** Some predators such as the Javan hawk-eagle but the black eagle, a nest predator are mobbed with equal intensity in all seasons.

**Mobbing:** Their habit of driving away predators from near their nests is believed to encourage other birds such as orioles, doves, pigeons, babblers, and especially bulbuls, to nest in the vicinity.



Nesting of Black Drongo Male female birds is alike

**d) Common Name: Common Hawk Cuckoo**

**Zoological Name:** *Hierococcyx varius*

**Family:** Cuculidae

**Conservation Status:** Least Concern

**Voice Call:** The call "Pee kahan" or "Papeeha" When moving with a flock of babblers the chick makes a grating kee-kee call to beg for food

**Habitat:** Wooded country, in deciduous and semi-evergreen forests, gardens, groves of cultivated trees.

**Feeding:** Common hawk-cuckoos feed mainly on insects and are specialized feeders that can handle hairy caterpillars.

**Breeding Season:** Breeds Mar–Jul in India, Jan–Apr in Sri Lanka.

**Nesting Pattern:** Nesting at top of tree using grass and sticks to make cup shaped nest.



Nesting of Common Hawk Cuckoo Male female birds is alike

**e) Common Name: Common Tailor Bird**

**Zoological Name:** *Orthotomus sutorius*

**Family:** Cisticolidae

**Conservation Status:** Least Concern

**Voice Call:** The song is a loud cheeup-cheeup-cheeup with variations across the populations.

**Habitat:** Favours bushy cover by villages, gardens, parks and also in forest areas.

**Feeding:** They forage for insects and have been known to feed on a range of beetles and bugs. They are attracted to insects at flowers and are known to favour the inflorescences of mango.

**Breeding Season:** March to December peaking from June to August in India



**Nesting Pattern:** The nest is a deep cup, lined with soft materials and placed in thick foliage and the leaves holding the nest have the upper surfaces outwards making it difficult to spot.

**Predators:** Mortality of eggs and chicks is high due to predation by rodents, cats, crow-pheasants, lizards and other predators.



Nesting of Common Tailor Bird



Male bird



Female bird

**f) Common Name: White Rumped Munia**

**Zoological Name:** *Lonchura striata*

**Family:** Estrildidae

**Conservation Status:** Least Concern

**Voice Call:** Loud call or distance call of male a single "peep!", female gives double or churring.

**Habitat:** It frequents open woodland, grassland and scrub, and is well able to adapt to agricultural land use

**Feeding:** It is a gregarious bird which feeds mainly on seeds

**Breeding Season:** Summer to pre monsoon

**Nesting Pattern:** The nest is a large domed grass structure in a tree, bush or grass into which three to eight white eggs are laid.



Nesting of White Rumped Munia



Male female birds is alike

**g) Common Name: Ashy Prinia**

**Zoological Name:** *Prinia socialis*

**Family:** Cisticolidae

**Conservation Status:** Least Concern

**Voice Call:** The song is a repetitive tchup, tchup, tchup or zeet-zeet-zeet. Another call is a nasal tee-tee-tee. It also makes a sound like "electric sparks" during the fluttery flight which is thought to be produced by the wings.

**Habitat:** Found in dry open grassland, open woodland, scrub and in home gardens in the cities.

**Feeding:** The ashy prinia is insectivorous.

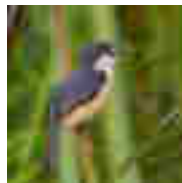
**Breeding Season:** The breeding season varies with locality and has been recorded Breeding around the year but mostly after the monsoons.

**Nesting Pattern:** The ashy prinia builds its nest close to the ground in a shrub or tall grass and lays 3–5 eggs. Several types of nests have been described including a flimsy cup made by sewing several large leaves; an oblong purse like structure with grass stems in the structure; and a flimsy ball of grass.

**Predators:** When the nest is threatened by predators such as cats, adults have been observed feigning injury.



Nesting of Ashy prinia



Male bird



Female bird

#### h) Common Name: Blyth Reed Warbler

**Zoological Name:** *Acrocephalus dumetorum*

**Family:** Acrocephalidae

**Conservation Status:** Least Concern

**Voice Call:** Song, given chiefly at night, characteristic, very varied mix of notes, some harsh tchar, some clear.

**Habitat:** Adapted to varied habitats, not necessarily close to water. This small passerine bird is a species found in scrub or clearings, often near water, but it is not found in marshes.

**Feeding:** Blyth's reed warbler is insectivorous, but will take other small food items, including berries.

**Breeding Season:** Season end of May to Jul; one brood per season. Monogamous, with facultative polygyny; pair formation takes place on breeding grounds.

**Nesting Pattern:** 4-6 eggs are laid in a nest in a bush.



Nesting of Blyth Reed Warbler



Male female bird is alike

**i) Common Name: Greenish Warbler**

**Zoological Name:** *Phylloscopus trochiloides*

**Family:** Phylloscopidae

**Conservation Status:** Least Concern

**Voice Call:** Call of nominate, given throughout year, a sharp, shrill and penetrating disyllabic “chee-wee.

**Habitat:** It breeds in lowland deciduous or mixed forest; non-breeding birds in the warmer parts of its range may move to mountain habitat in summer.

**Feeding:** This small passerine is insectivorous.

**Breeding Season:** May to mid-Aug

**Nesting Pattern:** The nest is on the ground in low shrub.



Nesting of Greenish Warbler      Male female bird is alike

**j) Common Name: Jungle Babbler**

**Zoological Name:** *Turdoides striata*

**Family:** Leiothrichidae

**Conservation Status:** Least Concern

**Voice Call:** The jungle babbler has harsh nasal calls. Harsh mewing calls, continual chattering, squeaking and chirping produced by its members.

**Habitat:** The jungle babbler's habitat is forest and cultivation.

**Feeding:** They feed mainly on insects, but also eat grains, nectar and berries.

**Breeding Season:** They breed throughout the year; peak breeding in northern India has been noted between March–April and July–September.

**Nesting Pattern:** The nest is built halfway in a tree, concealed in dense masses of foliage.

**Predator:** They are known to gather and mob potential predators such as snakes.



Nesting of Jungle Babbler      Male female bird is alike

**k) Common Name: Laughing Dove****Zoological Name:** *Spilopelia senegalensis***Family:** Columbidae**Conservation Status:** Least Concern**Voice Call:** The chuckling call is a low rolling croo-doo-doo-doo-doo with rising and falling amplitude.**Habitat:** It is a common and widespread species in scrub, dry farmland and habitation over a good deal of its range, often becoming very tame.**Feeding:** Laughing doves eat the fallen seeds, mainly of grasses, other vegetable matter and small ground insects such as termites and beetles.**Breeding Season:** The breeding season varies by location.**Nesting Pattern:** The nest is a very flimsy platform of twigs built in a low bush and sometimes in crevices or under the eaves of houses.**Predators:** Southern grey Shrike have been observed preying on an adult laughing dove in northwestern India while the lizard buzzard is a predator of the species in Africa.

Nesting of Laughing Dove



Male bird



Female bird

**l) Common Name: Indian cuckoo****Zoological Name:** *Cuculus micropterus***Family:** Cuculidae**Conservation Status:** Least Concern**Voice Call:** Indian Cuckoos have a loud call which mainly consists of four notes described as a 'bo-ko-ta-ko'. The male's song, goo-ko, is usually given from an open perch**Habitat:** The preferred habitat is deciduous and evergreen forests but also occur in garden lands and thick scrub.**Feeding:** Indian Cuckoos feed up on hairy caterpillars and other insects. They will also sometimes eat fruit. Indian Cuckoos tend to feed in the upper canopy of forests where they air-feed on flying termites.

**Breeding Season:** The breeding season varies from May to July in northern China, March to August in India, January to June in Burma and January to August in the Malay Peninsula.

**Nesting Pattern:** The male diverts the attention of hosts from their nest giving time for the female to lay her egg. It lays its single egg mostly in the nests of drongos and crows.



Nesting of Indian cuckoo



female



Male

m) **Common Name:** Eurasian Collared Dove

**Zoological Name:** *Streptopelia decaocto*

**Family:** Columbidae

**Conservation Status:** Least Concern

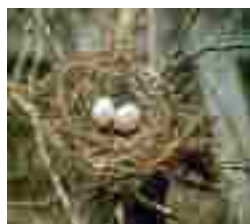
**Voice Call:** The song is a coo-coo-coo, sound is a hah-hah.

**Habitat:** In its original range in India, Sri Lanka and other parts of Asia inhabits semi-desert and arid.

**Feeding:** Takes seed, cereal grain, fruits of herbs and grasses and some green parts of plants.

**Breeding Season:** Season prolonged but mainly Mar–Oct in cooler parts of range.

**Nesting Pattern:** Collared doves typically breed close to human habitation wherever food resources are abundant and there are trees for nesting; almost all nests are within 1 km (0.62 mi) of inhabited buildings. The female lays two white eggs in a stick nest, which she incubates during the night and which the male incubates during the day



Nesting of Eurasian Collared Dove



Male female birds is alike

**n) Common Name: Asian Koel**

**Zoological Name:** *Eudynamys scolopacea*

**Family:** Cuculidae

**Conservation Status:** Least Concern

**Voice Call:** The familiar song of the male is a repeated koo-Ooo. The female makes a shrill kik-kik-kik... call. Calls vary across populations.

**Habitat:** The Asian koel is a bird of light woodland and cultivation land.

**Feeding:** It is insectivorous, but will also take berries and other soft fruit.

**Breeding Season:** March to August

**Nesting Pattern:** Brood parasite lays its single egg in the nests of a variety of birds, including the jungle crow.



**Male bird**



**Female bird**

**O) Common Name: Eurasian Golden Oriole**

**Zoological Name:** *Oriolus oriolus*

**Family:** Oriolidae

**Conservation Status:** Least Concern

**Voice Call:** The song is a beautiful fluting weela-wee-ooo or or-iii-ole, unmistakable once heard.

**Habitat:** The Eurasian golden oriole inhabits a range of habitats. In Western Europe they prefer open broadleaf forests and plantations, copses, riverine forest, orchards, large gardens; in Eastern Europe they may inhabit more continuous forest as well as mixed or coniferous forests. They generally avoid treeless habitats but may forage there. In their wintering habitat they are found in semi-arid to humid woodland, tall forests, riverine forest, woodland/savanna mosaic and savanna

**Feeding:** They feed on insects and fruit, using their bills to pick insects out of crevices.

**Breeding Season:** Eurasian golden orioles may delay breeding until they are 2 or 3 years of age. Males usually arrive at breeding area several days before the

females. The fidelity to a territory or even to a specific nest site suggests that the pair-bond may continue from one breeding season to the next

**Nesting Pattern:** The nest is placed high in a tree towards the edge of the crown. The deep cup-shaped nest is suspended below a horizontal fork of thin branches.



**Nesting of Eurasian Golden Oriole Male female birds is alike**

**P) Common Name: Paddy Field Pipit**

**Zoological Name:** *Anthus rufulus*

**Family:** Motacillidae

**Conservation Status:** Least Concern

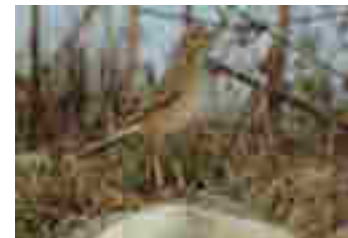
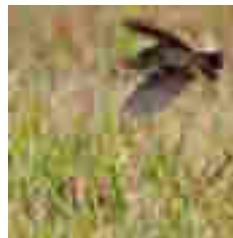
**Voice Call:** The birds flutter nearby with weak tsip-tsip-tsip calls.

**Habitat:** A wide spread species found in open habitats, especially short grassland and cultivation with open bare ground.

**Feeding:** It feeds principally on small insects but consumes larger beetles, tiny snails; worms etc. while walking on the ground, and may pursue insects like mosquitoes or termites in the air.

**Breeding Season:** The paddy field pipit breeds throughout the year but mainly in the dry season

**Nesting Pattern:** The nests are woven out of grass and leaves and are normally cup shaped.



**Nesting of Paddy Field Pipit**

**Female**

**Q) Common Name: Singing bush lark**

**Zoological Name:** *Mirafra javanica*

**Family:** Alaudidae

**Conservation Status:** Least Concern

**Voice Call:** Song, either from perch (usually not high) or in towering song flight.

**Habitat:** The Horsfield's Bushlark occurs in tropical and temperate grasslands, open woodlands, cereal crops and sparse sugar cane fields.

**Feeding:** The Horsfield's Bushlark feeds on grasses, seeds and insects. It often forages alone, but sometimes is found in small parties, foraging on the ground.

**Breeding Season:** The Horsfield's Bushlark will breed following significant rainfall in arid areas.

**Nesting Pattern:** It builds a deep, cup-shaped nest in a natural depression or a hollow scrape in the ground.



Nesting of Singing Bush Lark



Male female birds is alike

## R) Common Name: Common Sandpiper

**Zoological Name:** *Actitis hypoleucos*

**Family:** Scolopacidae

**Conservation Status:** Least Concern

**Voice Call:** This species is usually called *tiritavoi*.

**Habitat:** The common sandpiper forages by sight on the ground or in shallow water.

**Feeding:** Adult and larval insects (e.g. beetles, Diptera), spiders, molluscs, crustaceans and annelids, sometimes frogs, tadpoles or small fish etc.

**Breeding Season:** Mainly May–Jun,

**Nesting Pattern:** The nests can vary from an open shallow nest to a complex nest filled with leaves and grass and is often hidden in thick vegetation.



Nesting of Common Sandpiper



Male female birds is alike



**P) Saucer or Plate form nesting bird species found in OCP Chhal area:**

- **Common Name: Greater coucal or crow pheasant**

**Zoological Name:** *Centropus sinensis* (Stephens)

**Family:** Cuculidae

**Conservation Status:** Least Concern

**Voice Call:** The calls are a booming low **coop-coop-coops** repeated and with variations and some duets between individuals. Other calls include a rapid rattling "**lotok, lotok ...**" and a harsh scolding "**skeeaaw**" and a hissing threat call.

**Habitat:** Found in wide range of habitats from jungle to cultivation and urban gardens.

**Feeding:** The greater coucal is a large bird which takes a wide range of insects, caterpillars and small vertebrates such as the Saw-scaled vipers. They are also known to eat bird eggs, nestlings, fruits and seeds.

**Breeding Season:** June to September

**Nesting Pattern:** The nest is a deep cup with a dome in dense vegetation inside tangles of creepers, bamboo clump or Pandanus crowns.

**Interesting Fact:** It is highly destructive to the eggs and young of other birds.



**Nesting of Greater Coucal**



**Male bird**



**Female bird**

- **Common Name: Indian Pond Heron**

**Zoological Name:** *Ardeola grayii* (Skyles)

**Family:** Ardeidae

**Conservation Status:** Least Concern

**Voice Call:** They are usually silent but may give a harsh croak when flushed or near their nests.

**Habitat:** The water body needs to be either shallow enough, or have a shelving margin in which it can wade. Although most common in the lowlands it also occurs in mountain tarns, lakes, reservoirs, large and small rivers, marshes, ponds, ditches, flooded areas, coastal lagoons, estuaries and the sea shore.

**Feeding:** The Indian pond heron's feeding habitat is marshy wetlands. They usually feed at the edge of ponds but make extensive use of floating vegetation such as water hyacinth to access deeper water.

**Breeding Season:** The breeding season begins with the onset of the monsoons.

**Nesting Pattern:** They nest in small colonies, often with other wading birds, usually on platforms of sticks in trees or shrubs. Most nests are built at a height of about 9 to 10 m in large leafy trees.



**Nesting of Indian Pond Heron**



**Male bird**



**Female bird**

- **Common Name:** Cattle Egret  
**Zoological Name:** *Bubulcus ibis*

**Family:** Ardeidae

**Conservation Status:** Least Concern

**Voice Call:** This species gives a quiet, throaty rick-rack call at the breeding colony, but is otherwise largely silent.

**Habitat:** Cattle Egret sometimes feeds in shallow water, unlike most herons it is typically found in fields and dry grassy habitats, reflecting its greater dietary reliance on terrestrial insects rather than aquatic prey.

**Feeding:** The cattle egret feeds on a wide range of prey, particularly insects, especially grasshoppers, crickets, flies (adults and maggots), and moths, as well as spiders, frogs, and earthworms. In a rare instance they have been observed foraging along the branches of a banyan tree for ripe figs.

**Breeding Season:** Onset of monsoons in May.

**Nesting Pattern:** The cattle egret nests in colonies, which are often, but not always, found around bodies of water.



**Nesting of Cattle Egret**



**Male female bird is alike**

- **Common Name:** Little Egret  
**Zoological Name:** *Egretta garzetta*

**Family:** Ardeidae

**Conservation Status:** Least Concern

**Voice Call:** Rather vocal: gives “kre, kre, kre” or “kark, kark, kark” in aggression and flight, with an “aaah”

**Habitat:** The little egret's habitat varies widely, and includes the shores of lakes, rivers, canals, ponds, lagoons, marshes and flooded land, the bird preferring open locations to dense cover.

**Feeding:** Their diet is mainly fish, but amphibian, small reptiles, mammals and birds are also eaten as well as crustaceans, molluscs, insects, spiders and worms.

**Breeding Season:** Monsoon

**Nesting Pattern:** Little egrets nest in colonies on trees, often with other wading birds.



Nesting of Little Egret



Male female birds is alike

- **Common Name:** Rufous Treepie

**Zoological Name:** *Dendrocitta vagabunda*

**Family:** Corvini

**Conservation Status:** Least Concern

**Voice Call:** bob-o-link or ko-tree

**Habitat:** Open forest consisting of scrub, plantations and gardens.

**Feeding:** Like other curved it is very adaptable, omnivorous and opportunistic in feeding.

**Breeding Season:** April to June

**Nesting Pattern:** The nest is built in trees and bushes and is usually a shallow platform.



Nesting of Rufous Treepie



Male female birds is alike

- **Common Name:** Shikra

**Zoological Name:** *Accipiter badius*

**Family:** Accipitridae

**Conservation Status:** Least Concern

**Voice Call:** Pee-wee and kik-ki ... kik-ki

**Habitat:** The shikra is found in a range of habitats including forests, farmland and urban areas.

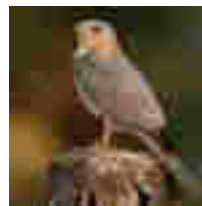
**Feeding:** They feed on rodents, squirrels, small birds, small reptiles (mainly lizards but sometimes small snakes) and insects.

**Breeding Season:** March to June

**Nesting Pattern:** The nest is a platform similar to that of crows lined with grass.



**Nesting of Shikra**



**Male bird**



**Female bird**

- **Common Name: Yellow-footed Green Pigeon**

**Zoological Name:** *Treron phoenicoptera*

**Family:** Columbidae

**Conservation Status:** Least Concern

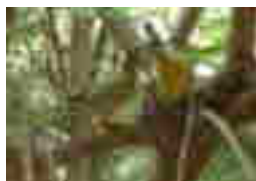
**Voice Call:** They have pleasant, soft and mellow whistling calls which usually give the first indication of their presence in a locality.

**Habitat:** Forest, scrubland, parks and gardens in lowlands and foothills; avoids high mountains.

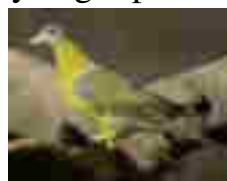
**Feeding:** The birds deftly climb about the twigs of fruit-bearing trees, often clinging upside down to get at some fig or berry, they keep in flocks of from 10 to 50 birds, and sometimes collect in enormous numbers on banyan or Peepal trees to gorge themselves on the ripe figs, in association with Mynas, Hornbills, Bulbuls and other frugivorous species.

**Breeding Season:** March to April

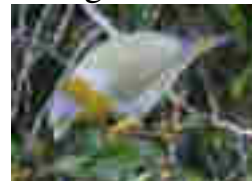
**Nesting Pattern:** Nest is a relatively slight platform of twigs in a tree or shrub.



**Nesting of Yellow-footed Green Pigeon**



**Male bird**



**Female bird**

- **Common Name: Jungle Crow**

**Zoological Name:** *Corvus macrorhynchos*

**Family:** Corvidae

**Conservation Status:** Least Concern

**Voice Call:** The voice is a harsh kaaw-kaaw.

**Habitat:** In the New World, a small population of house crows is established in the area around it is associated with human settlements throughout its range, from small villages to large cities.

**Feeding:** House crows feed largely on refuse around human habitations, small reptiles and mammals, and other animals such as insects and other small invertebrates, eggs, nestlings, grain and fruits.

**Breeding Season:** The breeding season is mainly March–April in northern India and earlier in south India.

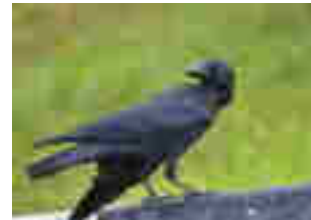
**Nesting Pattern:** The nest is a platform of twigs placed in a large tree and very rarely on buildings.



Nesting of Jungle Crow



Male



Female

- **Common Name: Little Cormorant**

**Zoological Name:** *Microcarbo niger*

**Family:** Phalacrocoracidae

**Conservation Status:** Least Concern

**Voice Call:** They also produce grunts and groans, a low pitched ah-ah-ah and kok-kok-kok calls.

**Habitat:** It inhabits wetlands, ranging from small village ponds to large lakes, and sometimes tidal estuaries.

**Feeding:** Little cormorants tend to forage mainly in small loose groups and are often seen foraging alone. They swim underwater to capture their prey, mainly fish.

**Breeding Season:** November to February

**Nesting Pattern:** They may nest beside Indian pond herons and little egrets in Colonies. The nest is built in about two weeks. The whitish eggs turn muddy with age and incubation begins when the first egg is laid.

**Predator:** predators on eggs and hatchlings include gulls and crows, fledging taken by bald eagles and white tailed eagles. The presence of humans or large predators will cause adults to leave nests, leaving them vulnerable to predation. (Hatch, et al., 2000)



Nesting of Little Cormorant



Male female birds is alike

- **Common Name: Common Buzzard**

**Zoological Name:** *Buteo buteo*

**Family:** Accipitridae

**Conservation Status:** Least Concern

**Voice Call:** The call is a plaintive pee-a-ay, similar to a cat's meow.

**Habitat:** Buzzards do not normally form flocks, but several may be seen together on migration or in good habitat. The Victorian writer on Dartmoor, William Crossing, noted he had on occasions seen flocks of 15 or more at some places.

**Feeding:** The common buzzard breeds in woodlands, usually on the fringes, but favours hunting over open land. It eats mainly small mammals, and will come to carrion.

**Breeding Season:** March to July

**Nesting Pattern:** The nest, built by both birds, is usually in a tree, rocky crag or cliff. It is a substantial structure of branches, twigs, heather and other available material. The average size of a newly built nest is 1 m in diameter and 60cm deep. Re-used nests can be 1.5 m across. The shallow cup in the nest is lined with green material immediately prior to egg laying, with further material added gradually until the young fledge.



Common Buzzard

- **Common Name: Great Egret**

**Zoological Name:** *Ardea alba*

**Family:** Ardeidae

**Conservation Status:** Least Concern

**Voice Call:** Rather vocal: gives “kre, kre, kre” or “kark, kark, kark” in aggression and flight, with an “aaah”

**Habitat:** The little egret's habitat varies widely, and includes the shores of lakes, rivers, canals, ponds, lagoons, marshes and flooded land, the bird preferring open locations to dense cover.

**Feeding:** Their diet is mainly fish, but amphibian, small reptiles, mammals and birds are also eaten as well as crustaceans, molluscs, insects, spiders and worms.

**Breeding Season:** Monsoon

**Nesting Pattern:** Little egrets nest in colonies on trees, often with other wading birds.



**Great Egret**



**Nesting of Great Egret**

**a) Common Name: Little Bittern**

**Zoological Name:** *Ixobrychus minutus minutus* (Linnaeus)

**Family:** Ardeidae

**Conservation Status:** Least Concern

**Voice Call:** It is variously rendered as “kohr, kohr, kohr, kohr,” “hork, hork, hork,” “Cor, orr, orr, orr,” or “gogh, gogh, gogh, gogh” and also “hogh”, “rru” and “woof.” The “Kwer” call is a flight call. It is rendered as “kuk-kuk, kuk-kak,” “cuck, cuck, cuck cuck,” “Cra, a, a, a, k,” “quer” or “ker-ack.”

**Habitat:** Most typically it uses freshwater wetlands having thick herbaceous vegetation with trees or bushes interspersed nearby. These habitats include peat bogs, reed swamps, edges of lakes, pools, reservoirs, oases, swamps, wooded and marshy edges of streams and rivers, wet grasslands, mangroves, salt marshes, lagoons.

**Feeding:** The diet is varied, fish, frogs and tadpoles, reptiles, eggs and youngbirds, shrimp, crayfish, worms, insects such as crickets, grasshoppers, caterpillars, water bugs, beetles, beetle larvae, dragonflies, spiders.

**Breeding Season:** Winter

**Nesting Pattern:** It nests on platforms of reeds in shrubs; and four to eight eggs are laid.



Nesting of Little Bittern



Male Bird



Female Bird

**Q) Pendant Nesting Bird species found in OCP Chhal area:**

**a) Common Name: Common Kingfisher**

**Zoological Name:** *Alcedo atthisp*

**Family:** Alcedinidae

**Conservation Status:** Least Concern

**Voice Call:** Uttering a sharp chi-chcc, chi-chec, shrit-it-it and nestlings call for food with a churring noise.

**Habitat:** Common kingfishers are found on the shores of lakes, ponds, streams, and in wetlands.

**Feeding:** Its diet consists of small fish, tadpoles, water beetles and their larva, and other aquatic insects.

**Breeding Season:** Common Kingfisher have 2-3 clutches yearly one in April, another by July and sometimes a final clutch in early October.

**Nesting Pattern:** Scrubs and bushes with overhanging branches close to shallow open water.

**Predators:** Common kingfishers have few natural predators as adults. Nestlings may be preyed on by snakes and other ground-dwelling predators, but kingfishers are aggressive birds and do defend their young against predators.



Nesting of Common Kingfisher



Male Bird



Female Bird

**b) Common Name: Purple Sunbird**

**Zoological Name:** *Cinnyris asiaticus*

**Family:** Nectariniidae

**Conservation Status:** Least Concern



**Voice Call:** The song is rapid rattle followed by ringing, metallic notes. "chwit" or "chwing!"

**Habitat:** Thin forest and garden land, including those in dense urban areas.

**Feeding:** They rarely hover at flowers and usually perch to forage for nectar. They are important pollinators of some plant species such as *Butea monosperma*, *Acacia* spp.

**Breeding Season:** The primary breeding season is before the Monsoons, April to June in northern India and January to June in Sri Lanka.

**Nesting Pattern:** The nest is a pouch made of cobwebs, thin strips of vegetation, lichens and bark. The entrance hole on the side is often shaded by an overhanging projection.

**Predators:** Owls are main predators.



Nesting of Purple Sunbird



Male bird



Female bird

### c) **Common Name: Indian Golden Oriole**

**Zoological Name:** *Oriolus kundoo*

**Family:** Oriolidae

**Conservation Status:** Least Concern

**Voice Call:** Song a fluty melodious "pee-lo" or "pee-lo-lo", "who-he-heer" or "weela whee-oh".

**Habitat:** Habitats including open deciduous forests, semi-evergreen forests, woodland, forest edge, mangroves, open country with scattered trees, parks, gardens orchards and plantations.

**Feeding:** Orioles feed on fruits, nectar and insects. They are capable of dispersing the seeds of many berry-bearing plants including the invasive *Lantana camera*.

**Breeding Season:** April to August

**Nesting Pattern:** The nest being a small cup placed in a fork near the end of a branch. Nests are often built in the vicinity of the nest of a black drongo.

**Predators:** Shikras and Crows.



Nesting of Golden Oriole



Male bird



Female bird

**d) Common Name: Crimson Backed Sunbird**

**Zoological Name:** *Leptocoma minima*

**Family:** Nectariniidae

**Conservation Status:** Least Concern

**Voice Call:** The calls include short chik calls and longer chee-chee-which-chee. Squeaky song “see-see-whi-see-see-siwee...” lasting 5–10 seconds, frequently repeated.

**Habitat:** They are tiny birds that are resident and are found in forests but are particularly attracted to gardens at the edge of the forest where people grow suitable flower-bearing plants. They usually perch while taking nectar.

**Feeding:** Insects, spiders (Araneae) and nectar. Forages singly, in pairs or in small groups.

**Breeding Season:** December to March.

**Nesting Pattern:** Two eggs are laid in a suspended nest on a thin drooping branch of low tree, fern frond or shrub.

**Predators:** Being small birds they may be preyed on by a number of predators including praying mantises and arachnids.



Nesting of Crimson Backed Sunbird



Male bird



Female bird

**e) Common Name: Thick Billed Flower Pecker**

**Zoological Name:** *Dicaeum agile*

**Family:** Dicaeidae

**Conservation Status:** Least Concern

**Voice Call:** Loud “chik-chik-chik-chik”, rattling “tititiitili”, and very high-pitched.

**Habitat:** They feed predominantly on fruits and are active birds that are mainly seen in the tops of trees in forests.

**Feeding:** They feed mainly on berries, nectar but sometimes take insects, Feeds on fruits, including those of mistletoes, lantana (*Lantana* spp), figs (*Ficus* spp).

**Breeding Season:** December to March.

**Nesting Pattern:** The nest has been described as appearing camouflaged like a dry leaf. It is a pendant purse like structure made of cobwebs or fine plant fibers and is located from 3 to 15 meters high suspended from a thin horizontal branch.



Nesting of Thick Billed Flower Pecker      Male female birds is alike

f) **Common Name:** Baya Weaver

**Zoological Name:** *Ploceus philippinus*

**Family:** Ploceidae

**Conservation Status:** Least Concern

**Voice Call:** Their calls are a continuous chit-chit... sometimes ending in a wheezy cheee-eee-ee that is produced by males in a chorus.

**Habitat:** Grassland, scrub with scattered trees, mangroves and cultivated areas.

**Feeding:** They forage in flocks for seeds, both on the plants and on the ground.

**Breeding Season:** The breeding season of the baya weavers is during the monsoons.

**Nesting Pattern:** These pendulous nests are retort-shaped, with a central nesting chamber and a long vertical tube that leads to a side entrance to the chamber.

**Predators:** They also feed on insects (including butterflies), sometimes taking small frogs, geckos and mollusks, especially to feed their young.



Nesting of Baya Weaver      Male female birds is alike

g) **Common Name:** Indian Silver bill

**Zoological Name:** *Euodice malabarica*

**Family:** Estrildidae

**Conservation Status:** Least Concern

**Voice Call:** The call of the Indian silverbill is a swift trill, and other vocalizations include a high-pitched ‘chirrup’ flight call and a harsh ‘tch wit’ alarm call.

**Habitat:** Indian silver bill inhabits dry, open, cultivated as well as sparse scrub-and-bush country, and avoids humid forest.

**Feeding:** They feed on the ground or on low shrubs and grass stalks.

**Breeding Season:** Breeds throughout year, varying locally, generally beginning with onset of rains; mainly in winter months in Indian Subcontinent;

**Nesting Pattern:** Nests have been found in a variety of locations, such as in low thorny bushes, up to 3-4 meters from the ground in trees, and even among the lower sticks of eagle nests.



Nest Material



Male



Female

#### h) Common Name: Indian Golden Oriole

**Zoological Name:** *Oriolus kundoo*

**Family:** Oriolidae

**Conservation Status:** Least Concern

**Voice Call:** Song a fluty melodious "pee-lo" or "pee-lo-lo", "who-he-heer" or "weela whee-oh".

**Habitat:** Habitats including open deciduous forests, semi-evergreen forests, woodland, forest edge, mangroves, open country with scattered trees, parks, gardens orchards and plantations.

**Feeding:** Orioles feed on fruits, nectar and insects. They are capable of dispersing the seeds of many berry-bearing plants including the invasive Lantana camara.

**Breeding Season:** April to August

**Nesting Pattern:** The nest being a small cup placed in a fork near the end of a branch. Nests are often built in the vicinity of the nest of a black drongo.

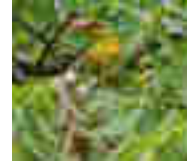
**Predators:** Shikras and Crows.



Nesting of Golden Oriole



Male bird



Female bird

**i) Common Name: Black Hooded Oriole**

**Zoological Name:** *Oriolus xanthornus*

**Family:** Oriolidae

**Conservation Status:** Least Concern

**Voice Call:** Song of liquid fluty whistles, very varied and differing among races, “tu-u-u-liu”

**Habitat:** It is a bird of open woodland and cultivation. The black hooded oriole lives in common contact with humans in rural and urban India.

**Feeding:** Its food is insects and fruit, especially figs, found in the tree canopies where they spend much of their time.

**Breeding Season:** Breeding throughout year, with local variations; two or more broods per season.

**Nesting Pattern:** The nest is built in a tree, and contains two eggs.

**Predators:** Shikras and Crows.



Nesting of Black Hooded Oriole



Male bird



Female bird

**R) Sphere Shaped nesting bird species found in OCP Chhal area:**

**S) Common Name: Red Vented Bulbul**

**Zoological Name:** *Pycnonotus cafer*

**Family:** Pycnonotidae

**Conservation Status:** Least Concern

**Voice Call:** The typical call has been transcribed as ginger beer but a number of sharp single note calls likened as pick are also produced.

**Habitat:** This is a bird of dry scrub, open forest, plains and cultivated lands.

**Feeding:** They consume leaves, flowers, buds, nectar, pollen, fruits, berries, and figs. Animal matter mainly includes insects and spiders. They were also found to prey on garden lizards and geckos.

**Breeding Season:** June to September

**Nesting Pattern:** Red-vented bulbuls build their nests in bushes at a height of around 2–3 m.

**Predators:** Predation cats, the small Indian mongoose and the Rat were also found to prey on eggs, nestlings and adult birds.



**Nesting of Red Vented Bulbul      Male female birds is alike**

**T) Common Name: Scaly Breasted Munia**

**Zoological Name:** *Lonchura punctulata*

**Family:** Estrildidae

**Conservation Status:** Least Concern

**Voice Call:** Soft contact call a repeated "tit-ti, tit-ti"; loud contact call "kit-tee, kit-tee.

**Habitat:** Scaly-breasted munias are found in a range of habitats but are usually close to water and grassland.

**Feeding:** They are especially common in paddy fields where they are considered a minor pest on account of their feeding on grain

**Breeding Season:** The breeding season is during the summer rainy season (mainly June to August in India) but can vary

**Nesting Pattern:** The nest is a large domed structure loosely woven from blades of grass, bamboo or other leaves with a side entrance and is placed in a tree or under the eaves of a house.



**Nesting Pattern**

**Male female birds is alike**

**U) Common Name: Jungle Prinia**

**Zoological Name:** *Prinia sylvatica*

**Family:** Cisticolidae

**Conservation Status:** Least Concern

**Voice Call:** The song is a repetitive pit-pretty, pit-pretty, pit-pretty.

**Habitat:** Favours dry scrubby bush-jungle, with boulders and grassland intermixed.

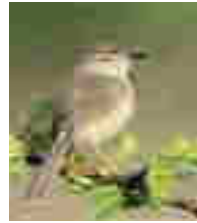
**Feeding:** Takes variety of small invertebrates, chiefly insects and their larvae.

**Breeding Season:** Season Mar–Oct, chiefly during Jun–Sept monsoon.

**Nesting Pattern:** It builds its nest in a shrub or tall grass.



Nesting of Jungle prinia



Male female birds is alike

V) **Common Name: Plain Prinia**

**Zoological Name:** *Prinia inornata*

**Family:** Cisticolidae

**Conservation Status:** Least Concern

**Voice Call:** The song is a repetitive tlee-tlee-tlee.

**Habitat:** This skulking passerine bird is typically found in wet lowland grassland, open woodland, scrub and sometimes gardens.

**Feeding:** Takes variety of small invertebrates, chiefly insects and their larvae.

**Breeding Season:** In India, chiefly during Jun–Oct monsoon in North and Mar–Jul in South.

**Nesting Pattern:** The plain prinia builds its nest in a shrub or tall grass and lays three to six eggs.



Nesting of Plain Prinia



Male female birds is alike

W) **Common Name: Red avadavat**

**Zoological Name:** *Amandava amandava*

**Family:** Estrildidae.

**Conservation Status:** Least Concern

**Voice Call:** Call a high "teei" or "tsi", also high-pitched chirps.

**Habitat:** Red avadavats are found mainly on flat plains, in places with tall grasses or crops, often near water.

**Feeding:** They feed mainly on grass seeds but will also take insects such as termites when they are available.

**Breeding Season:** Breeding can occur from January to April, varying regionally.

**Nesting Pattern:** They build a globular nest made of grass blades.



**Nesting material**



**Female**



**Male**



## ANNEXURE 4

### REPTILES

**Common Name:** Indian Python

**Zoological Name:** *Python molurus*

**Family:** Pythonidae

**Conservation Status:** Near Threatened

**Description:** In India, the nominate subspecies grows to 3 metres (9.8 ft) on average. This value is supported by a 1990 study in Keoladeo National Park, where the biggest 25% of the python population was 2.7–3.3 metres (8.9–10.8 ft) long. Only two specimens even measured nearly 3.6 metres (11.8 ft). Because of confusion with the Burmese Python, exaggerations and stretched skins in the past, the maximum length of this subspecies is hard to tell.

**Habitat:** Occurs in a wide range of habitats, including grasslands, swamps, marshes, rocky foothills, woodlands, "open" jungle and river valleys. They depend on a permanent source of water. Sometimes they can be found in abandoned mammal burrows, hollow trees, dense water reeds and mangrove thickets.

**Feeding:** Like all snakes, Indian Pythons are strict carnivores and feed on mammals, birds and reptiles indiscriminately, but seem to prefer mammals.

**Reproduction:** Oviparous, up to 100 eggs are laid by the animal, which are protected and incubated by the female. Towards this end, it has been shown that

they are capable of raising their body temperature above the ambient level through muscular contractions. The



hatchlings are 45–60 cm (18–24 in) in length and grow quickly.

**Common Name:** Russell's Viper

**Zoological Name:** *Daboia russelii*

**Family:** Viperidae

**Description:** *D. russelii* can grow to a maximum total length (body + tail) of 166 cm (5.5 ft) and averages about 120 cm (4 ft) on mainland Asian populations, although island populations may be slightly smaller on average. It is more slenderly built than most other vipers.

**Habitat:** *D. russelii* is not restricted to any particular habitat, but does tend to avoid dense forests. The snake is mostly found in open, grassy or bushy areas, but may also be found in second growth forests (scrub jungles), on forested plantations and farmland. It is most common in plains, coastal lowlands, and hills of suitable habitat.

**Feeding:** *D. russelii* feeds primarily on rodents, especially murid species. However, it will eat just about anything; including rats, mice, shrews, squirrels, lizards, land crabs, scorpions, and other arthropods. Juveniles are crepuscular, feeding on lizards and foraging actively.

**Reproduction:** *D. russelii* is ovoviparous. Mating generally occurs early in the year, although gravid females may be found at any time. The gestation period is more than six months. Young are produced from May to November, but mostly in June and July.



**Common Name:** Common Krait

**Zoological Name:** *Bungarus caeruleus*

**Family:** Elapidae

**Description:** The average length is 0.9 m (3.0 ft), but they can grow to 1.75 m (5 ft 9 in). Males are longer, with proportionately longer tails. The head is flat and the neck hardly evident. The body is cylindrical, tapering towards the tail. The tail is short and rounded. The eyes are rather small, with rounded pupils, indistinguishable in life. The head shields are normal, with no loreals; four shields occur along the margin of the lower lip; the third and fourth supraoculars touch the eye. The scales are highly polished, in 15-17 rows; the vertebral row is distinctly enlarged and hexagonal. Ventrals number 185-225 and caudals 37-50, entire.

**Habitat:** Its range comprises a wide variety of habitats. It is found in fields and low scrub jungle, as well as inhabited areas. It is known to take up residence in termite mounds, brick piles, rat holes, even inside houses. It is frequently found in water or in proximity to a water source.

**Feeding:** The Common Krait feeds primarily on other snakes, including: "blind worms" (snakes of the genus Typhlops); and cannibalizes on other kraits, including the young. It also feeds on small mammals (such as rats, and mice), lizards and frogs.

The young are known to eat arthropods.

**Reproduction:**

oviparous



**Common Name:** Banded Krait

**Zoological Name:** *Bungarus fasciatus*

**Family:** Elapidae

**Conservation Status:** Least Concern

**Description:** The Banded Krait is easily identified by its alternate black and yellow crossbands, its triangular body cross section, and the marked vertebral ridge consisting of enlarged vertebral shields along its body. The head is broad and depressed. The eyes are black. It has arrowhead-like yellow markings on its otherwise black head and has yellow lips, lores, chin, and throat. The longest banded Krait measured was 2.25 m (7 ft 5 in) long, but normally the length encountered is 1.8 m (5 ft 11 in).

**Habitat:** Banded kraits may be seen in a variety of habitats, ranging from forests to agricultural lands. They inhabit termite mounds and rodent holes close to water, and often live near human settlement, especially villages, because of their supply of rodents and water.

**Feeding:** The Banded Krait feeds mainly on other snakes, but is also known to



eat fish, frogs, skinks, and snake eggs.

**Reproduction:** Little is known of its breeding habits. In Myanmar, a female has been dug out while incubating a clutch of eight eggs, four of which hatched in May. Young have been recorded to measure 298 to 311 mm on hatching. The snake is believed to become adult in the third year of its life, at an approximate length of 914 mm.

**Common Name:** Chameleons or Chamaeleons

**Zoological Name:** *Chamaeleo zeylanicus*

**Family:** Chamaeleonidae

**Description:** Chameleons vary greatly in size and body structure, with maximum total lengths varying from 15 mm (0.59 in) in male *Brookesia micra* (one of the world's smallest reptiles) to 68.5 cm (27.0 in) in the male *Furcifer oustaleti*.

**Habitat:** Chameleons inhabit all kinds of tropical and mountain rain forests, savannas, and sometimes deserts and steppes. The typical chameleons from the subfamily Chamaeleoninae are arboreal, usually living in trees or bushes, although a few (notably the Namaqua chameleon) are partially or largely terrestrial.

**Feeding:** All chameleons are primarily insectivores that feed by ballistically projecting their long tongues from their mouths to capture prey located some distance away.

**Reproduction:** Chameleons are mostly oviparous, with some being ovoviviparous. The oviparous species lay eggs three to six weeks after copulation. The female will dig a hole — from 10–30 cm (4–12 in), deep depending on the species — and deposit her eggs.



**Common Name:** Monitor Lizards

**Zoological Name:** *Varanus varius*

**Family:** Varanidae

**Conservation Status:** According to IUCN Red List of threatened species, most of the Monitor lizard's species fall in the categories of least concern but the population is decreasing globally.

**Description:** The various species cover a vast area, occurring through Africa, the Indian Subcontinent, to China, down Southeast Asia to Brunei, Indonesia, the Philippines, New Guinea, Australia and islands of the Indian Ocean, and the South China Sea.

**Habitat:** Monitor lizards are, as a rule, almost entirely carnivorous, consuming prey as varied as insects, crustaceans, arachnids, myriapods, mollusks, fish, amphibians, reptiles, birds, and mammals. Most species feed on invertebrates as juveniles and shift to feeding on vertebrates as adults.

**Feeding:** The meat of monitor lizards is eaten by some tribes in India, Thailand, and Australia and in



West Africa as a supplemental meat source. The meat of monitor lizards is used in Nepal for medicinal and food purpose.

**Common Name:** Common House Gecko

**Zoological Name:** *Hemidactylus frenatus*

**Family:** Gekkonidae

**Conservation Status:** Least Concern

**Description:** Like many geckos, this species can lose its tail when alarmed. Its call or chirp rather resembles the sound "gecko, gecko". However, this is an interpretation, and the sound may also be described as "tchak tchak tchak" (often sounded three times in sequence).

**Habitat:** Most geckos are nocturnal, hiding during the day and foraging for insects at night. They can be seen



climbing walls of houses and other buildings in search of insects attracted to porch lights, hence their name "house gecko".

**Common Name:** Lizards

**Zoological Name:** *Hemidactylus flaviviridis*

**Family:** Gekkonidae

**Description:** Aside from legless lizards, most lizards are quadrupedal and move using gaits with alternating movement of the right and left limbs with substantial body bending. This body bending prevents significant respiration during movement, limiting their endurance, in a mechanism called Carrier's constraint. Several small species such as those in the genus *Draco* can glide: some can attain a distance of 60 metres (200 feet), losing 10 metres (33 feet) in height.

**Habitat:** Lizards are found worldwide, excluding the far north and Antarctica, and some islands. They can be found in elevations from sea level to 5,000 m (16,000 ft). They prefer warmer, tropical climates but are adaptable and can live in all but the most extreme environments.

**Feeding:** The majority of lizard species are predatory and the most common prey items are small, terrestrial invertebrates, particularly insects.

**Reproduction:** Most social interactions among lizards are between breeding individuals. Territoriality is common and is correlated with species that use sit-and-wait hunting strategies.

Males establish and maintain territories that contain resources which attract females and which they defend from other males.



## ANNEXURE 5

### MAMMALS

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**Common Name: Greater Short-nosed fruit Bat**

**Zoological Name:** *Cynopterus sphinx*

**Family:** Pteropodidae

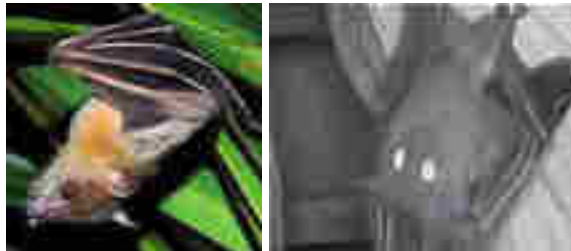
**Conservation Status:** Least Concern

**Description:** These bats have a relatively long snout. Their upper parts are brown to grey-brown with paler under parts. The fur is very fine and silky. The ears and wing bones of *C. sphinx* are edged in white. Lower cheek teeth rounded without accessory cusps. The wing span of the adult is about 48 cm. Juveniles are lighter than adults. Average forearm length 70.2mm (64-79mm).

**Habitat:** The greater short-nosed fruit bat is found from Pakistan to Vietnam. It is common in tropical forests and areas where fruit crops are cultivated.

**Feeding:** These bats are frugivorous, locate their preferred food items by scent. They have been described as voracious feeders, eating more than their body weight in food in one sitting. Some preferred fruits include ripe guava, banana, chikoo, dates and lychees. Short-nosed fruit bats inflict serious damage on many fruit crops, and are considered pests.

**Reproduction:** The adult sex ratio is very female biased. Researchers attribute this to the relatively rapid maturation of females compared to males.



**Common Name: Black-bearded Tomb Bat**

**Zoological Name:** *Taphozous melanopogon*

**Family:** Emballonuridae

**Conservation Status:** Least Concern

**Description:** Head and body length is 9–10 cm. Forearm 6 cm. Wingspan 37–40 cm. Tip of the tail is conspicuous and free. Grayish brown above with a grizzled appearance. Lighter on the shoulders, hind neck, and underside. Fur short and dense. Body appears rather flattened above and below. Hairy chin. In older males, at about 5–6 months, a blackish beard can be seen. Claws purplish with whitish tip. Young are grayer and darker. No gular sacs as in *Taphozous longimanus*. It has only small pores.

**Habitat:** Black-bearded tomb bats are found in habitats including rainforests, woodlands, tombs, deserted buildings, rock formations, caverns, cliffs, and arid country plains. They prefer densely sheltered areas.

**Feeding:** *Taphozous melanopogon* feeds primarily on flying insects, although it also sometimes feeds on small fruits. It hunts by echolocation emitting a "click" or "tic" that can be faintly audible, to humans. (Boonsong and McNeely, 1988)  
Primary Diet, carnivore, insectivore Animal Foods insects, Plants foods Fruits

**Reproduction:** Information on mating systems is not available. The mating season lasts for only a few weeks in the winter. The female gives birth to one live infant sometime in early spring. (Hill and Smith, 1986; Kunz and Pierson, 1994; Lekagul and McNeely, 1988).



**Common Name:** Field Rat

**Zoological Name:** *Bandicota bengalensis*

**Family:** Muridae

**Conservation Status:** Least Concern

**Description:** The lesser bandicoot and two other species are nocturnal or most active at twilight. They construct burrows to nest and bear their litters. The number of bandicoot babies can range from two to 18. Their staple diet is grains, fruit, and invertebrates. They are prone to destroying cultivated crops in fields. Of all the three species, the lesser bandicoot is an especially aggressive burrower and has been reported to make tunnels in concrete cellars.

**Habitat:** These rats are also known to inhabit houses in villages and are particularly aggressive when threatened. The controls are done by mechanical (mouse trap etc.), rodenticides and biological control (by introducing rodent diseases etc.)

**Reproduction:** Female can have up to 10





litters. Young (10-12 per litter) are born blind and naked. Young reach sexual maturity around 60 days after birth. Lifespan of adults is about 8–9 months.

**Common Name:** Indain Bush Rat

**Zoological Name:** *Golunda ellioti*

**Family:** Muridae

**Conservation Status:** Least Concern

**Description:** Head and body length is 12–14 cm. Tail is 9-11. Yellowish brown upperparts are speckled with black and reddish yellow. Ventral surface grayish with a yellowish speckle, Orange-yellow incisor teeth, Tail, dark above and yellowish below, Body fur spiny, Rounded head with a blunt nose, with small eyes mark, Relatively short bill.

**Habitat:** It is a partially diurnal, fossorial also terrestrial, semi-arboreal, not particularly gregarious, herbivorous species. It is found in varied habitat conditions from tropical dry deciduous, dry wood, shrub, tropical thorn forests and grassy clumps, may venture in to cultivated lands, bushes, orchards, scrublands, grasslands close to streams, tropical dry deciduous, except cold deserts. Also found near granite hills with sandy loam and silty soil. It has been found to occupy rocky and hilly tracts, burrows, grassland close to streams, build nests on thick bush, shrubs (Molur *et al.* 2005). This can be a serious agricultural pest species (Corbet and Hill 1992).



**Common Name:** Black Rat

**Zoological Name:** *Rattus rattus*

**Family:** Muridae

**Conservation Status:** Least Concern

**Description:** The black rat originated in India and Southeast Asia, and spread to the Near East and Egypt, and then throughout the Roman Empire, reaching Great Britain as early as the 1st century. Europeans subsequently spread it throughout the world. The black rat is again largely confined to warmer areas, having been supplanted by the brown rat (*Rattus norvegicus*) in cooler regions and urban areas. In addition to being larger and more aggressive, the change

from wooden structures and thatched roofs to bricked and tiled buildings favored the burrowing brown rats over the arboreal black rats.

**Habitat:** Black rats adapt to a wide range of habitats. In urban areas they are found around warehouses, residential buildings, and other human settlements. They are also found in agricultural areas, such as in barns and crop fields. In urban areas, they prefer to live in dry upper levels of buildings, so they are commonly found in wall cavities and false ceilings.

**Reproduction:** They often meet and forage together in close proximity within and between sexes. Rats tend to forage after sunset.

**Common Name:** Indian House Screw

**Zoological Name:** *Suncus murinus*

**Family:** Soricidae

**Conservation Status:** Least Concern

**Description:** The house shrew has a uniform, short, dense fur of mid-grey to brownish-grey color. The tail is thick at the base and a bit narrower at the tip, and is covered with a few long, bristle-like hairs that are thinly scattered. They have short legs with five clawed toes. They have small external ears and an elongated snout. They also emit a strong odor of musk, derived from musk glands that are sometimes visible on each side of the body. The odor is especially noticeable during the breeding season.

**Habitat:** It is widespread and found in all habitats, including deserts and human habitations. The habitat of this species is normally near human settlement, specifically near the house.

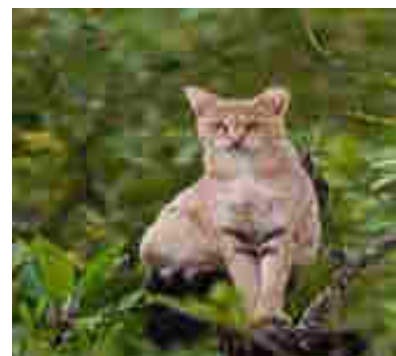
**Common Name:** Jungle Cat

**Zoological Name:** *Felis chaus*

**Family:** Felidae

**Conservation Status:** Least Concern

**Description:** The distribution of jungle cat is largely oriental; it occurs in the Middle East, the Indian



subcontinent, central and Southeast Asia, Sri Lanka and in southern China. It is the most common small wild cat in India

**Habitat:** The distribution of jungle cat is largely oriental; it occurs in the Middle East, the Indian subcontinent, central and Southeast Asia, Sri Lanka and in southern China. It is the most common small wild cat in India.

**Reproduction:** Both sexes become sexually mature by the time they are one year old. Females enter oestrus lasting for about five days, from January to March. In males, spermatogenesis occurs mainly in February and March.

**Common Name:** Indian Wildboar

**Zoological Name:** *Sus scrofa cristatus*

**Family:** Suidae

**Conservation Status:** Least Concern

**Description:** The Indian boar differs from its European counterpart by its large mane which runs in a crest along its back from its head to lower body, larger, more sharply featured and straighter skull, its smaller, sharper ears and overall lighter build. It is taller and more sparsely haired than the European form, though its back bristles are much more developed.

**Habitat:** The animal's primary habitat consists of well developed, broad-leaved and mixed forests, along with marshy mixed forests, with coniferous forests and undergrowths being of secondary importance. Forests made up entirely of oak groves and beeches are used only during the fruit-bearing season.

**Reproduction:** The breeding period in most areas lasts from November to January, though most mating only lasts a month and a half. Prior to mating, the males develop their subcutaneous armor, in preparation for confronting rivals.



**Common Name:** Common Mongoose

**Zoological Name:** *Herpestes edwardsi*

**Family:** Herpestidae

**Conservation Status:** Least Concern

**Description:** The Indian grey mongoose or common grey mongoose (*Herpestes edwardsi*) is a mongoose species mainly found in West Asia and on the Indian subcontinent. In North Indian languages (Hindi/Punjabi) it is called Nevlaa.



**Habitat:** They appear to be able to occupy a wide variety of habitats but preferring open types. These include grasslands, open areas, rocky patches, scrub, semi-desert, cultivated fields and other disturbed areas, areas of thickets, bushy vegetation, dry secondary forest, thorn forest, forest edges, and also near human settlement.

**Reproduction:** The Indian grey mongoose mates between March and October, it breeding two to three times each year. The gestation period lasts for 60 to 65 days; the female gives birth to two to four offsprings.



**Common Name:** Rhesus Macaque

**Zoological Name:** *Herpestes edwardsi*

**Family:** Herpestidae

**Conservation Status:** Least Concern

**Description:** The rhesus macaque is brown or grey in color and has a pink face, which is bereft of fur. Its tail is of medium length and averages between 20.7 and 22.9 cm (8.1 and 9.0 in). Adult males measure about 53 cm (21 in) on average and weigh about 7.7 kg (17 lb). Females are smaller, averaging 47 cm (19 in) in length and 5.3 kg (12 lb) in weight. Rhesus macaques have, on average, 50 vertebrae.

**Habitat:** Rhesus macaques are native to India, Bangladesh, Pakistan, Nepal, Burma, Thailand, Afghanistan, Vietnam, southern, China, and some neighboring areas. Inhabiting arid, open areas, rhesus macaques may be found in grasslands, woodlands, and in mountainous regions up to 2,500 m (8,200 ft) in elevation.

**Reproduction:** Adult male macaques try to maximize their reproductive success by entering into sex with females, both in and outside the breeding period. Females prefer to mate with males that will increase the survival of their young. Thus, a consort male provides resources for his female and protects her from predators. Larger, more dominant males are more likely to provide for the females. The breeding period can last up to 11 days, and a female usually mates with four males during that time.



**Common Name-** Common Indian Hare

**Zoological Name-** *Lepus nigricollis ruficaudates*

**Family-** Liporadae

**Conservation Status-** Least Concern

**Habitat-** *Lepus nigricollis* are generally found in areas where large tracts of bush and jungle alternate with farm land. They are also commonly sighted in coastal herb communities. Hilly areas, particularly the depressions at the base of hills, are preferred habitats for *Lepus nigricollis*.

**Physical Description-** *Lepus nigricollis* are also called black-naped hares due to the patch of black fur that runs along the nape of the neck. The top of the tail is also black and the back and face are brown with black hairs scattered throughout. The under parts are white. Total length ranges from 40 to 70 cm and weight ranges from 1.35 to 7 kg.

**Reproduction-** During mating season, male *Lepus nigricollis* become aggressive, spar ring with other males using their forepaws and "boxing" with their hind feet. Males will attempt to mate with as many females as they can.

**Common Name-** The Three Striped Palm Squirrel

**Zoological Name-** *Funambulus palmarum*

**Family-** Sciuridae

**Conservation Status-** Least Concern

**Habitat-** This is a very adaptable species. It is a diurnal and semi-arboreal. This species occurs in tropical and subtropical dry deciduous forest, mangrove forest, grasslands, scrublands, plantations, rural gardens and urban areas. In Sri Lanka, found throughout the island except in deep jungles.

**Physical Description-** The palm squirrel is about the size of a large chipmunk, with a bushy tail slightly shorter than its body. The back is a grizzled, grey-brown colour with three conspicuous white stripes which run from head to tail. The two outer stripes run from the forelegs to the hind legs only. It has a creamy-white belly and a tail covered with interspersed, long, black and white hair. The ears are small and triangular. Juvenile squirrels have significantly lighter coloration, which gets progressively darker as they age. Albinism is rare, but exists in this species.



**Reproduction-** Naturally active, their activity reaches levels of frenzy during the mating season. They tend to be very protective of their food sources, often guarding and defending them from birds and other squirrels. Unlike some other species of squirrel, the Indian palm squirrel does not hibernate.

**Common Name- Timber Wolf****Zoological Name-** *Canis lupus pallipes***Family-** Canidae**Conservation Status -** Least Concern**Habitat -** The gray wolf is a habitat generalist, and can occur in deserts, grasslands, forests and arctic tundras.

Habitat use by gray wolves is strongly correlated with the abundance of prey, snow

conditions, absence or low livestock densities, road densities, human presence and topography. In cold climates, the gray wolf can reduce the flow of blood near its skin to conserve body heat.

**Physical Description-** A small wolf with pelage shorter than that of northern wolves. Fur color ranges from greyish-red to reddish-white with black tips. The dark V shaped stripe over the shoulders is much more pronounced than in northern wolves. The under parts and legs are more or less white. Generally, wolves have a high heart weight of 0.93%-1.07% total body mass compared to the average mammal at 0.59% total body mass.**Reproduction-** The gray wolf is generally monogamous with mated pairs usually remaining together for life. Upon the death of one mated wolf, pairs are quickly re-established. Since males often predominate in any given wolf population, unpaired females is a rarity.**Common Name- Striped Hyena****Zoological Name-** *Hyaena hyaena***Family-** Hyaenidae**Conservation Status-** Near- Threatened**Habitat-** The Striped Hyena typically inhabits deserts, semi deserts, scrub forests, woodlands, grasslands, acacia bushlands, rocky terrain and

tropical savannas. Family groups live in dens which are usually caves with narrow entrances and are concealed with large boulders. Dens can extend over a distance of 4 – 5 metres.

**Physical Description-** Male and female striped hyenas are very similar in appearance, although males are slightly larger. Striped hyenas generally measure

between 1 – 1.15 metres in length excluding the tail (which measures 12.5 inches), and stand 0.66 – 0.75 metres at the shoulder. Males weigh between 26 – 41 kilograms (57 – 90 pounds) and females weigh 26 – 34 kilograms (57 – 75 pounds). Their coats are generally light grey to beige in colour and they have a black patch on their throat.

**Reproduction-** There is no specific breeding season for the Striped Hyena. After a gestation period of 90 – 92 days a litter of 2 – 4 helpless cubs are born in nesting dens. Hyena cubs are born blind and their ear canals are closed. Their coats are white to grey with clear black stripes. After 7 – 8 days, the cubs are able to open their eyes and their teeth develop after 3 weeks.

**Common Name- Indian Fox**

**Zoological Name** *Vulpes bengalensis*

**Family-** Canidae

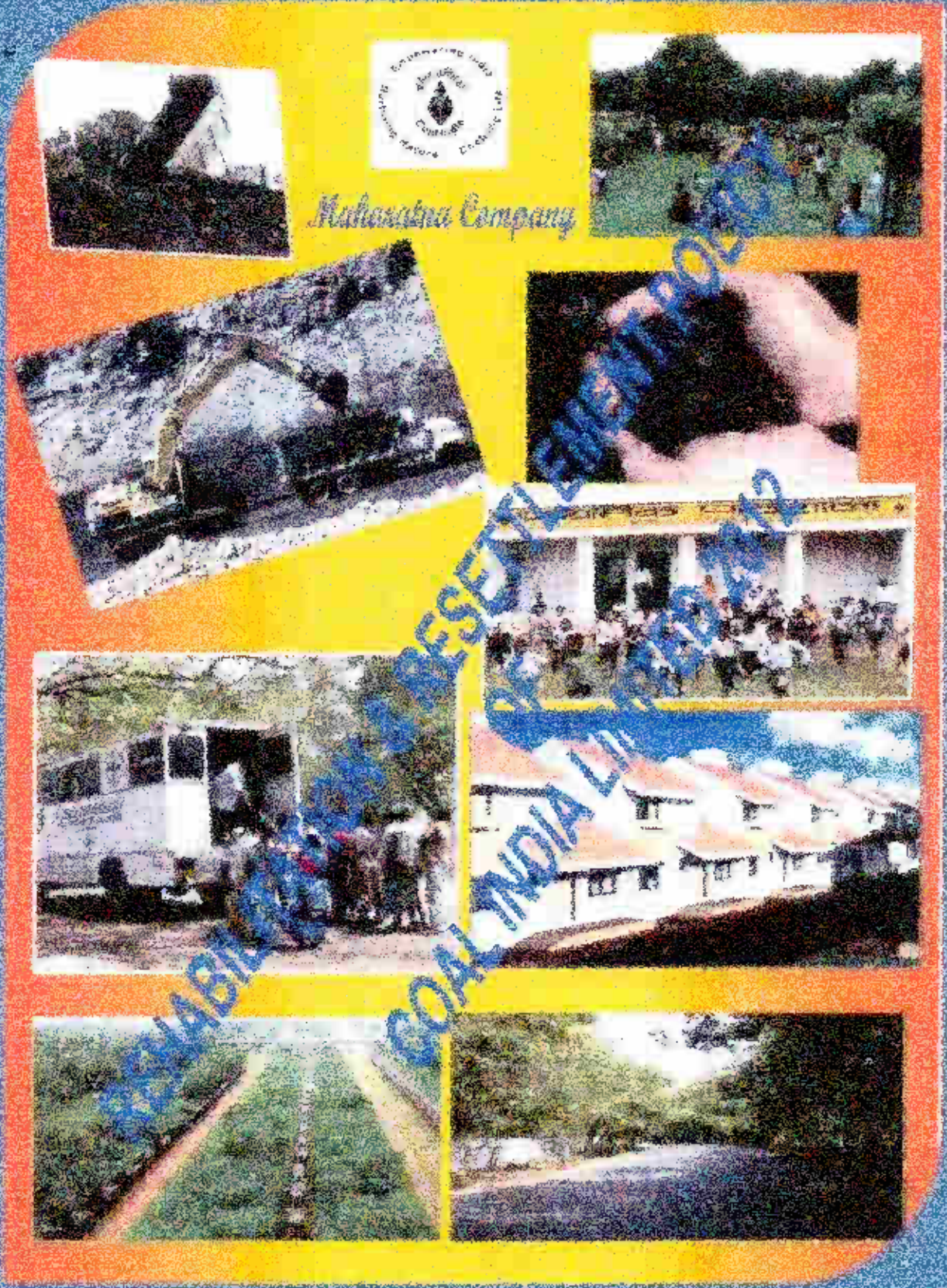
**Conservation Status-** Least Concern

**Habitat-** The Indian Fox prefers semi-arid, flat to undulating terrain, scrub and grassland habitats where it is easy to hunt and dig dens. It avoids dense forests, steep terrain, tall grasslands and true deserts (Johnsingh and Jhala 2004).



**Physical Description-** The Bengal Fox is a medium-sized fox with an elongated muzzle with black hair in small patches on the upper part of the muzzle. Its large, bushy, black-tipped tail is its most prominent feature, accounting for as much as 60% of the length of its body.

**Reproduction-** Bengal foxes are usually monogamous and form pair bonds that may last for their lifetime. The breeding season is from December to January, announced by digging a new den or re-excavating an old one. Pups are born from January to March. The gestation period is 50–60 days, and between 3 to 6 pups are born within a den. Both mother and father help to raise the pups, which are weaned at about 1 month old. Pups are sometimes nursed by a number of females. In the daytime they are likely to rest under bushes, but in summer they rest in dens. Independence is reached at 4 - 5 months old and sexual maturity by 1 - 2 years old.





श्रीप्रकाश जैसवाल  
SRIPRAKASH JAISWAL



श्रीप्रकाश जैसवाल  
श्रीप्रकाश जैसवाल  
महानिदेशक, कोयला विभाग  
MINISTER OF COAL  
GOVERNMENT OF INDIA  
New Delhi

26<sup>th</sup> March 2012

MESSAGE

Land acquisition has been identified as a major bottleneck coming in the way of Coal India's plans for augmenting coal production. I am of the firm view that Coal India has to have a generous 'relief and rehabilitation policy which can earn the confidence and goodwill of the project affected people to enable it to meet its ambitious production targets.

I have been deeply concerned about the issue and therefore constituted a Committee at Government level to take the process forward quickly. I am glad that the Committee could meet under the Chairmanship of Shri Alok Parti, Secretary (Coal) and Smt. Zohra Chatterji, Additional Secretary & CMD, Coal India Ltd and decided the broad principles of the policy.

I congratulate the Board of Coal India for approving a progressive Rehabilitation & Resettlement Policy 2012 and look forward to its successful implementation.

( SRIPRAKASH JAISWAL )

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Coal Office, Ministry of Coal, New Delhi-110002.

Dy.G.M.(M)/Sub Area Manaj  
Chhal Sub Area,SECI  
Raigarh Area

आलोक परती  
ALOK PERTI  
सचिव  
Secretary

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भारत सरकार  
कोयला मंत्रालय  
GOVERNMENT OF INDIA  
MINISTRY OF COAL  
शास्त्री भवन / SHASTRI BHAWAN

MESSAGE

I am very happy to learn that Coal India Ltd. has revised its Rehabilitation & Resettlement Policy and come up with a liberal policy which enables the land loser to choose between various options and adopt the package which best suits his needs. The focus on development of community facilities and skill development is also a positive feature.

The Ministry has held several meetings on the subject in view of the criticality of getting more land quickly for enhancing coal production. I am glad that the Policy has now been finalized and approved by the Coal India Board. I look forward to seeing much better progress in Coal India's efforts to acquire land as a result of this policy and wish them every success.

(Alok Perti)

New Delhi  
26<sup>th</sup> March, 2012

Dy.GM.(M)/Sub Area Manager  
Chhal Sub Area,SECI  
Raigarh Area

जोहरा चटर्जी

**Zohra Chatterji, IAS**

Additional Secretary to Govt.  
Ministry of Coal

Chairman-cum-Managing Director



कोल इण्डिया लिमिटेड

**COAL INDIA LIMITED**

(A Maharatna Company)

(A Govt. of India Enterprise)

"COAL BHAWAN"

10, NETAJI SUBHAS ROAD,  
KOLKATA - 700 001



**MESSAGE**

I feel privileged to present the Rehabilitation and Resettlement Policy 2012 of Coal India Limited which has been approved by the Board of Directors in its 279<sup>th</sup> Meeting held on 12<sup>th</sup> March, 2012.

I could well appreciate the urgent need to liberalize the policy and after chairing a meeting of the Committee constituted for the purpose by the Ministry of Coal, I seized upon the opportunity to fast track it when I was given additional charge of CMD, Coal India on 1<sup>st</sup> February, 2012.

I must appreciate the painstaking efforts of Director (RRR), Shri R. Mohan Das and his team including Shri Bhagwan Pandey, General Manager (RRR) and Shri T.R. Raja, Chief Manager (RR) for drafting and redrafting the policy after extensive deliberations at the level of the Functional Directors and the CMDs of subsidiary companies and the Board of Coal India.

I am hopeful that the RRR Policy 2012 which incorporates the collective wisdom of all levels from the Ministry to the field and provides sufficient flexibility to the subsidiary companies will prove to be a well conceived one which will facilitate land acquisition by Coal India in the years to come.

  
(Zohra Chatterji)

Kolkata  
16<sup>th</sup> March, 2012

  
  
**Dy.G.M.(M)/Sub Area M,  
Chhal Sub Area, SEC  
Raigarh Area**

आर मोहन दास

डायरेक्टर (फंडेडरल & IR)

R Mohan Das

Director (F&IR)



कोल इण्डिया लिमिटेड

COAL INDIA LIMITED

A MAHARAJA COMPANY

A Govt. of India Enterprise

Central Board

10, NITDA BUSINESS ROAD

AGRA 202001




### MESSAGE


I feel proud to place the liberalized law redrafted 'R&R policy of Coal India-2012' before the 279<sup>th</sup> meeting of the Board of Directors of Coal India Limited held on 12<sup>th</sup> and 13<sup>th</sup> March 2012 at New Delhi and got approval of the Board.

Though there was an existing R&R policy of CIL-2006 but there was an urgent need of redrafting the new policy in view of changing aspirations of the project affected persons in the competitive market and to redress the unique problems of the subsidiary companies of Coal India Limited for fast acquiring of land.

I would like to extend my personal congratulations to the tireless effort of Sri Bhagwan Pandey, General Manager (MP&IR), CIL and Sri I.B. Raju, Chief Manager (MP&IR), CIL and their team for their fast and prompt action in drafting the modification of the existing policy keeping in view the aspirations of the people and the difficulties encountered by the subsidiaries in acquiring land. They are of great value to the company.

I am very much hopeful that after implementation of this new policy of Coal India Limited the subsidiary companies will feel relaxed with greater flexibility in redressing the R&R issues and this will help in faster acquisition of land at all level.


  
(R Mohan Das)  
Director (F&IR)

  
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## REHABILITATION AND RESETTLEMENT POLICY OF COAL INDIA LTD 2012.

### Preamble

The location and quality of coal reserves, and their distance from major consumers determines to a great extent the selection of mine sites. For reserves that are close to the surface, opencast mining has proven to be the most efficient mining method. Opencast mines require relatively large areas of land. Population growth, particularly in India's eastern region, has made it increasingly difficult for the subsidiary coal companies to acquire the land they need for expanding their operations under the present Resettlement and Rehabilitation policy, 2006 of Coal India.


The resettlement and rehabilitation policies followed by the subsidiary companies have evolved over time and undergone numerous changes in response to changing circumstances. As and when the Central or State Governments enact amendments to the Land Acquisition Act, issue new guidelines for resettlement and rehabilitation, as per its requirement Coal India reviews and modifies its resettlement and rehabilitation policy taking into account the changing conditions in coal producing areas.

In addition to compensation for land coal companies provide Rehabilitation and Resettlement (R&R) package for project affected persons to compensate for loss of livelihood. Apart from compensation for house site, house, trees, cow shed, cost of shifting etc., employment is also provided to land oustees. In addition to this, efforts are made to rehabilitate them by construction of houses, building roads, streets, schools, providing water etc. wherever feasible. However, demand for both more land compensation and better R&R package has been raised by project affected persons and has been highlighted in various Parliamentary Committees. Coal Companies often have to face representations and agitations by these land oustees who obstruct the smooth working of existing mines and come in the way of expansion of new projects.

In the past, subsidiaries found it relatively easy to acquire land, if they were able to offer employment. Partly because of this practice, subsidiaries have built up a largely unskilled labour force beyond their needs. This has contributed to the heavy losses and many mines are incurring, and has also affected their efficiency and viability. The subsidiaries may still need to hire people in selected locations and continue to give preference to those whose livelihood will be affected by coal mining operations. However, increasingly subsidiaries will need to develop other ways and means to compensate land owners and others adversely affected by their projects and give them the option to choose which method of compensation best suits their needs. Greater emphasis will also need to be given to community requirements, like schools, hospitals etc. Only proper resettlement and rehabilitation will elicit the required cooperation of project affected people, and make it possible for Coal India to acquire the land it needs to fulfill the ever increasing demand of coal for the economic development of the Country.

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The purpose of the Resettlement and Rehabilitation Policy 2012 is to revise and provide greater flexibility to the basic principles for the resettlement and rehabilitation of people affected by coal mining projects i.e. Project Affect People (PAPs). It attempts to consolidate the different resettlement and rehabilitation practices that are being followed by subsidiaries as per the different State Land Acquisition Acts and various decisions of the Coal India Board and to modify the Policy of 2008 so as to give the Board of the subsidiary Companies greater flexibility to deal more effectively with resettlement and rehabilitation issues and determine the rehabilitation packages best suited to local needs in line with this policy. The provisions of the National Rehabilitation and Resettlement Policy, 2007 and the Land Acquisition, Rehabilitation & Resettlement Bill, 2011 have also been kept in mind while framing the policy.

While Coal India's basic philosophy for compensating land losers and other project-affected people remains substantially unchanged, the revised policy emphasizes the need to cultivate and maintain good relationships with the people affected by Coal India's projects starting as early as possible; it also underscores that the subsidiaries have a responsibility towards the land owners whose livelihood is often taken away. On the other hand, subsidiaries need to protect themselves more effectively against unjustified claims, redundant manpower and swelling Wage Bills. To this end, the statement proposes that subsidiaries prepare detailed resettlement and rehabilitation action plans (RAPs) that clearly identify, at an early stage, the entitlements of the people affected by coal projects and enables them to exercise a choice between various options. The concept of Annuity in lieu of compensation/employment is also being introduced to mitigate, if not eliminate the ever-dependence of Project Affected Families (PAFs) on CIL for provision of employment.

(1) The revised Resettlement & Rehabilitation Policy, 2012 is based on the deliberations of the Inter-Ministerial Committee set up vide O.M. 430191/2011-PR/W-1 dated 01-07-2011 of Ministry of Coal, deliberations of the CMDs meet held on 05/03/2012 at New Delhi and has been approved by the CIL Board in its 279<sup>th</sup> meeting held on 12<sup>th</sup> and 13<sup>th</sup> March, 2012.

**(2) Objectives and general principles of Coal India's Resettlement and Rehabilitation Policy- 2012**

- A. To re-visit CIL's existing R&R policy 2008 and evolve a RAP friendly policy by incorporating such provisions of the National Policy and The Draft Land Acquisition, Rehabilitation and Resettlement Bill-2011 as considered suitable in light of the growing difficulties many subsidiaries face in land acquisition.
- B. To accord the highest priority for avoiding or minimizing disturbance of the local population while taking decisions to open new mines or expand existing ones too (exploring alternative sites and project designs) and to ensure that wherever people are likely to be adversely affected by a project, the subsidiaries will prepare resettlement and rehabilitation action plans for the project.
- C. To ensure a humane, participatory, informed consultative and transparent process for land acquisition for coal mining and allied activities with the least disturbance to the owners of the land and other affected families.
- D. To provide just and fair compensation to the affected families whose land has been acquired or proposed to be acquired or are affected by such acquisition and make

  
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adequate provisions for loss of livelihood of such affected persons including their rehabilitation and resettlement.

- E. To ensure that the cumulative outcome of compulsory acquisition should be that the affected persons become partners in development leading to an improvement in their post acquisition social and economic status and matters connected therewith or incidental thereto.
- F. Through the preparation of resettlement and rehabilitation action plans, subsidiaries will safeguard that project-affected people improve or at least regain their former standard of living and earning capacity after a reasonable transition period. The transition period is to be kept to a minimum. However, the involvement of subsidiaries in resettlement and rehabilitation activities may continue until all the actions specified in the rehabilitation plan have been completed.
- G. Involuntary resettlement is conceived and executed as a development programme with project-affected people being provided sufficient resources and opportunities to share in a project's benefits. The efforts of subsidiaries are complementary to the Government's schemes in rural development and the concurrence, approvals and support from concerned Government authorities will be sought.
- H. In parallel, subsidiaries will work closely with non-governmental organizations of proven repute which are legally constituted and recognized and also have the confidence of the project-affected people in the preparation and implementation of rehabilitation plans.
- I. Corporate Social Responsibility (CSR) : Activities shall be intensified in and around the villages where land is being acquired in accordance with the CSR Policy of Coal India.
- J. Actual implementation of R&R package must follow a detailed survey of the project-affected villages to formulate the list of persons/families affected by the project, nature of the affect, the likely loss of income, etc. For this purpose, if necessary, the services of a reputed NGO with an impressive record of integrity and performance may be engaged.

### 3. SCOPE


This Policy may be called "Rehabilitation and Resettlement Policy of Coal India Limited-2012". It extends to the Coal India Limited and its subsidiary companies in India. It shall come into force from the date of its approval by theCIL Board and is applicable to all cases in which land is taken after the date of approval by the CIL Board. While implementing the policy it is to be ensured that the provisions of the concerned Acts applicable and Rules mentioned there under shall not be violated.

### 4. Definitions

(a) "affected family" means:

- (i) a family whose primary place of residence or other property or source of livelihood is adversely affected by the acquisition of land (including direct negotiation) for a project or involuntary displacement for any other reason, or



  
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(ii) any tenure holder, tenant, lessee or owner of other property, who on account of acquisition of land (including plot in the *road* or other property) in the affected area or other wise, has been involuntarily displaced from such land or other property; or

(iii) any agricultural or non-agricultural labourer, landless person (not having homestead land, agricultural land, or either homestead or agricultural land), rural artisan, small trader or self-employed person, who has been residing or engaged in any trade, business, occupation or vocation continuously for a period of not less than three years preceding the date of declaration of the affected area, and who has been deprived of earning his livelihood or alienated wholly or substantially from the main source of his trade, business, occupation or vocation because of the acquisition of land in the affected area or being involuntarily displaced for any other reason

(b) "**family**" includes a person, his/her spouse, son including minor sons, dependant daughters, minor brothers, unmarried sisters, father, mother residing with him or her and dependent on him/her for their livelihood and includes "**nuclear family**" consisting of a person, his/her spouse and minor children provided that where there are no male dependants, the benefit due to a land loser may devolve on dependent daughter nominated by the land loser.

(c) "**land owner**" includes any person—

(i) whose name is recorded as the owner of the land or part thereof, in the records of the concerned authority; or

(ii) who is entitled to be granted Patta rights on the land under any law of the State including assigned lands; or


(iii) who has been declared as such by an order of the court or District Collector;

(d) **Displaced person** - means, and includes any person who is deprived of his homestead on account of acquisition. Provided that the person/family who does not ordinarily reside in the homestead land acquired for the project can be termed "Displaced" but he will be eligible for compensation only for homestead and not for livelihood.

(e) "**Ordinarily resides**" shall mean residing in the homestead / acquired land for a period more than 6 months every year for at least the preceding 5 years.

#### 5. **Socio-economic Survey and preparation of RAP.**

A baseline socioeconomic survey will be carried out to identify the PAPs who are entitled to receive benefits in line with Coai India's Resettlement and Rehabilitation Policy. This survey will be conducted within two months of notification under the relevant land acquisition Acts by the subsidiaries with the help of reputed independent institutional agencies, who are well versed with the social matrix of the area.

  
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The basic objective of the socio-economic study will be to generate baseline data on the social and economic status of the population who are likely to lose their means of livelihood or homestead due to the acquisition of the land for the project. The data base will be used to formulate a viable and practical Rehabilitation Action Plan (RAP) for the affected persons in line with their entitlements. Digital Satellite Maps would also be prepared of the project Area freezing the dwelling units and habitations existing at the time of negotiation for Land Acquisition wherever feasible. The RAP will also address the following-

**(A) Implementation, Monitoring and Evaluation, Dispute Mechanism**

The rehabilitation action plan will address the following:

- i) The project design, including an analysis of alternative designs aimed at avoiding or minimizing resettlement.
- ii) Socio-economic survey and activities to ensure restoration of incomes of PAFs in line with Coal India's Resettlement and Rehabilitation Policy.
- iii) Description of the institutional and other mechanisms for provision of entitlements.
- iv) Time table for the acquisition and preparation of the resettlement site(s).
- v) The cost and budgets for the resettlement and rehabilitation of PAFs.
- vi) Project-specific arrangements to deal with grievances of PAFs; and
- vii) Time tables, benchmarks and arrangements for monitoring the resettlement and rehabilitation effort.

The RAP will be formulated in consultation with PAFs and State government.

**(B). Environment Impact Assessment (EIA)** will be conducted as per any law, rule and regulation of the locality in which the land has been acquired.

**6. Eligibility Criteria -**

**(A) Eligibility Criteria for Economic Rehabilitation Benefits**

This benefit shall accrue only to Entitled Project Affected Person. Entitled Project Affected Person shall be one from the following categories

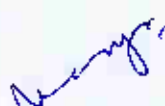

- (i) Persons from whom land is acquired including tribals cultivating land under traditional rights.
- (ii) Persons whose homestead is acquired
- (iii) Sharecroppers, land lessees, tenants & day labourers
- (iv) Tribal dependent on forest produce as certified by the District Forest Officer/Revenue Authorities.

**(B) Eligibility Criteria for Resettlement Benefits**

1. Only a 'Displaced' family / person shall be eligible for resettlement benefits.
2. A family/person shall be termed 'displaced' and hence eligible for resettlement benefits if such family/person has been a permanent resident and ordinarily residing in the project area on the date of publication of notification (U/S 9 of CBA(A&D) 1957 / U/S 11 of LA Act 1894/ Or both/ on the date of the land vested with the State/ Central government as the case may be.

and

- (a) on account of acquisition of his/her homestead land / structure is displaced from such areas
- or
- (b) He/she is a homesteadless or landless family/person who has been/is required to be displaced.

  
  
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### 7. Census & Identification of displaced families:

1. Within two months of publication of notice U/S 4(1) of the Land Acquisition Act or U/S 7(1) of CBA (A.D) Act 1957 for acquisition of land for the project a census would be undertaken in the manner to be decided by the Collector / project authority for identification of displaced families and for preparing their socio-economic profile and list of eligible persons for the purpose of receiving Rehabilitation & Resettlement Benefits

2. A photo identity card to each Entitled Project Affected Person shall be issued under the signature of the Collector / project authority concerned indicating the following particulars:

- (a) Name of the village/GP/PS :
- (b) Name, Father's name and address of the head of the family :
- (c) Category of entitlement :
- (d) Whether S.C./S.T./O.B.C./General :
- (e) Age, Sex, educational qualification of the members of the family :

### 8. Types of Compensation and Rehabilitation Entitlement

**Option to the land losers regarding Rehabilitation & Resettlement Benefit** - The land losers shall have the option for Rehabilitation and Resettlement benefits in accordance with the awards for each affected family in terms of the entitlements passed by the Concerned Collector of the State or as per this Policy with the consent of the concerned Collector

#### **8.1 Eligibility and Compensation**

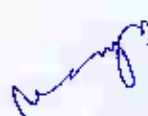
The table below shows the compensation and rehabilitation benefits will be offered by the subsidiaries for each Project Affected Person or family, affected by one of their projects. Evidence to the effect that a person is a legitimate PAP will need to be provided in the form of a written legal document, or reference to a record, such as a revenue officer certificate, electoral roll, ration card or school record

<b>Category of Persons affected by the Project</b>	<b>Compensation and Rehabilitation entitlement option</b>
	<b>Provisions</b>
(i) Persons (including tribals cultivating land under traditional rights) from whom land is acquired.	All land owners with titles will receive monetary compensation for the land acquired from them. The value of the land is determined on the basis of prevailing legal norms. In respect of tribals cultivating land under traditional rights, authentication of land held under traditional rights by state authorities will be necessary. In addition to above the following shall apply.

<p>Category of Persons affected by the Project</p>	<p><b>Compensation and Rehabilitation entitlement option</b></p>
	<p><b>Provisions</b></p> <p><b>A). Land Compensation</b> - Land compensation shall be paid as per the provisions of the concerned Act / or State Govt. notification. Where no notification of the State Govt. is available the concerned subsidiary Board may decide on the rate of compensation, keeping in view the compensation provided by the neighboring states. Authentication of land held under traditional rights by state authorities will be necessary.</p> <p>in addition to above Solatium will be paid as per provisions of the concerned Act / as imposed by the Concerned State Govt.</p> <p><b>Escalation of land compensation</b> - Escalation will be paid as per provisions of the concerned Act / as imposed by the Concerned State Govt. or Escalation at the rate of 12% per annum for a maximum period of three years.</p> <p><b>(B): Employment provision:</b> Apart from payment of the land compensation, employment may be given in the following manner -</p> <ol style="list-style-type: none"> <li>1) The maximum total number of employments that may be provided to the land losers would be limited to the total no. of acres of land acquired divided by two. However employments will be released in proportion to the land possessed</li> <li>2) For every two acres of land one employment can be considered;</li> <li>3) Subsidiaries of CIL may give an option to the Land losers having less than two acres of land to club together their land to the extent of two acres and nominate one of the land losers among the groups or their dependent for employment under package deal or employment under Descending order system by preparing the list of eligible land losers in the descending order of land lost subject to the cut off equivalent to the total number of permissible employments or any other method with the approval of the respective Board of the subsidiary.</li> <li>4) The land loser must be a domiciled resident/Mool Niwasi and the certificate to this effect shall be issued by the concerned State Authority</li> <li>5) The modalities for offering employment shall be such as may be approved by the Board of the Subsidiary companies as per the unique conditions of the subsidiary provided that -       <ol style="list-style-type: none"> <li>a) The initial employment shall be given with pay of Category-I pay scale of NCWA, with training period of 6 months.</li> <li>b) In the seniority list the seniority of the appointee should be reflected in appropriate manner in order to keep the senior most as senior.</li> <li>c) The land loser trainees shall be posted as per requirement, including underground duties.</li> </ol> </li> </ol>

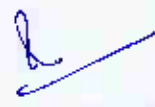
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<p>Category of Persons affected by the Project</p>	<p>Compensation and Rehabilitation entitlement option</p>
	<p><b>Provisions</b></p> <p><b>(C): Lumpsum Monetary Compensation –</b></p> <p>1. All the land losers who are not eligible for employment as above shall be entitled to receive monetary compensation in lieu of employment at the rate of Rs.5,00,000/- (Five Lakhs) for each acre of land on pro-rata basis .</p> <p>2. Land losers who are offered employment as per principle specified in point No ( 3.(i)B ) above will have the option either to opt for employment or to forego employment and opt for monetary compensation at the rate of Rs.5,00,000/- (Five lakhs) for each acre of land on pro-rata basis with minimum of Rs. 50,000 ( Fifty thousands) provided that the employment thus surrendered shall not be available for offer to any other person and will stand lapsed from the total sanctioned number of employments as specified in point No.( 3 (i)B1).</p> <p>3. The Land losers who have clubbed their land in Package Deal can claim employment for only one land loser of the clubbed two acres of land and remaining land losers of the package cannot claim either employment or lump sum monetary compensation in lieu of the land contributed by them.</p> <p>4. Annuity – All land losers who are entitled to get lump sum monetary compensation may opt for payment of compensation amount in the form of annuity made payable to the land losers monthly, annually or at such intervals (not less than one year) as may be opted for by him. The annuity to be paid for a maximum period extending to 60 years of age or the life of the project for which the land has been acquired, whichever is earlier</p> <p><u>Note:</u> A person receiving a job forgoes all claims to above compensation and a person receiving above compensation forgoes all claims to employment.</p>
<p>(ii) Person whose homestead is acquired</p>	<p>i. Compensation for homestead shall be paid as per the standard valuation method of the L.A Act. of the concerned State Govt.</p> <p>ii. One time lump sum payment of Rs.3,00,000/- (three lakhs) shall be paid in lieu of alternate House site, Assistance in designing Shifting Allowance, compensation for construction of cattle shed, Monetary compensation for construction of work shed etc. The compensation shall be paid to displaced persons only after vacation and demolition of the homestead/ work shed etc.</p> <p>iii. Subsistence allowance :Each affected displaced family will get subsistence allowance at the rate of 25 days (Minimum Agricultural Wage) per month for one year.</p>

  
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Category of Persons affected by the Project	Compensation and Rehabilitation entitlement option
	Provisions
(iii) Sharecroppers, land lessees, tenants and day labourers	<p>The subsidiary will assist PAP to take-up non farm self employment through petty contracts or formation of cooperatives. If such co-operatives will not be entitled for awarding work as per Manual for lack of experience, the said co-operative will be facilitated by awarding small jobs to acquire experience after relaxation of the provisions of the Manual pertaining to experience with approval of the Subsidiary Boards. Subsequent jobs may be awarded after getting report of the timely completion / quality / of the awarded jobs from the concerned Department or contractors.</p> <p>Contractors will also be persuaded to give job to eligible PAPs on a preferential basis, where feasible as per terms of contract.</p>
(iv) Landless tribals, Tribal dependent on forest produce	<p>The subsidiary will assist PAP to establish non farm self employment through the provision of infrastructure, petty contracts or formation of cooperatives and encourage provisions of Jobs with contractors. Contractors will be persuaded to give jobs to eligible PAPs on preferential basis, where feasible.</p> <ul style="list-style-type: none"> <li>- In addition, the subsidiaries will shift the tribal community as a unit and provide facilities to meet the specific needs of the tribal community that will allow them to maintain their unique cultural identity.</li> <li>- Tribal affected family will be given one time financial assistance of 500 days of MAW for loss of customary right or usages of forest produce. Loss of customary rights needs to be authenticated by the district authority.</li> <li>- Tribal affected families resettled out of the district shall be given 25% higher rehabilitation and resettlement benefit.</li> </ul>



  
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**9. Resettlement & Rehabilitation Committee** - A Committee will be constituted at project level under the chairmanship of the Collector to be called the Rehabilitation and Resettlement Committee with the following objectives to monitor and review the progress of implementation of the Rehabilitation and Resettlement scheme and to carry out post-implementation social audits in consultation with the village panchayat in rural areas and municipality in urban areas in the manner will be decided by the concerned State Govt.

- i. To approve the list of land losers and other PAPs;
- ii. To approve the list of persons eligible to be offered employment as per R&R Policy;
- iii. To approve the detailed Rehabilitation Plan for the project in consultation with the displaced persons and Gram Sabhas;
- iv. To expedite issue of domicile certificates and other necessary documentation required for State Authorities;
- v. To monitor and review the progress of the Rehabilitation Scheme, grant of benefits and handing over of possession of land in a smooth manner;
- vi. To facilitate the land acquisition process in any other manner as may be required including resolution of disputes;
- vii. To carry out post implementation social audit in consultation with the authorities.

**10. Community facilities** - The subsidiary will provide at the resettlement site a school, road with street light, pucca drain, pond, dugwell and/or tubewell for drinking water supply, community center, place of worship, dispensary, grazing land for cattle and play ground. Similar infrastructural facility, if necessary, will be extended to the host locality. The community facilities and services would be available to all residents of the area, including PAPs and the host population.

The approach for operation of community facilities would be flexible and all efforts will be made to involve the State and local self Government / Panchayat for operating the facilities. To achieve this, subsidiaries will pursue with these agencies to ensure the same. The planning of the community facilities and their construction should be undertaken in consultation with the affected community.

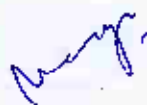
**11. Corporate Social Responsibilities** - This should be as per Company's Corporate Social Responsibility (CSR) Policy.


#### **12. Monitoring and Evaluation Mechanism.**

The RAP will be monitored and evaluated periodically after the completion of the land acquisition process.

- i. The resettlement and rehabilitation activities are the responsibility of a separate group, both at the projects and corporate level, which will be constituted for planning, implementation, monitoring and evaluation of the Rehabilitation Action Plan. At the corporate level the group will be headed by a senior manager, whereas at the project, an executive of the rank of manager will head the group. The project group should have at least one member with social science qualification / experience and skills.

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- ii. The project group will closely interact with the state authorities during the implementation of the RAP. Although the subsidiaries will develop the plots and infrastructural facilities in the resettlement colony and actively implement the RAP, assistance of State authorities will be taken for administrative services such as allotment of land. Implementation will be planned, monitored and corrective measures will be incorporated in the RAP, if needed. In addition to the State Government, the PAs, the village leaders including the Pradhans and NGOs will be consulted and associated with the implementation of the RAP.
- iii. The Resettlement and Rehabilitation Cell at the corporate level will evaluate the implementation of the RAP after its completion.


13. Flexibility to the Subsidiary Companies – The Subsidiary Companies Boards have been authorised to approve necessary modifications in the R&R Policy with reference to unique conditions prevailing at the concerned Subsidiaries as the policy is not exhaustive.

(The above list is only indicative and not exhaustive)

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General Manager  
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Chhal Sub Area,SECL  
Raigarh Area



# गुनाक्स खेत बाँझपुरा गाँव का खादिर नक्शा



**DETAILS ON AMENITIES AND INFRASTRUCTURAL FACILITIES  
PROVIDED IN LATI (LANSABARRI)  
REHABILITATION SITE.**

**TOTAL LAND ACQUIRED FOR REHABILITATION SITE - 13490 HA.**

Works at Rehabilitation site. Expenditure in Rs.

• Road	~ 2 Km.	18 Lakhs
• Power supply	~ 9 Km.	21 Lakhs
• School Building ( Building 15m x 8m )	~ 40 x 40 sqg mtrs.	6.54 Lakhs
• Health Centre ( Building 15m x 10m )	~ 40 x 30sq mtrs.	3.15 Lakhs
• Hand pumps for water supply	~ 6 Nos.	4.52 Lakhs
• Community hall ( Building 16m x 10m )	~ 40 x 40 sqg mtrs.	1.92 Lakhs
• Wells	~ 2 Nos. - 10 mtrs deep.	1.78 Lakhs
• Pond	~ 2 nos. - 80 x 80 sqg. Mtrs.	4.62 Lakhs
• Play ground	~ 100 x 60 sqg. Mtrs.	0.50 Lakhs
• Extra land for shops	~ 100 x 20 sqg. Mtrs. etc.	
• Boundary fencing, drainage and tree plantation.		



# गुनाफस खेत 13.490 हेक्टेयर का विवरण

(3)

Sl. No.	ACTIVITY	As per Survey (m <sup>2</sup> )	PROPORTION
01	DISHBENSARY	400400000000	-
02	VEGETATION WALL	400400000000	-
03	SCHOOL	400400000000	-
04	PLAY GROUND	400400000000	-
05	LAND ALLO. FOR PRIVATE SHOP	100000000000	2.5 NOS
06	GARDEN	200000000000	-
07	ROAD	400400000000	-
08	WELL	200000000000	0.11
09	HAND PUMP	100000000000	0.11
10	LIGHTING TOWER	100000000000	0.1
11	CONCRETE ROAD IN VARIOUS PHASES	200000000000	+
12	TRAVEL GROUND	200000000000	+
13	FOREST SURROUNDARY	-	+
14	APPROX. SURFACE WATER LAID	134900000000	+
15	REGULATORS, DRAIN AT BOUNDARY ETC	500000000000	+

16. रीजिस्टर नं. 300000000000 पृष्ठ 15

with you at 13.490 Hectares



30x चर्चवीर की भूमि (खण्ड) आवंटित

(1) (1) (4)

नाम पिता/पति का नाम	खण्ड नं.	
1. विनोद च. कार्कि राम	01 ✓	
2. चैतराम च. पुठे	02 ✓	
3. जयप्रकाश च. निरमल	03 ✓	
4. जगद्वन च. गणेश	04 ✓	
5. मिरजू प्रसाद च. गोपाल	05 ✓	
6. विल्ली काच च. निर्मल	06 ✓	
7. संतोष च. चरण	07 ✓	
8. भागीरथी च. नारायण	08 ✓	
9. अलीकाद च. निर्मल	09 ✓	
10. जयवीर च. गोपीराम	10 ✓	
11. मनीष सिंह च. सुभाषि	11 ✓	
12. राजकुमार च. जयशंकर सिंह	12 ✓	
13. जयवीर च. सुभाषि	13 ✓	
14. हरिभाद्र च. जयशंकर सिंह	14 ✓	
15. नेहरू, राम च. जयशंकर	15 ✓	ST
16. रामचंद्र च. जयशंकर	16 ✓	ST
17. धनवीर च. सुभाषि मण्डल च. जयशंकर	17 ✓	ST
18. जयशंकर च. सुभाषि	18 ✓	ST
19. जयशंकर च. जयशंकर	19 ✓	
20. जयशंकर च. जयशंकर	20 ✓	ST
21. सुभाषि सिंह च. सुभाषि	21 ✓	
22. जयशंकर च. जयशंकर	22 ✓	ST

SP/CLM/M/SUB Area Manager  
CHS Sub Area Secy  
Ghatampur Area

(5)

300 वर्गमीटर की भूमि (एकड़) आवंटित

क्र.सं.	नाम पिता/पति व नाम	एकड़ सं.	
23	जोगी राम व मताप	23 ✓	ST
24	बिंदर बाबा व राम बाब	24 ✓	ST
25	कर्णेश सिंह व नरेश सिंह	25 ✓	
26	बाबू नारायण व देवान	26 ✓	ST
27	गंगेश्वर व देवान	27 ✓	ST
28	बिजूराम व पद्मराम	28 ✓	ST
29	नारायण व वादुतम	29 ✓	ST
30	हेमल कुमार व रामीराम	30 ✓	ST
31	नाथ सिंह व सुपवास	31 ✓	ST
32	रमेश सिंह व बनावराम	32 ✓	ST
33	बाबूजी व नरेश सिंह	33 ✓	ST
34	महेन्द्र व नरेश सिंह	34 ✓	ST
35	दिनेश्वर व महेन्द्र	35 ✓	ST
36	जुधाव व लखाराम	36 ✓	ST
37	लीनराम व नरेश	37 ✓	ST
38	अबिदुल्लाह व मोहम्मद सलीम व मोहम्मद	38 ✓	
39	हकीम अली व तेजराम	39 ✓	
40	रमना बाई व सेखराम	40 ✓	
41	मंगल अब्दुल राम व मोताराम	41 ✓	
42	छातिशिवर व लक्ष्मीव	42 ✓	
43	विमलाबाई पति नारायण विजयधर व नारायण	43 ✓	
44	नेमनलाल शर्मा व मांजरी	44 ✓	
45	शंकराव व लखाराम	45 ✓	

CHAI SUB AREA SEC  
Muzam Area



41:6 एग्रीकल्चर की एरिया (एकड़) आवंटित

क्र.सं.	नाम पति/पत्नी का नाम	एकड़	श्रेणी
68	बिखामो बर्ड व सुधा राम	25	ST
69	जोश सिंह व बबलेन	26	ST
70	जोधन सिंह व चण्डीमाल	27	ST
71	कमल राम व प्रेम सिंह	28	ST
72	कमलेश व श्रीमनाथ जोशिन राम व शिव राम	29	ST
73	मोहन सिंह व राम देवाच	30	ST
74	बीकना बर्ड पति राजराज सिंह गंगा राम व गजराज सिंह	31	ST
75	दिधीप व इन्द्रजीत	32	ST
76	सुहृदा बर्ड व दिधीप सिंह	33	ST
77	मन्दिता व जगदीश	34	ST
78	गजराज व मनपत	35	ST
79	नगदेव व लेख सिंह	36	ST
80	एकदर सिंह व एकदर सिंह इंद्री बर्ड पति नाराज सिंह	37	ST
81	राजू राम व जगदीश दुर्याजी व लाल राम	38	ST
82	भवन लाल व मनपत	39	ST
83	राजू सिंह व भदुर सिंह	40	ST
84	शिव राम व सुब्बा	41	ST
85	बाबी राम व धोबी राम	42	ST

600 एग्रीकल्चर की एरिया (एकड़) आवंटित

86	जगदीश व लोभनाथ	01	ST
87	गजेतम व गंजीर लाल	02	ST
88	गजेतम व धन सिंह	03	ST
89	पेन्नाम व लाल राम	04	ST
90	रतू सिंह व जुरन सिंह	05	ST
91	बाबू राम व जुरन सिंह	06	ST
92	भानुप्रसाद व देव राम	07	ST

Result with Memo  
Chief Sub Area SEC  
Raigarh Area





व्यक्तिगत प्रारंभिक सूची (प्रारंभिक सूची) से प्रस्तावित प्रारंभिक सूची (प्रारंभिक सूची) की सूची  
 को बसाएट हेतु जमीनके दस्तावेज में रजिस्ट्रार/मुकदमा/मुकदमा प्रारंभिक सूची में

क्र.सं.	सूची सं.	एकड़ की सं.	नाम	पिता/पति का नाम	जाति	विवरण	आ	क	सूची सं.
1	3	3	समरसाम	समरसाम	जनक	गु	0	0	0632007 011-3-16
2	4	8.30	जमिनाबाई अनंतकुमार	अनंत सुखीरा	ब्राह्मण	ग	ग	ग	065864 01-3-06
3	5	8	नीलनाथ	नीलनाथ	ब्राह्मण	ग	ग	ग	065864 01-3-06
4	10	10	देशमाला	देशमाला	ब्राह्मण	ग	ग	ग	065864 01-3-06
5	11		सुखसाम	सुखसाम	ब्राह्मण	ग	ग	ग	065864 01-3-06
6	12		जगदीश	जगदीश	ब्राह्मण	ग	ग	ग	065864 01-3-06
7	13		सुखसाम	सुखसाम	ब्राह्मण	ग	ग	ग	065864 01-3-06
8	14		सुखसाम	सुखसाम	ब्राह्मण	ग	ग	ग	065864 01-3-06
9	15		सुखसाम	सुखसाम	ब्राह्मण	ग	ग	ग	065864 01-3-06
10	19	16	सुखसाम	सुखसाम	ब्राह्मण	ग	ग	ग	065864 01-3-06
11	21	24	सुखसाम	सुखसाम	ब्राह्मण	ग	ग	ग	065864 01-3-06

Sub Area Manager  
 CRRI Sub Area SEC  
 Raigarh Area

Sl. No.	Name	Address	Age	Sex	Religion	Phone No.	Remarks
22	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658776	
23	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658777	
24/1	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658778	
25	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658779	
27	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658780	पुनर्देव
28	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658781	
29	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658782	
30	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658783	
31	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658784	
32	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658785	
33	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658786	
34	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658787	
35	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658788	
36	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658789	
37	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658790	
38/1	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658791	
38/2	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658792	
38/3	पुनर्देव/पुं	पुनर्देव/पुं	30	M	Hindu	0658793	

PAID

Area Manager  
Sub Area SBT  
Vadgaon Area

Handwritten notes on the left margin, possibly a list of items or a scale.

Sl. No.	Name of the person	Address	Age	Sex	Religion	Occupation	Signature
1	...	...	...	...	...	...	...
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28	...	...	...	...	...	...	...
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31	...	...	...	...	...	...	...
32	...	...	...	...	...	...	...

Handwritten text at the bottom of the page, possibly a signature or official stamp.

		I	II	III	IV	V	VI	VI	
73		बाला	देवी	0000	10	40			
74/1		जासल	देवी	0000	10	40			
74	74/2	दीरगसिंह	समेटा	0000	10	40			
75	75/1	बहादुरसिंह	जोहरा	0000	10	40			
76	76/2	जोहरा	दीरगसिंह	0000	10	40			
77	77/3	लक्ष्मणसिंह	देवी	0000	10	40			
78	78	नारायणसिंह	सदाम	0000	10	40			
79	79/1	जोहरा	दीरगसिंह	0000	10	40			
80	80/2	जोहरा	दीरगसिंह	0000	10	40			
81	81/3	नारायणसिंह	सदाम	0000	10	40			
82	82/1	जोहरा	दीरगसिंह	0000	10	40			
83	83/2	जोहरा	दीरगसिंह	0000	10	40			
84	84/3	नारायणसिंह	सदाम	0000	10	40			
85	85/1	जोहरा	दीरगसिंह	0000	10	40			
86	86/2	जोहरा	दीरगसिंह	0000	10	40			
87	87/3	नारायणसिंह	सदाम	0000	10	40			
88	88/1	जोहरा	दीरगसिंह	0000	10	40			
89	89/2	जोहरा	दीरगसिंह	0000	10	40			
90	90/3	नारायणसिंह	सदाम	0000	10	40			

CMO MUMBAI SUB AREA  
 CHRI SUB AREA  
 Pradhan

...

Sl. No.	Plot No.	Area	Owner Name	Address	Category	Area (sq. ft.)	Rate	Assessment	Remarks
91			पुलकेशभाई	उदीनाथ	श्री	48		06/01/06	
92	92		पारशी	उदीनाथ	श्री	41		06/01/06	
95	94.95.00		भागीरथी वसुधामणि	बाळकृष्ण जगदास	श्री	75		06/01/06	
96	94.95.96		इशवरीलाल	कल्याणशिव	श्री	28		06/01/06	
98	94.95.98		भवानीलाल	कल्याणशिव	श्री	17		06/01/06	
99	98.00		सादिकराम	भागीरथी	श्री	45		06/01/06	
100	102	102/2	जाधव बाई	सुदीराम	श्री	7		06/01/06	
101	104		सुशीला शंकर	सुधाकर शंकर	श्री	11		06/01/06	
102	104		सुशीला शंकर	सुधाकर शंकर	श्री	11		06/01/06	
103	106	106/2	साधना	साधना	श्री	18		06/01/06	
104	107	107	सादिकराम	सुधाकर	श्री	9		06/01/06	
105	108		भागीरथी	साधना	श्री	15		06/01/06	
106	109		साधना	साधना	श्री	10		06/01/06	
107	110	110/2	सुशीला	सुधाकर	श्री	3		06/01/06	
108	111	111	साधना	साधना	श्री			06/01/06	

City Municipal Corporation  
 (7th Sub Area) Durgam Area

STATE OF KARNATAKA  
 CIVIL SUPPLY DEPT.

112	विश्वम्	अनंत	विश्वम्	विश्वम्	11	11	069150	09-3-06
113	सुन्दर नाथ	विश्वम्	विश्वम्	विश्वम्	11	11	069151	09-3-06
114	सुन्दर नाथ	विश्वम्	विश्वम्	विश्वम्	11	11	069152	09-3-06
115	115/1	इनायत	अनंत	अनंत	11	11	069153	09-3-06
116	116/2	इनायत	अनंत	अनंत	11	11	069154	09-3-06
117	117	गोपीनाथ	पद्मनाभ	गोपीनाथ	11	11	069155	09-3-06
118	118	गोपीनाथ	पद्मनाभ	गोपीनाथ	11	11	069156	09-3-06
119	119/1	गोपीनाथ	पद्मनाभ	गोपीनाथ	11	11	069157	09-3-06
120	120/2	सुन्दर नाथ	अनंत	अनंत	11	11	069158	09-3-06
121	121/1	अनंत	अनंत	अनंत	11	11	069159	09-3-06
122	122/1	अनंत	अनंत	अनंत	11	11	069160	09-3-06
123	123	अनंत	अनंत	अनंत	11	11	069161	09-3-06
124	124	अनंत	अनंत	अनंत	11	11	069162	09-3-06
125	125	अनंत	अनंत	अनंत	11	11	069163	09-3-06

Chief Sub Area Secy  
Rampath Area

Sl. No.	Plot No.	Area (sq. ft.)	Owner Name	Address	Age	Sex	Height	Weight	Remarks
127	127/1		सलिल	अंधेवाडी	वसि	पु	5	3	069163 09-3-06
99	127	127/2	शिवतपुवन	अंधेवाडी	वसि	पु	5	3	069164 09-3-06
100	129	129	विद्याती	विश्वनाथ	वसि	पु	4	1	069165 09-3-06
101	132	132	छन्नुनाथ	विश्वनाथ	वसि	पु	3	30	069166 09-3-06
102	135	135	शैलदास	विश्वनाथ	वसि	पु	3	22	069167 09-3-06
103	138	138/1 146	अनंदमाला	विश्वनाथ	वसि	पु	4	51	069168 09-3-06
104	138	138/2	साली	विश्वनाथ	वसि	पु	4	3	069169 09-3-06
105	140	140/1	सत्य	विश्वनाथ	वसि	पु	4	3	069170 09-3-06
106	140	140/2	सत्य	विश्वनाथ	वसि	पु	4	3	069171 09-3-06
107	141	141/1	दशरथ	सुजात	वसि	पु	3	36	069172 09-3-06
108	142	142/1	अनंदमाला	विश्वनाथ	वसि	पु	4	1	069173 09-3-06
109	143	143	सोनादुर महेन्द्र	सुजात सुजात	वसि वसि	पु पु	2 3	70 30	069174 09-3-06
110	145	145/2	सुजात	विश्वनाथ	वसि	पु	3	36	069175 09-3-06
111	147	147/1	सुजात	विश्वनाथ	वसि	पु	3	3	069176 09-3-06
112	147	147/2	सुजात	विश्वनाथ	वसि	पु	3	3	069177 09-3-06
113	148	148/1	सुजात	विश्वनाथ	वसि	पु	3	3	069178 09-3-06

  
 नाम विद्याती माला  
 पत्नी सुजात माला  
 रावठि माला

  
 नाम सुजात माला  
 पत्नी सुजात माला

(52)

Sl. No.	1	2	3	4	5	6	7	8	9
146	146/2	सुपार	सुजरास	पंजर	5	27	069180	09-3-06	
147	146/3	सुपार	सुपार	पंजर	5	27	069180	09-3-06	
148	146/3	सुपार	सुपार	पंजर	5	27	069181	09-3-06	
117	150	150/1	देवडास	सुपार	पंजर	5	27	069182	09-3-06
118	150	150/1	सुपार	सुपार	पंजर	5	27	069183	09-3-06
119	150	150/2	सुपार	सुपार	पंजर	5	27	069184	09-3-06
120	150	150/2	सुपार	सुपार	पंजर	5	27	069185	09-3-06
121	150	150/2	सुपार	सुपार	पंजर	5	27	069186	09-3-06
121	151	151	सुपार	सुपार	पंजर	5	27	069187	09-3-06
122	151	151	सुपार	सुपार	पंजर	5	27	069188	09-3-06
124	152	152	सुपार	सुपार	पंजर	5	27	069189	09-3-06
125	154	154	सुपार	सुपार	पंजर	5	27	069190	09-3-06
126	155	155/2	सुपार	सुपार	पंजर	5	27	069191	09-3-06
127	156	156/2	सुपार	सुपार	पंजर	5	27	069192	09-3-06
128	156	156/1	सुपार	सुपार	पंजर	5	27	069193	09-3-06
129	156	156/2	सुपार	सुपार	पंजर	5	27	069194	09-3-06
130	157	157	सुपार	सुपार	पंजर	5	27	069195	09-3-06

146/1 (146/1) 146/1  
 146/2 (146/2) 146/2  
 146/3 (146/3) 146/3



Sl. No.	Plot No.	Area	Owner Name	Category	Phase	Area	Value	Remarks
127	157/1	300	बादशान	महाराष्ट्र	महाराष्ट्र	10	0692190 09-3-06	महाराष्ट्र
128	157/2	300	जगल	महाराष्ट्र	महाराष्ट्र	20	0692197 09-3-06	महाराष्ट्र
129	158	300	जगल-बाई	महाराष्ट्र	महाराष्ट्र	10	0692198 09-3-06	महाराष्ट्र
134	160/1	300	महाराष्ट्र	महाराष्ट्र	महाराष्ट्र	10	0692199 09-3-06	महाराष्ट्र
135	160/2	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692200 09-3-06	महाराष्ट्र
136	161	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692201 09-3-06	महाराष्ट्र
137	162/1	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692202 09-3-06	महाराष्ट्र
138	162/2	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692203 09-3-06	महाराष्ट्र
139	163	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692204 09-3-06	महाराष्ट्र
140	164	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692205 09-3-06	महाराष्ट्र
141	165	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692206 09-3-06	महाराष्ट्र
142	166	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692207 09-3-06	महाराष्ट्र
143	168	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692208 09-3-06	महाराष्ट्र
144	169	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692209 09-3-06	महाराष्ट्र
145	170	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692210 09-3-06	महाराष्ट्र
146	171	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692211 09-3-06	महाराष्ट्र
147	172	300	जगल	महाराष्ट्र	महाराष्ट्र	10	0692212 09-3-06	महाराष्ट्र

1. The above details are correct as per the records of the Survey Office, Mumbai.  
 2. The above details are correct as per the records of the Survey Office, Mumbai.  
 3. The above details are correct as per the records of the Survey Office, Mumbai.

Sl. No.	Plot No.	Area	Name	Category	Sex	Age	Phone No.	Remarks
160	170	170/2	जगदाम	विश्व	पु	28	069217	
170	170		दीपलाल	विश्व	पु	20	069216	
160	170	170	साधु	विश्व	पु	28	069215	सुनीलपुर
181	171	171/1	मुष्मलाल	विश्व	पु	28	069216	
103	171	171/2	नोहरलाल	विश्व	पु	29	069217	
153	173	173/1	दिलराम	विश्व	पु	22	069218	
164	173	173/2	विमला सिद्ध	विश्व	पु	27	069219	
163	173	173/3	विमल	विश्व	पु	25	069220	
164	174	174/1	रुक्मिणी	विश्व	पु	24	069221	
167	174	174/2	राजकुमार	विश्व	पु	24	069222	
156	174	174/3	राजकुमार	विश्व	पु	28	069223	
156	174	174/4	उमेश्वर	विश्व	पु	28	069224	
160	174	174/5	अनवराम	विश्व	पु	28	069225	
161	174	174/6	अनवराम	विश्व	पु	28	069226	
161	174	174/7	अनवराम	विश्व	पु	28	069227	
161	174	174/8	अनवराम	विश्व	पु	28	069228	
161	174	174/9	अनवराम	विश्व	पु	28	069229	
161	174	174/10	अनवराम	विश्व	पु	28	069230	
161	174	174/11	अनवराम	विश्व	पु	28	069231	
161	174	174/12	अनवराम	विश्व	पु	28	069232	
161	174	174/13	अनवराम	विश्व	पु	28	069233	
161	174	174/14	अनवराम	विश्व	पु	28	069234	
161	174	174/15	अनवराम	विश्व	पु	28	069235	
161	174	174/16	अनवराम	विश्व	पु	28	069236	
161	174	174/17	अनवराम	विश्व	पु	28	069237	
161	174	174/18	अनवराम	विश्व	पु	28	069238	
161	174	174/19	अनवराम	विश्व	पु	28	069239	
161	174	174/20	अनवराम	विश्व	पु	28	069240	
164	183	183/2	अनवराम	विश्व	पु	28	069241	

IN CHARGE  
 Dholi Sub Area, SEC-1  
 Raigarh, Arun



103	210	210	सुराण	उपस्थान	मह	11	18	069251	09-3-06	
103	211	211	सामयुक्त	उपस्थान	मह	11	18	069252	09-3-06	
104	212	212	सामयुक्त	उपस्थान	मह	11	18	069253	09-3-06	
105	213	213/1	सुराण	उपस्थान	मह	11	18	069254	09-3-06	
105	213	213/2	उपस्थान	उपस्थान	मह	11	18	069255	09-3-06	
107	216	216	सुराण	उपस्थान	मह	11	18	069256	09-3-06	
108	219	219	सुराण	उपस्थान	मह	11	18	069257	09-3-06	
109	221	221	सुराण	उपस्थान	मह	11	18	069258	09-3-06	
100	224	224	सुराण	उपस्थान	मह	11	18	069259	09-3-06	
101	227	227/1	सुराण	उपस्थान	मह	11	18	069260	09-3-06	
102	231	230	सुराण	उपस्थान	मह	11	18	069261	09-3-06	
103	232	232	सुराण	उपस्थान	मह	11	18	069262	09-3-06	
104	233	233	सुराण	उपस्थान	मह	11	18	069263	09-3-06	
105	234	234	सुराण	उपस्थान	मह	11	18	069264	09-3-06	
107	236	236	सुराण	उपस्थान	मह	11	18	069265	09-3-06	
108	238	238	सुराण	उपस्थान	मह	11	18	069266	09-3-06	


ALL PUNJABI ARMS BATTALION  
 Central Sub Arms SGT  
 Raddi Arns

2	3	4	5	6	7	8	9	10	11	12
240	240	नामदार	सामान	मिटर	1	11	01-02-06	09-3-06		
241	241	उपवर्ग	सामान	मिटर	1	20	069265	09-3-06		
242	242/2	सामदार	सामान	मिटर	1	21	069266	09-3-06	सामदार	
243	243	सामदार	सामान	मिटर	1	22	069267	09-3-06		
250	250	सुधामकुमार	सामदार	मिटर	3	20	069268	09-3-06	सुधामकुमार	
252	252	सुधाम	सामदार	मिटर	3	20	069269	09-3-06		
253	253	सुधामकुमार	सामदार	मिटर	1	17	069270	09-3-06	सुधामकुमार	
255	255	सुधाम	सामदार	मिटर	1	1	069271	09-3-06		
256	256	सुधाम	सामदार	मिटर	3	17	069272	09-3-06	सुधाम	
258	258	सुधाम	सामदार	मिटर	1	14	069273	09-3-06		
259	259/1	सुधाम	सामदार	मिटर	1	13	069274	09-3-06		
259	259/1	सुधाम	सामदार	मिटर	1	10	069275	09-3-06		
259	259/1	सुधाम	सामदार	मिटर	1	14	069276	09-3-06		
259	259/1	सुधाम	सामदार	मिटर	1	21	069277	09-3-06		
259	259/1	सुधाम	सामदार	मिटर	1	11	069278	09-3-06		
259	259	सुधाम	सामदार	मिटर	1	20	069279	09-3-06		
261	261	सुधाम	सामदार	मिटर	3	2	069281	09-3-06		
262	262	सुधाम	सामदार	मिटर	1	1	069282	09-3-06		

Sub Area Manager  
Central Sub Area SECT  
Oshtnath Area

Sub Area Manager  
Central Sub Area SECT  
Oshtnath Area

Sl. No.	Serial No.	Name	Address	Age	Sex	Religion	Occupation	Signature	Remarks
219	265	मोहनराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
220	266	पुनोराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
221	267	पुनोराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
222	268	विश्वनाथ	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
223	269	मोहनराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
224	270	मोहनराव विठ्ठलराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
225	271	विठ्ठलराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
226	272	मोहनराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
227	273	विठ्ठलराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
228	274	विठ्ठलराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
229	275	विठ्ठलराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
230	276	मोहनराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
231	277	विठ्ठलराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
232	278	विठ्ठलराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
233	279	मोहनराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
234	280	विठ्ठलराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
235	281	मोहनराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
236	282	विठ्ठलराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
237	283	मोहनराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
238	284	विठ्ठलराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		
239	285	मोहनराव	विठ्ठलराव	मदर	म	३५	०६९२५० ०९-३-०६		

  
 Area Manager  
 Chitli Sub Area GRC  
 Rahim Area

  
 Area Manager  
 Chitli Sub Area GRC  
 Rahim Area

## CHAPTER-XVIII MINE CLOSURE PLAN

### 18.1 Closure Planning details of mine

Chhal OC (Seam III) (6.0Mty) is an extension/recasting project of three existing projects. The project comprises mostly (i.e. 981.268Ha, 73.07 % tenancy land. The block area is involved with industrial and mining activities for which regular environmental monitoring/audit are being done. The core & Buffer zone environmental data for Chhal OC (Seam III) Expansion Project in respect of air quality, water quality, noise level, flora fauna, socio economical data etc. are available for preparation of this Chapter.

CMPDI on behalf of SECL carried out environmental base line data generation by Govt. approved labs at different locations in core & buffer zone of Chhal OC (Seam III) Project.

The project has been planned for a target capacity of 6.0 Mty for 30 years life, to meet power grade coal. Beyond this life, the mine will be closed if no further expansion towards the above adjoining blocks is considered. The closure details are described below.

#### 18.1.1 Mined out Land & proposed final land use:--

Present and conceptual post mining land use is given in tables 18.1 & 18.2 below respectively.

Table - 18.1

Sl. No	REQUIREMENT OF LAND	TENANCY / AGRICULTURE LAND			FOREST LAND			GOVT. LAND			TOTAL LAND		
		ALREADY ACQUIRED	TO BE ACQUIRED	TOTAL	ALREADY ACQUIRED	TO BE ACQUIRED	TOTAL	ALREADY ACQUIRED	TO BE ACQUIRED	TOTAL	ALREADY ACQUIRED	TO BE ACQUIRED	TOTAL
1	LAND FOR QUARRY	111.75	15.80	127.55	0	105.15	105.15	0	188.41	188.41	0	325.71	473.01
2	FOR EXTERNAL DUMP	0	110.72	110.72	0	0	0	0	20	20	0	130.72	130.72
3	FOR INDUSTRIAL DEVELOPMENT PLAN SUCH AS ROAD APPROACH ROAD, ETC.	0	0	0	0	0	0	0	10	10	0	10	10
4	RESIDENTIAL COLONY	0	0	0	0	0	0	0	0	0	0	0	0
5	LAND FOR HOUSING/STAFF QUARTERS	0	0	0	0	0	0	0	0	0	0	0	0
6	SAFETY STAIR	0	144.47	144.47	0	0	0	0	0	0	0	144.47	144.47
7	LAND REQUIRED FOR SW/DRINKING AND SAFETY	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL LAND	111.75	467.29	579.04	0	105.15	105.15	0	178.41	178.41	0	820.89	1142.86
	TOTAL LAND TO BE ACQUIRED	0	467.29	467.29	0	105.15	105.15	0	178.41	178.41	0	750.85	1142.86

  
 Mr. M. S. Singh, District Manager  
 Chkal Sub Area, SEQ,  
 Panchajanya Area

R.V./MST

Date: 09/02/24

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Table 18.2 Post-Mining Land Use Figures in Ha.

Sl. No.	Particulars	Quarry Area (After backfilling & reclamation)	External Dump (After Reclamation)	Safety zone as green belt	Infrastructure, Explosive magazine etc.	R&R site	Others	Grand Total
1.	Afforested area	794.01	130.73	144.47	5.00	0.00	0.00	1074.21
2.	Cultivable land	0.00	0.00	0.00	0.00	0.00	92.85	92.85
3.	Final Void / Water Body	51.00	0.00	0.00	0.00	0.00	0.00	51.00
4.	Silt-Up Area	0.00	0.00	0.00	45.00	50	0.00	95.00
Total Land for the project		875.01	130.73	144.47	50.00	50	92.85	1342.55

## 18.2 Water quality management:

### a) Physiography and drainage

The general topography of the block is plain. The elevation above MSL varies from 231m to 267m in the north-eastern part of the block. The elevation of the ground varies between 255m to 267m along a linear patch running NE-SW in the central part of the property. The ground has general slope towards NW, SE and SW. Except a few outcrops of sandstone occurring along the banks of Mand River, the area is covered by soil and cultivated land. The south-eastern part of the block is covered by Lath protected forest and Edu reserve forest.

The southerly flowing Mand River and westerly flowing Kurket River with their tributaries form the main drainage of the Block. A small earthen dam has been constructed for the purpose of irrigation near Khedapali village in the eastern part of the block.

**b) Details of Locations:** For base line environmental data generation, following locations were selected in the core and buffer zone of the project covering mine effluent, surface water, and ground water of the area. The details of locations are given below in table - 18.3(a).

  
 Unit Manager  
 Chhat Sio Area, SEI  
 Raigarh Area

Table-18.3(a)

Sl. No.	Location	Direction (w.r.L centre of core zone)	Distance (km)	Reasons for selection
1.0	Bore well , Lat village (CW1)	East	0.5	To assess the well water quality within mine area
2.0	Mand river water U/S (CW2)	North	1.0	To assess the river water quality before contamination with mine discharge
3.0	Mand river water D/S (CW3)	South west	1.0	To assess the river water quality after contamination with mine discharge
4.0	Mine water (CW4)	West	0.5	To assess the mine water quality

c) **Water quality status;** The summarised water quality data generated for the period Apr. – June 2012 is given below in tables 18.3(b), 18.3(c), 18.3(d) & 18.3(e) respectively. The water quality data of different locations are found to be within the permissible limit of CPCB.

**SUMMARISED WATER QUALITY DATA**  
Table 18.3(b) Period-Apr. 12 to June.12

Location	Parameters	Result	Permissible as per IS 10500
Bore well water , Lat village (CW1)	pH	6.40 – 6.52	6.5 to 8.5
	Fluoride (mg / l)	0.34 - 0.39	1.0
	Dissolved solids (mg / l)	230 - 250	500
	Nitrates (mg / l)	5.65 – 5.81	45
	Iron(mg / l)	0.22 – 0.24	0.0
	Chlorides (mg / l)	22 - 26	250
	Sulphates (mg / l)	38 - 47	200

Table 18.3(c) Period-Apr. 12 to June.12

Location	Parameters As per GSR 742(E) dated 25.9.2000	Result	Permissible limit as per GSR 422(E) (Inland surface water)
River water U/S ( CW 2)	pH	7.127- 7.37	5.5-9.0
	Total suspended solids (mg/l)	47 - 52	100
	COD(mg/l)	50 - 67	250
	Oil & Grease (mg/l)	Nil	10

Table 18.3(d) Period-Apr. 12 to June.12

Location	Parameters As per GSR 742(E) dated 25.9.2000	Result	Permissible limit as per GSR 422(E) (Inland surface water)
River water D/S ( CW 3)	pH	7.56 - 7.65	5.5-9.0
	Total suspended solids (mg/l)	50 - 63	100
	COD(mg/l)	105 - 115	250
	Oil & Grease trap(mg/l)	Nil	10

Table 18.3(e) Period-Apr. 12 to June.12

Location	Parameters As per GSR 742(E) dated 25.9.2000	Result	Permissible limit As per GSR 742(E) dated 25.9.2000
Mine water ( CW 4)	pH	7.18 - 7.25	5.5-9.0
	Total suspended solids (mg/l)	34 - 45	100
	COD(mg/l)	35 - 58	250
	Oil & Grease trap(mg/l)	Nil	10

Ground water quality in all the two locations found to be conforming drinking water standard as per IS 10500 and the quality of river water which receives treated mine discharge water through nearby local streams satisfies the standards as per GSR 742(E).

#### d) Measures for control of pollution

##### Management of surface water drainage:-

Garland drainage will be made around the periphery of the quarry. These drains will be connected to local nala which are not likely to be disturbed by mining operation. In the workings, heavy duty pumps will be deployed in rainy season which after passing through settling ponds will throw the accumulated water from the working face into these garland drains.

##### Mine Water Discharge

The collected water at the floor of mine sump (351551cum capacity) will be pumped to the settling tank where suspended solids will get settled. The clear water after sedimentation & treatment will be reused for water sprinkling, plantation & agriculture purpose, ground water recharge & for use by the local villagers etc. Workshop effluents will be discharged through Oil and Grease trap and sedimentation tank.

##### Domestic Effluent Treatment:-

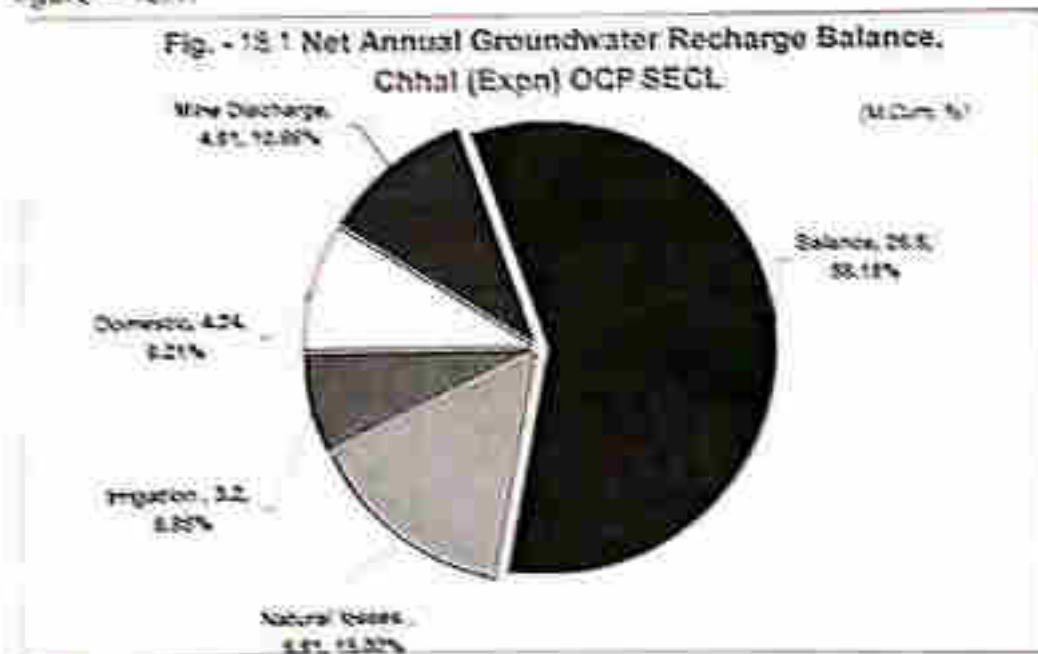
Domestic effluent from the colony will be treated in a conventional septic tank and soak pit arrangement.

**Water Conservation:** -

The waste water recycling after due treatment for the purpose mentioned above will enable conservation of water. Storage of conserved water in mine pits will be given due emphasis to provide water round the year and quality of water will be maintained.

**e) Water balance of the area (from EMP)**

**Groundwater Recharge Balance:** The net groundwater recharge and draft for the buffer zone were estimated as 39.15 M.Cum and 12.35 M.Cum respectively. Thus, about 26.80 M.Cum groundwater recharge would be available annually in the area to meet any future demand. The detailed groundwater balance is shown in the following pie diagram in figure - 18.1.



**f) Acid mine drainage source (if any), the existing practice of control and future plan.**

The existing mine water quality of the nearby mines are not acidic and it is expected the acid mine drainage problem will not arise in the project also. If however acid mine drainage problem arises suitable measures will be taken as per standard prevailing practice.

*(Signature)*  
 Chief S.D. Area SECL  
 Reserve Area

- g) Underground water/ quarry water management after closure (specify its usage like domestic water supply, irrigation, pisciculture or stabilizing the ground water regime).

- Already discussed in para 18.1.1 d above.

- h) Water quality monitoring for three years after closure (specify the monitoring sampling station and frequency). The sampling stations shall be one no. mine water with quarterly frequency and two numbers ground water samples in core and buffer zone with quarterly frequency.

Regular monitoring is being done in & around the mine on the following monitoring stations and will continue up to 3 years after closure of the mine. Presently, water quality monitoring is being done on six locations. These locations were selected in the core and buffer zone of the project covering mine effluent, surface water, and ground water of the area. The details of locations are given below in table – 18.4.

Table – 18.4

Sl. No.	Details of Location
1	Mine Discharge water
2	Jamunia Nala (Up-stream)
3	Jamunia Nala (Down-stream)
4	Drinking water of Chhal GH
5	WTP Water of Dharam UG
6	Bheri Village Hand pump water

Three sampling points will be utilized for water quality monitoring for three years after closure of the mine. Frequency will be as per guide line.

### 18.3 Air quality management:-

- a) Air quality (Monitored data) Monitoring for next three years will be done. 3 samples at quarterly frequency for 3 years. One sample will be at core zone and one sample each in upwind and downwind directions of the project.

Regular environment monitoring is being done in & around the mine on the above monitoring stations and will continue up to 3 years after closure of the mine.

Presently, the following six monitoring stations are fixed on the basis of physiography of the area, meteorological parameters like predominant wind direction, wind speed etc.

Table – 18.5

Sl. No.	Details of Location
1	Manager's Office, Chhal OC
2	Primary School at Lal village
3	Loading point at Chhal OC
4	Manager's Office, Chhal UG
5	Near tippler, Chhal UG
6	Nawapara Village

On the above, three sampling points will be utilized for air quality monitoring for three years after closure of the mine. Frequency will be as per guide line.

#### b) Ambient Air quality in core and buffer zone

Base line environmental data generated for the period April, 12 to June, 12 in respect of SPM, RPM, SO<sub>2</sub>, & NO<sub>x</sub> for different locations are shown in the following tables 18.6 (a) & 18.6 (b). The locations were selected on the basis of physiography of the area, meteorological parameters like predominant wind direction, wind speed etc. This data will enable to obtain a comprehensive idea of air quality in and around the mining area. The data under different category are within the permissible limit of CPCB.

Table 18.6 (a)

Sl. No.	Location	Distance (km)	Direction	Reasons for selection
		(W.r.t. centre of core zone)		
1.0	Mine office (CA-1)	-	Core zone	To assess pollution levels in the mining area.
2.0	Chhal village (CA <sub>2</sub> )	3.5	North-northeast	To assess pollution levels in the village area
3.0	Khedapali village (CA <sub>3</sub> )	2.5	East - south east	To assess the pollution levels in the village area.
4.0	Eidu village (CA <sub>4</sub> )	3.5	South - south east	To assess the pollution levels in the village area in the down-wind direction.
5.0	Lal village (CA <sub>5</sub> )	0.5	Within mine area	To assess pollution levels in the village within mining area.
6.0	Nandgaon village (CA <sub>6</sub> )	2.0	North west	To assess the pollution levels in the village area in the up-wind direction as control station.

Table 18.6(b) Summserised Air Quality Data

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 SUD Area Manager  
 Chhal Sub Area, SEQ  
 Raigarh Area

Period: Oct, 12 – Dec, 12 (Values are in  $\mu\text{g}/\text{m}^3$ )

Name of monitoring equipment used			SPM Respirable Dust Sampler			RPM Respirable Dust Sampler			SO <sub>2</sub> Respirable Dust Sampler			NO <sub>x</sub> Respirable Dust Sampler			Pb**		
Equipment sensitivity																	
Permissible AAQ standard (CPCB)																	
		R	200			100			80			50					
		I	500			250			120			120					
		S	100			25			30			30					
Monitoring Location	No. of samples Drawn	Category* (R, I, S)	Min	Max	98 % tile	Min	Max	98 % tile	Min	Max	98 % tile	Min	Max	98 % tile	Min	Max	98 % tile
Core zone																	
(1)GA1	***	I	245	269	268	107	116	114	17	24	23	18	25	24	-	-	-
Buffer Zone																	
(2)CA2	***	R	157	169	158	72	79	78	15	19	18	17	20	20	-	-	-
(3)CA3	***	R	160	169	169	78	87	75	16	19	18	15	20	19	-	-	-
(4)CA4	***	R	162	169	169	78	85	82	17	20	19	17	22	22	-	-	-
(5)CA5	***	R	158	167	167	76	85	83	16	19	19	15	20	19	-	-	-
(6)CA6	***	R	150	163	163	64	76	76	13	17	17	15	19	19	-	-	-

\*\*\* 24 samples for SPM / RPM and 72 samples for SO<sub>2</sub> / NO<sub>x</sub>.

\*R = Residential; I = Industrial;

In general, all SPM, RPM SO<sub>2</sub> and NO<sub>x</sub> values are found to be well within the prescribed limits of CPCB for Residential and rural area.**c) Proposed Air Quality Management (if needed)**

Following air pollution control measures will be practiced within the mining area and at coal handling plants and railway siding site.

1. Water spraying will be done regularly on approach roads within the mining area to minimise the dust generation.
2. Water sprinkling arrangement will be provided at the transfer point of coal.
3. Intensive plantation of adequate width all along the haul road and other road will be raised to minimise transport generated pollutants.
4. CHP will be provided with dust extraction arrangements.
5. Minimising the transport of coal from the crusher house to silo loading system, belt conveyor has been provided.
6. Coal transportation to railway siding will be done in covered trucks.
7. Exposed overburden dumps will be covered through an appropriate plantation.
8. Optimum blast hole geometry will be followed to reduce the dust during blasting.
9. Regular monitoring of ambient air quality of project area.

**16.4 Waste disposal :-**

- n) External OB dump & internal backfilling details (specify the reclaimed backfilled area, area of voids for water reservoir and also the OB dump area height and volume) prior to closure of mine or during progressive mine closure (as the case be).

The total volume of OB has been estimated as 848.50 Mcum, out of which 780.55 MCum is planned to place in internal dump and 71.52 MCum in external dump. The external and internal dumps involve 130.73Ha and 677.82Ha. of land. The balance left out mine area will be 81.00 Ha. which will act as water reservoir and will be utilised as water resource by the local population after mine closure.

Maximum height of internal dump will be upto 90m (above ground level)

Slope of waste bench of internal dump	-	37 degrees
Height of individual bench	-	30 m
Width of berm.	-	30 m

**b) Stabilization of external O.B. dumps and backfilled area (Technical Reclamation)**

Technical reclamation would involve breaking and levelling the top of OB dumps, filling of gulleys and terracing etc. The maximum depth of the project will be 300 m. Initially, upto 6<sup>th</sup> year OB (71.52MCum) will be dumped externally in 130.73 Ha. land. Internal dumping will continue from 6<sup>th</sup> year onwards. The technical reclamation of backfilled dump will start from 4<sup>th</sup> year onwards. It involves levelling of backfilled dump by means of dozers keeping a mild slope of about 1 in 200 for surface-water drainage for plantation and other recreational purposes.

Initially, to the extent possible, top soil will be removed and stored separately. Subsequently this soil will be directly spread over the leveled graded backfilled spoil for reclamation of the quarried out land. Biological reclamation work will follow in next progressive year.

The estimated life of the mine is 30 years. Maximum height of the external & internal dump would be 90m from the ground level. Final depth of the quarry would be about 300m from ground level. Approximate total no. of plants are estimated as 2685525 Nos. in which about 1985025 nos. of plants would be planted in internal dump. An area of 81 Ha. would be left as final void/water body after mine closure.

The final stage reclamation plan & cross-section thereof are shown in figures – 16.2 & 16.3 respectively of Chapter – XVI.

Year wise programme of OB removal, dumping, & plantation has been given in table 16.16 of Chapter – XVI.



**c) Top soil / soil amendment application**

The stock piling of top soil will be as follows:

- i) Top soil and other materials removed shall be stock-piled only when it is impractical to promptly redistribute such materials on regraded areas.
- ii) Stock-piled materials shall be selectively placed on a stable area, not disturbed, and protected from wind and water erosion, unnecessary compaction, and contaminants which lessen the capability of the materials to support vegetation when redistributed.
- iii) After the final grading the topsoil would be redistributed in a manner that achieves an approximate uniform stable thickness consistent with the post mining land uses, contours, and surface water drainage system.

**d) Plantation on external & backfilled area, avenue and block plantation with type of plantation i.e. local/native species. Name the local species for plantation.****Green belt on dumps:-**

After technical reclamation of OB dumps and redistribution of top soil over it, the dumps will be biologically reclaimed followed by plantation as details shown in table 18.5 above. About 1841075 nos. of plants would be planted over internal dump and plantation will continue after mine closure for 3 years.

**Green Belt Around Mine: -**

In the directions where natural forest does not exist, there is need for creating green belt of adequate width as an effective dust and sight curtain in the periphery of mining area. The trees planted in the green belt area shall act as buffers and shock absorber against dusts, noise and stone flying. The trees in the green belt will be tall, wind firm, broad leaved and evergreen.

**Haul Roads:-**

A green belt of adequate width on either side of the haul road will be raised and the existing vegetation will be protected. The plants will be raised at spacing of 2.0x2.0 m.

**All other roads: -**

Along the roads other than the haul roads also, dust resistant plants will be planted.

**Infrastructural Facilities (Nursery):-**

A nursery is a prerequisite for supply of seedlings of suitable species of right size to the extent required. Rajya Van Vikas Nigam may be contracted for the above supply.

**Species for plantation:-**

- **Fruit bearing trees**
  - Jamun, Mango, Imli, Sitaphal, Bel, Ganga Imli, etc.
- **Medicinal trees**
  - Neemi, Karanj, Harra, Behara, Aonla, Arjun, Shikakai, Mahua, Kusum.
- **Timber value trees**
  - Teak, Shivan / Ghamar, Sissoo, Sisham, Safed Sius, Bamboo, Peltaforum, Babool.
- **Ornamental trees**
  - Gulmohur, Kachnar, Amaltas, Saptapami, Grevelia, Peepal, Palm tree.

**e) Disposal of Coal beneficiation process reject.**

There is no coal beneficiation except silo proposed in Chhal OC (Seam III) Expansion Project.

**18.5 Details of surface structures proposed for dismantling (brief description) ( Unless used in a gainful way )****a) Industrial / mine structures**

The CHP, Workshop, Managers & Pit Offices will be dismantled unless otherwise gainfully utilized by company, State Govt. /Local Body.

**b) Residential Buildings**

Will be handed over to closest project.

**c) Service buildings**

Dispensary, telephone exchange, sub area Managers Office, Store will be handed over to closest project.

**d) Telephone Cables**

Telephone cables will be removed for re-use in other projects of the area, as far as practicable.

**e) Sub-stations**

Will be dismantled and equipment will be gainfully utilized in other projects.

**f) Transformers**

Will be dismantled and equipment will be gainfully utilized in other projects.

**g) Community Services:** Will be handed over to the local authorities.

**h) Water line:** Will be handed over to the local authorities.

**i) Water Treatment Plants:** Will be handed over to the local authorities.

**j) Rly. Siding:** There is no Rly. siding in the mine area.

**k) ETP/STP:** Will be handed over to the local authorities.

**l) Power line:** Will be dismantled.

**18.6 Disposal of Plants & Machineries.**


Table-18.7

S No.	Particulars	Proposed Disposal Practice
a	Disposal or reuse of existing HEMM, CHP, workshop and railway siding for OC.	HEMM and other equipments will be transferred to other project as per requirement.
b	Disposal or reuse of haulage system, ventilation, CHP, workshop, and railway siding for UG.	Structure Will be dismantled & its equipment will be gainfully reused in other project

E.L.V, OMPDI

Job No. 504024

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12  
  
 Sub Area Manager,  
 Ohhal Sub Area, SER,  
 Raigarh Area

c	Disposal or rouse of transmission and sub-station.	- Do -
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### 18.7 Safety and security arrangement

Table- 18.8


S No.	Particulars	Proposed Disposal Practice
a	Details of fencing around abandoned quarry indicating the length of the fencing.	In the last there will be a void of 197.19-Ha.
b	Mine entry sealing arrangements and subsidence management for UG mines. Sealing details and dimensions shall also be provided.	- Not applicable.
c	Providing one time lighting arrangement.	Will be provided.
d	Slope stability arrangement for high wall and back filled dumps.	Not applicable.

**NOTE:** However, possibility shall be explored for handing over the residential & non-residential buildings and other infrastructures including the reclaimed land to state govt. for the benefit of local villagers and strengthening the area infrastructures. The end use of these facilities shall be decided by State Govt. with the help of local govt. and Village Panchayat.

### 18.8 Economic Repercussions of closure of mine

**18.8.1 Manpower of the Project-** Proposed manpower requirement of the extension project for different options are as under,

- Departmental option – 1916 Nos.
- Outsourcing option – 296 Nos.

  
 I.V.G.M.(M)/SUI Area Management  
 Chhal Sub Area, SEC  
 Raigarh Area

R.V. CMPDI

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## 18.6.2 Assessment of Income Scenario of Local People

Table – 18.9

Sl. No.	Particulars	Proposed Disposal Practice
a	Number of local employees redeployed in other projects of the company till their superannuation	All manpower including local employees in the role of SECL will be engaged in other projects of SECL till their superannuation.
b	Approximate no. of people engaged in indirect employment / ancillary activities	This number would vary. It would be about 3 to 4 times of departmental employees. They would find no financial loss due to the mine closure as their activities will be shifted in the new or expansion mines located in the same or other coalfield area.
c	Resettlement / Redeployment of a & b.	(i) Decided by the company. (ii) Will be decided in consultation with local authority if required.
d	If no redeployment is possible then sustenance plan. i) Compensation for losing employment or income. ii) Vocational training for continuance / sustenance of income level	Affected persons would be given vocational and skill development training for continuance / sustenance of income level.
e	Views of society and expectation on closure of mine.	Society's anxiety is limited to assurance about continuation of employment opportunities and availability of civic amenities presently provided by mine management. The employment opportunities will remain available, albeit in other nearby projects. Civic amenities will also be available as the infrastructure for same will be handed over to State Government for future use of society.

**NOTE:** It is proposed that reclaimed and afforested land will be handed over to State Forest Dept for the benefit of local ecosystem. The forest wealth can also be utilized by local people or tribal in the form of fruits and fodders. The water reservoir in the mine voids will be utilized for pisciculture, irrigation, domestic drinking water or stabilizing the ground water regime. Landscaping during closure of mine will make the spot for tourist attraction.

  
 U. S. M. (M)/SUD Area Manager  
 Chhal Sub Area, SECL  
 Raigarh Area

Job No. 504024

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R.V. CMPDI

### 18.9 Time Schedule

The closure of mines involves environmental, technical, social aspect and financial assurance for implementing the post closure activities as per guidelines of Ministry of Coal. The post closure implementing activities will run for three years. The following activities will be implemented as per bar chart. The manpower for implementing the above activities with time bound manner will be provided.

Figure- 18.2

Sl. No.	Activities	Time Frame	Half Yearly					
			1	2	3	4	5	6
1.	Preparation of Survey & Disposal Report	6 months	■					
2.	Slope Stability study for high walls and internal backfilled dumps	-	Not Applicable					
3.	Disposal of P&M including HEMM, CHP, W/S, Siding	2 and half years	■	■	■	■	■	
4.	Backfilling of mined out Area ( OC )	2 years	■	■	■	■		
5.	Dismantling of Industrial structure	2 years	■	■	■	■		
6.	Grading & dozing of high walls for OC	2 years	■	■	■	■		
7.	Fencing of quarry	2 years	■	■	■	■		
8.	Clearing of Coal Stock and Infrastructural Area.	2 years	■	■	■	■		
9.	Disposal / Dismantling of Residential colony	2 & 1/2 years	■	■	■	■	■	
10.	Plantation & landscaping on backfilled area.	3 years	■	■	■	■	■	
11.	Plantation over cleaned land of Infrastructure.	from 2 <sup>nd</sup> year			■	■	■	■
12.	Sealing of mine entries for UG mine	from 2 <sup>nd</sup> year	Not Applicable					
13.	Environmental Monitoring	3 years	■	■	■	■	■	■
14.	Subsidence Management for U/G	3 years	Not Applicable					
15.	Post closure subsidence monitoring for UG	3 years	Not Applicable					
16.	Any project specific activities	Nil						

NOTE: The progressive mine closure will be done as per the calendar plan of the project for technical and biological reclamation of dumps and internal voids.

### 18.10 Mine Closure Cost

18.10.1 The mine closure cost will cover the following activities for which a corpus escrow account @ Rs. 6.0 lakhs per Ha. for OCP & @ Rs. 1.0 lakh per Ha for UG mine of the project area shall be opened with the coal controller organization. In case of mines having acid mine drainage, post closure acid mine drainage management cost shall also be included in the total closure cost.

### 18.10.2 Mine Closure Cost for OC mine

As per the guidelines of the MoC, the cost of the mine closure is to be computed based on the basis of project area involved in the project. In Chhal OC (Seam III), the total mining lease area is 1226.67 Ha. So, the closure cost is to be computed considering a total project area of 1342.86 Ha. Considering the wholesale price index as 171.6 as on May 2013, the updated cost of the mine closure is estimated to be Rs. 7.94 lakhs per hectare considering the admissible escalation over Rs. 6.00 lakh per Ha as on August 2009 when wholesale price index was 129.60.

Total Final mine closure cost (@ Rs.7.94/Ha.):Rs. 10662.31lakhs upto two decimal place.

### 18.10.3 The detail of escrow account

The current value of corpus is Rs. 10662.31 Lakhs (as on May, 2013). This corpus is to be divided by balance life of mine. Since, this is a running mine and the balance life after expansion is estimated as 30 years as on 01/04/2013, the annual corpus comes to Rs. 355.41 Lakhs (up to two decimal place) by dividing 30 years. This amount is to be deposited in escrow account every year.

**Fund to be deposited in escrow account:** Year wise amount to be deposited has been given below in table 18.10.


  
D.V.G.M. (M) SUD Area Manager  
Chhal Sub Area, SEC  
Raigarh Area

Table - 18.10

Year	Fund Deposited in Escrow Fund	Fund to be Reimbursed (Maximum)	
1	355.41	Nil	(-) accrued interest as applicable
2	373.18	Nil	
3	351.84	Nil	
4	411.43	Nil	
5	432.00	Nil	
<b>Phase-1 Total</b>	<b>1963.86</b>	<b>1571.09</b>	
6	453.60	Nil	
7	476.28	Nil	
8	500.10	Nil	
9	525.10	Nil	
10	551.56	Nil	
<b>Phase-2 Total</b>	<b>2506.44</b>	<b>2005.16</b>	
11	578.93	Nil	
12	607.87	Nil	
13	638.27	Nil	
14	670.18	Nil	
15	703.69	Nil	
<b>Phase-3 Total</b>	<b>3198.93</b>	<b>2559.14</b>	
16	738.87	Nil	
17	775.82	Nil	
18	814.61	Nil	
19	855.34	Nil	
20	898.10	Nil	
<b>Phase-4 Total</b>	<b>4082.73</b>	<b>3266.19</b>	
21	943.01	Nil	
22	990.16	Nil	
23	1039.67	Nil	
24	1091.55	Nil	
25	1145.23	Nil	
<b>Phase-5 Total</b>	<b>5210.72</b>	<b>4168.57</b>	
26	1203.54	Nil	
27	1263.72	Nil	
28	1325.91	Nil	
29	1393.25	Nil	
30	1462.92	Nil	
<b>Final Stage- Total</b>	<b>6650.34</b>	<b>5320.27</b>	
<b>Grand Total</b>	<b>23613.03</b>		



**18.10.3 Tentative Final Mine Closure Activities & Cost Break-up:**

The break-up of some major mine closure activities alongwith their tentative estimation of cost in terms of percentages of the total mine closure cost has been indicated in Table-18.11 below. The detailed activity schedule for the 'Final Mine Closure Plan' would be prepared five years before the intended final closure of the mine along with the detailed mine closure cost break-up.

**Table 18.11**  
**TENTATIVE MINE CLOSURE ACTIVITIES & COST BREAK-UP**  
 Type of mine: Open cast      Production Capacity: 6.0 MTY  
 Mining Lease Area: 1342.855 Ha.      Depth of the mine: 300m

Sl. No.	Major Closure Activities	Quantity	% of Total Closure Cost
<b>A</b>	<b>Dismantling of Structures</b>		
	Service Buildings		0.20
	Residential Buildings		2.67
	Industrial Structures i.e. workshop complex, 33kv/3.3kv Sub-Station, Unit Stores, Security Barrack		0.30
<b>B</b>	<b>Permanent fencing of mine void &amp; other dangerous areas</b>		
	Random rubble masonry of height 1.2m including levelling up in cement concrete 1:6:12 in mud mortar.		1.50
<b>C</b>	<b>Grading of highwall slopes</b>		
	Levelling & grading of highwall slopes		1.77
<b>D</b>	<b>OB Dump Reclamation</b>		
	Handling/Dozing of external OB dump into mine void.		88.68
	Bio-reclamation including soil spreading, plantation & maintenance.		0.00
<b>E</b>	<b>Landscaping</b>		
	Landscaping of the cleared land for improving its esthetic		0.30
<b>F</b>	<b>Plantation</b>		
	Plantation over area obtained after dismantling.		0.50
	Plantation around fencing.		0.20
	Plantation over the cleared off external OB dump.		0.00
<b>G</b>	<b>Monitoring / testing of environmental parameters for three years.</b>		
	Air quality		0.22
	Water quality		0.20
<b>H</b>	<b>Entrepreneurship development (vocational and skill development training for sustainable income of affected people)</b>		0.28
<b>I</b>	<b>Miscellaneous &amp; other mitigative measures</b>		2.60
<b>J</b>	<b>Manpower Cost for supervision</b>		0.80
	<b>Total (%)</b>		<b>100.00</b>

*[Handwritten Signature]*  
 Chhal (6.0 MTY)  
 Mining Area

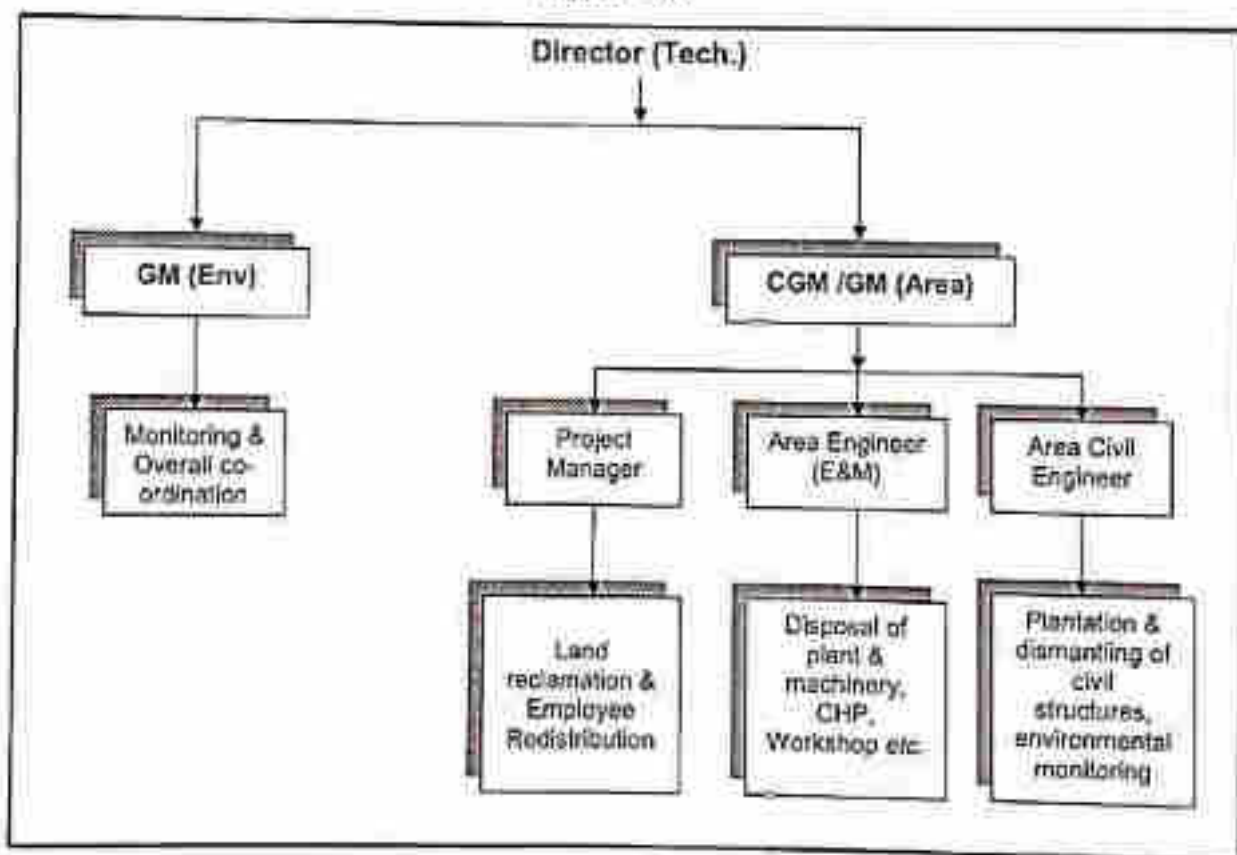
**NOTE:** The above cost expenditures will be met from the corpus escrow account deposited by the mine operator. In case of mines having acid mine drainage, post closure acid mine drainage management cost shall also be included in the total closure cost.

However, the additional amount beyond the escrow account will be provided by the mine operator after estimating the final mine closure cost five years prior to mine closure (as per the mine closure guideline).

### 18.11 Implementation Protocol

For implementing the mine closure activities, the following organisational structure has been proposed:

Figure 18.3



Environmental monitoring for three years after closure of mine will be carried out to evaluate the environmental quality of the area. If needed, proper mitigation measures will be taken up after evaluating the environmental quality. The funds for this have been provided in the cost estimate. Before closure of the mine, Area GM will prepare survey and disposal report and the same will be submitted to DGMS for acceptance.



South Eastern Coalfields Limited  
"A Mini Ratna Company"  
A Subsidiary of Coal India Ltd.)  
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E-mail - seclrgb@gmail.com

ANNEXURE-06

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/51

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition A(x) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall carry out the undermentioned activities in the mining lease area of the project as per the approved soil & moisture conservation Plan.

- (a) Mitigative measures to minimize soil erosion and choking of stream shall be implemented within a period of three years with effect from the issue of Stage-II clearance in accordance with the approved Plan in consultation with the State Forest Department.
- (b) Planting of adequate drought hardy plant species and sowing of seeds, in the appropriate area within the mining lease to arrest soil erosion in accordance with the approved scheme.
- (c) Construction of check dams, retention /toe walls to arrest sliding down of the excavated material along the contour in accordance with the approved scheme.
- (d) Stabilize the overburden dumps by appropriate grading/benching, in accordance with the approved scheme, so as to ensure that angles of repose at any given place is less than 28°; and
- (e) No damage shall be caused to the top-soil and will follow the top soil management plan.

  
General Manager,  
Raigarh Area, SECL  
General Manager  
राईगाँव, रा. क्षेत्र  
SECL, Raigarh Area



South Eastern Coalfields Limited  
"A Mini Ratna Company"  
A Subsidiary of Coal India Ltd.)  
Chhote Anamada, Raigarh-495006  
G.M. Office (forest & Env't)  
Website: [www.secl.gov.in](http://www.secl.gov.in)

fax NO. - 07762-223152  
Tel NO. - 07762-223008  
M.NO. - 9425222388  
E-mail - [seclgh@gmail.com](mailto:seclgh@gmail.com)

ANNEXURE-07

CIN-U10102CT1985GO1903161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/52

Date: - 12/10/2022

## //UNDERTAKING//

In reference to condition A(xi) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CG, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall carry out gap plantation and soil & moisture conservation activities through CGRVVN, CG to restock and rejuvenate the degraded open forests (having crown density less than 0.40), if any, located in the area within 100 meters from outer perimeter of the mining lease.

  
General Manager,  
Raigarh Area, SECL  
General Manager,  
राई को. एल. रायगढ़ क्षेत्र  
SECL, Raigarh Area

**SOUTH EASTERN COALFIELDS LIMITED**

**(A MINI RATNA COMPANY)**

**BILASPUR (CHHATTISGARH)**

# **CHHAL OC PROJECT**



**PROJECT REPORT**

**ON**

**DESILTATION OF PONDS**

**LOCATED WITHIN FIVE KM FROM THE CHHAL OC PROJECT**

**DETAILS OF DESILTATION PONDS LOCATED WITHIN FIVE KM FROM CHHAL OC PROJECT**

S. NO.	VILLAGE NAME	Length (m)	Width (m)	Desiltation Depth (m)	Volume (m <sup>3</sup> )	Rate (per m <sup>3</sup> )	Total	GPS LOCATION	
								LATITUDE	LONGITUDE
<b>I MAWAPARA</b>									
1	Bagra Pond	154	66	1.5	15416	194.58	2610483	22°07'00" N	83°02'54" E
2	Pond near weekly Market	71	31	2.0	5491	194.58	1066761	22°07'10" N	83°08'37" E
3	Pond behind Newspaper colony	72	33	2.0	5774	194.58	1113776	22°07'14" N	83°08'28" E
4	Pond near Temple	99	59	2.0	8763	194.58	1704533	22°07'14" N	83°07'43" E
<b>II Boliya</b>									
5	Sodekh Pura	89	48	1.5	7255	194.58	1415318	22°07'13" N	83°09'32" E
6	Lunah	35	70	1.5	3975	194.58	770955	22°07'54" N	83°09'30" E
<b>III CHITAPAU</b>									
7	Nava Pond	55	30	1.5	4125	194.58	802642	22°06'25" N	83°10'07" E
8	Sand Pond	79	58	1.5	5275	194.58	1027348	22°06'28" N	83°10'04" E
<b>IV Gadobahadur</b>									
9	Pond-1	63	51	1.5	4725	194.58	919370	22°07'33" N	83°08'33" E
10	Pond-2	55	48	1.5	4248	194.58	826575	22°07'30" N	83°08'30" E
11	Pond-3	68	54	1.5	5253	194.58	1024463	22°07'47" N	83°08'14" E

Measurement taken <sup>13/11/20</sup>  
By Jomura Poudel Head civil engineer

A.G.M. (Civil) and A. B. M. (Civil)  
Chhal OC Area, SPT  
Kailashpur Area

S. NO.	VILLAGE NAME	Length (m)	Width (m)	Desiltation Depth (m)	Volume (m <sup>3</sup> )	Rate (per m <sup>3</sup> )	Total	GPS LOCATION	
								LATITUDE	LONGITUDE
<b>V Domnara</b>									
12	Lahmoree pond	94	55	1.5	7255	194.58	1508967	22°04'40" N	83°06'01" E
13	Shankar pond	04	67	1.5	8742	194.58	1701018	22°04'45" N	83°05'47" E
<b>VI Farkanara</b>									
14	hutarha pond	178	71	1.5	20826	194.58	4052323	22°05'55" N	83°03'44" E
15	Dandhu pond	61	60	1.5	5490	194.58	1068244	22°05'19" N	83°04'24" E
<b>VII Chhote Pandarmuda</b>									
16	holia sagar	95	65	1.5	9762	194.58	1892296	22°05'04" N	83°04'51" E
17	Kawan mukhalla pond	62	50	1.5	4650	194.58	904792	22°05'12" N	83°05'07" E
<b>VIII AGASMAR</b>									
18	Pond 1	94	60	1.5	8100	194.58	1810761	22°07'45" N	83°05'52" E
<b>IX CHIRPANI</b>									
19	Pond 1	228	50	1.5	17100	194.58	3327318	22°04'07" N	83°05'08" E
<b>X BARBHAINA</b>									
20	NIJA PR MARY SCHOOL	97	65	1.5	9432	194.58	1840240	22°04'17" N	83°04'50" E
21	LINA POND	173	60		15750	194.58	3064635	22°04'03" N	83°05'00" E
<b>XI CHANDRASHEKHARPUR</b>									
22	POND 1	84	81	1.5	10206	194.58	1985883	22°04'16" N	83°07'19" E

*Shubh Chaudhary*

*Signature*  
*Shubh Chaudhary*  
*20/04/2023*  
*1945*

S. NO.	VILLAGE NAME	Length (m)	Width (m)	Desitation Depth (m)	Volume (m <sup>3</sup> )	Rate (per m <sup>3</sup> )	Total	GPS LOCATION	
								LATITUDE	LONGITUDE
<b>XII GURDA</b>									
22	GAIRAMUDA POND	116	90	1.5	15888	194.58	3047122	22°02'56" N	83°09'29" E
<b>XIII CHHAL</b>									
24	NEAR MAA CHANDRAMASINI TEMPLE Pond	55	53	1.5	4372	194.58	852801	22°07'25" N	83°07'16" E
25	JAMUNAR PARA POND	95	72	1.5	10360	194.58	1996390	22°07'43" N	83°07'06" E
26	NEAR BOYS HOSTEL	77	55	1.5	6352	194.58	1239268	22°08'11" N	83°07'11" E
<b>XIV PUNARWAS LAAT</b>									
27	Pond 1	72	50	1.5	5400	194.58	1050732	22°08'30" N	83°07'41" E
<b>XV PUSALDAH</b>									
28	NEAR PRIMARY SCHOOL Pond	80	52	1.5	7020	194.58	1365804	22°05'27" N	83°09'14" E
<b>XVI DEHARI</b>									
29	Pond 1	128	81	1.5	15744	194.58	3083807	22°02'30" N	83°07'51" E
<b>XVII TUMDIN</b>									
30	POND 1	81	61	1.5	7470	194.58	1452064	22°08'57" N	83°05'27" E
<b>XVIII NAGDI</b>									
31	POND 1	96	90	1.5	12960	194.58	2521956	22°07'20" N	83°04'25" E
32	POND 2	88	58	1.5	7742	194.58	1512278	22°07'50" N	83°05'18" E
33	POND 3	80	90	1.5	10800	194.58	2155618	22°07'40" N	83°05'09" E
34	POND 4	116	90	1.5	15888	194.58	3047122	22°07'43" N	83°04'39" E

*Chhal Man*

*Chhal Man*  
 U.K.G.M. (P) / Sub Area Manager  
 Chhal Sub Area, SECI  
 Nalanda Area



S. NO.	VILLAGE NAME	Length (m)	Width (m)	Excavation Depth (m)	Volume (m <sup>3</sup> )	Rate (per m <sup>3</sup> )	Total	GPS LOCATION	
								LATITUDE	LONGITUDE
<b>XII GURDA</b>									
23	DARRAMUDA POND	115	90	1.5	15660	194.58	3047132	22°07'56" N	83°07'29" E
<b>XIII CHHAL</b>									
24	NEAR MAA CHANDRAMASINI TEMPLE Pond	55	53	1.5	4372	194.58	850901	22°07'25" N	83°07'16" E
25	JAMINDAR PARRA POND	95	72	1.5	10260	194.58	1996390	22°07'47" N	83°07'06" E
26	NEAR BOYS HOSTEL	77	55	1.5	6387	194.58	1238068	22°08'11" N	83°07'11" E
<b>XIV PUNAWAS LAAT</b>									
27	Pond 1	72	50	1.5	5100	194.58	1000732	22°08'10" N	83°07'33" E
<b>XV PUSALDAH</b>									
28	NEAR PRIMARY SCHOOL Pond	80	52	1.5	6240	194.58	1215351	22°05'22" N	83°07'16" E
<b>XVI DEHARI</b>									
29	Pond 1	128	57	1.5	11040	194.58	2153457	22°07'36" N	83°07'53" E
<b>XVII TUMIDIR</b>									
30	POND 1	81	48	1.5	5838	194.58	1135244	22°06'57" N	83°07'27" E
<b>XVIII NAGDI</b>									
31	POND 1	95	40	1.5	5700	194.58	1111756	22°07'20" N	83°04'25" E
32	POND 2	48	58	1.5	3742	194.58	727270	22°07'50" N	83°03'18" E
33	POND 3	60	50	1.5	4500	194.58	875910	22°07'45" N	83°03'09" E
34	POND 4	115	23	1.5	3960	194.58	771122	22°07'45" N	83°04'39" E

Official  
Clear - Man

Water Resources Department  
Chhal Sub Area, SECL  
Raigarh Area

S. NO.	VILLAGE NAME	Length (m)	Width (m)	Desitation Depth (m)	Volume (m <sup>3</sup> )	Rate (per m <sup>3</sup> )	Total	GPS LOCATION	
								LATITUDE	LONGITUDE
XIX NANGAON									
35	POND 1	117	66	1.5	11583	194.58	2251820	22°08'48" N	83°05'09" E
XX PUCHHIYAPALI									
36	POND 1	98	48	1.5	7056	194.58	1372256	22°08'11" N	83°03'23" E
37	POND 2	107	64	1.5	10272	194.58	1998726	22°08'11" N	83°03'46" E
TOTAL					28902		3882796		

*Shahid*  
 Measurement taken by  
 Jaganendra Prasad  
 Head Chitral Sub Area

H.C.S. (Chitral Sub Area) Mandan  
 Chitral Sub Area SEC  
 Rajdhar Arin

**NAME OF WORK: DESILTATION OF PONDS / WATER BODIES LOCATED WITHIN FIVE KM FROM THE CHHAL OC PROJECT**

S. NO	DESCRIPTION OF WORK	ESTIMATED AMOUNT			JUSTIFIED AMOUNT (AS PER ANALYSIS)		REMARKS
		QTY M3	RATE (PER M3)	AMOUNT (Rs)	RATE (PER M3)	AMOUNT (Rs)	
1	37 ponds located within 5 km	338642	146.50	49611053	194.58	65892960	Item rate 26.1 as DSOR 2013 & analysis of rate

*Field Measurement taken  
By  
Jyoti Basal  
Head chain Man  
Chhal Sub Area*

*Preparation  
of Bill of Materials  
Chhal Sub Area, SEC  
Raigarh Area*



South Eastern Coalfields Limited  
"A Mini Ratna Company"  
A Subsidiary of Coal India Ltd.)  
Chhote Alarmuda, Raigarh-495006  
G.M. Office (West & East)  
Website: [www.secl.mva.in](http://www.secl.mva.in)

fax NO - 07762-223152  
Tel NO - 07762-222008  
M.NO. - 9425282388  
E-mail - [seclgh@gmail.com](mailto:seclgh@gmail.com)

ANNEXURE-09

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/ 53

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition A(xiii) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall carry out the undermentioned activities at the project cost for the management of safety zone as per the relevant guidelines issued by the MOEF & CC.

- (a) Ensure demarcation of safety zone (7.5-meter strip all along the inner boundary of the mining lease area), and its fencing, protection and regeneration by erecting adequate number of 6 feet high RCC boundary pillars inscribed with DGPS coordinates with barbed wire fencing and deploying adequate number of watchers under the supervision of the State Forest Department.
- (b) Boundary of the safety zone of the mining lease, adjacent to habitation/roads shall be properly fenced.
- (c) Safety zone shall be maintained as green belt around mining lease and to ensure dense canopy in the area, regeneration shall be taken up in this area at the project cost under the supervision of the State Forest Department.
- (d) Along with the State Forest Department shall ensure that safety zone is maintained as per the prescribed norms.
- (e) Deposit the cost of felling of trees with the State Forest Department.

  
General Manager,  
Raigarh Area, SECL  
SECL, Raigarh Area



## कार्यालय कलेक्टर (मू-अभिलेख शाखा), रायगढ़ (छ.ग.)

सूचनांक / 1720 / स.नि.का. / 2014  
प्रति

रायगढ़ दिनांक 22 / 12 / 2014

मुख्य वन संरक्षक (मू-प्रबंध)  
एवं नोडल अधिकारी वन संरक्षण अधिनियम  
अनुसार भवन मेडिकल कॉलेज रोड  
रायपुर (छ.ग.)

विषय :-

एलईसीएल रायगढ़ क्षेत्र की प्रस्तावित छाल खुली कोयला खदान SEAM - III परियोजना (0 MATV) में स्थित कुल वन भूमि 185.017 हे० में स्थित राजस्व वन भूमि 8.307 हे० का अनापत्ति प्रमाण-पत्र गैर वानिकीय उपयोग हेतु प्रदाय करने का कार्य ।

संदर्भ :-

कार्यालय महाप्रबंधक एलईसीएल रायगढ़ क्षेत्र की पत्र सं. 1846 दिनांक 12.03.2014

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विषयसंबंधित संदर्भित पत्र द्वारा तहसील धरमजयगढ़ के ग्राम खेदापाली के राजस्व वन भूमि छोटे झाड़ के जंगल खसरा नंबर 5/2, 0.980 हे. एवं 85/2क, 7.886 हे. रकबा कुल रकबा 8.307 हे. का गैर वानिकीय उपयोग हेतु अनापत्ति प्रमाण-पत्र जारी किया है।

उपरोक्त आवेदित भूमि के संबंध में अनुविभागीय अधिकारी (रा.) धरमजयगढ़ के प्रतिवेदन अनुसार अनापत्ति प्रमाण-पत्र दिये जाने हेतु प्रकरण प्रस्तुत किया गया है।

अतः अनुविभागीय अधिकारी (रा.) धरमजयगढ़ के अनापत्ति प्रमाण-पत्र के अनुशंसा अनुसार आवेदित ग्राम खेदापाली तहसील धरमजयगढ़ के कुल खसरा नंबर 02 कुल रकबा 8.307 हे. राजस्व वन भूमि छोटे झाड़ का जंगल को गैर वानिकीय उपयोग हेतु वन संरक्षण अधिनियम 1980 तहत नियमानुसार गैरवानिकी/व्यपवर्तन हेतु उच्च कार्यालय की आवेदन प्रस्तुत करने पर इस कार्यालय को कोई आपत्ति नहीं है।

अनापत्ति देने का तात्पर्य यह कदापि नहीं माना जावेगा कि उपरोक्त भूमि आवेदक विमान को हस्तांतरित करने का निर्णय लिया जा भूषण है।

कलेक्टर

रायगढ़ (छ.ग.)

रायगढ़ दिनांक / 22 / 12 / 2014

सूचनांक / 1720 / स.नि.का. / 2014

प्रतिनिधि :-

महाप्रबंधक एलईसीएल रायगढ़ क्षेत्र को सूचनांक ।

कलेक्टर

रायगढ़ (छ.ग.)

NO (10-11)



## कार्यालय कलेक्टर भू-अभिलेख रायगढ़ (छ.ग.)

क्रमांक / 232 / स.अ.भू.अ. / 2015 रायगढ़ दिनांक 24/02/2015  
प्रति,

अपर प्रधान मुख्य वन संरक्षक (भू-प्रबंध/व.स.अ.)  
अरण्य भवन मेडिकल कालेज रोड  
रायपुर (छ.ग.)

- विषय :- वन संरक्षण अधिनियम 1980 अन्तर्गत व्यपवर्तित की जाने वाले वन भूमि के लिए वन अधिकार अधिनियम 2006 से प्रावधान अनुसार प्रदर्श 'स' प्रदाय करने बाबत।
- संदर्भ :- 1. आपका पत्र क्रं./भू-प्रबंध/खनिज/106/1082 रायपुर दिनांक 14.06.2012  
2. मेसर्स एसईसीएल/रायगढ़/उ.क्षे.प्र./छाल/वन एवं पर्या./15/455 दिनांक 23.02.2015

—00—

विषयांतर्गत महाप्रबंधक एस.ई.सी.एल.रायगढ़ क्षेत्र, छाल उपक्षेत्र द्वारा खुली खदान परियोजना हेतु रायगढ़ जिले के धरमजयगढ़ वन मण्डल के अन्तर्गत ग्राम लात एवं ग्राम खेदापाली तहसील धरमजयगढ़ स्थित वन भूमि कुल रकबा 185.017 हे. गैर वानिकीय उपयोग हेतु वन संरक्षण अधिनियम 1980 के अन्तर्गत व्यपवर्तित की जाने वाली वन भूमि के लिए वन अधिकार अधिनियम 2006 के तहत प्रदर्श "स" में प्रमाण पत्र हेतु आवेदन पत्र प्रस्तुत किया गया है। अनुविभागीय अधिकारी राजस्व धरमजयगढ़ से उपरोक्तानुसार ग्राम लात एवं ग्राम खेदापाली का प्रदर्श "स" में प्रमाण पत्र लिया गया।

अतः अनुविभागीय अधिकारी (रा.) धरमजयगढ़ के प्रमाण पत्र अनुसार प्रदर्श "स" सादर संप्रेषित है।

संलग्न :- उपरोक्तानुसार।

कलेक्टर

रायगढ़ (छ.ग.)

पृ. क्रमांक / 232A / स.अ.भू.अ. / 2015 रायगढ़ दिनांक 24/02/2015  
प्रतिलिपि:-

1. सचिव, छ.ग. शासन एवं आपदा प्रबंधन विभाग, मंत्रालय, महानदी भवन नया रायपुर की ओर सादर सूचनार्थ संप्रेषित।
2. वन मण्डलाधिकारी धरमजयगढ़ को सूचनार्थ।
3. महाप्रबंधक एस.ई.सी.एल. छाल रायगढ़ को सूचनार्थ।

कलेक्टर

रायगढ़ (छ.ग.)



## कार्यालय कलेक्टर (मू-अभिलेख शाखा), रायगढ़ (छ.ग.)

प्रदर्श 'स'

### प्रमाण पत्र

मेसर्स एसईसीएल रायगढ़ क्षेत्र द्वारा प्रस्तावित छाल खुली कोयला खदान Seam-III परियोजना (6 MTY) के लिये 185.017 हे. राजस्व वन भूमि ग्राम लात में वन भूमि 176.710 हे. एवं ग्राम खेदापाली राजस्व वन भूमि 8.307 हे. कुल रकबा 185.017 हे., तहसील धरमजयगढ़ स्थित राजस्व वन भूमि एवं वन भूमि गैरवैज्ञानिकीय उपयोग हेतु वन संरक्षण अधिनियम 1980 के अन्तर्गत व्यपवर्तित की जाने वाली राजस्व वन भूमि के लिए अनुसूचित जनजाति एवं अन्य परंपरागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2006 का पालन प्रतिवेदन अनुविभागीय अधिकारी (रा.) धरमजयगढ़ जिला रायगढ़ के प्रमाण पत्र के आधार पर प्रमाणित किया जाता है :-

1- कि अनुसूचित जनजाति एवं अन्य परंपरागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2006 में नियत संपूर्ण प्रक्रिया का पालन कर अधिकारों को स्थापित किया गया है तथा संपूर्ण प्रस्तावित क्षेत्र की वन भूमि ग्राम लात में वन भूमि 176.710 हे. एवं ग्राम खेदापाली राजस्व वन भूमि 8.307 हे. कुल रकबा 185.017 हे., तहसील धरमजयगढ़ स्थित राजस्व वन भूमि जो इस कार्य हेतु व्यपवर्तित की जानी है, अनुविभागीय अधिकारी (रा.) धरमजयगढ़ के द्वारा प्रस्तुत प्रदर्श 'स' के आधार पर तैयार किया गया है।

ग्राम लात में ग्राम सभा की बैठक एवं उसमें पारित प्रस्ताव दिनांक 02.10.2013 एवं ग्राम खेदापाली में ग्राम सभा की बैठक एवं उसमें पारित प्रस्ताव दिनांक 08.10.2014 (प्रदर्श 'अ') एवं वन तथा राजस्व विभाग का संयुक्त जांच प्रतिवेदन (प्रदर्श 'ब') पर दर्शित है।

2- कि उक्त प्रकरण का प्रस्ताव दिनांक 02.10.2013 को ग्राम लात के श्री रूपसिंह राठिया की अध्यक्षता में हुई ग्राम सभा की बैठक दिनांक 02.10.2013 को रखा गया था, इसमें 60 प्रतिशत ग्राम सभा के तथा ग्राम वन समिति के सदस्य उपस्थित थे एवं ग्राम खेदापाली के श्रीमती पार्वती बाई कंवर की अध्यक्षता में हुई ग्राम सभा की बैठक दिनांक 08.10.2014 को रखा गया था, इसमें 52 प्रतिशत ग्राम सभा के तथा ग्राम वन समिति के सदस्य उपस्थित थे जिनको परियोजना के क्रियान्वयन एवं प्रकरण के पूर्ण विवरण तथा प्रभाव से अवगत कराकर विस्तार से समझाईस हिन्दी एवं स्थानीय भाषा में दी गई।

3- प्रस्तावित राजस्व वन क्षेत्र में प्रदत्त वन अधिकार मान्यता पत्र धारकों की संख्या निम्नानुसार है :-

क्रं.	तहसील का नाम	ग्राम का नाम	वन अधिकार मान्यता पत्र धारक का नाम	खसरा नंबर	रकबा (हे.में.)
1	2	3	4	5	6
			निरक		

4- कि जो भी चर्चा एवं निर्णय लिये गये उन ग्राम सभा के न्यूनतम 50 प्रतिशत सदस्यों की उपस्थिति का कोरम पूर्ण था।

5- कि ऐसे विलुप्त प्राय जनजाति समूह (पी.टी.जी.) के सदस्य व्यपवर्तन हेतु प्रश्नाधीन भूमि पर निवासरत नहीं है, जिसका वन अधिकार " अनुसूचित जनजाति एवं अन्य परंपरागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2006 " की धारा 3 (1) (E) अंतर्गत विशेष कर संरक्षित रखना है।

संलग्न :- उपरोक्तानुसार।

कलेक्टर

एवं

अध्यक्ष- जिला वन अधिकार समिति  
जिला-रायगढ़ (छ.ग.)

मेसर्स एसईसीएल रायगढ़ क्षेत्र की प्रस्तावित छाल खुली कोयला खदान Seam-III परियोजना (6 MTY) के लिये ग्राम लात के वन भूमि 176.710 हेक्टेयर के प्रकरण में अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम, 2006 का पालन प्रतिवेदन।

1. प्रमाणित किया जाता है कि अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम, 2006 में नियत संपूर्ण प्रक्रिया का पालन कर अधिकारों को स्थापित किया गया है तथा संपूर्ण प्रस्तावित क्षेत्र की ग्राम लात के वन भूमि 176.710 हेक्टेयर जो इस कार्य हेतु व्यपवर्तित की जानी है तथा ग्राम लात, तहसील धरमजयगढ़ में स्थित है, में तदनुसार यह कार्यवाही पूर्ण की गई है।

ग्राम सभा की बैठक एवं उसमें पारित प्रस्ताव दिनांक 02 अक्टूबर 2013 को संपन्न ग्राम लात के ग्राम सभा एवं राजस्व विभाग संयुक्त जांच प्रतिवेदन (प्रदर्श-“ब”) दर्शित है।

2. प्रमाणित किया जाता है कि उक्त प्रकरण का प्रस्ताव ग्राम लात के श्री रूपसिंह राठिया की अध्यक्षता में हुई ग्राम सभा की बैठक दिनांक 02 अक्टूबर 2013 में रखा था एवं इसमें 60 प्रतिशत ग्राम सभा के तथा ग्राम वन समिति के सदस्य उपस्थित थे, जिनको परियोजना के क्रियान्वयन एवं प्रकरण के पूर्ण विवरण तथा प्रभाव से अवगत कराकर विस्तार से समझाईस हिन्दी एवं स्थानीय भाषा में दी गई। यह पाया गया कि इस क्षेत्र में उपरोक्त अधिनियम के तहत वन अधिकार की मान्यता पत्र की पात्रता रखने वाले व्यक्ति नहीं है।

अथवा

प्रस्तावित वन क्षेत्र में प्रदत्त वन अधिकार मान्यता पत्र धारकों की संख्या ग्रामवार निम्नानुसार है :-

क्रमांक	ग्राम का नाम	वन अधिकार मान्यता पत्र धारक का नाम	रकबा (हेक्टेयर में)
	निरंक	निरंक	निरंक

3. यह प्रमाणित किया जाता है कि जो भी चर्चा एवं निर्णय लिये गये उसमें ग्राम सभा के न्यूनतम 50 प्रतिशत सदस्यों की उपस्थिति का कोरम पूर्ण था।
4. यह प्रमाणित किया जाता है कि संयुक्त सत्यापन प्रतिवेदन एवं ग्राम सभा के ठहराव प्रस्ताव दिनांक 02 अक्टूबर 2013 अनुसार ऐसे विलुप्तप्राय जनजाति समूह (पी.टी.जी.) के सदस्य व्यपवर्तन हेतु प्रश्नाधीन वन भूमि पर निवासरत नहीं है, जिनका वन अधिकार "अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2006" की धारा 3(1) (e) अन्तर्गत विशेष रूप से संरक्षित रखना है।
5. संयुक्त सत्यापन प्रतिवेदन एवं ग्राम सभा के दिनांक 02 अक्टूबर 2013 के संकल्पों के आधार यह प्रमाणित किया जाता है कि व्यपवर्तन के लिये प्रस्तावित वन भूमि पर अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम, 2006 की धारा 3(2) अन्तर्गत शासन द्वारा संचालित कोई सुविधा विद्यमान नहीं है।

संलग्न :- उपरोक्तानुसार।

(मुकेश बंसल)

कलेक्टर

एवं

अध्यक्ष-जिला वन अधिकार समिति, जिला रायगढ़ (छ.ग.)

दिनांक

23 FEB 2015

अनुविभागीय अधिकारी (राठ)  
धरमजयगढ़



मेसर्स एसईसीएल रायगढ़ क्षेत्र की प्रस्तावित छाल खुली कोयला खदान Seam-III परियोजना (6 MTY) के लिये ग्राम खेदापाली के राजस्व वन भूमि 8.307 हेक्टेयर के प्रकरण में अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम, 2006 का पालन प्रतिवेदन।

1. प्रमाणित किया जाता है कि अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम, 2006 में निर्यत संपूर्ण प्रक्रिया का पालन कर अधिकारों को स्थापित किया गया है तथा संपूर्ण प्रस्तावित क्षेत्र की ग्राम खेदापाली के राजस्व वन भूमि 8.307 हेक्टेयर जो इस कार्य हेतु व्यपवर्तित की जानी है तथा ग्राम खेदापाली, तहसील धरमजयगढ़ में स्थित है, में तदनुसार यह कार्यवाही पूर्ण की गई है।  
ग्राम सभा की बैठक एवं उसमें पारित प्रस्ताव दिनांक 08 अक्टूबर 2014 को संपन्न ग्राम खेदापाली के ग्राम सभा एवं राजस्व विभाग संयुक्त जांच प्रतिवेदन (प्रदर्श-“ब”) दर्शित है।
2. प्रमाणित किया जाता है कि उक्त प्रकरण का प्रस्ताव ग्राम खेदापाली के श्रीमति पार्वती बाई कंवर की अध्यक्षता में हुई ग्राम सभा की बैठक दिनांक 08 अक्टूबर 2014 में रखा था एवं इसमें 52 प्रतिशत ग्राम सभा के तथा ग्राम वन समिति के सदस्य उपस्थित थे, जिनको परियोजना के क्रियान्वयन एवं प्रकरण के पूर्ण विवरण तथा प्रभाव से अवगत कराकर विस्तार से समझाईस हिन्दी एवं स्थानीय भाषा में दी गई। यह पाया गया कि इस क्षेत्र में उपरोक्त अधिनियम के तहत वन अधिकार की मान्यता पत्र की पात्रता रखने वाले व्यक्ति नहीं है।

अथवा

प्रस्तावित वन क्षेत्र में प्रदत्त वन अधिकार मान्यता पत्र धारकों की संख्या ग्रामवार निम्नानुसार है :-

क्रमांक	ग्राम का नाम	वन अधिकार मान्यता पत्र धारक का नाम	रकबा (हेक्टेयर में)
	निरंक	निरंक	निरंक

3. यह प्रमाणित किया जाता है कि जो भी चर्चा एवं निर्णय लिये गये उसमें ग्राम सभा के न्यूनतम 50 प्रतिशत सदस्यों की उपस्थिति का कोरम पूर्ण था।
4. यह प्रमाणित किया जाता है कि संयुक्त सत्यापन प्रतिवेदन एवं ग्राम सभा के ठहराव प्रस्ताव दिनांक 08 अक्टूबर 2014 अनुसार ऐसे विलुप्तप्राय जनजाति समूह (पी.टी.जी.) के सदस्य व्यपवर्तन हेतु प्रश्नाधीन वन भूमि पर निवासरत नहीं है, जिनका वन अधिकार "अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2006" की धारा 3(1) (e) अन्तर्गत विशेष रूप से संरक्षित रखना है।
5. संयुक्त सत्यापन प्रतिवेदन एवं ग्राम सभा के दिनांक 08 अक्टूबर 2014 के संकल्पों के आधार यह प्रमाणित किया जाता है कि व्यपवर्तन के लिये प्रस्तावित वन भूमि पर अनुसूचित जनजाति एवं अन्य परम्परागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम, 2006 की धारा 3(2) अन्तर्गत शासन द्वारा संचालित कोई सुविधा विद्यमान नहीं है।

संलग्न :- उपरोक्तानुसार।

दिनांक

23 FEB 2015

(मुकेश बंसल)

कलेक्टर

एवं


अनुविभागीय अधिकारी(सो), अध्यक्ष-जिला वन अधिकार समिति, जिला रायगढ़ (छ.ग.)  
धरमजयगढ़

कार्यालय, ग्राम पंचायत लात  
तहसिल-धरमजयगढ़, जिला-रायगढ़ (छत्तागढ़)

दिनांक,  
20.3.2022

सहमति/अनापत्ति प्रमाण-पत्र

एस0ई0सी0एल0 के छाल खुली खदान की क्षमता विस्तार 01 मिलियन टन प्रति वर्ष कोयला उत्पादन से 3.5 मिलियन टन प्रति वर्ष कोयला उत्पादन क्षमता हेतु ग्राम पंचायत लात द्वारा सहमति/अनापत्ति पत्र प्रदान की जाती है।

  
सचिव  
ग्राम पंचायत लात  
तहसिल-धरमजयगढ़,  
जिला-रायगढ़ (छत्तागढ़)

मन्तोषी  
सरपंच  
ग्राम पंचायत लात  
तहसिल-धरमजयगढ़  
जिला-रायगढ़ (छत्तागढ़)

क्र	विषय	विवरण
<p>असई सीपल का के सिरा अति अधिक के सवध के</p>	<p>असई वारा सभा के के शासन के द्वारा कुल के परसरावि के परसल खेदापाली के सवध खाला धारी के कांठरी</p>	<p>यह बोली किया गया कि यह खेदापाली 1400 सेकंड वॉटर, जो कि अधिशेद ग्राम वासीयों के अंतर्गत आम वृद्धि को, सिया गार एवं सवध दिया जाए, अंतर यह की यह</p>
<p>असई सी असई वारा अधिकार के सवध के</p>	<p>आज यह सभा नाम के उपरिक्त व्यवस्था ग्राम खेदापाली के आर एवं ग्राम के सवध द्वारा यजनी नाम दिया खाला धार अर्थात् के अंतर दिया गया।</p>	<p>ये यह वार्ड किया गया कि 9 अंतर यह सजा दिया गया कि समस्त वार्ड के अधिकार दिया खाला धार के कांठरी दिया जाए गया कि सजा के अति इस उचित सुवापन दिया जाए। यह सवध एवं सवध पर</p>
	<p>असई वही असई वारा के अंतर दिए गए अंतर के अंतर के अंतर के अंतर के</p>	<p>अति-वार्ड, अंतर एवं दिया गया जाता है तो हम ग्राम वासीयों को</p>

पंचायत  
असई वही  
असई वारा के अंतर  
के अंतर के अंतर के

असई वही  
असई वारा के अंतर  
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असई वही  
असई वारा के अंतर  
के अंतर के अंतर के

1	उपनिषद्	गणेशाय नमः	गणेशाय नमः
2	व्यासयोग	ब्रह्मसूत्र	ब्रह्मसूत्र
3	सामान्य	सामान्य	सामान्य
4	सामान्य	सामान्य	सामान्य
5	सामान्य	सामान्य	सामान्य
6	सामान्य	सामान्य	सामान्य
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9	सामान्य	सामान्य	सामान्य
10	सामान्य	सामान्य	सामान्य
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13	सामान्य	सामान्य	सामान्य
14	सामान्य	सामान्य	सामान्य
15	सामान्य	सामान्य	सामान्य
16	सामान्य	सामान्य	सामान्य
17	सामान्य	सामान्य	सामान्य
18	सामान्य	सामान्य	सामान्य
19	सामान्य	सामान्य	सामान्य
20	सामान्य	सामान्य	सामान्य

श्री गुरुभ्यो नमः

श्री गुरुभ्यो नमः

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श्री गुरुभ्यो नमः

## ग्राम सभा की बैठक का कार्यवाही का विवरण

प्रदर्श-“ब”

ग्राम — लात

दिनांक 02/10/2013

स्थान — पंचायत कार्यालय प्रांगण, लात

आज दिनांक 02/10/2013 को ग्राम—लात, तहसील—धरमजयगढ़, के श्री रूपसिंह राठिया की अध्यक्षता में ग्राम सभा बैठक की सभा আহूत की गई। इस बैठक में ग्राम सभा एवं वन समिति के कुल लगभग 60% सदस्य उपस्थित थे। बैठक में निम्न विषयों पर चर्चा की गई :-

1. मेसर्स साऊथ ईस्टर्न कोलफिल्ड्स लिमिटेड, रायगढ़ क्षेत्र ने ग्राम लात की वन भूमि 176.710 हेक्टेयर के व्यपवर्तन (गैर वानिकी कार्य) के लिये आवेदन पत्र क्रमांक एसईसीएल/उ.क्षे.प्र./छाल उपक्षेत्र/13/3242 दिनांक 29/09/2013 के सहित मांग की गई है। इस प्रस्ताव बावत् विस्तृत चर्चा की गई।
2. प्रस्ताव के लक्ष्य, उद्देश्य एवं लक्ष्य प्रस्तावित व्यपवर्तित किये जाने वाली वन भूमि के उपयोग बावत् ग्राम सभा की बैठक में विस्तृत चर्चा की गई।
3. इस वन भूमि की व्यपवर्तन प्रकरण के परिप्रेक्ष्य में अनुसूचित जनजाति एवं अन्य परंपरागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2006 के नियम एवं प्रावधानों पर चर्चा की गई। जो कुल वन भूमि 176.710 हेक्टेयर गैर वानिकी कार्य के व्यपवर्तन के लिए प्रस्तावित है, में कोई भी आदिवासी, गैर परंपरागत वनवासी इस प्रस्तावित वन भूमि पर कृषि कार्य, आवास या अन्य पारंपरिक गतिविधि सम्पादित नहीं कर रहे हैं एवं कोई भी वन अधिकार (व्यक्तिगत या सामुदायिक) किसी आदिवासी या गैर परंपरागत वनवासी को इस प्रस्तावित वन भूमि पर नहीं दिया गया है।

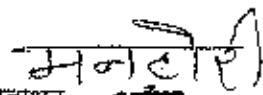
अथवा

आदिवासी/गैर परंपरागत वनवासी व्यक्तियों को वन अधिकार मान्यता पत्र वितरित किया गया है जिसका विवरण पृथक से सूची अनुसार संलग्न है।

अतः यह एकमत से ग्राम सभा में निर्णय लिया गया कि ग्राम —लात की कुल वन भूमि 176.710 हेक्टेयर को गैर वानिकी प्रायोजन हेतु मेसर्स साऊथ ईस्टर्न कोल फिल्ड्स लिमिटेड छाल उपक्षेत्र को अन्य प्रचलित नियमों एवं प्रावधान अनुसार व्यपवर्तित की जाये।

उपस्थित सदस्यगण :-

ग्राम सभा में उपस्थित ग्रामवासियों की सूची एवं हस्ताक्षर संत्यागित कर संलग्न किया गया।

  
हस्ताक्षर ~~सर्वेश~~  
न ~~सर्वेश~~ पंचायत - लात  
(सर्वेश, ग्राम पंचायत लात)  
सील

# ग्राम सभा की बैठक का कार्यवाही का विवरण

प्रदर्श-“ब”

ग्राम - खेदापाली

दिनांक 08/10/2014

स्थान - पंचायत कार्यालय प्रांगण, खेदापाली

आज दिनांक 08/10/2014 को ग्राम-खेदापाली, तहसील-धरमजयगढ़, के श्रीमती पार्वती वाई कवंर की अध्यक्षता में ग्राम सभा बैठक की सभा আহूत की गई। इस बैठक में ग्राम सभा एवं वन समिति के कुल लगभग 300 (52%) सदस्य उपस्थित थे। बैठक में निम्न विषयों पर चर्चा की गई :-

1. ग्राम खेदापाली में आवेदक मेसर्स साऊथ ईस्टर्न कोलफिल्ड्स लिमिटेड, रायगढ़ क्षेत्र ने (गैर वानिकी कार्य) के लिये वन भूमि के व्यपवर्तन हेतु कुल 8.307 हेक्टेयर राजस्व वन भूमि की मांग की गई है। इस प्रस्ताव बावत् विस्तृत चर्चा की गई।
2. प्रस्ताव के लक्ष्य, उद्देश्य एवं उक्त प्रस्तावित व्यपवर्तित किये जाने वाली वन भूमि के उपयोग बावत् ग्राम सभा की बैठक में विस्तृत चर्चा की गई।
3. इस वन भूमि की व्यपवर्तन प्रकरण के परिप्रेक्ष्य में अनुसूचित जनजाति एवं अन्य परंपरागत वन निवासी (वन अधिकारों की मान्यता) अधिनियम 2006 के नियम एवं प्रावधानों पर चर्चा की गई। जो कुल राजस्व वन भूमि 8.307 हेक्टेयर गैर वानिकी कार्य के व्यपवर्तन के लिए प्रस्तावित है, में कोई भी आदिवासी, गैर परंपरागत वनवासी इस प्रस्तावित वन भूमि पर कृषि कार्य, आवास या अन्य पारंपरिक गतिविधि सम्पादित नहीं कर रहे हैं एवं कोई भी वन अधिकार (व्यक्तिगत या सामुदायिक) किसी आदिवासी या गैर परंपरागत वनवासी को इस प्रस्तावित वन भूमि पर नहीं दिया गया है।

अधिका

आदिवासी / गैर परंपरागत वनवासी व्यक्तियों को वन अधिकार मान्यता पत्र वितरित किया गया है जिसका विवरण पृथक से सूची अनुसार संलग्न है।

अतः यह एकमत से ग्राम सभा में निर्णय लिया गया कि ग्राम -खेदापाली की कुल राजस्व वन भूमि 8.307 हेक्टेयर को गैर वानिकी प्रायोजन हेतु मेसर्स साऊथ ईस्टर्न कोल फिल्ड्स लिमिटेड छत्तल उपक्षेत्र को अन्य प्रचलित नियमों एवं प्रावधान अनुसार व्यपवर्तित की जावे बशर्ते ग्राम के समस्त भूमि को अधिग्रहण किया जावे एवं ग्राम के समस्त खातेदारों को नौकरी दिया जावे तथा उचित मुआवजा दिया जावे।

उपस्थित सदस्यगण :-

ग्रामसभामें उपस्थित ग्रामवासियों की सूची एवं हस्ताक्षर सत्यापित कर संलग्न किया गया।

हस्ताक्षर

नाम

ग्राम - खेदापाली

(सील)

कार्यालय अनुविभागीय अधिकारी (रा) धरमजयगढ़, जिला-रायगढ़

:: ज्ञापन ::

क्रमांक 1142/वाचक-1/2015  
प्रति,

धरमजयगढ़ दिनांक 23/02/2015

कलेक्टर

रायगढ़ (छ.ग.)

**विषय :-** एस.ई.सी.एल. रायगढ़ क्षेत्र की प्रस्तावित छाल खुली कोयला खदान SEAM-III परियोजना (6 MTY) के लिए ग्राम लात के वन भूमि 176.710 हे० एवं ग्राम खेदापाली के राजस्व वन भूमि 8.307 हे० कुल वन भूमि 185.017 हे० का वन अधिकार अधिनियम 2006 के तहत अनापत्ति प्रमाण पत्र प्रदाय करने के संबंध में।

**संदर्भ :-** उप महाप्रबंधक (खनन) उप क्षेत्रीय प्रबंधक एस.ई.सी.एल. छाल उपक्षेत्र का ज्ञापन क्रमांक एस.ई.सी.एल/राय/उक्षेप्र/छाल/वन एवं पर्या/15/295 दिनांक 31 जनवरी 2015

—00—

उपरोक्त संदर्भित विषयान्तर्गत उप महाप्रबंधक (खनन) उपक्षेत्रीय प्रबंधक एस.ई.सी.एल. छाल उपक्षेत्र द्वारा संदर्भित पत्र में ग्राम लात के वन भूमि 176.710 हे० एवं ग्राम खेदापाली के राजस्व वन भूमि 8.307 हे० कुल वन भूमि 185.017 हे० भूमि का वन अधिकार अधिनियम 2006 के तहत अनापत्ति प्रमाण पत्र प्रदाय करने निवेदन किया गया है।

इस संबंध में सरपंच ग्राम पंचायत लात एवं सरपंच ग्राम पंचायत खेदापाली से ग्राम सभा का प्रस्ताव मंगाया गया।

(1) सरपंच ग्राम पंचायत लात द्वारा ग्राम सभा की बैठक दिनांक 02 अक्टूबर 2013 की कार्यवाही विवरण प्रदर्श "ब" में पेश किया है जिसमें सरपंच द्वारा उल्लेख किया गया है कि ग्राम लात के कुल 22 अनुचित जनजाति तथा अन्य परम्परागत वन निवासियों को वन अधिकार पत्र दिनांक 26 सितम्बर 1984 को प्रदान किया गया है साथ ही सरपंच द्वारा तथाकथित भू स्वामित्व प्रमाण पत्र की फोटोकॉपियाँ संलग्न किया गया है। प्रस्तुत भू स्वामित्व प्रमाण पत्र में किसी भी सक्षम अधिकारी का हस्ताक्षर नहीं है। उक्त दस्तावेज को वन अधिकार पत्र के रूप में स्वीकार नहीं किया जा सकता है। अतः प्रदत्त वन अधिकार की संख्या निरंक मानी जावेगी।

(2) ग्राम पंचायत खेदापाली का बैठक दिनांक 08 अक्टूबर 2014 की कार्यवाही विवरण प्रदर्श "ब" में पेश किया है जिसके अनुसार ग्राम खेदापाली में अनुचित जनजाति तथा अन्य परम्परागत वन निवासियों को वन अधिकार पत्र किसी को प्रदान नहीं किया गया है। अतः प्रदत्त वन अधिकार की संख्या निरंक मानी जावेगी।

उपरोक्तानुसार ग्राम लात एवं ग्राम खेदापाली के वन भूमि का अनापत्ति प्रमाण पत्र हेतु वन अधिकार अधिनियम 2006 के तहत प्रदर्श "स" तैयार कराकर श्रीमान् कलेक्टर महोदय रायगढ़ की ओर सादर सम्प्रेषित।

सहपत्र:-उपरोक्तानुसार।

अनुविभागीय अधिकारी (रा)  
अनुविभागीय अधिकारी (रा)

ENVIRONMENTAL  
CLEARANCE

**Government of India  
Ministry of Environment, Forest and Climate Change  
(Impact Assessment Division)**

To,

The GENERAL MANAGER(ENVIRONMENT)  
SOUTH EASTERN COALFIELDS LIMITED  
SOUTH EASTERN COALFIELDS LIMITED, SECL BHAVAN, SEEPAT  
ROAD BILASPUR (C.G.) PIN 495006,SOUTH EASTERN COALFIELDS  
LIMITED, SECL BHAVAN, SEEPAT ROAD BILASPUR (C.G.) PIN  
495006,Bilaspur,Chhattisgarh-495006

**Subject:** Grant of Environmental Clearance (EC) to the proposed Project Activity  
under the provision of EIA Notification 2006-regarding

Sir/Madam,

This is in reference to your application for Environmental Clearance (EC)  
in respect of project submitted to the Ministry vide proposal number  
IA/CG/CMIN/11029/2007 dated 09 Jul 2021. The particulars of the environmental  
clearance granted to the project are as below.

- |   |                                     |
|---|-------------------------------------|
| 1. <b>EC Identification No.</b>                       | <b>EC22A042CG113476</b>             |
| 2. <b>File No.</b>                                    | No.J-11015/1000/2007-IA.II(M)       |
| 3. <b>Project Type</b>                                | Expansion                           |
| 4. <b>Category</b>                                    | A                                   |
| 5. <b>Project/Activity including<br/>Schedule No.</b> | 1(a) Mining of minerals             |
| 6. <b>Name of Project</b>                             | Chhal Opencast Exprn                |
| 7. <b>Name of Company/Organization</b>                | SOUTH EASTERN COALFIELDS<br>LIMITED |
| 8. <b>Location of Project</b>                         | Chhattisgarh                        |
| 9. <b>TOR Date</b>                                    | 20 Jul 2017                         |

The project details along with terms and conditions are appended herewith from page  
no 2 onwards.

Date: 02/08/2022

(e-signed)  
Lalit Bokolia  
Scientist F  
IA - (Coal Mining sector)

*Note: A valid environmental clearance shall be one that has EC identification  
number & E-Sign generated from PARIVESH.Please quote identification  
number in all future correspondence.*

*This is a computer generated cover page.*



**File No. J-11015/1000/2007-IA. II(M)**  
Government of India  
Ministry of Environment, Forest and Climate Change  
(Impact Assessment Division)

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**Dated: 2<sup>nd</sup> August, 2022**

To

The General Manager (W B P & Environment)  
M/s South Eastern Coalfields Ltd,  
W B P & Environment Department, Seepat Road,  
Bilaspur - 495006 (Chhattisgarh) Email: gmenvtseel@gmail.com

**Sub: Expansion of Chhal Opencast coal mining from 3.5 MTPA to 6 MTPA (Peak) with increase of mine lease area from 641.013 ha to 1342.86 ha by M/s South Eastern Coalfields Limited located in Tehsil Dharamjaigarh, District Raigarh (Chhattisgarh) - For Environmental Clearance - reg.**

Sir,

This has reference to your online proposal No. IA/CG/CMIN/11029/2007 dated 9<sup>th</sup> July, 2021, submitted to this Ministry for grant of Environmental Clearance (EC) in terms of the provisions of the Environment Impact Assessment (EIA) Notification, 2006 under the Environment (Protection) Act, 1986 for Expansion of Chhal Opencast coal mining from 3.5 MTPA to 6 MTPA (Peak) with increase of mine lease area from 641.013 ha to 1342.86 ha by M/s South Eastern Coalfields Limited located in Tehsil Dharamjaigarh, District Raigarh (Chhattisgarh).

2. The project/activity is covered under category 'A' of item 1(a) 'Mining of Minerals' the Schedule to the EIA Notification, 2006

3. The proposal was considered by the sectoral Expert Appraisal Committee (EAC) in its 16th EAC meeting held on 22nd July, 2021 and 29<sup>th</sup> EAC meeting held on 25 - 26 April, 2022. The details of the project, as per the documents submitted by the project proponent, and also as informed during the meeting, are reported to be as under: -

- i. The project area is covered under Survey of India Topo Sheet No. 64-N/4 and is bounded by the geographical coordinates ranging from 22°4'40" N and 22°6'27" N and longitudes 83°6'10" E and 83°9'10" E
- ii. Coal linkage: Thermal Power Stations
- iii. Joint venture: No Joint Venture
- iv. Project does not fall in the Critically Polluted Area (CPA), where the MoEF&CC's vide its OM dated 13<sup>th</sup> January, 2010 has imposed moratorium on grant of environment clearance. Employment generation/To be generated: 296

- v. **Benefits of the Project:** The coal mine will go a long way in fulfilling the demand nation's electricity and other coal-based industries, apart from earning revenue for the government. Opportunity of employment for the project affected villagers and allied industries
- vi. Earlier, the environment clearance to the project was obtained under EIA Notification, 2006 vide Ministry's letter No J-11015/1000/2007-IA-II(M) dated 27.04.2010 for 3.5 MIPA in mine lease area of 641.013 ha.
- vii. Total mining lease area as per block allotment is 1342.86 ha. Mining Plan (Including Progressive Mine Closure Plan) has been approved by the CIL Board on 16.12.2013.
- viii. The land usage pattern of the project is as follows:

**Pre-mining land use details (Area in Ha)**

S. N.	LAND USE	Within ML Area (Ha.)	Outside ML Area (Ha.)	Total
1	Agricultural Land	695.826	130.001	825.827
2	Forest Land	240.867	0	240.867
3	Waste Land	172.799	0	172.799
4	Grazing Land	31.632	0	31.632
5	Surface Water Bodies	23.426	0	23.426
6	Settlements	18.089	0	18.089
7	Others	24.056	6.164	30.220
<b>Total</b>		<b>1206.695</b>	<b>136.165</b>	<b>1342.86</b>

**Land Use During Mining**

S. No.	Land Use during Mining	Land Use (Ha)				
		Plantation	Water Body	Public Use	Undisturbed	Total
1.	External OB Dump	130.73	0	0	0	130.73
2.	Top Soil Dump	0	0	0	0	0
3.	Excavation	794.01	81	0	0	875.01
4.	Roads	0	0	3.5	0	3.5
5.	Built up areas	5	0	41.5	0	46.5
6.	Safety Zone as green belt	144.47	0	0	0	144.47
8.	Undisturbed Area	0	0	92.65	0	92.65
10	R&R	0	0	50	0	50
<b>TOTAL</b>		<b>1074.21</b>	<b>81</b>	<b>187.65</b>	<b>0</b>	<b>1342.86</b>

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**Post Mining Land use**

S. No.	Type	Total Area	Reclaimed Area (ha)	Un-reclaimed area (ha)
1.	Excavation/Quarry Area:			
	(a) Backfilled areas	794.01	794.01	0
	(b) Excavated Void	81.00	0	81
2.	External Dump	130.73	130.73	0
3.	Safety Zone	144.47	144.47	0
4.	Road and infrastructure	50.00	5	45
5.	Garland Drains	3.360	0	3.360
6.	Embankment	33.6	0	33.6
7.	R&R	50	0	50
8.	Others	55.69	0	55.69
	<b>TOTAL</b>	<b>1342.86</b>	<b>1074.21</b>	<b>268.65</b>

- ix. Total geological reserve reported in the mine lease area is 197.257 MT with 151.36 MT mineable reserve. Out of total mineable reserve of 151.36 MT, 151.36 MT are available for extraction. Percent of extraction is 100%.
- x. 13 seams with thickness ranging from 0.5 m to 11 m are workable. Grade of coal is G-11, stripping ratio 5.63, while gradient is 4° to 11°
- xi. Method of mining would be Opencast method (Coal- Surface miner with front end loader and dumper; OB-Shovel and dumper combination)
- xii. Life of mine is 30 years.
- xiii. The project has one external OB dumps in an area of 130.73 ha with 90 m height and 71.52 Meum of OB two internal OB in an area of 794.01 ha with 780.55 Meum of OB is envisaged in the project.
- xiv. Total quarry area is 875.01 ha out of which backfilling will be done in 794.01 ha while final mine void will be created in an area of 81 ha with a depth of 300 m. Backfilled quarry area of 794.01 ha shall be reclaimed with plantation. Final mine void will be converted water body
- xv. Transportation of coal has been proposed by In-pit by trucks and in-pit belt conveyors both, from surface to siding by trucks and loading at sidings by railway and to local customers by trucks
- xvi. Total afforestation Plan in an area of 1074.21 ha, comprising of 130.73 ha of external dump, 794.01 ha of internal dump and 144.47 ha of safety zone as green belt & 5 Ha others.
- xvii. 185.017 ha of forest land has been reported to be involved in the project for which application has been made on 10th May 2016, Forest Clearance awaited.
- xviii. No National Parks, Wildlife Sanctuaries and Eco-Sensitive Zones have been reported with 10 km boundary of the project.
- xix. The ground water level has been reported to be varying between 2.52 m to 14.27 m during pre-monsoon and between 5.85 m to 14.27 m during post-monsoon between 2.52 m to 8.02 m. Total water requirement for the project is 6874 m<sup>3</sup>/day
- xx. Application for obtaining the approval of the Central Ground Water Authority for dewatering ground water has been submitted on 30<sup>th</sup> December, 2017
- xxi. Public hearing for the project of Chhal OC Seam-(III) 6.0 MTPA & 7.5 Peak capacity in an area of 1342.86 ha was conducted on 12.03.2021 near govt middle school, Nawapara, Tehsil- Dharamjaigarh, Dist. Raigarh (C.G.) under the Chairmanship of Additional Collector

Raigarh. Major issues raised in the public hearing include compensation, RR, Environment, employment.

- xxii. Consent to Operate for the existing capacity was obtained from the State PCB on 19/10/2020 and is valid till 25.09.2022
- xxiii. Mand River is in the west, flowing southerly of the project
- xxiv. Regular monitoring of ambient air quality is being carried out on fortnightly basis. The documented report is submitted to SPCB and also to MoEF&CC along with half yearly EC compliance report. In general, the results of ambient air quality monitoring data were found within prescribed limits except few aberrations which can be attributed to the specific local conditions during the day of sampling.
- xxv. Pending legal litigations: -
- Case No. 218/2014 - case has been disposed of.
  - Case No. Cr.MP 408-413/207 - Both the cases 408 & 413 have been disposed of.
- xxvi. The project involves 450 project affected families. The PAF's and PAP's are being rehabilitated and paid economic compensation/ employed as per State Govt. R&R package and Coal India rule.
- xxvii. Total cost of the project is Rs. 610.63 crores. Cost of production is Rs.685.02/- per tonne. at 85% production level, CSR cost is 2% of the average net profit of the company for the three immediate preceding financial years or Rs. 2.00 per tonne of coal production of previous year whichever is higher. R&R cost is Rs. 5554.49 lakhs. Environment Management Cost is Rs. 7731.45 lakh.

4. The proposal was considered by the sectoral Expert Appraisal Committee (EAC) in 29<sup>th</sup> EAC meeting held on 25 – 26 April, 2022 through Video Conferencing and recommended for grant of Environment Clearance. Based on recommendations of the EAC, the Ministry of Environment, Forest and Climate Change hereby accords approval to Expansion of Chhal Opencast coal mining from 3.5 MTPA to 6 MTPA (Peak) with increase of mine lease area from 641.013 ha to 1342.86 ha by M/s South Eastern Coalfields Limited located in Tehsil Dharamjigarh, District Raigarh (Chhattisgarh), under the provisions of Environment Impact Assessment Notification, 2006 and subsequent amendments/circulars thereto subject to the compliance of the following terms & conditions / specific conditions for environmental safeguards as stated below:-

- i. Environment Clearance is granted based on Stage-I FC submitted by PP on 06.07.2022 for non-forestry use of 240,867 ha, comprising of 185,017 ha Revenue Forest Land and 55,850 ha identified as forest land in terms of dictionary meaning under the Forest (Conservation) Act, 1980 subject to certain terms and conditions.
- ii. PP shall obtain CTO for 6 MTPA (Peak) from State Pollution Control Board. PP must obtain the CTE and CTO of STP. No wastewater from mine lease area shall be disposed outside the mine lease area into the river. Treated wastewater from STP and ETP shall be utilised within area and treatment plants designed should be based on zero liquid discharge.
- iii. PP shall deploy of atleast 10 nos of fog cannon for mitigation of fugitive dust on the haul road, coal storage yard and transportation route. Also 5 Movable long range fog cannon on the affected village must be immediately installed within 3 months.
- iv. Further expansion (if applied) in capacity will only be considered by EAC when at least 75% of EC conditions are complied fully and PP to obtain 5-star rating from Ministry of Coal as per their guidelines.
- v. PP must plant 150,000 of native trees other than the green belt development proposed in the EIA /EMP report, also the broad leaves along the transportation route in three years to prevent the effect of air pollution. PP shall implement Peripheral tree plantation along the mine lease area with miyawaki method of 50 mts width within 2 years through independent

expert. After completion of tree plantation, number of trees shall be duly endorsed from District Forest Officer.

- vi. PP will construct community toilet blocks in nearby areas in consultation with gram panchayats within 1 year to the grant of this EC.
- vii. As committed, PP to install silo loading and railway siding with full mechanized system to transport coal from pit head to railway siding by October 2023. No CTO shall be granted by SPCB by road transportation after October 2023. SPCB shall allow only 10% coal by road against the sanctioned capacity (i.e 0.6 MTPA) beyond October 2023.
- viii. Coal extraction mandatory by surface miner method only and it should be deployed by December 2022. SPCB shall grant the CTO accordingly.
- ix. No village road shall be used for transportation of coal and no road transport route shall be adopted, which is passing through any sensitive location such as schools, hospitals etc. PP shall take legal undertaking from its consumers accordingly.
- x. PP to fulfil the commitment made during public hearing and a progressive record must be submitted to IRO
- xi. PP shall deploy only 40-50 tones covered trucks/dumper to reduce fleet size
- xii. PP to undertake the recruitment of a full-fledged qualified manpower with Environmental Engineer/Environment Science degree background in Environment Management Cell etc at coal mining site for compliance of EC conditions.
- xiii. PP must adopt the proper mitigation measure as propose under EMP with budgetary of 7731.45 lakhs as proposed by PP. The progressive audit of the same may be given to IRO
- xiv. PP to install solar lights within 1 year from the grant of this EC along the road used for transportation of minerals to avoid the accidents at night and also seek its maintenance. PP is asked to also identify the rural areas for installation of solar light with its maintenance within the study area of 10 km radius buffer zone within one year
- xv. Project proponent shall supply clean drinking water and for domestic purpose for the people coming under the zone of influence of this mining activity.
- xvi. Persons of nearby villages shall be given training on livelihood and skill development to make them employable.
- xvii. PP to install 2 nos of continuous ambient air quality monitoring stations at suitable locations preferably village side in consultation of SPCB. The real time data so generated shall be uploaded on company website. In addition, data should also be displayed digitally at entry and exit gate of mine lease area for public display. These monitoring station shall be deploy by December 2022.
- xviii. Continuous monitoring of occupational safety and other health hazards, and the corrective actions need to be ensured.
- xix. Proponent shall appoint an Occupational Health Specialist for Regular and Periodical medical examination of the workers engaged in the Project and maintain records accordingly; also, Occupational health check-ups for workers having some ailments like BP, diabetes, habitual smoking, etc. shall be undertaken once in six months and necessary remedial/preventive measures taken accordingly. The Recommendations of National Institute for ensuring good occupational environment for mine workers shall be implemented; The prevention measure for burns, malaria and provision of anti-snake venom including all other paramedical safeguards may be ensured before initiating the mining activities.
- xx. The illumination and sound at night at project sites disturb the villages in respect of both human and animal population. Consequent sleeping disorders and stress may affect the health in the villages located close to mining operations. Habitations have a right for darkness and minimal noise levels at night. PPs must ensure that the biological clock of the villages is not disturbed; by orienting the floodlights/ masks away from the villagers and keeping the noise levels well within the prescribed limits for day light/night hours

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- xxi. PP shall implement rain water harvesting mechanism in order recharge the ground water or as water conservation measure in addition to the proposed structure. PP shall carry out regular monitoring of Ground water level and quality.
- xxii. PP shall pay to farmers of agricultural land if there is any loss due to pollution found by concerned District Commissioner as per extent rules or norms.
- xxiii. Hon'ble Supreme Court in an Writ Petition(s) Civil No. 114/2014, Common Cause vs Union of India & Ors vide its judgement dated 8th January, 2020 has directed the Union of India to impose a condition in the mining lease and a similar condition in the environmental clearance and the mining plan to the effect that the mining lease holders shall, after ceasing mining operations, undertake re-grassing the mining area and any other area which may have been disturbed due to their mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna etc. Compliance of this condition after the mining activity is over at the cost of the mining lease holders/Project Proponent". The implementation report of the above-said condition shall be sent to the Regional Office of the MoEF&CC.

4.1. The grant of environmental clearance is further subject to compliance of the Standard EC conditions as under:

**(a) Statutory compliance**

- (i) The project proponent shall obtain forest clearance under the provisions of Forest (Conservation) Act, 1986, in case of the diversion of forest land for non-forest purpose involved in the project.
- (ii) The project proponent shall obtain clearance from the National Board for Wildlife, if applicable.
- (iii) The project proponent shall prepare a Site-Specific Conservation Plan / Wildlife Management Plan and approved by the Chief Wildlife Warden. The recommendations of the approved Site-Specific Conservation Plan/Wildlife Management Plan shall be implemented in consultation with the State Forest Department. The implementation report shall be furnished along with the six-monthly compliance report (in case of the presence of schedule-I species in the study area).
- (iv) The project proponent shall obtain Consent to Establish/Operate under the provisions of Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the concerned State pollution Control Board/ Committee.
- (v) The project proponent shall obtain the necessary permission from the Central Ground Water Authority.
- (vi) Solid/hazardous waste generated in the mines needs to be addressed in accordance to the Solid Waste Management Rules, 2016/Hazardous & Other Waste Management Rules, 2016.

**(b) Air quality monitoring and preservation**

- (i) Continuous ambient air quality monitoring stations as prescribed in the statute be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>x</sub>. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board. Online ambient air quality monitoring stations may also be installed in addition to the regular monitoring stations as per the requirement and/or in consultation with the

SPCB. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc to be carried out at least once in six months.

(ii) The Ambient Air Quality monitoring in the core zone shall be carried out to ensure the Coal Industry Standards notified vide GSR 742 (E) dated 25<sup>th</sup> September, 2000 and as amended from time to time by the Central Pollution Control Board. Data on ambient air quality and heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly reported to the Ministry/Regional Office and to the CPCB/SPCB.

(iii) Transportation of coal, to the extent permitted by road, shall be carried out by covered trucks/conveyors. Effective control measures such as regular water/mist sprinkling/rain gun etc. shall be carried out in critical areas prone to air pollution (with higher values of PM<sub>10</sub>/PM<sub>2.5</sub>) such as haul road, loading/unloading and transfer points. Fugitive dust emissions from all sources shall be controlled regularly. It shall be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the Central/State Pollution Control Board.

(iv) The transportation of coal shall be carried out as per the provisions and route envisaged in the approved Mining Plan or environment monitoring plan. Transportation of the coal through the existing road passing through any village shall be avoided. In case, it is proposed to construct a 'bypass' road, it should be so constructed so that the impact of sound, dust and accidents could be appropriately mitigated.

(v) Vehicular emissions shall be kept under control and regularly monitored. All the vehicles engaged in mining and allied activities shall operate only after obtaining 'PUC' certificate from the authorized pollution testing centres.

(vi) Coal stock pile/crusher/feeder and breaker material transfer points shall invariably be provided with dust suppression system. Belt-conveyors shall be fully covered to avoid air borne dust. Side cladding all along the conveyor gantry should be made to avoid air borne dust. Drills shall be wet operated or fitted with dust extractors.

(vii) Coal handling plant shall be operated with effective control measures w.r.t. various environmental parameters. Environmental friendly sustainable technology should be implemented for mitigating such parameters.

**(c) Water quality monitoring and preservation**

(i) The effluent discharge (mine waste water, workshop effluent) shall be monitored in terms of the parameters notified under the Water Act, 1974 Coal Industry Standards vide GSR 742 (E) dated 25<sup>th</sup> September, 2000 and as amended from time to time by the Central Pollution Control Board.

(ii) The monitoring data shall be uploaded on the company's website and displayed at the project site at a suitable location. The circular No.J-20012/1/2006-IA.11 (M) dated 27<sup>th</sup> May, 2009 issued by Ministry of Environment, Forest and Climate Change shall also be referred in this regard for its compliance.

(iii) Regular monitoring of ground water level and quality shall be carried out in and around the mine lease area by establishing a network of existing wells and constructing new piezometers during the mining operations. The monitoring of ground water levels shall be carried out four times

a year i.e. pre-monsoon, monsoon, post-monsoon and winter. The ground water quality shall be monitored once a year, and the data thus collected shall be sent regularly to MOEFCC/RO.

(iv) Monitoring of water quality upstream and downstream of water bodies shall be carried out once in six months and record of monitoring data shall be maintained and submitted to the Ministry of Environment, Forest and Climate Change/Regional Office.

(v) Ground water, excluding mine water, shall not be used for mining operations. Rainwater harvesting shall be implemented for conservation and augmentation of ground water resources.

(vi) Catch and/or garland drains and siltation ponds in adequate numbers and appropriate size shall be constructed around the mine working, coal heaps & OB dumps to prevent run off of water and flow of sediments directly into the river and water bodies. Further, dump material shall be properly consolidated/ compacted and accumulation of water over dumps shall be avoided by providing adequate channels for flow of silt into the drains. The drains/ ponds so constructed shall be regularly de-silted particularly before onset of monsoon and maintained properly. Sump capacity should provide adequate retention period to allow proper settling of silt material. The water so collected in the sump shall be utilised for dust suppression and green belt development and other industrial use. Dimension of the retaining wall constructed, if any, at the toe of the OB dumps within the mine to check run-off and siltation should be based on the rainfall data. The plantation of native species to be made between toe of the dump and adjacent field/habitation/water bodies.

(vii) Adequate groundwater recharge measures shall be taken up for augmentation of ground water. The project authorities shall meet water requirement of nearby village(s) after due treatment conforming to the specific requirement (standards).

(viii) Industrial waste water generated from CHP, workshop and other waste water, shall be properly collected and treated so as to conform to the standards prescribed under the standards prescribed under Water Act 1974 and Environment (Protection) Act, 1986 and the Rules made there under, and as amended from time to time. Adequate ETP /STP needs to be provided.

(ix) The water pumped out from the mine, after siltation, shall be utilized for industrial purpose viz. watering the mine area, roads, green belt development etc. The drains shall be regularly desilted particularly after monsoon and maintained properly.

(x) The surface drainage plan including surface water conservation plan for the area of influence affected by the said mining operations, considering the presence of river/riivulet/pond/lake etc. shall be prepared and implemented by the project proponent. The surface drainage plan and/or any diversion of natural water courses shall be as per the approved Mining Plan/EIA/EMP report and with due approval of the concerned State/Gol Authority. The construction of embankment to prevent any danger against inrush of surface water into the mine should be as per the approved Mining Plan and as per the permission of DGMS or any other authority as prescribed by the law.

(xi) The project proponent shall take all precautionary measures to ensure riverine/riparian ecosystem in and around the coal mine up to a distance of 5 km. A rivarine/riparian ecosystem conservation and management plan should be prepared and implemented in consultation with the irrigation / water resource department in the state government.



**(d) Noise and Vibration monitoring and prevention**

(i) Adequate measures shall be taken for control of noise levels as per Noise Pollution Rules, 2016 in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with personal protective equipments (PPE) like ear plugs/muffs in conformity with the prescribed norms and guidelines in this regard. Adequate awareness programme for users to be conducted. Progress in usage of such accessories to be monitored.

(ii) Controlled blasting techniques shall be practiced in order to mitigate ground vibrations, fly rocks, noise and air blast etc., as per the guidelines prescribed by the DGMS.

(iii) The noise level survey shall be carried out as per the prescribed guidelines to assess noise exposure of the workmen at vulnerable points in the mine premises, and report in this regard shall be submitted to the Ministry/RO on six-monthly basis.

**(e) Mining Plan**

(i) Mining shall be carried out under strict adherence to provisions of the Mines Act 1952 and subordinate legislations made there-under as applicable.

(ii) Mining shall be carried out as per the approved mining plan (including Mine Closure Plan) abiding by mining laws related to coal mining and the relevant circulars issued by Directorate General Mines Safety (DGMS).

(iii) No mining shall be carried out in forest land without obtaining Forestry Clearance as per Forest (Conservation) Act, 1980.

(iv) Efforts should be made to reduce energy and fuel consumption by conservation, efficiency improvements and use of renewable energy.

**(f) Land reclamation**

(i) Digital Survey of entire lease hold area/core zone using Satellite Remote Sensing survey shall be carried out at least once in three years for monitoring land use pattern and report in 1:50,000 scale or as notified by Ministry of Environment, Forest and Climate Change(MOEFCC) from time to time shall be submitted to MOEFCC/Regional Office (RO).

(ii) The final mine void depth should preferably be as per the approved Mine Closure Plan, and in case it exceeds 40 m, adequate engineering interventions shall be provided for sustenance of aquatic life therein. The remaining area shall be backfilled and covered with thick and alive top soil. Post-mining land be rendered usable for agricultural/forestry purposes and shall be diverted. Further action will be treated as specified in the guidelines for Preparation of Mine Closure Plan issued by the Ministry of Coal dated 27<sup>th</sup> August, 2009 and subsequent amendments.

(iii) The entire excavated area, backfilling, external OB dumping (including top soil) and afforestation plan shall be in conformity with the "during mining"/"post mining" land-use pattern, which is an integral part of the approved Mining Plan and the EIA/EMP submitted to this Ministry. Progressive compliance status vis-a-vis the post mining land use pattern shall be submitted to the MOEFCC/RO.

(iv) Fly ash shall be used for external dump of overburden, backfilling or stowing of mine as per provisions contained in clause (i) and (ii) of subparagraph (8) of fly ash notification issued vide SO 2804 (E) dated 3rd November, 2009 as amended from time to time. Efforts shall be made to utilize gypsum generated from Flue Gas Desulfurization (FGD), if any, along with fly ash for external dump of overburden, backfilling of mines. Compliance report shall be submitted to Regional Office of MoEF&CC, CPCB and SPCB.

(v) Further, it may be ensured that as per the time schedule specified in mine closure plan it should remain live till the point of utilization. The topsoil shall temporarily be stored at earmarked site(s) only and shall not be kept unutilized. The top soil shall be used for land reclamation and plantation purposes. Active OB dumps shall be stabilised with native grass species to prevent erosion and surface run off. The other overburden dumps shall be vegetated with native flora species. The excavated area shall be backfilled and afforested in line with the approved Mine Closure Plan. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry of Environment, Forest and Climate Change/ Regional Office.

(vi) The project proponent shall make necessary alternative arrangements, if grazing land is involved in core zone, in consultation with the State government to provide alternate areas for livestock grazing, if any. In this context, the project proponent shall implement the directions of Hon'ble Supreme Court with regard to acquiring grazing land.

**(g) Green Belt**

(i) The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered/endemic flora/fauna, if any, spotted/reported in the study area. The Action plan in this regard, if any, shall be prepared and implemented in consultation with the State Forest and Wildlife Department.

(ii) Greenbelt consisting of 3-tier plantation of width not less than 7.5 m shall be developed all along the mine lease area as soon as possible. The green belt comprising a mix of native species (endemic species should be given priority) shall be developed all along the major approach/ coal transportation roads.

**(h) Public hearing and Human health issues**

(i) Adequate illumination shall be ensured in all mine locations (as per DGMS standards) and monitored weekly. The report on the same shall be submitted to this ministry & it's RO on six-monthly basis.

(ii) The project proponent shall undertake occupational health survey for initial and periodical medical examination of the personnel engaged in the project and maintain records accordingly as per the provisions of the Mines Rules, 1955 and DGMS circulars. Besides regular periodic health check-up, 20% of the personnel identified from workforce engaged in active mining operations shall be subjected to health check-up for occupational diseases and hearing impairment, if any, as amended time to time.

(iii) Personnel (including outsourced employees) working in core zone shall wear protective respiratory devices and shall also be provided with adequate training and information on safety and health aspects.

(iv) Implementation of the action plan on the issues raised during the public hearing shall be ensured. The project proponent shall undertake all the tasks/measures as per the action plan submitted with budgetary provisions during the public hearing. Land oustees shall be compensated as per the norms laid down in the R&R policy of the company/State Government/Central Government, as applicable.

(v) The project proponent shall follow the mitigation measures provided in this Ministry's OM No.Z-11013/5712014-IA,II (M) dated 29<sup>th</sup> October, 2014, titled 'Impact of mining activities on habitations-issues related to the mining projects wherein habitations and villages are the part of mine lease areas or habitations and villages are surrounded by the mine lease area'.

#### **(i) Corporate Environment Responsibility**

(i) Fund allocation for Corporate Environment Responsibility (CER) shall be made as per Ministry's O.M. No. 22-65/2017-IA,III dated 30th September 2020 and based on commitment made during public consultation process for incorporating in EIA-EMP for deliberation of EAC

(ii) The company shall have a well laid down environmental policy duly approved by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental/forest/wildlife norms/conditions. The company shall have defined system of reporting infringements/deviation/violation of the environmental/forest/wildlife norms/conditions and/or shareholders/stake holders.

(iii) A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly to the head of the organization.

(iv) Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six Monthly Compliance Report.

(v) Self environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.

#### **(j) Miscellaneous**

(i) The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.

(ii) The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.

(iii) The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.

(iv) The project proponent shall monitor the criteria pollutants level namely; PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>x</sub> (ambient levels) or critical sectoral parameters, indicated for the projects and display the same at a convenient location for disclosure to the public and put on the website of the company.

(v) The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the ministry of Environment, Forest and Climate Change at environment clearance portal.

(vi) The project proponent shall follow the mitigation measures provided in this Ministry's OM No.Z-11013/5712014-IA.II (M) dated 29<sup>th</sup> October, 2014, titled 'Impact of mining activities on habitations-issues related to the mining projects wherein habitations and villages are the part of mine lease areas or habitations and villages are surrounded by the mine lease area'.

(vii) The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.

(viii) The project authorities shall inform to the Regional Office of the MOEFCC regarding commencement of mining operations.

(ix) The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.

(x) The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report, commitment made during Public Hearing and also that during their presentation to the Expert Appraisal Committee.

(xi) No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment, Forests and Climate Change.

(xii) Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.

(xiii) The Ministry may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.

(xiv) The Ministry reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.

(xv) The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information/monitoring reports.

(xvi) The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India / High Courts and any other Court of Law relating to the subject matter.

5. The proponent shall abide by all the commitments and recommendations made in the EIA/EMP report and also that during presentation to the EAC. All the commitments made on the issues raised during public hearing shall also be implemented in letter and spirit.

6. The proponent shall obtain all necessary clearances/approvals that may be required before the start of the project. The Ministry or any other competent authority may stipulate any further condition for environmental protection. The Ministry or any other competent authority may stipulate any further condition for environmental protection.

7. Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

8. The coal company/project proponent shall be liable to pay the compensation against the illegal mining, if any, and as raised by the respective State Governments at any point of time, in terms of the orders dated 2<sup>nd</sup> August, 2017 of Hon'ble Supreme Court in WP (Civil) No.114/2014 in the matter of 'Common Cause Vs Union of India & others.

9. The concerned State Government shall ensure no mining operations to commence till the entire compensation for illegal mining, if any, is paid by the project proponent through their respective Department of Mining & Geology, in strict compliance of the judgment of Hon'ble Supreme Court.

10. This environmental clearance shall not be operational till such time the project proponent complies with the above said judgment of Hon'ble Supreme Court, as applicable, and other statutory requirements.

11. All the conditions stipulated in earlier Environment Clearance vide letter No J-11015/1000/2007-IA-I(M) dated 27.04.2010 shall be complied.

This issue with approval of the competent Authority.

  
(Lalit Bokolia)  
Director

**Copy to:**

1. The Secretary, Ministry of Coal, Shastri Bhawan, New Delhi
2. Deputy Director General of Forests (C), Ministry of Env., Forest and Climate Change, Integrated Regional Office, Aranya Bhawan, North Block, Sector-19 Naya Raipur, Atal Nagar, Chhattisgarh - 492002
3. The Chairman, Chhattisgarh State Environment Conservation Board, 1-Tilak Nagar, Shiv Mandir Chowk, Main Road, Avanti Vihar, Raipur-Chhattisgarh- 492001
4. The Member Secretary, Central Pollution Control Board, CBD-cum-Office Complex, East Arjun Nagar, New Delhi - 32
5. The Chairman, Central Ground Water Authority, Ministry of Jal Shakti, Jammagar House, 18/11, Man Singh Road Area, New Delhi, Delhi 110001
6. The District Collector, Raigarh, Government of Chhattisgarh.
7. Monitoring File/Guard File/Record File;
8. PARIVESH Portal



**(Lalit Bokolia)**

Signature Not Verified

Digitally signed by Lalit Bokolia  
Scientist F

Date: 8/2/2022 2:37:11 PM



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Annexure-A

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/33

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(i) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall ensure that legal status of the diverted forest land of 240.867 Ha. (185.017 Ha. of Revenue Forest Land + 55.850 Ha. of Deemed Forest Land) of the project remains unchanged.

  
General Manager,  
Raigarh Area SECL  
SECL, Raigarh Area



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A Subsidiary of Coal India Ltd.)  
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Annexure-09

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/ 53

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition A(xiii) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall carry out the undermentioned activities at the project cost for the management of safety zone as per the relevant guidelines issued by the MOEF & CC.

- (a) Ensure demarcation of safety zone (7.5-meter strip all along the inner boundary of the mining lease area), and its fencing, protection and regeneration by erecting adequate number of 6 feet high RCC boundary pillars inscribed with DGPS coordinates with barbed wire fencing and deploying adequate number of watchers under the supervision of the State Forest Department.
- (b) Boundary of the safety zone of the mining lease, adjacent to habitation/roads shall be properly fenced.
- (c) Safety zone shall be maintained as green belt around mining lease and to ensure dense canopy in the area, regeneration shall be taken up in this area at the project cost under the supervision of the State Forest Department.
- (d) Along with the State Forest Department shall ensure that safety zone is maintained as per the prescribed norms.
- (e) Deposit the cost of felling of trees with the State Forest Department.

  
General Manager,  
Raigarh Area, SECL  
SECL, Raigarh Area





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Annexure-07

CIN-U10102CT1985GO1903161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/52

Date: - 12/10/2022

## //UNDERTAKING//

In reference to condition A(xi) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CG, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall carry out gap plantation and soil & moisture conservation activities through CGRVVN, CG to restock and rejuvenate the degraded open forests (having crown density less than 0.40), if any, located in the area within 100 meters from outer perimeter of the mining lease.

  
General Manager,  
Raigarh Area, SECL  
General Manager  
रायगढ़ क्षेत्र, रायगढ़ क्षेत्र  
SECL, Raigarh Area



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CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/51

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition A(x) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall carry out the undermentioned activities in the mining lease area of the project as per the approved soil & moisture conservation Plan.

- Mitigative measures to minimize soil erosion and choking of stream shall be implemented within a period of three years with effect from the issue of Stage-II clearance in accordance with the approved Plan in consultation with the State Forest Department.
- Planting of adequate drought hardy plant species and sowing of seeds, in the appropriate area within the mining lease to arrest soil erosion in accordance with the approved scheme.
- Construction of check dams, retention /toe walls to arrest sliding down of the excavated material along the contour in accordance with the approved scheme.
- Stabilize the overburden dumps by appropriate grading/benching, in accordance with the approved scheme, so as to ensure that angles of repose at any given place is less than 28°; and
- No damage shall be caused to the top-soil and will follow the top soil management plan.

  
 General Manager,  
 Raigarh Area, SECL  
  
 SECL, Raigarh Area



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Annexure-S

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/ 50

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(xix) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall submit the annual self-compliance report in respect of the conditions stipulated in Stage-I Forest Clearance of the project to the State Government, concerned Regional Office and to this Ministry by the end of March every year regularly.

  
General Manager,  
Raigarh Area, SECL  
62  




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Annexure-R


CIN-U11102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/49

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(xviii) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall not violate of any of the conditions stipulated in Stage-I Forest Clearance granted to the project and shall be responsible for legal action that would be taken as prescribed in para 1.21 of Chapter 1 of the Handbook of comprehensive guidelines of Forest (Conservation) Act, 1980 as issued by this Ministry's letter No. 5- 2/2017-FC dated 28.03.2019 as violation of any of the said conditions will amount to violation of Forest (Conservation) Act, 1980.

  
General Manager,  
Raigarh Area, SECL  
SECL, Raigarh Area



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Annexure-Q

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/ 48

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(xvii) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall comply with all the provisions of all the Acts, Rules, Regulations, Guidelines, Hon'ble Court Order (s) and NGT Order (s) pertaining to this project, if any, for the time being in force, as applicable to the project.

  
General Manager,  
Raigarh Area, SECL  




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Annexure-P

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/ 47

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(xvi) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall comply with the provisions of any other condition that the concerned Regional Office of this Ministry may stipulate with the approval of competent authority in the interest of conservation, protection and development of forests & wildlife.

  
General Manager,  
Raigarh Area SECL  




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Annexure-O

CIN-U10702CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/46

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(xv) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall ensure that no damage to the flora and fauna of the adjoining area to the project is caused due to mining.

*Singh*  
General Manager,  
Raigarh Area, SECL  
SECL Raigarh Area



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Annexure-N

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/45

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(xiv) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall ensure that the forest land of 240.867 Ha. of the project proposed to be diverted is not transferred to any other agency, department or person without prior approval of the Central Government.

*[Handwritten Signature]*  
General Manager,  
Raigarh Area, SECL,  
SECL Raigarh Area





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Annexure-M

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/ 44

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(xiii) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall ensure that the layout plan of the mining plan/proposal is not changed without the prior approval of the Central Government and the forest land is not used for any purpose other than that specified in the proposal.

  
General Manager,  
Raigarh Area, SECL  




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Annexure-L

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/43

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(xii) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall ensure that the boundary of the diverted forest land, mining lease and safety zone, as applicable, is demarcated on ground at the project cost, by erecting four feet high reinforced cement concrete pillars, each inscribed with its serial number, distance from pillar to pillar and GPS coordinates.

  
General Manager,  
Raigarh Area, SECL  




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Annexure-K


CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/42

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(xi) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall ensure that no labour camp is established on the forest land and alternate fuels preferably domestic gas to the labourers and the staff working at the site is provided so as to avoid any damage and pressure on the nearby forest areas.

  
General Manager,  
Raigarh Area, SECL  
SECL, Raigarh Area



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CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/41

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(ix) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall comply with the statutory provisions in connection with the validity of period of approval of forest diversion proposal of 240.867 Ha. which shall be co-terminus with the period of validity of the mining lease if, granted under the Mines and Minerals (Development and Regulation) Act, 1957, as amended and the Rules framed there-under.

*Devg*  
 General Manager  
 Raigarh Area, SECL  
 SECL Raigarh Area



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Annexure-H

CIN-U10102CT1985GO1003161

Ref:- SECL/GM/RGH/S.O. (P&P)/2022/40

Date:- 17/10/2022

## //UNDERTAKING//

In reference to condition B(viii) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall undertake mining in a phased manner after taking due care for reclamation of the mined over area. Further, this is to undertake that the concurrent reclamation plan as per the approved mining plan shall be executed by the Mine Management from the very first year, and an annual report on implementation thereof shall be submitted to the Nodal Officer, Forest (Conservation) Act, 1980, Government of Chhattisgarh and Integrated Regional Office, Raipur.

  
General Manager,  
Raigarh Area, SECL

  
SECL Raigarh Area



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Annexure-G

CIN-U10102CT1985GO1003161

Ref. - SECL/GM/RGH/S.O. (P&P)/2022/89

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(vii) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall comply with the Hon'ble Supreme Court order on re-grassing and re-grass the mining area and any other areas which may have been disturbed due to mining to restore them to a condition which is fit for growth of fodder, flora, fauna, etc. in a timely manner.

*Devi Prasad*  
General Manager,  
Raigarh Area, SECL  
SECL Raigarh Area



South Eastern Coalfields Limited  
"A Minerata Company"  
A Subsidiary of Coal India Ltd.  
Chhota Anarimain, Raigarh-495006  
G.M. Office (Forest & Env't)  
Website: www.secl.co.in

fax NO:- 07762-223152  
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E-mail:- seclrgh@gmail.com

Annexure-F

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/38

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(vi) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall explore the possibility of translocation of maximum number of trees identified to be felled and shall ensure that any tree felling is done only when it is unavoidable and that too under strict supervision of the State Forest Department.

  
General Manager,  
Raigarh Area, SECL

  
SECL, Raigarh Area



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Annexure-E

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/37

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(v) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall ensure that trees are felled in phased manner as per the requirement in the approved Mining Plan with prior permission of DFO, Dharamjaigarh, (C.G.).

  
General Manager,  
Raigarh Area, SECL

  
SECL Raigarh Area





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Annexure-D

CIN-U10102CT1985GO1003181

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/36

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(iv) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall pay the additional amount of NPV, if so determined, as per the final decision of the Hon'ble Supreme Court of India to already paid NPV amount of Rs.29,36,77,168.86 in Chattisgarh State CAMPA A/C No. 150645816237745, IFSC Code-UBIN0996335 vide UTR No.UTIBR52022090100354111, dtd.31.08.2022 for the diversion of 240.867 Ha. of forest land (Rs. 22,50,60,417.36 for 185.017 Ha. of Revenue Forest land and Rs. 6,86,16,751.50 for 55.850 Ha. of Deemed Forest land), as per the guidelines issued by this Ministry vide its letters No. 5-3/2011-FC (Vol.) dated 06.01.2022 read with letter dated 22.03.2022.

  
General Manager,  
Raigarh Area, SECL  
SECL, Raigarh



South Eastern Coalfields Limited  
"A Min Ratna Company"  
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Annexure-C

CIN-U10102CT1985GC01003161

Ref - SECL/GM/RGH/S.O. (P&P)/2022/35

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(iii) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall ensure that a minimum of 120 meters distance from the bank of Mand River is kept as intact and no mining is carried out in this area. Further, it shall be ensured that embankment is constructed for the protection of the river and its hydrology from the mining.

*[Signature]*  
17/10/2022  
General Manager,  
Raigarh Area, SECL  
General Manager,  
राइगरह क्षेत्र, SECL,  
SECL, Raigarh Area



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Annexure-B

CIN-U10102CT1985GO1003161

Ref: - SECL/GM/RGH/S.O. (P&P)/2022/34

Date: - 17/10/2022

## //UNDERTAKING//

In reference to condition B(ii) of the Stage-I Forest Clearance granted to Chhal OC Seam-III 6.0 MTY Project by MOEF & CC, GOI, New Delhi vide letter no. 8-15/2021-FC, dtd.06.07.2022, this is to undertake that the Mine Management/Project Proponent of Chhal OC Seam-III 6.0 MTY Project shall ensure that compensatory afforestation over orange forest land, double in extent to the forest land being diverted, is raised by the State Forest Department at the project cost within three years from the date of grant of Stage - II approval.

  
General Manager,  
Raigarh Area, SECL  
General Manager,  
राईगढ़ क्षेत्र, SECL  
SECL, Raigarh Area