DRAFT ENVIRONMENT IMPACT ASSESSMENT REPORT

FOR

MINING OF MINOR MINERAL (SAND, BAJRI AND BOULDERS)
FROM JAKHAN-2 RIVER BED, VILLAGE MAJRI GRANT
TEHSIL AND DISTRICT DEHRADUN, UTTARAKHAND
(M.L. AREA OF 96.50 HA, PRODUCTION CAPACITY -2866050.00 TPA)
SCHEDULE: 1 (a), CATEGORY: A

(AS RAJAJI TIGER RESERVE SITUATED AT 5.40 KM FROM RAJAJI TIGER RESERVE)

PROJECT PROPONENT



UTTARAKHAND FOREST DEVELOPMENT CORPORATION, DEHRADUN, UTTARAKHAND



DOC. No: MCPL/EMD/MIN/2019-21/09/01(DEIA)

JULY, 2021



PREPARED BY







MANTEC CONSULTANTS PVT. LTD.

(QCI Accredited EIA Consultant at S.No.155 as per List of Accredited Consultant Organizations/Rev.12, July 09, 2021

(NABET Accredited EIA consultant, MoEF&CC and NABL approved Laboratory)

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NABET ANNEXURE - VII

DISCLOSURE OF CONSULTANTS

Declaration by Experts contributing to the EIA for Mining of Minor Mineral (Sand, Bajri and Boulders) from the river bed of ORiver Jakhan-2 by M/s Uttarakhand Forest Development Corporation, located in Dehradun Forest Division. District- Dehradun, Uttarakhand.

Declaration by Experts contributing to the EIA:

I, hereby, certify that I was part of the EIA team in the following capacity that developed the above EIA.

EIA Coordinator:

Name	Mr. Punit Lal Mehto	Dr. B.J Prasad
Signature and Date	20.12.2019 Punet Lat Malita	18.02.2020 Porasad
Period of Involvement	December 2019- January 2020	February 2020 -till date
Contact Information	9911537948	9650991514

Associate EIA Coordinator

Name	Mr. A.S. Brara	
Signature and Date	Allen	
Period of Involvement	Dec 2019-till now	

Functional Area Expert

S. No.	Functional	Name of the	Involvement	Signature & Date
5. 110.	Areas	Experts	(task & period)	Signature & Date
1		•	`	
1	AP*	Mr. A.S. Brara	 December 2019 - March 2020; Identification of Air Quality Monitoring Network Supervision of ambient air quality monitoring Review of primary air quality monitoring report and analysis Addressing air quality issues in EIA Report and suggesting mitigation measures for impacts due to air pollution and review Review and analysis of primary meteorological data December 2019 - March 2020; Identification of Air Quality Monitoring Network Supervision of ambient air quality monitoring Review of primary air quality monitoring report and analysis Addressing air quality issues in EIA Report and suggesting mitigation measures for impacts due to air 	Thams
2	WP*	Mr. A.S Brara Ms. Preeti	pollution and review Review and analysis of primary meteorological data December 2019 - March 2020 Identification of water sampling locations, their time and frequency pertaining to site conditions Counter checking of analysis of data by literature study and consultation with local people and concerned departments Identification of water quality by analysis report study and detection of potential hazards due to developmental activity Checking of water availability by literature study and by interacting concerned Govt. Officials like GWB and irrigation dept. December 2019 - March 2020; Identification of water sampling locations, their time and frequency pertaining to site conditions Counter checking of analysis of data	Thams

		Ms. Pratibha	by literature study and consultation with local people and concerned departments • Identification of water quality by analysis report study and detection of potential hazards due to developmental activity • Checking of water availability by literature study and by interacting concerned Govt. Officials like GWB and irrigation dept.	Downson.
3	SHW*	Mr. R.A Wani Ms. Pratibha	 December 2019 - March 2020; Estimated the waste generation quantity due to various construction activity Devising measures to minimize wastes; recycle and disposal Identification methods of recycling and reuse Ensured incorporation of the same into the EIA report. 	R. A. Wow
4	SE*	Mr. Anil Kumar	 December 2019 - March 2020; Design and develop format/questionnaire for baseline survey, social changes arising out of development projects and assessment of data so collected Evaluation of socio economic status of tribal/non-tribal areas Assessment of social impact Collection of secondary information Survey tool design Reconnaissance study, transect walk Community participation, Mitigation plan Stakeholder consultation 	Anic Kumpa.
		Mr. Braj Vallabh Pandey	June 2020 to Till Now; Design and develop format/questionnaire for baseline survey, social changes arising out of development projects and assessment of data so collected Evaluation of socio economic status of tribal/ non- tribal areas Assessment of social impact Collection of secondary information Survey tool design Reconnaissance study, transect walk Community participation, Mitigation plan Stakeholder consultation	Brig Valle Werenday

5	EB*	Dr. Rajdeep	 December 2019 - Feb 2020; Visited site to identify the ecological condition of project area by direct field study and identification of major floral and faunal species Identification of potential impact due to the project interventions and developing mitigation measures by direct field study and consulting the stakeholders like forest and wildlife officials, local people etc. 	Rajdeef
		Dr. BJ Prasad	 Feb 2020 -Till now; Visited site to identify the ecological condition of project area by direct field study and identification of major floral and faunal species Identification of potential impact due to the project interventions and developing mitigation measures by direct field study and consulting the stakeholders like forest and wildlife officials, local people etc. 	Brasad
6	HG*	Capt. H.K Sharma	 December 2019 -March 2020; Identification of the water sources and drainage pattern Analyze them to identify the likely impacts Devise mitigation measures and assisted in preparation of the EIA report. 	decimal HKdun)
7	GEO*	Mr. B.M. Sinha	 December 2019 – March 2020 Identification of nature of geology of the project area Identification of areas likely to be affected by soil erosion Devised protection measures for embankment slope and water bodies 	Poslish
8	SC*	Dr. Vivek Diwedi	 December 2019 -Feb 2020 Identification of soil quality and soil type for establishing the baseline conditions Assessing the impact on soil due to various activities of the project Suggest mitigation measures to control the adverse impact Preparation of report for incorporation in the EIA 	lutidoneh

		Dr. BJ Prasad	 Feb 2020-March 2020; Identification of soil quality and soil type for establishing the baseline condition Assessing the impact on soil due to various activities of the project Suggest mitigation measures to control the adverse impact Preparation of report for incorporation in the EIA 	Brasad
9	AQ*	Mr. A.S. Brara	 December 2019 - March 2020; Analysis of air quality data, meteorological data, traffic data etc. as per the requirements of Pollution Dispersion model (AERMOD) Assessment of secondary data requirements for modeling, collection of secondary data like mixing height, stability class etc. Predict air quality using pollution dispersion model (AERMOD) Interpretation, analysis and presentation of predicted results of pollution dispersion modeling Review and finalization of report 	Allen
10	NV*	Mr. A.S. Brara		Abbras

		Capt. H.K. Sharma	 Identification of Noise Quality Monitoring Network and noise sensitive location along the project stretch Supervision of ambient noise quality monitoring Review of noise quality monitoring report Addressing noise related issues in EIA report and suggesting measures for impacts due to noise pollution Analysis of noise quality data, traffic data etc. as per the requirement of mathematical model of FHWA-TNM Interpretation, analysis and presentation of predicted results. 	HK duns)
11	LU*	Mr. Manoj Kumar Singh	 December 2019 -March 2020; Identification and collection of satellite images and other associated maps for the project area Creation of GIS data base and processing of satellite imageries Devised measure to save sensitive and productive land uses by suggesting option of realignment, bypass and eccentric widening Analysis of land use map and incorporation of land use details into EIA 	Dane 1.
12	RH*	Mr. R.A Wani	 December 2019 -March 2020; Identification of the potentially hazardous material and events that night occur during various phases of the project Devising contingency plan for each type of hazard Incorporation of the same in the EIA report 	R. A. Davi

.

Part B: Declaration by Head of the ACO/ authorized person

I, <u>A. S. Brara</u>, hereby, confirm that the above mentioned experts prepared the EIA "Mining of Minor Mineral (Sand, Bajri and Boulder) from the riverbed of river Jakhan-2 of Village- Majri Grant, Tehsil & District-Dehradun and State-Uttarakhand and EIA Coordinator (EC) is fully aware of the content. The consultant organization shall be fully accountable for any mis-leading information. It is also certified that EIA Report has been analysed by the system for plagiarism check using Smalls tools software in accordance with good scientific practice. No unethical practices have been carried out and external data / text has not been used without proper acknowledgement, while preparing this EIA report.

Certificate of Plagiarism check		
Title of EIA Report:	Mining of Minor Mineral (Sand, Bajri and Boulder) from the riverbed of river Jakhan-2 of Village- Majri Grant, Tehsil & District- Dehradun and State-Uttarakhand.	
Name of Accredited Organisation:	M/s Mantec Consultants Pvt. Ltd., Noida	
Unique Identification Number:	MCPL/EMD/MIN/2018-19/06/01/(EIA-V01)	
Name of EIA Co-ordinator:	Dr. B. J. Prasad	
Name of the Software:	Smallseotools	
Date of Check:	March, 8 th 2021	
Time of Check:	Multiple time due to word limit	

^{*}Note – The ACO may use/take help of appropriate software to detect plagiarism issues of the EIA content.

EIA Co-ordinator:

Name : Dr. B.J. Prasad (Principal Consultant)

Signature : Porasac

Head of ACO / authorised person:

Name : Mr. A.S. Brara (CMD)

Signature

Consultant Organization: M/s Mantec Consultants Pvt. Ltd., Noida

NABET Certificate no. & Issue date: NABET/EIA/2023/RA 0205 & Date of Issue 07/05/2021

Undertaking by Project Proponent

The Environmental Impact Assessment Report of "Mining of Minor Mineral (Sand, Bajri and Boulder) from the riverbed of Jakhan-2 of Village-Majri Grant, Tehsil & District-Dehradun and State-Uttarakhand prepared by Mantec Consultants Pvt. Ltd. has been reviewed thoroughly at our end before submission. I, on behalf of M/s Uttarakhand Forest Development Corporation, hereby undertake that the data and information provided in the report are correct to the best of our understanding, and we own responsibility for correctness of contents of the EIA report.

Authorized Signatory

Uttrakhand Forest Development Corporation

उत्तराखण्ड वन विकास निगम

Undertaking by Accredited Consultant Organization

I, <u>A. S. Brara</u>, hereby, confirm that this EIA/ EMP Report Mining of Minor Mineral (Sand, Bajri and Boulder) from the riverbed of Jakhan-2 of Village- Majri Grant, Tehsil and District- Dehradun, State-Uttarakhand. I also confirm that I shall be fully accountable for any miss-leading information mentioned in this Report.

Signature

Name : Mr. A.S. Brara

Designation : CMD

Name of the EIA Consultant Organization: Mantec Consultants Pvt. Ltd., Noida-01301

QCI/NABET Accredited EIA Consultant at S.No. 155 as per List of Accredited Consultant Organizations/(Alphabetically) Rev. 12, July 09, 2021 and MoEF&CC and NABL approved Laboratory.

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ABBREVIATIONS			
AAQM	Ambient Air Quality Monitoring		
Avg.	Average		
BOD	Biochemical Oxygen Demand		
BIS	Bureau of Indian Standards		
COD	Chemical Oxygen Demand		
CEC	Cation Exchange Capacity		
CGWA	Central Ground Water Authority		
СРСВ	Central Pollution Control Board		
CER	Corporate Environment Responsibility		
CSR	Corporate Social Responsibility		
dB	Decibel		
DMP	Disaster Management Plan		
EHS	Environmental Health and Safety		
EMP	Environmental Management Plan		
На	Hectare		
IMD	Indian Meteorological Department		
IUCN	International Union for Conservation of Nature		
KLD	Kilo Liter per Day		
LU/LC	Land use/Land Cover		
M asl	Mean Sea Leve		
mRL	Mean Reference Level		
MCDR	Mining Conservation & Development Rules		
MoEF&CC	Ministry of Environment and Forest and Climate Change		
MTPA	Million Tonns Per Annum		
NH	National Highway		
NAAQ	National Ambient Air Quality		
NABET	National Accreditation Board for Education and Training		
NABL	National Accreditation Board for Testing and Calibration Laboratories		
NOx	Nitrogen Oxides		
OH&S	Occupational Health & Safety		
PM	Particulate Matter		
LOS	Level of Service		
PCU	Passenger Car Unit		
QCI	Quality Council of India		
-	Risk Assessment		
RA R&R	Risk Assessment Rehabilitation & Resettlement		
RDS			
SEIAA	Respirable Dust Sampler State Environment Impact Assessment Authority		
	Survey Of India		
SOI SPCB	State Pollution Control Board		
SPM	Suspended Particulate Matter Solid Hazardous Waste		
SHW	Total Dissolve Solid		
TDS			
TOR	Terms of Reference United State Environmental Protection Agencies		
US EPA	United State Environmental Protection Agencies		
w.e.f.	With Effective From		
w.r.t.	With Reference To		

COMPLIANCE TO TOR CONDITIONS

Point wise compliance of ToR issued by MoEF7CC, New Delhi, vide letter F.No. J-11015/90/2020-IA.II (M), New Delhi by Honorable EAC, on dated 04.03.2021 for the project Mining of Sand, Boulder and Bajri (Minor Mineral) Mine from the river bed of River Jakhan-2 by M/s Uttarakhand Forest Development Corporation, located in Dehradun Forest Division, Uttarakhand over an area of 96.50 ha with Production Capacity of 2866050.00 TPA.

S.NO.	ToR POINT	COMPLIANCE OF TOR	Reference
	Specific TOR		
I.	The PP needs to submit the details of Scientific Replenishment Study carried out as per Enforcement and Monitoring Guidelines for Sand Mining, 2020.	Detailed Replenishment Study report is attached as Annexure-VII in EIA report.	Annexure-VII
II.	The PP shall ensure that the impacts on aquatic and terrestrial ecosystems due to mining activity be properly addressed in the EIA/EMP report.	Impacts on aquatic as well as on terrestrial ecosystems have been addressed in Chapter 4 of EIA Report.	Item no. 4.10 to 4.11.2, Chapter- 4, page no. 110,
III.	The PP needs to ascertain the impact of transportation and details of transportation route viz. (length of the road, type of road, passing through the village or habitation) and mitigtve measures to be taken for abatement of pollution due to transportation. The budget for the same needs to be provided.	Traffic study was carried out as per IRC guideline and analyzed that not much impact on local transport. The LOS value from the proposed mine may be "Good" for village road. So the additional load on the carrying capacity of the concern roads is not likely to have any significant adverse effect. The details of traffic study is given in Chapter-3	Section 3.10 of Chapter-3 on Page No.50
IV.	The PP needs to confirm that is there any other homogenous mining lease within 500 meters of this lease and forming cluster. If yes, details of the same needs to be provided.	No mining lease is present in 500m of this project lease area.	NA
V.	The PP needs to submit the Forest Clearance and Wildlife Clearance at the time of appraisal of EC.	The Forest clearance of the project vide proposal number File no. 8-62/1999FC (VOL) dated 4 th February 2021 is attached as Annexure-I. Wildlife Clearance will be taken at time of appraisal of EC.	Annexure-I.
VI.	The PP should submit the Affidavit in a Non- Judicial Stamp paper to comply with all statutory requirement & judgement of Hon'ble Supreme Court dated 2 nd	Affidavit is attached as Annexure- VIII in EIA Report.	Annexure- VIII

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	August 2017 in Writ Petition (Ciil) No. 114 of 2014 in the mtter of Common Cause versus Union of India & Ors as applicable s per Ministry OM dated 30.05.2018. Additional TOR's		
I.	PP Should provide in the EIA Report details of all the statutory clearances, permissions, no objection certificates, consents etc. required for this project under various Acts, Rules and regulations and their status or estimated timeline after grant of EC.	Details of all statutory clearances have been mentioned in Chapter-I of EIA Report.	Item 1.2 of Chapter-1 on page no. 2.
II.	PP should submit the revenue plan for mining lease, revenue plan should be superimposed on the satellite imginery clearly demarcate the Govt. land, private land, agricultural land, etc.	The revenue plan for mining lease will be submitted during EC Presentation.	
III.	PP should submit the real time aerial footage & video of the mining lease area and of transportation route. PP should submit the detailed plan in tabular format (year wise for life of mine) for afforestation and green belt development in and around the mining lease. The PP should submit the no. of saplings to be planted, area to be covered under afforestation & green belt, location of plantation, target for survival rate and budget earmarked for the afforestation & greenbelt development. In addition to this, PP should show on surface plan (5 year interval for life of mine) of suitable scale that are to be covered uner afforestation & greenbelt clearly mentioning the lat and long of the area to be covered during each 5 years. The capital and recurring expenditure to be incurred needs to be submitted. Presently in India there are many agencies which are developing forest in short interval of time. Thus, for the plantation activities details of the experts/agencies to be engazed needs to be provided with budgetry provisions.	Real time photographs of the project mine lease area have been incorporated in Chapter-2. The Schedule for plantation for the five years has been given in EIA/EMP report. The most suitable floral species for green belt development and plantation activities in the project area are given in Chapter-10.	Figure 2.4, Chapter-2 on Page no.17 Section 10.5 of Chapter-10 on Page No. 135
IV	PP should submit the quantity of surface or groundwater to be used for this project. The complete water balance cycle needs to be submitted. In addition to this, PP should submit a detailed plan for rainwater	Water requirement for plantation and dust suppression will be 35.7 KLD which will be fulfilled by Water Tanker. The details of water requirement is given in Chapter-2.	Section 2.9.2 of Chapter-2 on page no 26.

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	harvesting measures to be taken. PP should submit the yearwise target for reduction in consumption of ground/surface water by developing alternative source of waterthrough rain water harvesting measure. The capital and recurring expenditure to be incurre needs to be submitted.	Water balance is given in Figure 2.8. Provision of Rainwater Harvesting is incorporated in section 4.8 in Chapter-3.	Figure 2.8 , page no. 26, Page No. 108
V.	PP should clearly bring out the details of the manpower to be engaged for this project with their roles/responsibilities/designations. In addition to this, PP should mention the no. and designation of person to be engaged for implementation of EMP. The capital & recurring expenditure to be incurred needs to be submitted.	Details of manpower are mentioned in Chapter-2.	Item no. 2.9.4 on page no. 27, Table 2.4.
VI.	PP should submit the year wise activity wise and time bound budget earmarked for EMP, occupational health surveillience & CER. The capital and recurring expenditure to be incurred to be submitted.	Budget earmarked for Environment Management Plan, Occupational Health Surveillience are mentioned in Chapter-10.	Item No, 10.11, table no. 10.4, page no. 138 & 139, figure no. 10.3.
VII	PP should submit the measures/technology to be adopted for prevention of illegal mining and pilferage of mineral. PP should submit the detailed mineralogical and chemical composition of the mineral and percentage of free silica from a NABL/MoEF&CC accredited laboratory.	The measures / technology to be adopted for prevention of illegal mining and pilferage of mineral are given in Chapter-4. The mineralogical and chemical composition of the mineral are given in Chapter-2.	Section 4.8.2 of Chapter-4 on page no: 109. Section 2.13 of Chapter-2 on page no: 28.
VIII	PP should clearly show the transport route of the mineral and protection and mitigative measures to be adopted while transportation of the mineral. The impact from the centre line of the road on either side should be clearly brought out supported with the line source modeling and isopleth. Further, frequency of testing of Poly Achromatic Hydrocarbon needs to be submitted alongwith budget. Based on the above study the compensation to be paid in the event of damage to the crop and land on the either side of the	Transport route Map is incorporated in Chapter-3. Anticipated impacts and mitigation measures are addressed in Chapter-3.	Figure-2.3, page no.16 Item 4.14, page no.115 Isopleths- Figure 4.1 to 4.4, page no.103 to 106
	road needs to be mentioned. The PP should provide the source of equations used and complete		Table 4.2 page 99 &100, chapter-4

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	calculations for computing the emission rate from the	sources are addressed in Chapter-4.	
	various sources.		
IX	PP should clearly bring out that what is the specific diesel consumption and steps to be taken for reduction of the same. Year-wise target for reduction in the specific diesel consumption needs to be submitted.	There is no requirement of diesel. Only vehicle for transportation will be used. There will be no requirement of any DG SET or anything which required Diesel fuel as it is open cast mining.	_
X	PP should bring out the awareness campaign to be carried out on various environmental issues, practical training facility to be provided to the environmental engineer/diploma holders, mining engineer/ diploma engineers, geologists and other trades related to mining operations. Target for the same needs to be submitted.	Will be complied.	_
XI	The budget to be earmarked for the various activities shall be decided after perusal of the Standard EC Conditions if agreed PP should also submit an undertaking by the way of affidavit for Compliance of Standard EC Conditions already prescribed by the Ministry vide O.M. No. and Specific condition if prescribed by the EAC/MoEF&CC.	Will be complied.	_
XII	The PP should ensure that only NABET accredited consultant shall be engaged for the preparation of EIA/EMP Reports. PP shall ensure that accredition of consultant shall be valid during the collection of baseline data, preparation of EIA/EMP report and during the apparaisal process. The PP and consultant should submit an undertaking the information and data provided in the EIA Report and submitted to the Ministry are factually correct and PP and consultant are fully accountable for the same.	Nabet Accredited Consultant via certificate no. NABET/EIA/2023/RA 0205 is engaged for preparation of EIA/EMP Report. Details are: EIA Consultant- M/s Mantec Consultants Pvt. Ltd., Noida-201301 Date of Issue of Certificate-07/05/2021 Validity-20/04/2023 Category of Organization- "A" During the Baseline Data collection, preparation of EIA/EMP report and during the appraisal process the accreditation is valid. Undertaking is incorporated in EIA Report.	
XIII	The PP should submit the photograph of monitoring stations & sampling locations. The photograph should bear the date, time, latitude & longitude of the	Monitoring Photographs depicting date, time, latitude & longitude are incorporated in Chapter-2. Original lab reports are attached as Annexure- VII.	Figure 3.12, Chapter-3, page no.

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	monitoring station/sampling location. In addition to		50
	this PP should submit the original test reports and		A
	certificates of the labs which will analyze the samples. Standard TOR		Annexure-VII.
1	Year-wise production details since 1994 should be	The year wise production details (2011-2019) of the	Section 2.8 of
	given, clearly stating the highest production achieved	mine is given in Chapter-2.	Chapter-2 on Page
	in any one year prior to 1994. It may also be	inne io given in chapter 21	No. 24.
	categorically informed whether there had been any		1101211
	increase in production after the EIA notification 1994		
	came into force W.R.T the highest production		
	achieved prior to 1994.		
2	A copy of the document in support of the fact that the	Mine has been allotted in the name of M/s UKFDC	Attached as am
	proponent is the rightful lessee of the mine should be	vide Letter of Intent (LOI) no 536/खनन/ आशय पत्र /	Annexure III.
	given	व॰वि॰नि॰/ भू॰ खनि॰ ई ॰/2018-19 dated 24/07/2018	
		by Director of Mines & Geology Department	
		Uttarakhand (Copy of same attached as Annexure	
		III)	
3	All documents including approved mine plan, EIA and	All the documents are compatible with one another	Attached as an
	Public Hearing should be compatible with one another	in terms of the mine lease area, production levels,	Annexure IV.
	in terms of the mine lease area, production levels,	waste generation and its management and mining	
	waste generation and its management mining	technology.	
	technology etc. and should be in the name of the	Approved mine plan letter is attached as Annexure	
	lessee.	IV.	
		Lessee Name- M/s Uttarakhand Forest	
		Development Corporation	
		Mine Lease area- 96.50 ha	
		Proposed Capacity- 2866050.00 TPA	
		Waste Generation and Management- No solid	
		Waste other than the negligible amount of clay	
		which will be further used for the plantation.	
		Mining Method- Open Cast Manual method.	
4	All corner coordinates of the mine lease area,	All of corner coordinates of the ML area are	Figure 2-2 of

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	superimposed on a High Resolution Imagery	incorporated in EIA/ EMP Report.	Chapter No. 2 page
	/Toposheet, topographic sheet, geomorphology and	Land use maps are also incorporated in Chapter no.	no. 14.
	geology of the area should be provided. Such an	<u> </u>	Figure-3.2, Page No.
	Imagery of the proposed area should clearly show the		32, Chapter-3
	land use and other ecological feature of the study area		-
	(core and buffer zone)		
5	Information should be provided in survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area important water bodies, streams and rivers and soil characteristics.	All maps are provided superimposed on Toposheet of survey of India in 1:50,000 scales showing all land forms of the area given in chapter-2 of EIA/EMP report. Important water bodies, streams and rivers related information given in Chapter-1.	Figure 2-2 of Page No. 14. Section 1.4 of Table 1-1 on Page No. 3-5.
6	Details about the land proposed for mining activities	The mine lease area is 96.50 ha which is a forest	Attached as an
	should e given with information as to whether mining	land. The Lease of Intent (LOI) is attached as an	Annexure III.
	conforms to the land use policy of the state land	Annexure II.	
	diversion for mining should have approval from state	No land diversion occurs.	
	land use board or the concerned authority.		
7	It should be clearly stated whether the proponent	Environment Policy attached as Annexure-V .	Attached as
	company has a well laid down environment policy		Annexure-V.
	approved by its board of Directors. If so, it may be		
	spelt out in the EIA report with description of the		
	prescribed operating process/procedures to bring		
	into focus any infringement/deviation/violation of the		
	environmental or forest norms/conditions. The		
	hierarchical system or administrative order of the		
	company to deal with the environmental issues and		
	for ensuring compliance with the EC condition may		
	also be given. The system of reporting of non-		
	compliances/violations of environmental norms to		
	the Board of Directors of the company and/or		
	shareholders or stakeholders at large, may also be detailed in the EIA Report.		
	uetaneu in the EIA Report.		

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8	Issues relating to Mine safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.	Mining will be carried out by opencast method only without blasting as per mining plan/ Scheme with Progressive Mine Closure Plan approved by Director Geology & Mining, Uttarakhand. Subsidence is not envisaged because the overburden and waste will be backfilled in the voids created in mining works. Clay mixed Over Burden which may be in very meager quantity will be used in plantation works. Depth of bench will not exceed 3m. The average bench height is 3m. The sides of the benches will have slopes at a safe angle of 45° to the horizontal. Moreover, all Safety standards/ safeguards will be implemented as per Guidelines prescribed by Director General of	
9	The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc. should be for the life of the mine/lease period.	Mines Safety. The study area comprises of 10km zone around the mine lease periphery as shown in the study area map is given in Figure 1.1 of Chapter-1 of EIA report.	Figure 1.1 of Chapter-1 of Page No.6.
	should be for the me of the immerituate period.	No solid waste other than the clayey soil which will be further used for the plantation. purposes.	
10	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological	A map delineating all the environmental sensitive features has been prepared and given in Figure 1.1 of Chapter 1 of EIA report.	Figure 1.1 of Chapter-1 of Page No. 6.
	features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted impact. if any, of change of land	Land use classification of 10km radius study area around the mine site, is given in Figure 3.4 of Chapter-3 of EIA reports.	Figure 3.2 of Chapter-3 of Page No. 32.
	use should be given.	Impact of change of land use is given in section 4.8 of Chapter-4, along with the mitigation measures.	Section 4.8 of Chapter-4 of Page No. 109.
11	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if	As there is no cognitive outcome of Over Burden is found in mining area, no proposal for storage of overburden outside the mining lease area are	

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	any, should be given.	proposed. R&R issue is not envisaged with this mine as no habitation fall within the mine area.	
12	A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.	The Forest clearance of the project vide proposal number File no. 8-62/1999FC (VOL) dated 4 th February 2021 is attached as Annexure-I.	Annexure-I.
13	Status of forestry clearance for the broken up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory a forestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	The Forest clearance of the project vide proposal number File no. 8-62/1999FC (VOL) dated 4 th February 2021. NPV is totally exempted by Hon'ble Supreme Court's order dated 28.3.2008 and order dated 9.5.2008 in IA No 826 in566 and related IA's regarding the rate of Net Present Value (NPV) of forest land.	Attached as an Annexure I.
14	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.	NA	_
15	The vegetation in the RF/PF areas in the study area, with necessary details, should be given.	Detailed list of vegetation is mentioned in Chapter-3	Section 3.11 on page no. 55
16	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.	Detailed Wildlife Conservation Plan is attached in Chapter-10 of EIA Report.	Item no. 10.13, chapter-10, page no.139

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17	Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/(existing as well as proposed), if any, within 10 km of the mine lease should be clearly indicated, supported by a location map duly authenticated by Chief Wildlife Warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished.	Rajaji Tiger Reserve located at 5.40kms from proposed mine site.	
18	A detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	Detailed of Biological Study (Flora & Fauna) within 10km radius of the project site have been incorporated in section 3.11 of Chapter no-3 in the EIA report. Fauna listed in Schedule-I have been found in the study area so the necessary conservation plan is incorporated in then Chapter-10.	Section 3.11 on page no. 55 Section 10.13 of Page No. 139.
19	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravali Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Dept. Should be secured and furnished to the effect that the proposed mining activities could be considered	The proposed project does not come within 10km radius of any 'critical polluted area neither it comes under Aravali range. Hence it is not applicable.	
20	Similarly, for coastal Projects, A CRZ duly authenticated by one of the authorized agencies demarcating LTL. HTL, CRZ area, location of the mine lease w.r.t CRZ, coastal features such as mangroves, if	NA	NA

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	any, should be furnished.		
21	R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs /STs and other weaker sections of the society in the study area, a need based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.	As per the Socio-Economic Survey, no R&R Plan is envisaged; as there is no displacement of people from their respective areas. However, M/s Uttarakhand Forest Development Corporation Ltd. realizes its responsibility towards community and environment.	
22	One season (non-monsoon) [i.e. March-May (Summer Season); October-December (post monsoon season); December-February (winter season)]primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-wise in the EIA and EMP Report. Site specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant Down wind direction and location of sensitive receptors. There should be at least one monitoring station within 500 m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.	Primary baseline data of study area within 10 Km radius of the project site has been generated for the post monsoon season from December 2019-February 2020. The monitoring location has been identified on the basis of CPCB Notification of 2009, water quality, noise level, soil and flora and fauna the same has been given in the Chapter-3.	Chapter-3

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23	Air quality modeling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modeling should be provided. The air quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.	Prediction of impacts on air Environment has been carried out employing mathematical model by using AERMOD was done and mentioned in EIA report. Wind rose map showing pre-dominant wind direction has been carried out and the results are delineated in EIA report.	Section 4.3.1, of Chapter-4 on Page No. 99.
24	The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	Water is not required in entire process of mining. Water requirement for plantation, dust suppression and drinking purposes is 35.7 KLD which will be fulfilled by Water Tankers. The details of water requirement is given in Chapter-2	Section 2.9.2 of Chapter-2 on page no 26.
25	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided	Not Applicable, as water requirement is fulfilled by the water tanker supply.	
26	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	Provision of Rainwater Harvesting is incorporated in section 4.8 in Chapter-3.	Section 4.8, Page No. 108
27	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.	Impact of the proposed project on the water quality both surface and ground water is negligible and the impact, mitigation measures on the quality of water both surface and ground water is given in Chapter-4 .	Section 4.10 of page no:- 110 of Chapter- 4
28	Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect groundwater table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report inter-alia, shall include details of the	The working will not intersect the ground water. Hence the details of Hydro Geological study is not required. The ground water table is given in Chapter-4 Water requirement will be met by tanker supply therefore permission from Central Ground Water Authority for pumping of ground water is not required.	Figure 4-5 of Chapter -4 on Page no 108.

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	aquifers present and impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of ground water should also be obtained and copy furnished.		
29	Details of any stream, seasonal or otherwise, passing through the lease area and modification/diversion proposed, if any, and the impact of the same on the hydrology should be brought out.	Proposed mining of Sand/Bajri/Boulder is to be carried out itself in Jakhan river bed to channelize the river flow. No other stream crosses the mine site	
30	Information on site elevation, working depth, groundwater table etc. Should be provided both in AMSL and bgl. A schematic diagram may also be provided for the same.	The working depth will be restricted to 3.0 meter from the average reserve level at 464.6m and 550 m bgl is the ground water table. Hence, ground water table will not be intersected. A schematic diagram is provided in the Chpater-4.	Figure 4-5 of Chapter -4 on Page no 108
31	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the Project. Phase-wise plan of plantation and compensatory afforestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and native species and the species which are tolerant to pollution.	As this proposal is a renewal proposal of previous sanctioned project, hence, Compensatory Afforestation is not applicable here. The Schedule for Green Belt Development plantation for the five years has been given in EIA/EMP report. The most suitable floral species for green belt development plantation activities in the project area are given in Chapter-10.	Section 10.5 of Chapter-10 on Page No. 135
32	Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if	Traffic study was carried out as per IRC guideline and analyzed that not much impact on local transport. The LOS value from the proposed mine may be "Good" for village road. So the additional load on the carrying capacity of the concern roads is not likely to have any significant adverse effect.	Section 3.10 of Chapter-3 on Page No.50.

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	contemplated (including action to be taken by other agencies such as State Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.		
33	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Site facilities which will be provided by M/s Uttarakhand Forest Development Corporation are given as. The site services include (a) mines office, (b) rest shelter, (c) first aid center, (d) store room, water tank, public convenience, water-man-shed Road	Sub Section-2.9.3 of Chapter-2 on Page No. 27.
34	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.	Excavation of mineral will be done only up to 3.0 meter depth or up to river water level whichever is less and during monsoon riverbed will be replenished naturally. However, it will be ensured that riverbed surface is uniformly extracted so that there could not be irregular water accumulation in pits. Hence, no reclamation and restoration activity has been carried out.	
35	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Occupational Health and Safety details are given in Chapter-6. Its Monitoring Schedule is given in Chapter-5	Section 6.4.8 of Chapter-6 on Page No-122.
36	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with	Corporate social responsibility of the company is given in report, indicating public health implications of the project and related activities for the population in the impact zone has been public hearing action plan by providing aid and	

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	budgetary allocations.	employment facilities.	
37	Measures of socio economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation	Socio-economic measure provided by the company for the local community is given in EIA report.	Chapter-3
38	Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Environment Management Plan has been given in Chapter 10.	Chapter 10
39	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project.	Public hearing will be conducted after submission of Draft EIA to Uttarakhand State Pollution Control Board. The Public Hearing outcomes will be incorporated in Final EIA report.	
40	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	No litigation is pending against the project.	
41	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out	The cost of project 5.15 Crores and EMP cost is 40 lakhs has been given in EIA report.	Table 1.1 of Chapter-1 on page no. 3.
42	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Disaster Management Plan is given in chapter 7.	Section 7.5 of Chapter-7 on Page No. 126.
43	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic,	Project benefits are given in chapter 8.	Chapter 8 on page no. 130.

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	employment potential, etc.		
	employment potential, etc.		
44	Activity-wise time-bound action plan on the issues raised and commitment made during public hearing to be submitted as part of the final EMP Report in compliance of the Ministry's OM F.No.22-65/2017-II.III dated 30.09.2020.	Will be complied and submitted.	
Besides the	above, the below mentioned general points are also t	o be followed:	
a.	All documents to be properly referenced with index and continuous page numbering.	Complied	
b.	Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.	Complied	
c.	Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project.	Baseline Reports are attached as Annexure-VI	Annexure-VI.
d.	Where the documents provided are in a language other than English, an English translation should be provided.	Documents are provided in English language.	
e.	The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.	Complied	
f.	While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF vide O.M. No. J-11013/41/2006-IA. II(I) dated 4th August, 2009, which are available on	The EIA report has been prepared and complying with the circular issued by MoEF vide O.M. No. J-11013/41/2006-IA.II (I) dated 4th August, 2009.	

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	the website of this Ministry, should be followed.		
g.	Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation.	No such changes has been done.	
h.	As per the circular no. J-11011/618/2010-IA.II(I) dated 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	We will submit at the time of Final EC Presentation.	
i.	The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	All plans are attached as Annexure IV of Scheme of Mine. The drainage map is given EIA report.	Annexure IV of Mining Scheme. Figure 2.5 on page no.22

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CHAPTER-1: INTRODUCTION

1.1 INTRODUCTION

Mineral resources of the nation reflect in terms of potential economic growth of the country at large. Our natural mineral wealth has been exploited considerably during the past 50 years. With increase in industrialization coupled with population growth, the demand for different minerals has increased and is likely to grow further in years to come. This has resulted in irreversible impacts on diminishing reserves, with simultaneous generation of solid wastes and effluents causing environmental degradation. It is therefore important to tackle the problem for control of pollution and mining of minerals in a cost-effective method causing least damage to the environment. In order to commence/enhance production/ renewal of any mines, it is necessary to obtain Environmental Clearance from the Ministry of Environment and Forests, Govt. of India as per EIA Notification 2006 and consecutive amendments.

Mining Operation Plan, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) etc. are some of the important requisites from investor for Environmental Clearance. Hence, the lessee has to prepare an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) report for Environmental Clearance before commencement of mining activities. To prepare an effective and sustainable EIA and EMP, it is necessary to conduct a baseline survey of the existing environmental attributes. It helps to evaluate anticipated environmental impacts to the proposed activities and in formulating a scientific Environmental Management Plan.

Irrespective of magnitude of operation, attempts have been made to maintain Environmental balance of the study area. Environmental Impact Assessment (EIA) is one of the tools available with the planners to achieve the above mentioned goal. It is desirable to ensure that the development options under consideration are sustainable. In doing so, environmental consequences must be characterized early in the project cycle and accounted for in the project design.

There are many Acts/Rules & Notifications issued by MoEF&CC, New Delhi for keeping the environment in and around project sites congenial for healthy/better standard of living. Few of them are mentioned below:

- 1. Environment (Protection) Act, 1986
- 2. Environment (Protection) Rules, 1986
- 3. Water (Prevention & Control of Pollution) Act, 1974
- 4. Air (Prevention & Control of Pollution) Act, 1981
- 5. Environmental Impact Assessment (EIA) Notification, dated 27th January, 1994
- 6. Environmental Impact Assessment (EIA) Notification, dated 14th September, 2006
- 7. Environmental Impact Assessment (EIA) Notification as amended on 1st December, 2009
- 8. Environmental Impact Assessment (EIA) Notification as amended on 14th August, 2018

M/s UKFDC has proposed for mining of Sand, Bajri and Boulder minor mineral in their mining lease area of 96.50 hectare in Village Majri Grant, Tehsil & District- Dehradun for production of 2866050.00 TPA. The applicant is seeking prior Environmental Clearance project as per EIA notification 2006 and its amendments. Since the Rajaji Tiger Reserve is situated at 5.4 kms from the Project site, it falls under "Category A" based on the Schedule Clause number 1(a) of EIA notification 2006 and subsequent amendments.

In order to assess the likely impacts arising out of the project, the Environmental Impact Assessment (EIA) study is undertaken, which will be followed by preparation of a detailed Environmental Management Plan (EMP) to minimize those adverse impacts.

1.2 PURPOSE OF REPORT

The applicant M/s Uttarakhand Forest Development Corporation, Aranya Vikas Bhawan, 73 Nehru Road, Dehradun, is seeking prior Environmental Clearance for Collection of Minor Mineral (Sand, Bajri and Boulders) from the river bed of River Jakhan-2 over an area of 96.50 ha with Production Capacity of 2866050.00 TPA.

M/s Uttarakhand Forest Development Corporation (UKFDC) has granted earlier Environmental Clearance vide MoEF&CC letter no. J-11015/343/2009-JI (M) on 15.04.2011.

As the mine lease lies falls in the reserve forest so, the M/s Uttarakhand Forest Development Corporation granted the Forest clearance vide letter No. MoEF (FC division) **F.No. 8-62/99- FC** for the period of 10 years on 26.05.2009. As the Forest clearance is expired on 26.05.2019 the Environmental Clearance is also expired so, the M/s Uttarakhand Forest Development Corporation applied for the Fresh Environmental Clearance.

The Stage I Forest Clearance is approved by Ministry of Environment, Forest and Climate Change (Forest Conservation Division) with **File no. 8-62/1999FC (VOL)** dated **4**th **February 2021**. The Stage-I forest Clearance letter attached as an **Annexure I**.

As per EIA Notification 2006 and subsequent amendments, the project falls in Schedule 1 (a) in Category 'A' due to presence of Rajaji Tiger Reserve at 5.4kms from Project site.

In this context, Form-I and Pre-Feasibility Report has been submitted to MoEF&CC, New Delhi on date 21/12/2020 (online) and requesting for issue of "Terms of Reference" (ToR). The ToR Presentation was held on 04.02.2021 before EAC of MoEF&CC New Delhi. Subsequently, the ToR was issued on date 04.03.2021 by Honorable EAC, New Delhi vide letter no F.No. J-11015/90/2020-IA.II (M) (enclosed as **Annexure-II**). Baseline data have been collected for one season i.e. from 1st December 2019 to 29th February 2020.

Letter of Intent: The letter of intent (LoI) has been issued by the Director of Mines & Geology department, Uttarakhand vide No 536/खनन/ आशय पत्र / ব৹বি৹নি০/ মৃ০ खनि০ ई ০/2018-19 dated 24.07.2018 in favour of M/s Uttarakhand Forest Development Corporation, for mining of Sand, Bajri and Boulder (Copy of LOI has been enclosed as Annexure-III).

Lease Period: 5 Years

Mine Plan and Progressive Mine Closure Plan: The mining plan for the Jakhan-2 river mining lease over an area of 100.0 ha was earlier approved by the Director Geology and Mining Uttarakhand vide letter No. 104/ उত্তৰ০/मা আন/ दे তুর ন০2016-17 dated 12/05/2017. The present scheme of mining is approved by the Director Geology and Mining Uttarakhand with an area of 96.50 Ha (Copy enclosed as Annexure-IV).

1.3 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

Identification of the Project

Mining of Minor mineral (Sand, Bajri and Boulders) from the river Jakhan-2 by M/s Uttarakhand Forest Development Corporation having an area of 96.50 ha with production capacity of

2866050.00 TPA. The mine is situated in the Village- Majri Grant, Tehsil and District-Dehradun. The mine lease area falls in the survey of India Toposheet no **53J/4**.

Project Proponent

Uttarakhand Forest Development Corporation (UKFDC) is a statutory body constituted by the State Government of Uttarakhand. The Corporation was formed for the better preservation, supervision and development of forest also for better exploitation of forest produce within the State and for matters connected there with.

The Corporation has been progressing forward not only in its financial aspect but also has taken a big leap in the direction of diversification of its activities.

The Corporation has added the collection and disposal of minor minerals from the rivers situated inside reserved forest areas, collection and marketing of medicinal plants and Eco tourism in its works apart from the removal of dead, dying and uprooted trees as allotted by the Forest department.

The applicant details are given below:-

S.No.	Name of the Mine	Applicant	Proponent Name	Proponent Name
	lease area			
1.	Mining of Sand,	M/s	M/s Uttarakhand Forest	M/s Uttarakhand
	Bajri and Boulder	Uttarakhand	Development Corporation	Forest Development
	(Minor Mineral)	Forest	Mob No: +91-	Corporation
	from Jakhan-2	Development	9568003225	Mob No: +91-
	Riverbed Village	-	Email id:	9568003225
	Majri Grant, Tehsil	Corporation	dmlkhanand.dun@gmail.c	Email id:
	& District		om	dmlkhanand.dun@gmai
	Dehradun,			<u>l.com</u>
	Uttarakhand			

1.4 BRIEF DESCRIPTION OF NATURE, SIZE, LOCATION OF THE PROJECT AND ITS IMPORTANCE TO THE COUNTRY REGION

Table 1-1: Brief Description of the Project

S. No.	Particulars	Details	·	
A.	Nature and Size of the	Mining o	of Minor Minerals	(Sand, Bajri and
	Project	-) from the riverbed of	,
		M/s U	Ittarakhand Fores	t Development
		Corporati	ion, located in l	Dehradun Forest
		Division,	District Dehradun, Ut	tarakhand over an
		area of 9	96.50 ha with Produ	action Capacity of
		2866050.	.00 TPA.	
B.	Location			
Geographical	Latitude and Longitude	Pillar	Latitudes	Longitudes
Coordinates	of		Latitudes	Longitudes
		No.		
		S. No	Lat	Long
		A	30°10'53.91" N	78°11'32.03" E
		В	30°10'50.36" N	78°11'37.87" E

	T		
		C 30°10'32.99" N 78°11'09.04" E	
		D 30°10'24.86" N 78°10'47.51" E	
		E 30°10'11.19" N 78°10'19.44" E	
		F 30°10'07.55" N 78°10'15.64" E	
		G 30°09'42.73" N 78°10'04.71" E	
		H 30°09'15.14" N 78°10'00.41" E	
		I 30°08'47.09" N 78°09'56.21" E	
		J 30°08'52.56" N 78°09'46.82" E	
		K 30°09'16.28" N 78°09'54.78" E	
		L 30°09'45.33" N 78°09'58.96" E	
		M 30°10'11.12" N 78°10'11.06" E	
		N 30°10'16.18" N 78°10'13.48" E	
		0 30°10'32.63" N 78°10'43.35" E	
		P 30°10'39.79" N 78°11'05.62" E	
	Toposheet (OSM) No.	53 J/4	
C.	Lease Area Details		
	Lease Area	96.50 ha	
	Topography	Undulated (Riverbed)	
	Site Elevation Range	464.6m amsl to 550.0m amsl	
		Source: Mining Plan	
D.	Cost Details		
	Cost of the project	Rs. 5.15 Crores	
	Cost for EMP	Rs. 37.10 Lakhs/Yr (Capital Cost)	
		Rs. 12.23 Lakhs/Yr (Recurring Cost)	
	OH&S	Rs. 3.00 Lakh/Yr (Capital Cost)	
		Rs 2.00 Lakhs/Yr (Recurring Cost)	
	Cost For Biodiversity	Rs. 4.80 Lakhs (Capital Cost)	
	Conservation	Rs. 2.03 Lakhs (Recurrimg Cost)	
E.	Environmental Settings of		
	Ecological Sensitive	Rajaji Tiger Reserve~5.40 Km, SW	
	Areas (National Park,	Lachhiwala Range Reserve Forest ~5.1 Km, NW	
	Wild Life Sanctuary,	Barkot Range Reserve Forest ~1.4 Km, ES	
	Biosphere Reserve,	Rishikesh Reserve Forest ~3.7 Km, N	
	Reserve/ Protected		
	Forest etc.) within 10 Km radius		
	Inter-state boundary	None	
	within 5 Km radius	None	
	Nearest Town/ Major City	r Dehradun~17.46 Km, N	
	Nearest Railway Station	Doiwala Railway Station~4.6 Km, W	
	Nearest State Highway/ National Highway	/ NH 7 Haridwar Dehradun Road ~2.27 km, W	
	Nearest Airport	Jolly Grant Airport ~1.8 km, N (Aerial distance)	
	Nearest Post Office	India Post Office Ranipokhri~4.12 Km, N	
	Nearest Police Station	Jolly Grant Police Station~1.18 kms in NNW	
	medicati once atation	,- ,	

Medical Facilities	Himalayan Hospital~2.46 Km, N
Education Facilities	Swami Rama Himalayan University~ 2.4 Km, N CNS High School~0.73Km, N
Seismic Zone	Zone-IV (As per 1893:2002)
Water Body	Song River ~ 3.6 kms in W Chandrabhaga River ~ 8.4 kms in E

(Source: Site visit /Baseline Data and Pre-feasibility Report)

All corner-coordinates of ML area are superimposed on Toposheet No. 53 J/4 Figure 1.1

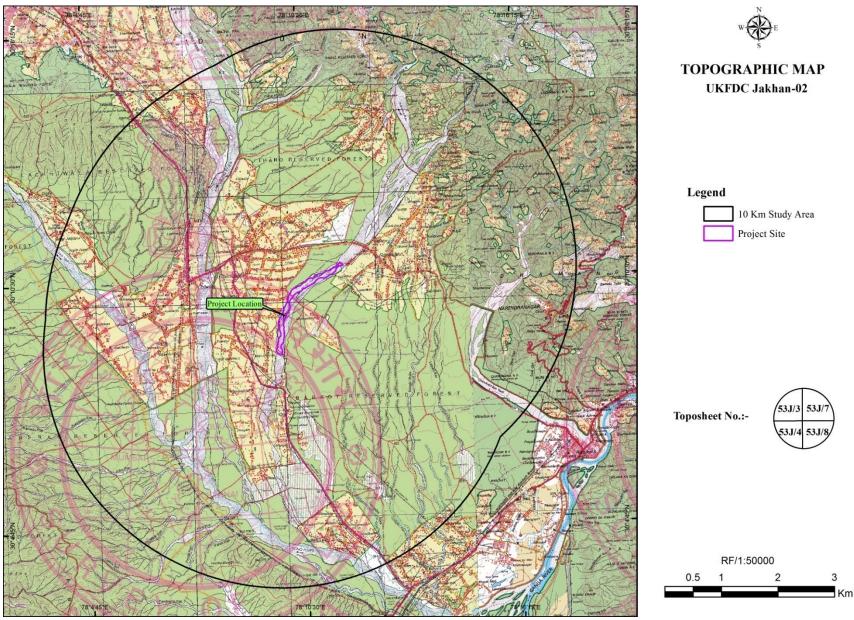


Figure 1-1: Toposheet map of 10 km study area with showing the Coordinates of Proposed Mine Lease area

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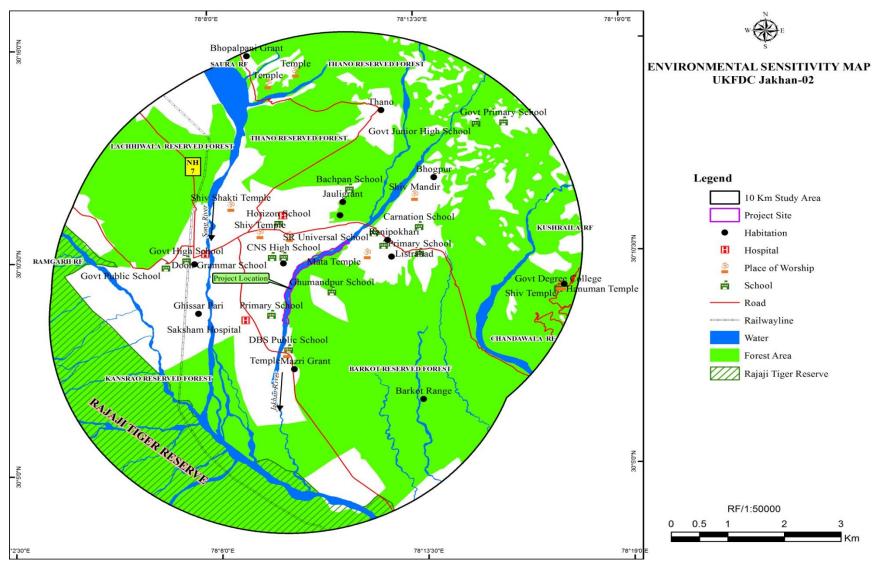


Figure 1-2: Environmental Sensitivity Map of 10 km Study Area

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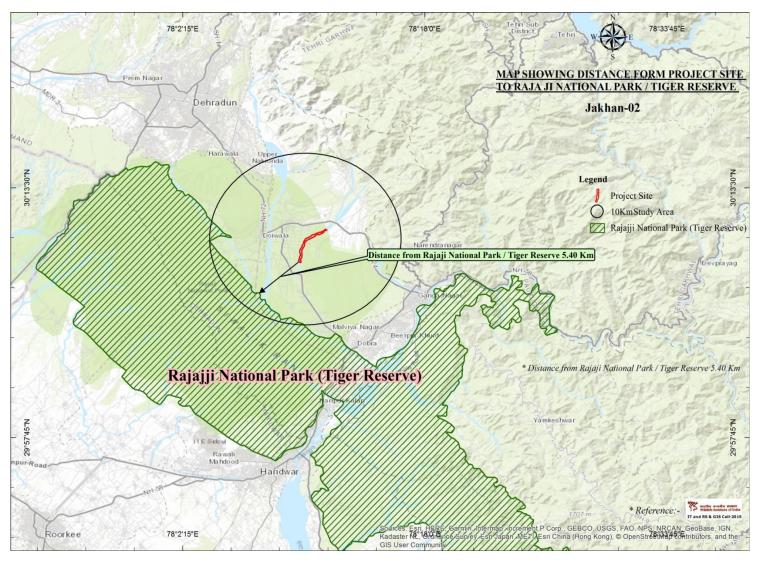


Figure 1.3: MAP SHOWING DISTANCE OF RAJAJI NATIONAL PARK FROM PROJECT SITE

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1.5 IMPORTANCE OF THE PROJECT FOR COUNTRY OR REGION

Building huge infrastructure as envisaged by Government of India particularly in road and housing sector requires basic building and construction raw materials. The Sand, Bajri and Boulders are the primary building material required for the purpose. The mining activities as proposed are the backbone of all construction and infrastructure projects as the raw material for construction is made available only from such mining. The mineral to be excavated is in high demand at the local market for real estate and infrastructure industry. This project will also provide employment to local people helping them to increase their household income for the betterment of livelihood. In addition to this, it will further prevent widening of the Jakhan-2 River bed due to the deposition of sediments which if not mined out will result in raising of the river bed causing flooding, damage to the adjoining areas, destruction of life and property. The applicant's proposed riverbed mine get 2866050.00 TPA of Sand, Bajri and Boulder for the fulfillment of the indigenous need of market.

1.6 SCOPE OF STUDY

In line with the Terms of Reference (TOR) prescribed by MoEF&CC reference vide letter no F.No. J-11015/90/2020-IA.II(M) dated **04.03.2021**, the area comprising 10 km radius around the proposed mine lease boundary is considered as the study area. The scope of the study includes detailed characterization of the environmental attributes like Air, Water, Noise, and Land, Biological and Socio-economic aspects.

1.6.1 Preparation of EIA

The EIA includes the following details:

- 1. Study of the reports like Geological report, Pre-Feasibility Report (PFR) or mining plan made available by the client.
- 2. Present Environmental Setting
- 3. Identification, prediction and evaluation of Anticipated Environmental Impact due to the proposed mine and related facilities.

The environmental impacts would be anticipated in core and buffer zone on:

- Topography and drainage
- Climate
- Water quality (Surface/Ground)
- Hydro-geological Regime
- Air quality
- Noise Levels
- Soil Quality
- Flora and Fauna
- Traffic density survey
- Land-Use
- Socio-Economic Conditions
- Habitat
- Health, culture, human environment including public health, occupational health and safety
- Sensitive Places/Historical Monuments.

This EIA Report is prepared in accordance with EIA Notification, 2006 and its subsequent amendments and that has been divided into twelve chapters (in addition to Executive Summary) as briefed hereunder:

Chapter 1 - Introduction

The chapter provides description of project background, site and surroundings, objectives, scope and organization of the study and format of this report.

Chapter 2 - Project Description

This chapter provides information on project and capacity; need for the project; location; size or magnitude of operation; technology and process description; maps showing project layout, component of projects etc.

Chapter 3- Description of the Environment

This chapter deals with the methodology and findings of field studies undertaken with respect to ambient air, meteorology, water, soils, noise levels, ecology to define the various existing environmental status in the area of the project. This also deals with the infrastructural development as a part of project and sources of pollution from the proposed mining project.

Chapter 4 - Anticipated Environmental Impacts and Mitigation Measures

In this chapter, the potential impacts of the proposed mining and allied activities, which could cause significant environmental concerns, are identified and discussed. This discussion will form the basis for environmental management activities.

Chapter 5 - Analysis of Alternatives (Technology and Site)

This chapter will include a comparison of alternatives in this chapter to determine the best method of achieving the project objectives with minimum environmental impacts or indicates the most environmentally friendly and cost effective options, if any.

Chapter 6 - Environmental Monitoring Program

This chapter will include ascertaining the environmental impacts; state of pollution within the mine lease and in its vicinity; planning for predictive or corrective actions in respect of pollution to keep it within permissible limits.

Chapter 7 - Additional Studies

This chapter will include outcomes of public consultation, risk assessment, social impact assessment, R&R action plan, biodiversity conservation plan, watershed management etc.

Chapter 8 - Project Benefits

This chapter deals with improvements in the physical infrastructure, social infrastructure, employment potential and other tangible benefits due to proposed project activity.

Chapter 9 - Environmental Cost Benefit Analysis

This chapter includes environmental value enhancement (biodiversity, crop productivity, eco tourism etc.)

Chapter 10 - Environmental Management Plan

This chapter will include the description of administrative aspects of ensuring that the mitigation measures suggested are implemented and their effectiveness is monitored, after approval of the EIA.

Chapter 11 - Summary

This will constitute the summary of EIA Report.

Chapter 12 - Disclosure of Consultant

This will includes the names of the consultants engaged in preparation of EIA and nature of consultancy rendered.

1.7 LAWS APPLICABLE TO THIS PROJECT

The Acts, Notifications, Rules and Amendments applicable for setting up a new mining industry or its expansion of an existing mine and for operation of a mine include the following:

- EIA Notification, 2006 under EPA Act, 1986.
- Uttarakhand Mines and Mineral Concession, Stock, Transportation of Mineral and Prevention of Illegal Mining Rules, 2005.
- The Mines and Mineral (Development and Regulation) Act, 1957.
- The Mines Act, 1952.
- Mines Rules, 1955.
- Mineral Concession Rules, 1960.
- Mineral Conservation and Development Rules, 1968
- The Water (Prevention & Control of Pollution) Acts1974/ Rules 1975
- The Air (Prevention & Control of Pollution) Acts 1981/ Rules 1982
- The Environment (Protection) Acts1986/Rules 1986
- Contract Labor (Regulation & Abolition) Act 1970 & Its Central Rule 1971
- The Central Motor Vehicle Rules 1989(Under Motor Vehicle Act 1988)
- Enforcement & Monitoring Guidelines for Sand Mining, 2020
- Sustainable Sand Mining Management Guideline, 2016

CHAPTER-2: Project Description

2.1 GENERAL

Proposed proposal pertains to riverbed sand, bajri boulder mining project by open cast manual method on allotted mine lease area at the Jakhan-2 river near village Majri Grant of Tehsil and District - Dehradun, Uttarakhand. The total allotted Mine lease for the proposed project is 96.50 ha with their maximum annual production capacity i.e. 2866050.00 TPA. This chapter deals with the broad description of the project, location, type of mineral deposit(s), quality of reserve, Mining methodology, various site utilities and infrastructure, etc. The downstream use of sand, bajri, boulders for value addition and its importance is also described.

2.2 TYPE OF THE PROJECT

The project is proposed for mining of "Sand, Bajri and Boulder" from the allotted mine lease area on the bed of River Jakhan-2. It is an opencast manual mining project. M/s Uttarakhand Forest Development Corporation, Village Majri Grant, Tehsil & District- Dehradun, is the project proponent who is seeking prior environmental clearance for the proposed project.

2.3 NEED FOR THE PROJECT

River channels and their flood plains are important sources of construction grade aggregate materials like Sand, Bajri and Boulder. The durability of river-borne coarser clastics and their sorting by fluvial action make them best suitable raw materials/ingredients for building constructions. The market demands of such construction raw materials are high throughout the country for the construction and infrastructure development projects.

The project lies on bed of Jakhan river and also on the palaeo channels (derived from "palaeo" or "old", and channel) of the river. Because of this, during monsoon season, the water may rise above the high flood level causing heavy and devastating floods. Such disasters may damage large tracts of land laying on both the banks of the river especially the agricultural lands. Hence, it is necessary to remove the materials so that the river gets channelized.

Apart from this the project will also serve the following:

- Generate various employment opportunities especially to the local people hosting the mining project.
- Economic development of the state by contributing to state exchaquer.

2.4 DESCRIPTION OF MINE LEASE AREA

The proposed activity of Sand, Bajri and Boulder mining is located at Village Majri Grant, over an area of 96.50 Ha in Jakhan-2 river bed in Tehsil and District -Dehradun, Uttarakhand. The lease area falls in Survey of India Toposheet (OSM) No. **53** J/4.

2.4.1 Location of Project

The proposed Sand, Bajri and Boulder (minor minerals) mining project has lease area of 96.50 ha ha is a forest land lying in the river bed of Jakhan river. and the status of the land is given below:

The location and coordinate map of the mine lease area is given in **Figure 2-1** and **2-2**.

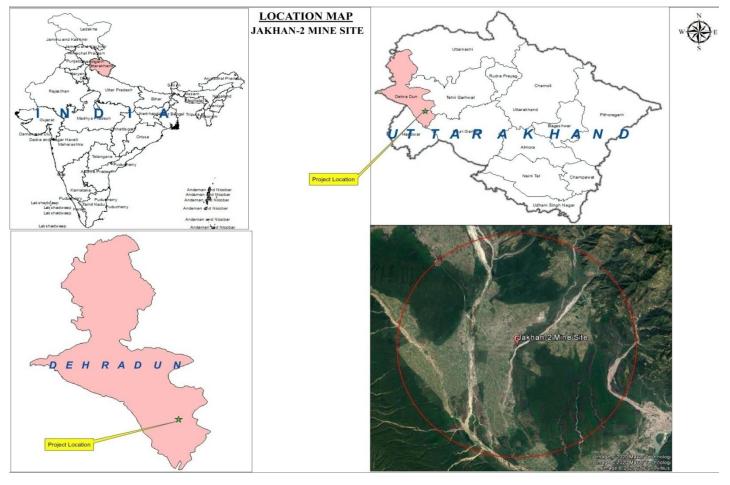


Figure 2-1: Location Map of the Project Site

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Figure 2-2: Corner Coordinate map of the Project Site

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2.4.2 Site Location

Majri Grant village is located in Tehsil & District- Dehradun (Uttarakhand). Mining site is situated 17.46 Km away from Dehradun. The Route Map is given in Fig 2.3.

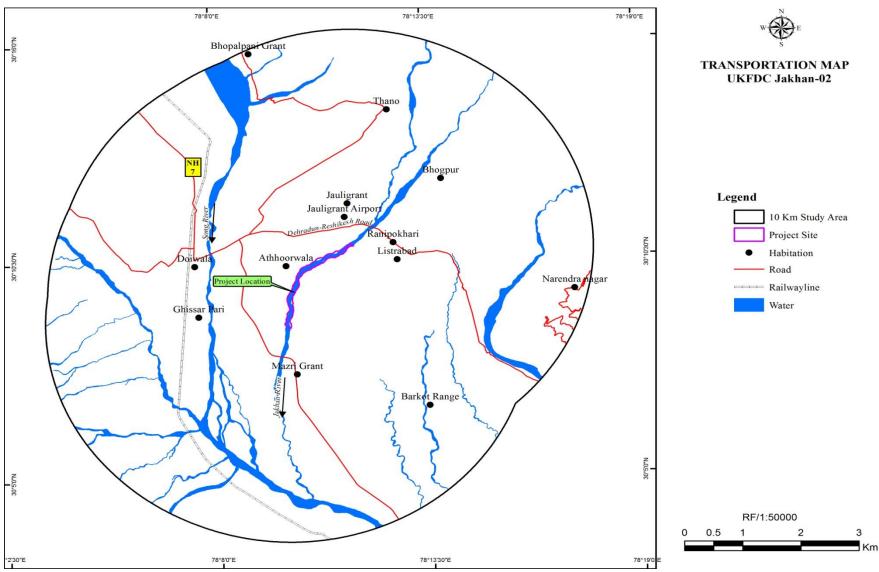


Figure 2-3: Transportation Map of proposed project site (Google image)

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2.4.3 Site visit Photographs:



Figure 2-4: Site Photographs

2.5 SIZE OR MAGNITUDE OF OPERATION (Incl. Associated activities required by or for the project)

The proponent has taken an area of 96.50 Ha on for mining of river bed materials as per LoI. The maximum rated capacity of the project will be 2866050.00 TPA which will be excavated out in layers upto a depth of 3m in riverbed.

Table 2-1: Details of Mining

S. No.	Particulars	Details
1.	Method of Mining	Open Cast manual
2.	Geological Reserves	5730420.42 TPA
3.	Mineable Reserves	3184500.00 TPA
4.	Proposed Production	2866050.00 TPA
5.	Elevation Range of the Mine Site	464.6m amsl to 550.0m amsl
6.	Bench Height	3.0 m in Riverbed
7.	Bench Slope	45°

2.6 Topography of the Area

The topography of the area is flat terrain and the elevation 464.6m amsl to 550.0m amsl. The general slope of the land surface is from North West to South East.

2.6.1 Geology

2.6.2 Regional Geology

Studied in the annals of Garhwal Himalaya, the district of Dehradun occupies the long tectonic 'Doon valley' of the outer Himalaya. It lies within the Pre-Tertiary ranges of Lesser Himalaya to the north, and the siwalik ranges of the Outer Himalaya to the South. The siwalik rocks have been folded into an overtuned syncline, flanked by two anticlines. The syncline shape of siwaliks has controlled the geomorphological development of Doon valley.

The terrain around Dehradun is fall of minor ridges and valleys. A prominent ridge runs north-south. Western part is washed by the river Tons, Noon Nadi and Asan, tributaries of Yamuna, flowing towards southwest and the eastern segment is drained by the WNW-ESE flowing river Suswa, tributary of Ganga and Song & Jakhan are the tributaries of river Ganga.

Lithostraitgraphy of the Upper Siwalik and Post-Siwalik sediment in Tons Valley is given below:

Age	Formations	Divisions	Lithology	Average
				Thickness
Recent	Doon Gravels	Tons/Asan	Alluvium	
(Quaternary)		Alluvium		
Sub-Recent	Post-Siwaliks	New Terrace	Gravel and	70m
		Sediments	Pebble beds with	
			brown clay	
			bands	

Upper-		Old Terrace	Boulder beds,	44m	
Pleistocene-		Sediments	sand, yellow and		
Mild			maroon clay		
Pleistocene			bands		
	Unconformity				
Lower	Upper Siwaliks	Boulder	Alternating	147m	
Pleistocene		Conglomerates	Conglomerates		
			Sand		

The Upper Siwalik partly ranges into Pleistocene which is probably represented by the Boulder Conglomerate Stage here. These are overlain by Post-Siwalik sediments with a pronounced unconformity. The siwalik rocks constitute low ranges in this area, whereas the Post-Siwalik constitutes the older and newer terraces of the river Tons/Asans. The Quaternary part of the Upper Siwalik consists mainly of conglomerates contain pebble mainly of quartzite, slate, limestone, sandstone etc embedded in a sandy matrix. The old Terrace sediments contain boulder and gravel beds with smooth, but often cracked boulders mainly of quartzite, phyllite, schist, sandstone etc. embedded in coarse sandy matrix. There are some bands of yellow and maroon clay along with some sandy and sandy clay horizon. These sediments generally lie horizontally, but occasionally show gentle southerly dips. The new terrace sediments contain pebble and gravel horizons with unconsolidated material composed mainly of limestone, quartzite etc. There are some brown colored clay bends, which appear to be older Alluvium. There are some brown colored clay bends, which appear to be older Alluvium. These are usually placed horizontally, uncoformably overlying the old Terrace sediments. Sometimes, these even overlap the Old Terrace, and directly overlie the Siwalik and other formation. The Post-Siwalik sediments exhibit variable thicknesses. Tube well data shows a gradual increase in their thickness from west to east. In the western part of the area the Old Terrace is 12m and New Terrace is 36m thick.

In Lesser Himalayan Zone steeply sloping northern flank of the valley comprising rock of the Lesser Himalayan Formations, such as quartzite, schist, slates, phyllite, hard, sandstone, limestone and dolomite of the Chandpur, Nagthat, Blaini, Krol and Tal Formations and having secondary porosity and permeability and are characterized by springs and seepages. Though sedimentary in nature the rocks have very low intergrainular porosity and are characterized by fissures, fracture and joints. The zones of lineament, faults and the main boundary Thrust show pockets of high secondary porosity. The groundwater/sub-surface water in this zone occurs largely as disconnected local bodies in favorably perched aguifers under both confined and unconfined conditions and also in zones of jointing, fracturing and faulting. Relatively flat areas and gentle sloping grounds characterized by deep weathering, such as hill-tops, ridges, saddles, spurs and bulges of old landslide-debris, river terraces and fluvial fans from the recharge area while steeper hill-slopes, 1st or 2nd order stream at slope breaks and scraps of fans are site of discharges. The upper portions of the catchment areas are saucer-shaped. The springs in the rocks of the secondary porosity show great variability in yield even within short distances. The limestone and dolomite of the Krol formation is characterized by cavities and solution channels oriented along WNW-ESE and NW-SE trending joints. The sand gravel deposits of fluvial and colluvial origin in the Lesser Himalayan Zone lying in the lower reaches of the stream or near the confluence of two streams in the form of fan and terraces are highly porous and permeable and therefore hold, sufficient quantities of water. The soil cover of the study area was found to be mostly yellowish grey with some soils having

brownish colour. The texture of the soil in the study area was found predominantly sandy clay loam in nature.

In Synclinal central zone classified under piedmont zone occupied by the Doon gravels, having primary porosity and permeability, is forming the main aquifer in the area. The groundwater is present in aquifers under unconfined and confined conditions. The course and gravels underlain by clay beds is the main water bearing strata. The zone is characterized by high infiltration rate. The Siwalik Zone the water is present under confined conditions and the water table is relatively deep.

2.6.3 Local Geology

The Synclinal trough shaped Doon Valley bounded by the rocks of the Lesser Himalayan formations in north and Siwalik in south, forms a part of the sub-mountain region of the Garhwal Himalaya. Geologically the valley is divided into:

The Lesser Himalaya: Mussoorie mountain range in northwest and northeastern parts. It comprises rocks of the Jaunsar (Chandpur phyllite and Nagthat quartzites) and Mussoorie Group (shlaes, sandstone, greywacks, calcareous slates, dolomite and limestone of Blaini-Krol-Tal sequence) of Proterozoic-Cambrian age.

A synclinal structural depression: Filled with coarse elastic/River Borne Material (RBM) consisting fan deposits of late Pleistocene and Holocene age known as the Doon Gravels. The Doon Gravels have been further subdivided into oldest, Younger and Youngest Doon Gravels. The oldest Doon Gravels resting over the Upper and Middle Siwalik beds and at places directly over Chandpur phyllite are consist of poorly sorted pebbles and gravels set in sandy matrix and red clays. The oldest Doon Gravels consist partly of crushed Upper Siwaliks cobbles, angular pebbles of quartzites, slates and shales from the Nagthat, Chandpur and Tal formations and limestone pebbles from the Krol Limestone alternating with clay beds. The Younger Doon Gravels, resting uncoformably over the oldest Doon Gravels in northern part, are characterized by very large boulders present in debris flow and braided river deposits. The unit consists of poorly sorted mixture of clay, sands, gravels and large bounders. The major part of the valley is occupied by Younger Doon Gravels occurring in the form of large fans, formed by reworking of Oldest Doon Gravels and are called as Principal Doon fans. The Youngest Doon Gravels are braided river deposits and sub-recent terrace deposits along Asan and Song River. A number of coalesced fan have also descend down from the Siwalik range forming "Piedmont zone", are also part of youngest Doon Gravels.

The Siwalik Range: The Siwalik range in the south comprises the middle and Upper Siwalik. The rocks of the middle Siwalik have the characteristics facies of continental deposits of large low land rivers and consist of friable medium grained grey coloured sandstone rich in micaceous minerals with mudstone. The rocks of the Upper Siwalik indicate a change in the region of the large braided rivers and are characterized by alternate polymictic conglomerates and subordinate grey micaceous sandstone. The conglomerates consists of well rounded to subrounded clasts of white, pink and grey quartzite, granite, phyllite and rare limestone.

2.6.4 Drainage

District Dehradun is drained by Ganga, Yamuna and their tributaries. The two basins are separated by a ridge starting from Mussoorie and passing through Dehradun. The easterly flowing rivers join River Ganga and the westerly flowing rivers join River Yamuna. Ganga River enters the district near

Rishikesh where Chandrabhaga River joins it. Song and Suswa are two main tributaries of the Ganges. Suswa flows SE, draining the eastern Doon along with its ephemeral tributaries like Bindal Rao, Rispana Rao etc. and joins River Song SE of Doiwala. Song River has its origin from the adjoining Tehri district. Initially it runs parallel to the Mussoorie Mountain chain in NW direction for few kilometers and then takes a sudden turn in SE direction and joins Suswa River south of Doiwala. Yamuna River emerges from Yamnotri, which falls in district Uttarkashi. It enters Dehradun district at the point called Khat Bhondar which is about 20km east of Deoban. Tons is the main tributary of Yamuna which has its emerging point in the north of Yamnotri and receives water from Supin and Rupin (tributaries of Tons). River Tons separates Uttarakhand from Himachal Pradesh. The western part of Doon Valley is drained by Asan and its tributaries; it joins Yamuna near Rampur Mandi. Yamuna River roughly divides the district in two halves, the hilly region in the north and Doon valley in the south. Drainage pattern of the mine lease area is shown in **Figure 2.5**

Table 2-2: Details of Site Elevation

Lowest Elevation (mRL)	Highest Elevation (mRL)	Working Depth (in meters)	Ground Water Table
464.6	550.0	River Bed: upto	Pre Monsoon
		3.0 m bgl	Depth to water-0-1.94 m bgl
			Post Monsoon
			Depth to water- 2-4.5m bgl.

(Source: Mining Plan and Progressive Mine Closure Plan)

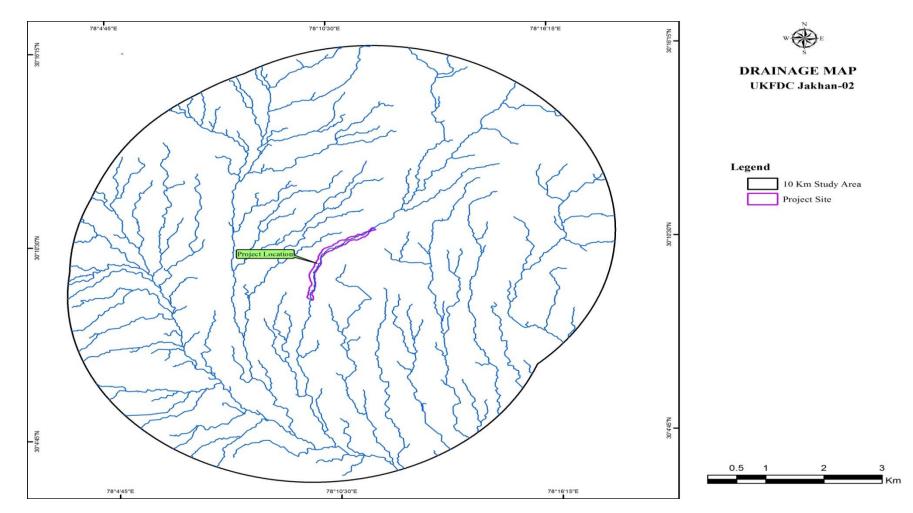


Figure 2-5 Drainage Pattern Map of the Study Area

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2.6.5 Climate

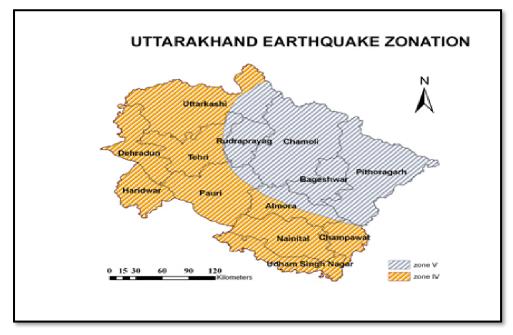
The climate of the district in general, is temperate. The temperature depends on the elevation. In the Doon Valley, the heat is often intense. The temperature drops below freezing point during the winters. The summer starts by March and lasts up to mid of June when the monsoon sets in. Generally, the month of May and early part of June is hottest. Winter starts from November and continue up to February.

2.6.6 Rainfall

The district receives an average annual rainfall of 2073.3 mm. Most of the rainfall is received during the period from June to September, July and August being the wettest months. The region around Raipur gets the maximum rainfall, while the southern part receives the least rainfall in the district. About 87% of the annual rainfall is received during the period June to September.

2.7 SEISMICITY OF THE AREA

Many parts of India subcontinent have historically high seismicity. Seven catastrophic earthquakes of magnitudes after greater than 8 Richter scale have occurred in the western, northern and eastern parts of India and adjacent countries in the past 100 years. By contrast, peninsular India is relatively less seismic, having suffered only infrequent earthquakes of moderate strength. The main seismogenic belts are associated with the collision plate boundary between the Indian and Eurasian plates. The project site as well as study area leis in Zone-IV of seismic Zoning Map **Figure-2-6**, and thus can be said to be located in an area of moderate seismic hazard by national standards. Hence the risk of earthquake at the site persists through there has been no incident in the near past.



(Source: Disaster Mitigation and Management Center, Government of Uttarakhand)

Figure 2-6: Seismic Zone Map of Uttarakhand

2.8 MINERAL RESERVES

The method of cross-section has been adopting for calculating geological reserve. The intersectional volume between two section lines has been determined by the following manner:

V = (S1+S2)/2x L, Where,

V: Volume

S1 & S2: Section Area of mineral body

L: Strike Influence (14m to 632m)

The incidence of RBM has been taken as 90% of the total volume considering rest 10% as waste and would be used as backfilled material for reclaiming the excavated benches. The extraction/removal of the deposited minor mineral (sand, bajri and boulder) from the river will be made by leaving 25% width of the river on either side of the riverbed. While computing the geological mineral reserves the depth of mineralization is taken upto 3m in all the applied area.

There are two categories of reserve which is proved and probable reserves. The mineral present in proved category is upto 2m depth and in probable it is 1m depth.

Proved Reserves: 3820263.42 tonnesProbable Reserves: 1910157.00 tonnes

Mineral Production

Mine lease area is a part of river bed and mining will be done manually by opencast method in quite systematic manner. The maximum limit of mineral extraction is about 2866050.00 TPA and from First to Fifth year maximum exploitable limit of mineral extraction will be 14330250 Tonne. Details of yearwise exploitable minerals is summarized in **Table-2.3.**

Year	Production (Tonnes)
1st Year	2866050.00
2 nd Year	2866050.00
3 rd Year	2866050.00
4 th Year	2866050.00
5 th Year	2866050.00

2.8.1 METHOD OF MINING

As per Environmental Impact Assessment Guidance Manual for Mining of Minerals released by MoEF&CC- the project is a type of surface mining. The typical operations involved in a surface mining is shown given below in the flowchart in the **Figure-2.7**.

The Project will be accomplished by fully manual opencast method of mining and does not involve any processes such as drilling, blasting and beneficiation.

- The mining process involves collection of material by simple hand tool such as shovel, pans, spade, pick axe and sieves.
- Hand operated tools like spade tasla will be used for collection of sand.

- This is followed by sorting and manual picking, stacking and loading into the trucks/tractortrolley for transporting.
- The only waste is clayey sand which will be used for plantation.
- Mining Plan is being prepared after leaving safety zone i.e. 25% of each side from lease boundary.
- The material is transported through the high velocity flow and is deposited in downstream where the bed slope is mild.

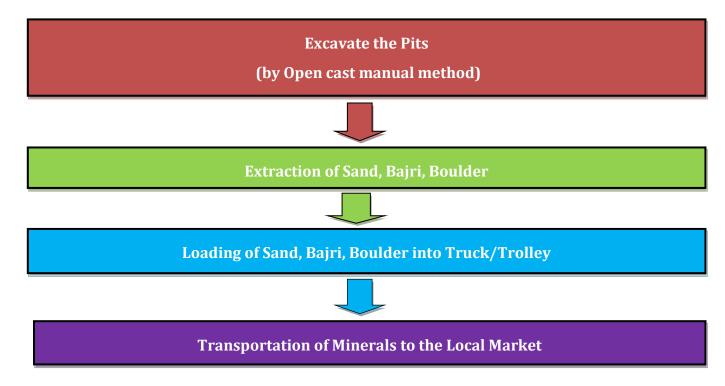


Figure 2-7: Schematic Flowchart of Sand, Bajri, Boulder Mining Process

As per Uttarakhand Minor Mineral (Sand, Bajri, Boulder) Mining Policy 2016, the pits from where the material is picked are not deeper than 1.5m each year including replenishment as allowed in mining area and shall follow the normal channel direction of the river.

Now the Government of Uttarakhand vide its notification no. 334/Vli-A-1/5(15)/19 dated 04 March 2020 have done changes in Uttarakhand Minor Mineral Concession Rule-2001 Rule no. 11 and 29 Ka sub rule-1 and in place provide that "The length of the area under a mining lease shall ordinarily nor exceed four times its breadth and the maximum permissible depth for collection of minor minerals shall be fixed at 3.0 meter or up to ground water level whichever is less".

The guidelines of the Ministry of Environment & Forests and Directorate of Geology and Mining will be followed; the most important is as under: Uttarakhand Minor Mineral (Sand, Bajri, Boulder) Mining Policy 2016.

2.8.2 Production Parameters

• Dry pit mining will be followed which means mining all times will be above the water flow level of river. Mining activity will be immediately stopped when water comes in the mining pits.

- RBM (sand, bajri & boulder) will be collected upto a depth of 3.0m from first to fifth year or river water levels whichever less than prescribed. Bench/levels in post monsoon & pre monsoon are given according to sequence of mining from lower elevation to higher elevation.
- Stream will not be diverted to form inactive channel and mining at the concave side of the river channel will be avoided to prevent bank erosion.
- Mining will be restricted minimum 25% from both sides of river bank to minimize effect of river bank erosion and to avoid consequent channel migration. So mining activity will be done in 48.25 ha area, leaving a safety zone or non-mining area.
- Area of mining lease will be demarcated prior to mining and Pillars will be erected on ground.
- No mining operations shall be carried out in proximity of any bridge and or embankment.
- No construction will be done at site except for construction of initial temporary shelter house and office hut.
- No water intake from river will be done. Water will be supplied by tankers from outside sources.
- No machineries will be used and mining will be completely stopped during monsoon season.
- Mining will be carried out only during the day time. The factors such as topography, bed gradient, soils, rainfall etc will be taken into consideration for the same.

2.9 Basic requirements of the Project

The RBM containing sand, bajri & boulders of quartzite mineral is an important material for construction. The RBM will be used in road, bridge and building constructions.

2.9.1 Power

No electrical power shall be required for operations.

2.9.2 WATER REQUIREMENT

Water requirement for the proposed project for domestic use, dust suppression and plantation, shall be met from the tanker supply. Total Water requirement shall be **35.7 KLD**. The breakup of water requirement shows in **figure 2-8**

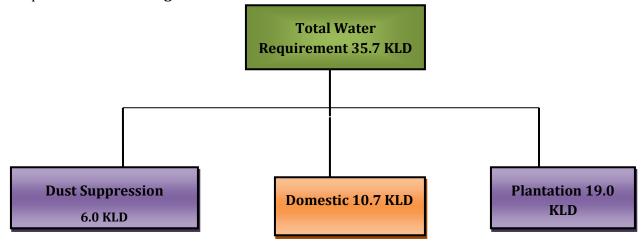


Figure 2.8: Water Balance Diagram

2.9.3 GENERAL FEATURES

Facilities which will be required at the mine site during operational phase are described below:

- **Mine Office:** Power site services such as First aid, attendance record, complaint box and telephone facility will be provided to the workers.
- **Workshop:** Temporary workshop for storage and maintenance of hand equipment will be made.
- **Security:** Security guards will be deployed at the mine site.
- **Rest Shelter:** Rest shelter along with first-aid station complying with all the provisions of Mines Rules will be constructed temporarily in the lease area itself.
- Sanitation Facility: Bio-toilets will be provided to workers during operational phase of mining.
- Drinking Water Facility: Arrangement of water will be done separately for drinking purpose of workers.

2.9.4 EMPLOYMENT POTENTIAL

About 410 workers including skilled, semi-skilled & unskilled labours shall be engaged through project proponent for extraction of sand, bajri, boulder (minor mineral) and loading & handling of mineral in mining area. Breakup of manpower is given in **Table-2.4**:

S.No.	Labour Categorization	No. of Persons			
	Skilled				
1	Supervisor	2			
2	Office Assistant/Dispatch	4			
	Supervisor				
	Unskilled				
3	Safety Guard & Field Staff	9			
4	Daily Wages/mining workers	316			
5	Truck Driver	79			
•	Total Manpower	410			

Table 2-4: Manpower Requirement

2.9.5 Extent of Mechanization

No mechanization is required. The Sand, Bajri and Boulders mine is manual open cast. Hence disposal of mining machineries are not required.

2.10 WASTE MANAGEMENT

Not applicable, as the mining activity will not be generating any overburden or waste water. There will be no OB or waste generation as the minor mineral is exposed in the river bed.

But, at the later stage, if any soil or waste will be obtained during mining, then same will be stored with proper protection and will be used for reclamation (plantation).

2.11 USE OF MINERAL

The RBM containing sand, bajri & boulders of quartzite mineral is an important material for construction. The RBM will be used in road, bridge and building constructions.

2.11.1 Infrastructure/Site Services

The site service include a) mines office b) rest shelter c) First aid centre d) store room, water tank, public convenience, water –man-shed, Road-for adjacent mines and factory, drinking water facilities, telephone lines etc.

2.12 Litigation

There is no court case against this project.

2.13 Chemical and mineralogical composition:

Rock type	Top Site	Middle Site	Lower Site	Average
Sand	18%	20%	21%	19.7%
Bajri	42%	40%	43%	41.7%
Boulder	40%	36%	36%	38.6%

CHAPTER-3: DESCRIPTION OF THE ENVIRONMENT

3.1 GENERAL

The main objectives of describing the environment, which may be potentially affected, are (i) to assess present environmental quality and the environmental impacts and (ii) to identify environmentally significant factors that could preclude Mine development. This chapter discusses about the present scenario of the study area with reference to the prominent environmental attributes. The study area covers 10 Km radius of the mine lease area. Baseline data has been collected during the Winter Season 1st December to 28th February 2020 by M/s Mantec Laboratory {NABL Accredited Lab, Certificate No.TC-6440 (in lieu of 1417) (Certificate enclosed as **Annexure A**) in accordance with the Guidelines for EIA issued by the Ministry of Environment Forests and Climate Change, Government of India and CPCB, New Delhi.

The impact identification always commences with the collection of baseline data such as Ambient Air Quality, Micro-Meteorology, Ground and Surface Water Quality, Noise levels, Soil Quality, Land use pattern, Biological Environment and Socio-economic aspects, Solid and Hazardous waste, Risk Assessment, Geology and Hydrology within the study area.

The baseline information on micro-meteorology, ambient air quality, water quality, noise levels and soil quality are largely drawn from the data generated by Mantec Laboratory (NABL Accredited Lab). Long term meteorological data recorded at the nearest IMD station, Dehradun was also collected. Site specific micrometeorological data was recorded by using automatic weather station. Apart from these, secondary data have been collected from Census Handbook, Revenue Records, Statistical Department, Soil Survey and Landuse Organization, District Industries Centre, Forest Department, Central Ground Water Authority, Botanical Survey of India, Zoological Survey of India, Geological Survey of India, etc.

Following environmental attributes has been assessed during baseline study;

- Physical environment (Air, Water, Soil and Noise) baseline data.
- Relevant meteorological data, for previous decades from Indian Meteorological
- Department (IMD) and primary data.
- Land use pattern within core zone and buffer zone (10 Km radious around the core zone) based on Survey of India Toposheet map, ground truth and satellite image.
- Identification of water bodies, hills, roads etc. within 10 Km radius.
- Eco-sensitive places, sanctuaries, biosphere reserves within 10 Km radius.
- Religious places / historical monuments and tourist places within 10 Km radius.
- Details of fauna and flora within a distance of 10 Km from the project site and information about forests, if any.
- Demography and Socio-economic based on last available Census data for entire study area.
- Major industries within 10 Km radius.
- Study of present environmental protection and mitigation measures in nearby operating similar projects, if any

3.2 LAND ENVIRONMENT

The impacts on land environment would be in the form of permanent change in landuse pattern as well as direct and indirect impacts on surrounding land due to discharge of wastes on the land and unscientific means of disposal. Area statistics of land-use classes has been generated within 10 Km radius of mine lease area (Core zone and Buffer zone) and given in Table 3.1.

3.2.1 Methodology for Baseline Data Generation

Land use /Land cover map preparation, Base map creation; Geometric and Radiometric correction of satellite image has been processed using ERDAS Imagine 9.2 and ArcGIS 9.3 Software. The methodology used for present LU/LC of study area is shown in Figure 3-1 and is detailed below:

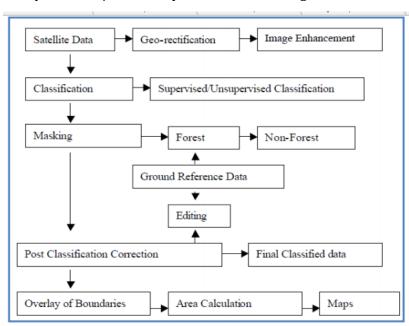


Figure 3-1: Methodology Used for Landuse Classification & Mapping

Methodology Adopted for Thematic Data Extraction from The Satellite Imageries:

ERDAS image processing software and ArcGIS Software were used for the project. Erdas 9.2 Image Processing Software was used for digital processing of the spatial data. Digital image processing techniques were applied for the mapping of the land use/land cover classes of the provided area from the satellite data. The methodology applied comes under following steps:

Image Extraction:

Satellite imageries were obtained and a sub set for the area of interest was created through ERDAS image processing software.

Geo-Rectification:

Geometric correction includes correction for geometric distortions due to sensor, earth geometry variations and conversion of the data to real world coordinates (e.g. Latitude and Longitude) on the Earth's surface. The satellite imagery was geometrically rectified with reference to the georeferenced toposheets and vector data.

Image Enhancement:

Image enhancement is one of the important image processing functions primarily done to improve the appearance of the imagery to assist in visual interpretation and analysis. Various options of image enhancement techniques were tried out to get the best image for visual interpretation. Histogram equalized stretch enhancement techniques was applied to the imagery of the study area for better interpretation of different features in the satellite imagery.

Classification:

Satellites images are composed of array of grid, each grid have a numeric value that is known as digital number. Smallest unit of this grid is known as a pixel that captures reflectance of ground features represented in terms of Digital number, which represent a specific land features. Using image classification technique, the satellite data is converted into thematic information map based on the user's knowledge about the ground area.

Hybrid technique has been used i.e. visual interpretation and digital image processing for identification of different land use and vegetation cover classes based on spectral signature of geographic feature. Spectral signature represents various land use classes. Image interpretation keys are developed based on image characteristics like color, tone, size, shape, texture, pattern, shadow, association etc. which enables interpretation of satellite images for ground feature. Training sites are then assigned based on their spectral signature and interpretation elements. Land use/Land cover Map has been broadly classified into five classes namely Agriculture, Forest Land, Built-up Area, Water Bodies and Waste Land and all other land uses have been categorized in others class. Using image classification algorithm land use map is then generated.

3.2.2 Land Use/Land Cover Pattern of the Study Area

The existing land use pattern of the study area based on the latest satellite imagery is given in Table 3-1 as follows and is shown in Figure 3-2.

Table 3-1: Land Use Pattern of the Study Area

S. No	Classes	Area (sq.km)	Area in %
1	Agriculture Land	8846.98	21.01
2	Built-Up Area	1520.62	3.61
3	Forest	24178.43	57.43
4	Shrub	4850.08	11.52
5	Barren Land	572.33	1.36
6	Waste Land	103.99	0.25
7	Water Bodies	2027.94	4.82
Total		42100.37	100.00

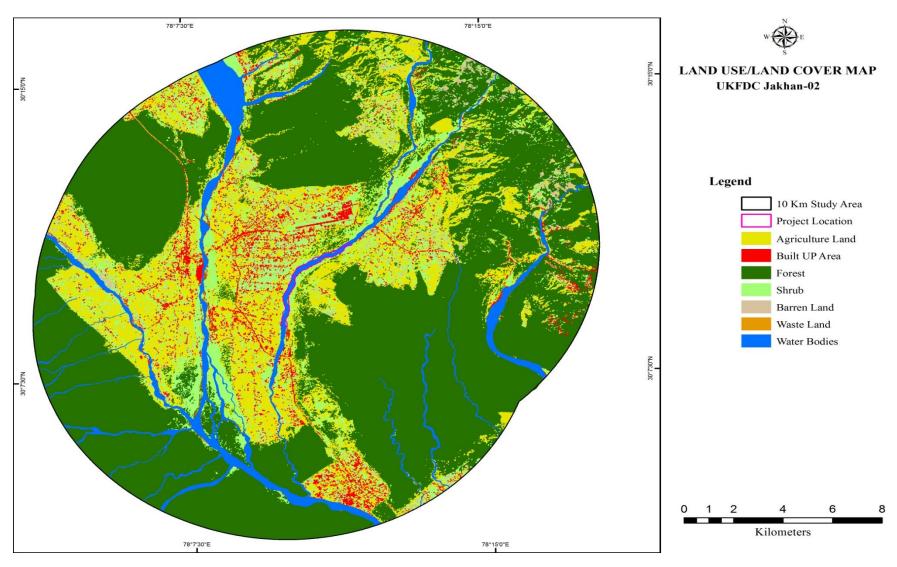


Figure 3-2: Land-Use/Land-Cover Map of the Study Area

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3.2.3 Description of Land Use

The study area is prominently covered by forest land (57.43%). Agricultural land covers 21.01% of the study area. The water bodies cover 4.82% while shrubs are covering 11.52% of the study area. Waste land constitutes about 0.25% of the study area.

3.3 SOIL ENVIRONMENT

Soil is the largest pool of terrestrial organic carbon. Soil may be defined as a thin layer of earth's crust, which serves as a natural medium for the growth of plants. It is the environmental sieve that controls the fate of contaminants, and directs water in the various pathways of the hydrologic cycle. The soil characteristics are mainly classified into three groups which include physical, chemical and electrical properties. For studying soil quality of the region 8 samples were collected to assess the existing soil conditions in and around the area. The study area has medium sandy loam.

3.3.1 Methodology of Baseline Data Generation

The soil survey was carried out to assess the soil characteristics of the area. For studying soil quality of the region, 8 samples were collected from 8 different locations in the study area (in and around the mine lease area) to assess the existing soil conditions. Distance and direction of soil sampling station from the mine site have been given below in Table 3-2.

S.	Code	Location Name	Distance	Direction	Latitude	Longitude
No.			(kms)			
1.	S1	Mine Site	0.0	_	30°10'8.13"N	78°10'15.66"E
2.	S2	Anthoorwala	0.30	W	30°10'21.87"N	78°10'4.52"E
3.	S3	Doiwala	4.17	W	30°10'36.08"N	78° 7'36.77"E
4.	S4	Jolly Grant	2.17	NW	30°11'26.02"N	78° 9'47.99"E
5.	S5	Chidderwala	6.98	SE	30° 5'11.38"N	78°11'16.27"E
6.	S6	Lal Tappad	3.19	S	30° 7'3.94"N	78°10'2.27"E
7.	S7	Thano	6.73	NE	30°14'20.40"N	78°12'54.07"E
8.	S8	Narender Nagar	9.21	Е	30° 9'28.69"N	78°17'8.78"E

Table 3-2: Details of Soil monitoring Locations

The samples were collected by driving an auger into the soil up to the depth of 90cm. The present study on the soil quality establishes the baseline characteristics and identifies the incremental concentrations if any, due to the proposed project. The objective of the sampling is:-

- To determine the baseline soil characteristics of the study area;
- To determine the impact of proposed activity on soil characteristics and;
- To determine the impact on soil more importantly agriculture production point of view.

The soil samples were collected from three different depths viz. 30cm, 60cm and 90cm. The samples were then packed in polythene plastic bags and sealed. The samples from three different depths are homogenized and are then analysed. Map showing monitoring locations of Soil samples for physico-chemical analysis of soil is shown below in Figure 3-3.

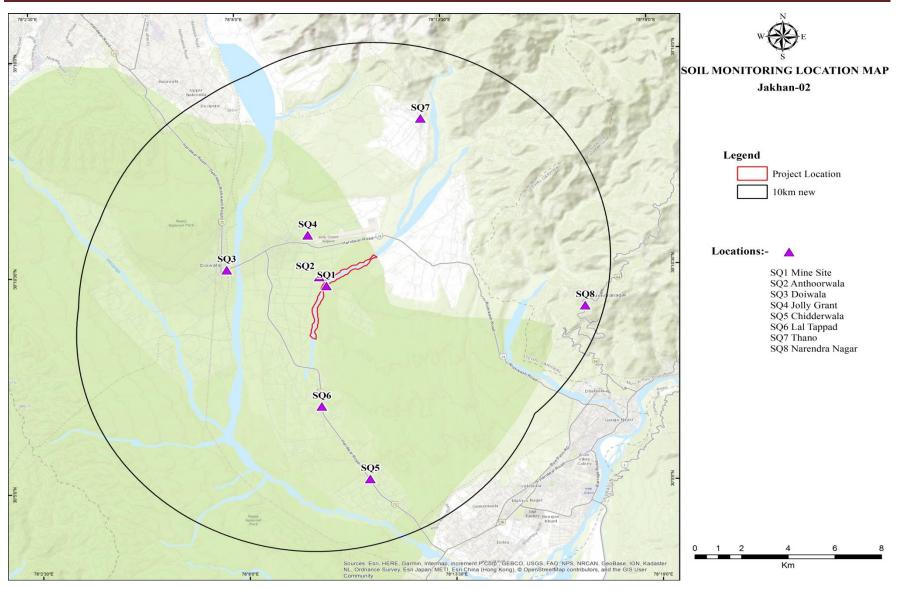


Figure 3-3: Soil Monitoring Location Map

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Table 3-3: Soil Quality Analysis Results

		Location	Location 1	Location 2	Location 3	Location 4	Location 5	Location 6	Location 7	Location 8
			Near Mine Site	Anthoorwala	Doiwala	Jolly Grant	Chidderwala	Lal Tappad	Thano	Narender Nagar
Sr. No.	Parameters	Units	Value	Value	Value	Value	Value	Value	Value	Value
1	рН	-	7.14	7.63	7.45	7.15	7.26	7.61	7.26	7.48
2	Bulk Density	gm/cm ³	1.74	1.34	1.48	1.36	1.95	1.42	1.85	1.62
3	Conductivity	micro mhos/cm	327	348	352	348	384	362	315	347
4	Moisture	%	6.54	7.15	7.48	7.15	7.45	7.42	7.58	7.63
5	Texture	-	Sandy Clay Loam	Sandy Loam	Sandy Loam	Sandy Loam				
6	Sand	%	62	58	62	64	62	62	58	56
7	Clay	%	20	22	20	20	22	18	18	14
8	Silt	%	18	20	18	16	16	20	24	30
9	Sodium	mg/100gm	8.5	7.8	7.1	7.5	8.3	7.6	7.8	7.5
10	Potassium	mg/100gm	4.7	4.2	4.2	4.6	5.2	4.4	4.8	4.5
11	Nitrogen	mg/100gm	11.7	9.4	10.8	11.3	9.8	10.8	10.6	10.5
12	Phosphorous	mg/100gm	0.41	0.41	0.63	0.52	0.54	0.72	0.59	0.58
13	Organic Matter	%	1.19	1.46	0.95	1.62	1.68	1.02	0.84	1.07
14	Organic Carbon	%	0.69	0.85	0.55	0.94	0.97	0.59	0.49	0.62
15	SAR	meq /100gm	0.69	0.71	0.63	0.70	0.77	0.71	0.73	0.67
16	CEC	meq/100gm	12.38	13.92	11.90	13.24	14.36	11.04	10.68	9.14
17	Calcium	meq /100gm	6.28	4.85	5.15	4.62	4.37	4.18	4.32	5.18
18	Magnesium	meq/100gm	3.14	2.48	2.62	2.35	2.62	2.71	2.51	2.48

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3.3.2 Interpretation of Results

Monitoring data shows that the texture of soil at all locations is Sandy Loam. The monitoring sites have sand ranging from 56% to 64% in soil samples. Silt content varies from 16% to 30%, while Clay content varies from 14% to 22% in the soil samples.

- The data shows that value of pH ranges from 7.14-7.63.
- Near village Chidderwala shows maximum conductivity of 384μmhos/cm, Thano village shows minimum conductivity of 315 μmhos/cm.
- Values of CEC ranges from 9.14 meq/100g as lowest at Narendra Nagar village and 14.36 meq/100g as maximum at Chhiderwala village.
- Magnesium values ranges from 2.35 meq/100g as lowest at Jolly Grant and 3.14 meq/100g as highest near mine site.
- The average concentration of Nitrogen, Phosphorus and Potassium in the soil samples varies from 9.4 to 11.7 mg/100gm, 0.41 to 0.72 mg/100gm and 4.2 to 5.2 mg/100gm.

3.4 WATER ENVIRONMENT

3.4.1 Methodology Adopted for Selection of Sampling Station

The sampling was done both for surface water and underground water. The samples were taken from the identified monitoring locations within the 10 Km radius of the study area. Total of 11 samples were taken (8 for ground water and 3 for surface water). The water quality sampling locations are described in Table 3-4 and shown in Figure 3-4.

Longitude S. No. Code Location **Distance Direction** Latitude (kms) 1. GW1 **Near Mine Site** 30° 9'50.67"N 78°10'38.71"E 0.67 Ε 2. GW2 Anthoorwala 0.44 W 30°10'20.85"N 78° 9'58.37"E GW3 Doiwala 4.20 W 30°10'35.79"N 78° 7'35.20"E 3. GW4 **Jolly Grant** 2.25 NW 30°11'28.51"N 78° 9'46.99"E 4. 5. GW5 Chidderwala 7.00 SE 30° 5'11.12"N 78°11'18.19"E GW6 3.80 S 30° 7'7.05"N 78°10'1.28"E 6. Lal Tappad 7. GW7 Thano 6.85 NE 30°14'25.86"N 78°12'49.34"E GW8 Narendra Nagar 9.42 E 30° 9'32.55"N 78°17'7.31"E 8. 30°12'35.28"N 78° 8'2.84"E 9. SW1 Lachhiwala 5.52 NW Picnic Spot SW2 Bindal Rao 30° 9'36.66"N 78° 5'46.93"E 10. 6.58 W 30°10'25.03"N 78°16'25.03"E 11. SW3 Chandra Bhaga 7.72 E

Table 3-4: Water Sampling Stations

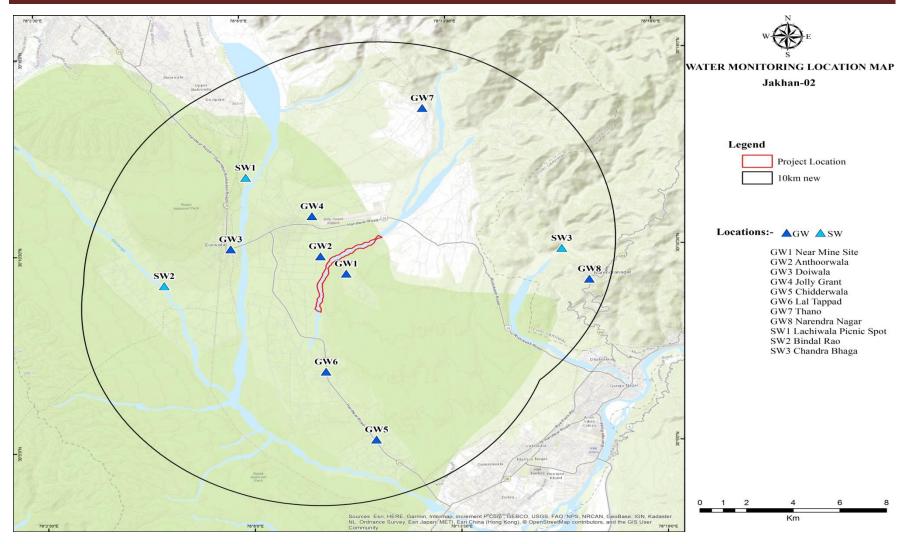


Figure 3-4: Key Plan of Water Sampling Stations

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	Locations		GW 01 Near Mine Site	GW 02 Anthoorwal a	GW 03 Doiwala	GW 04 Jolly Grant	GW 05 Chidderw ala	GW 06 Lal Tappad	GW 07 Thano	GW 08 Narendra Nagar
SL. No.	Parameters	Units of Measuremen ts								
1	Colour	Hazen Units	<5	<5	<5	<5	<5	<5	<5	<5
2	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeabl e	Agreeable	Agreeable	Agreeable
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeabl e	Agreeable	Agreeable	Agreeable
4	рН	-	7.56	7.31	7.11	7.49	7.25	7.28	7.36	7.14
5	Temperature	°C	25	24	24	24	26	23	23	24
6	Turbidity	NTU	1.3	1.1	1.3	1.4	1.2	1.4	1.1	1.4
7	Conductivity	μmhos/cm	400	483	554	551	521	576	510	490
8	Alkalinity as CaCO ₃	mg/l	83	88	106	92	100	112	102	98
9	Total Dissolved Solids	mg/l	261	313	360	361	338	375	332	319
10	Total Hardness as CaCO ₃	mg/l	167	233	180	282	169	192	244	234
11	Calcium as Ca	mg/l	39.9	58.7	43.2	69.6	40.6	48.0	63.2	60.7
12	Magnesium as Mg	mg/l	16.4	21.0	17.4	26.2	16.4	17.4	20.8	20.0
13	Chloride as Cl	mg/l	58	81	94	78	88	96	88	84
14	Total Phosphorus	mg/l	0.64	0.55	0.56	0.77	0.53	0.61	0.71	0.68
15	Nitrate as NO ₃	mg/l	5.8	5.5	6.2	7.2	5.8	7.2	6.4	6.1
16	Sulphate as SO ₄	mg/l	45	58	58	64	55	60	52	50
17	Fluoride as F	mg/l	0.58	0.64	0.69	0.66	0.65	0.72	0.58	0.56
18	Arsenic as As	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
19	Lead as Pb	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
20	Zinc as Zn, Max	mg/l	0.22	0.16	0.16	0.16	0.14	0.18	0.19	0.16
21	Sodium as Na	mg/l	22	16	45	28	20	47	13	18
22	Potassium as K	mg/l	3	2	5	2	2	4	1	2
23	Total Coliform	MPN/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
24	Faecal Coliform	MPN/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

Table 3-5: Ground Water Analysis Results

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Table 3.6 Surface water Analysis

	Location	s	SW 01 Lachhiwala Picnic Spot	SW 02 Bindal Rao	SW 03 Chandra Bhaga
Sl. No.	Parameters	Units of Measurements	Dec. 2019	Dec. 2019	Dec. 2019
1	Colour	Hazen Units	<5	<5	<5
2	Odour	-	Agreeable	Agreeable	Agreeable
3	Taste	-	Not done	Not done	Not done
4	рН	-	7.36	7.33	7.48
5	Temperature	°C	23	22	24
6	Turbidity	NTU	2.1	3.1	1.8
7	Conductivity	μmhos/cm	312	295	324
8	Alkalinity as CaCO ₃	mg/l	64	75	58
9	Total Dissolved Solids	mg/l	204	192	212
10	Total Suspended Solids	mg/l	4	4	3
11	Total Hardness as CaCO ₃	mg/l	102	118	114
12	Calcium as CaCO ₃	mg/l	62	94	118
13	Magnesium as CaCO ₃	mg/l	78	24	80
14	Chloride as Cl	mg/l	48	36	54
15	Total Phosphorus	mg/l	0.52	0.42	0.56
16	Nitrate as NO ₃	mg/l	9.2	8.30	10.2
17	Sulphate as SO ₄	mg/l	28	23	32
18	Fluoride as F	mg/l	0.63	0.31	0.61
19	Arsenic as As	mg/l	< 0.01	< 0.01	< 0.01
20	Lead as Pb	mg/l	< 0.01	< 0.01	< 0.01
21	Zinc as Zn, Max	mg/l	0.12	0.1	0.14
22	Sodium as Na	mg/l	25	20	22
23	Potassium as K	mg/l	3	2	3
24	Dissolved Oxygen	mg/l	6.5	6.1	6.8
25	BOD	mg/l	6	<4	8
26	COD	mg/l	38	18	54
27	Total Coliform	MPN/100ml	2612	712	3642
28	Faecal Coliform	MPN/100ml	1302	405	1845

3.4.2 INTERPRETATION

Analysis results of **Ground water** reveal the following;

- pH varies from to 7.11 to 7.56
- Total Hardness varies from 167.00 to 282.00 mg/L.
- Total Dissolved Solids varies from 261.00 to 375.00 mg/L.
- Fluoride varies from 0.56 to 0.72 mg/L
- Chloride varies from 58.00 to 96.00 mg/L

Analysis results of **Surface water** reveal the following;

- pH varies from to 7.33 to 7.48
- Total Hardness varies from 102.00 to 118.00 mg/L.
- Total Dissolved Solids varies from 192.00 to 212.00 mg/L.
- Fluoride varies from 0.31 to 0.63 mg/L
- Chloride varies from 36 to 54 mg/L
- COD varies from 18.00 to 54.00 mg/L
- BOD varies from <4 to 8 mg/L

A review of the above chemical analysis reveals that there is some variation in chemical composition of water tapped from different sources but the ground water from all sources remains suitable for drinking purposes as all the constituents are within the limits prescribed for drinking water standards promulgated by Indian Standards (IS: 10500).

3.5 METEOROLOGY

Meteorology plays a vital role in affecting the dispersion of pollutants, once it discharged into the atmosphere cannot be controlled. Since meteorological factors show wide fluctuations with time, meaningful interpretation can be drawn only from long-term reliable data. Such data source is the India Meteorological Department (IMD), which maintains a network of meteorological stations at several important locations. The nearest IMD station is Dehradun. The Meteorological parameters viz. temperature, humidity, rainfall, wind speed, and wind direction, etc. are obtained from the IMD Dehradun

Meteorological station was set-up at site to record surface meteorological parameter during study period; 1st December 2019 to 28th February 2020. The nearest IMD station is taken at Uttarakhand.

3.6 Climate and Rainfall

The temperatures shooting upto $36.2~^{\circ}\text{C}$ at Dehradun. The maximum temperature rises to over $42~^{\circ}\text{C}$ at Dehradun. The mean daily maximum temperature during winter is $19.1~^{\circ}\text{C}$ at Dehradun. The district receives an average annual rainfall of 2073.3~mm. Most of the rainfall is received during the period from June to September, July and August being the wettest months. The region around Raipur gets the maximum rainfall, while the southern part receives the least rainfall in the district. About 87% of the annual rainfall is received during the period June to September. Monsoon starts by the mid of June and lasts upto September.

3.7 Wind Speed / Wind Rose Diagram

Wind speed and wind direction data recorded during the study period is useful in identifying the influence of meteorology on the air quality of the area. Based on the collected meteorological data, relative percentage frequencies of different wind directions are calculated and plotted as wind roses of Sixteen directions viz., N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW and NNW for 24 hours duration respectively. Maximum and minimum temperatures including percentage relative humidity were recorded simultaneously.

The average wind speed recorded was 6.1 to 7.2 km/h during December 2019 to Februaray 2020. Wind Rose diagram from the monitored data shows that the predominant wind direction during the study period was mainly from West of North-West (WNW) to East of South-East (ESE) to. The meteorological

condition of the study area has been tabulated in Table 3-5. The Wind Rose diagram has been shown in Figure 3.5.

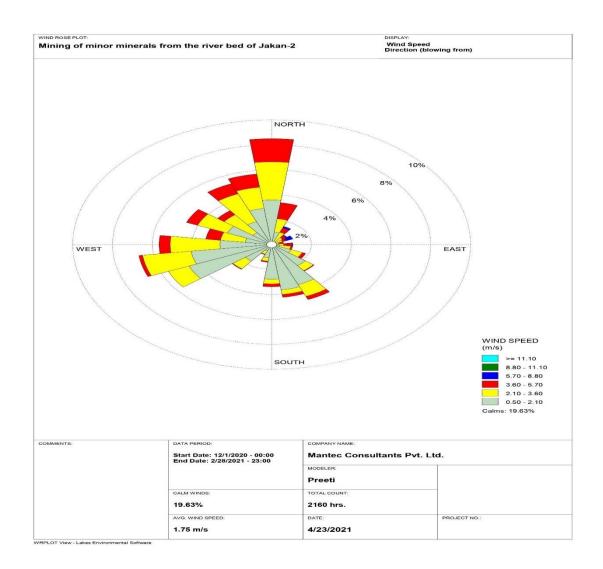


Figure 3-5: Wind Rose Diagram of Study Area

3.8 AMBIENT AIR QUALITY

The ambient air quality with respect to the study area of 10 Km radius around the lease area forms the baseline information. The various sources of air pollution in the region are dust rising from unpaved roads, domestic fuel burning, vehicular traffic, agricultural activities etc. The prime objective of baseline air quality monitoring is to assess existing air quality of the area. This will also be useful in assessing the conformity to standards of the ambient air quality during the operations.

3.8.1 Selection of Sampling Station

The baseline status of the ambient air quality has been assessed through scientifically designed Ambient Air Quality Network. The design of monitoring network in the air quality surveillance program has been based on the following considerations:

- a) Representation of Mine leases area.
- b) Representation of the down wind direction and cross-sectional distribution.
- c) Representation of residential areas.
- d) Representation of regional background levels.
- e) Representation of sensitive receptor.
- f) Meteorological conditions (predominant wind direction and wind speed.
- g) Topography of the study area.

Keeping in view above mentioned points, 08 nos. of Ambient Air Quality Monitoring Stations were established with in the study area. The sampling locations are shown in **Table 3-7** and in Figure 3-6. Villages/locations have been selected in downwind direction as well as in the upwind direction for AAQ monitoring from the proposed activity site.

S. No.	Code	Location	Distance (kms)	Direction	Latitude	Longitude
1.	A1	Mine Site	0.00		30°10'7.75"N	78°10'19.23"E
2.	A2	Anthoorwala	0.31	W	30°10'19.17"N	78°10'1.96"E
3.	A3	Doiwala	4.00	W	30°10'38.58"N	78° 7'40.63"E
4.	A4	Jolly Grant	2.57	NW	30°11'36.98"N	78° 9'42.39"E
5.	A5	Chidderwala	7.20	SE	30° 5'4.73"N	78°11'18.67"E
6.	A6	Lal Tappad	3.00	S	30° 7'9.43"N	30° 7'9.43"N
7.	A7	Thano	6.86	NE	30°14'26.01"N	78°12'50.08"E
8.	A8	Narender Nagar	9.12	Е	30° 9'46.29"N	78°16'59.19"E

Table 3-7: Ambient Air Quality Monitoring Sampling Stations

3.8.2 Baseline Data

Ambient air monitoring at 08 locations were carried out on during 1^{st} December 2019 to 28^{th} February 2020, in the study area to assess the ambient air quality at the source. Major air pollutants viz., Particulate Matter (PM_{10}), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), representing the basic air quality in the region were identified for Ambient Air Quality Monitoring (AAQM). The ambient air quality results are given in Table 3-9 for each location.

3.8.3 Sampling process and Analytical Techniques and Instruments Used for Sampling process

The various instruments used and technique adopted for sampling is given in table below:-

Table 3-8: Testing Procedure Used for Determining Various Air Quality Parameters

Parameter	Testing procedure
PM_{10}	Gravimetric Method by using Repairable particulate matter sampler "Repairable
	Dust Sampler" (RDS)
PM _{2.5}	Cyclonic Method by using Fine particulate sampler.
NO ₂	Absorption in diluted NaOH and then estimated calorimetrically with sulphanilamide and N (I-Nepthyle) Ethylene Diamine Dihydrochloride and Hydrogen Peroxide (IS: 5182 1975, Part-VI).
SO ₂	Absorption in Sodium Tetra Chloromercurate followed by Colorimetric estimation using P-Rosaniline hydrochloride and Formaldehyde (IS: 5182 Part – II, 2001).

Table 3-9: Ambient Air Quality Monitoring Results

Station	Description	PM ₁₀	PM _{2.5}	SO ₂	NO ₂
		$(\mu g/m^3)$	$(\mu g/m^3)$	(μg/m³)	(μg/m³)
AQ1	Max	69	38	12	26
	Min	50	27	6	17
	Avg	59.10	32.35	8.83	22.13
	98 percentile	67.76	37.17	11.54	26.32
AQ2	Max	56	31	14	25
	Min	40	22	6	15
	Avg	48.08	26.40	9.92	20.20
	98 percentile	55.68	30.72	13.54	24.08
AQ3	Max	56	38	12	30
	Min	39	24	6	20
	Avg	47.83	29.58	8.63	24.33
	98 percentile	55.08	36.16	12.00	29.08
AQ4	Max	55	38	12	24
	Min	40	22	6	14
	Avg	46.38	29.17	9.63	19.75
	98 percentile	52.70	37.08	12.00	24.00
AQ5	Max	56	36	14	25
	Min	42	21	7	15
	Avg	48.32	29.92	9.63	19.84
	98 percentile	55.68	36.48	13.52	24.96
AQ6	Max	63	36	15	23
	Min	54	25	5	16
	Avg	58.08	30.75	8.42	19.79
	98 percentile	63.00	35.54	13.16	23.00
405	Max	62	36	9	22
AQ7	Min	49	28	5	16
	Avg	57.33	32.46	6.67	18.46

	98 percentile	61.54	35.54	9.00	21.54
	Max	67	36	12	28
AQ8	Min	49	27	5	17
TiQo	Avg	59.79	30.42	7.00	21.75
	98 percentile	67.00	35.54	10.62	27.08

3.8.4 Interpretation of Results

Ambient Air Quality Monitoring reveals that the minimum and maximum concentrations of PM_{10} were found to be 39.0 to 69.0 Minimum and maximum concentrations of $PM_{2.5}$ were found to be 21.0 $\mu g/m^3$ and 38.0 $\mu g/m^3$ respectively. The minimum and maximum concentrations of NO_2 were found to be 14.0 $\mu g/m^3$ and 30.0 $\mu g/m^3$ respectively. The prescribed CPCB limit of SO_2 and NO_2 is 80 $\mu g/m^3$ for residential and rural areas has never surpassed at any monitoring station. The minimum & maximum concentrations of SO_2 for all the 8 AAQM stations were found to 5.0 $\mu g/m^3$ and 15.0 $\mu g/m^3$ respectively. From the above study and discussions, it can be concluded that air quality of the area is good as the levels are well within the prescribed limits as prescribed by CPCB.

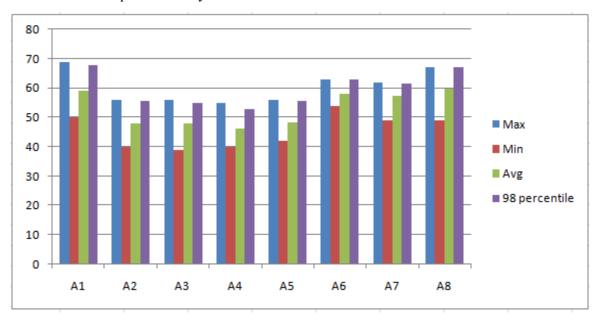


Figure 3-6: PM₁₀ Concentration in μg/m³

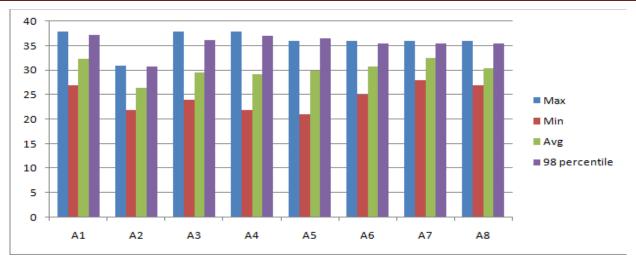


Figure 3-7: PM_{2.5} Concentration in μg/m³

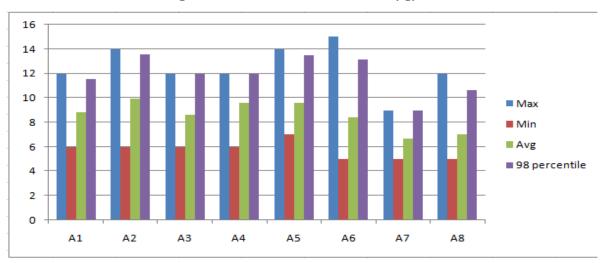


Figure 3-8: SO₂ Concentration in μg/m³

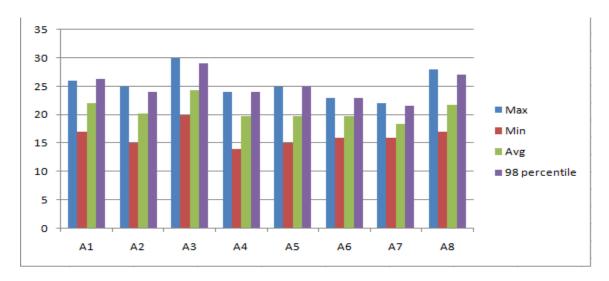


Figure 3-9: NO₂ Concentration in μg/m³

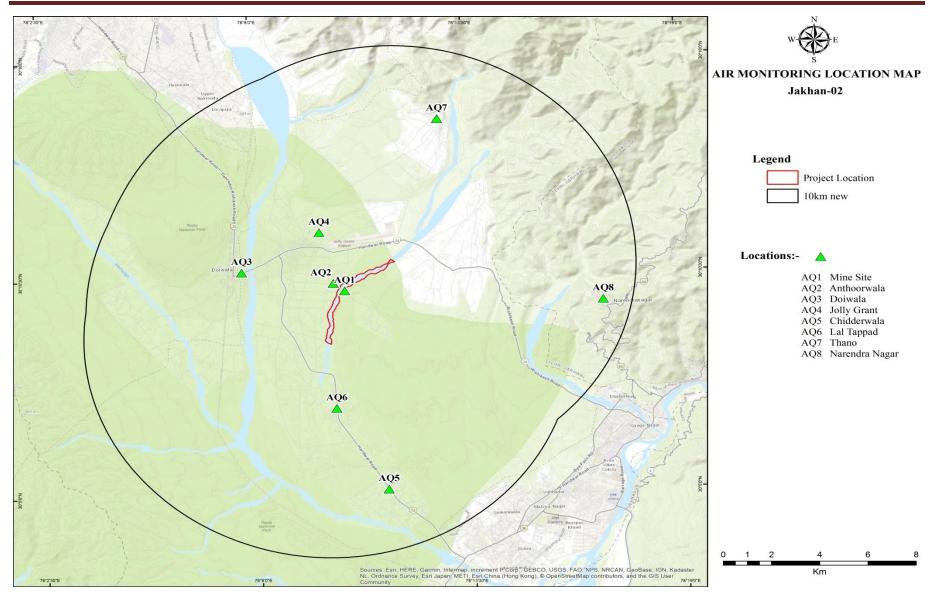


Figure 3-10: Key plan of Air Monitoring Stations

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3.9 NOISE ENVIRONMENT

Noise in general we can say that the sound, which is composed of many frequency components of various loudness distributed over the audible frequency range. Various noise scales have been introduced to describe, in a single number, the response of an average human being to a complex sound made up various frequencies at different loudness levels. The most common and heavily favored of those scales is the A weighted decibel (dBA). This is more suitable for audible range of 20 to 20,000 Hertz. The scale has been designed to weigh various components of noise according to the response of a human ear. The main objective of the noise level monitoring is to assess the background noise levels in different zones viz., industrial, commercial, residential and silence zones within the study area. Noise levels were measured in residential areas, bus stands and other settlements located within 10Km radius around the site.

3.9.1 Noise Analysis within the Study Area

The noise analysis within the study area was recorded using 4012 Maxtech sound level meter. The instrument was calibrated with a Standard Acoustic calibrator before using in the field. The measurements were carried out continuously for the 24-hour period to obtain hourly equivalent sound pressure level, per hour Leq. from these values, day and night time as well as 24 hours Leq values were also calculated. The Leq value is the equivalent continuous sound level, which is equivalent to the same sound energy as the fluctuating sound measured in the same period.

3.9.2 Methodology adopted for Selection of Sampling Station

Noise levels are more annoying in the night time particularly in the residential areas. The environmental impact of noise can have several effects varying from annoyance to hearing loss depending on loudness of noise levels. The monitoring for noise levels were done in 8 locations keeping considering the population and traffic of the area. The locations are depicted in Table 3.10 and levels recorded stated in Table 3.11.

S. No. Code Location Distance Direction Longitude Latitude (kms) 30°10'5.07"N 78°10'18.72"E 1. **A1 Near Mine Site** 0.16 E 2. A2 Anthoorwala 0.05 W 30°10'19.21"N 78° 9'53.73"E 3. W 30°10'33.09"N 78° 7'27.23"E А3 Doiwala 4.35 78° 9'47.79"E 4. A4 **Jolly Grant** 2.21 NW 30°11'27.43"N 30° 5'12.41"N 78°11'15.17"E 5. A5 Chidderwala 7.20 SE 6. S 30° 6'51.94"N 78°10'3.75"E A6 Lal Tappad 3.55 A7 NE 30°14'21.45"N 78°12'54.96"E 7. 6.77 Thano E 30° 9'31.33"N 78°17'8.18"E 8. **A8** 9.54 Narender Nagar

Table 3-10: Noise Monitoring Sampling Stations

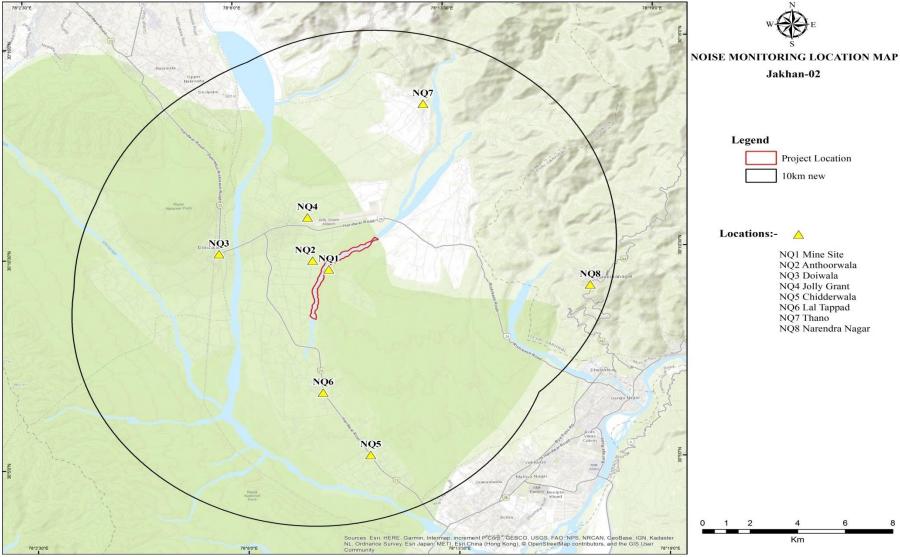


Figure 3-11: Key plan of Noise Monitoring Station

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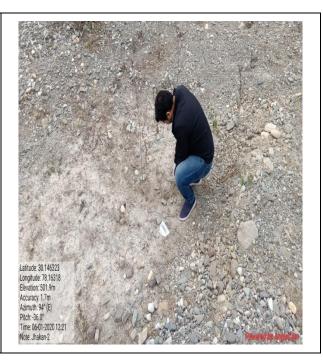
Table 3-11: Noise Levels in Study Area

	Noise		Standards	Standards of Noise Level			
Sr.No.	Location	D.O.S	Category of Area	Day dB (A)	Night dB (A)	Day (Ld)	Night (Ln)
1	Near Mine Site	01.12.2019	Residential Area	55	45	55.3	43.8
2	Anthoorwala	04.12.2019	Residential Area	55	45	48.6	39.5
3	Doiwala	16.12.2019	Residential Area	55	45	51.6	38.5
4	Jolly Grant	08.12.2019	Commercial Area	65	55	58.6	40.4
5	Chidderwala	12.12.2019	Residential Area	55	45	46.7	38.7
6	Lal Tappad	24.12.2019	Residential Area	55	45	50.2	41.5
7	Thano	16.12.2019	Residential Area	55	45	49.5	37.5
8	Narender Nagar	20.12.2019	Residential Area	55	45	51.8	39.4

3.9.3 Result of Noise Monitoring

Ambient noise levels were measured at 8 locations around the proposed project site. The noise levels recorded during the day time were from 46.7 Leq dB to 58.6 Leq dB respectively and level of noise during night time were from 37.5 Leq dB to 43.8 Leq dB respectively. Thus noise levels at all locations were observed to be within the prescribed limits. From the above study and discussions it can be concluded that noise levels in the study area are well within the prescribed limits as prescribed by the CPCB and State Pollution Control Board.





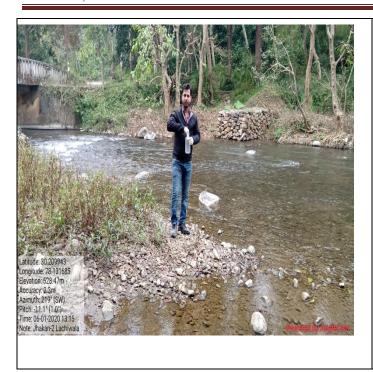




Figure 3-12: Sampling Photographs of Air, Water, Noise and Soil

3.10 TRAFFIC STUDY

Traffic density measurements were performed at NH-72 and Thano road near to mine site.

Traffic analysis is carried out by understanding the existing carrying capacity of the roads near to the project site and the connecting main roads in the area. Then depending on the capacity of the mine, the number of trucks that will be added to the present scenario will be compared to the carrying capacity.

The results of measurements are given in Table- 3-12.

Table 3.12: Traffic Scenario for NH-72

Time (Hrs.)	HMV	LMV	Two-Wheeler	Total
09:00-10:00	40	38	54	132
10:00-11:00	35	35	52	122
11:00-12:00	35	33	42	110
12:00-13:00	34	32	40	216
13:00-14:00	28	32	35	95
14:00-15:00	28	30	33	61
15:00-16:00	28	30	35	93
16:00-17:00	32	30	40	102
17:00-18:00	30	28	48	106
18:00-19:00	30	32	45	107
19:00-20:00	28	25	35	88
20:00-21:00	25	20	30	75
21:00-22:00	25	25	30	75
22:00-23:00	15	20	25	60

23:00-24:00	18	10	25	53
24:00-01:00	12	10	10	32
01:00-02:00	9	15	8	32
02:00-03:00	7	8	8	55
03:00-04:00	4	8	5	20
04:00-05:00	10	10	10	30
05:00-06:00	12	10	15	37
06:00-07:00	15	13	14	42
Total	500	494	674	1668

Table 3. 13: Calculation for PCU/hr (NH-72)

S.No	Vehicle	No. of Vehicles per day	Passenger	Total No. of vehicle
	distribution	on Village road	Car unit	PCU/Hr on Village road
1	HMV	500	3	1500
2	LMV	494	1	494
3	Two-Wheeler	674	0.5	337
Total			Total	2331/24=97.12

Table 3. 14: Existing traffic scenario & LOS (NH-72)

Road	V (Volume in PCU/hr)	C (Capacity in PCU/hr)	Existing V/C ratio	LOS
NH-72	97.12	3600	0.026	A

Table 3.15: The existing Level

V/C	LOS	Performance
0.0-0.2	A	Excellent
0.2-0.4	В	Very Good
0.4-0.6	С	Good/Average/Fair
0.6-0.8	D	Poor
0.8-1.0	Е	Very Poor

During Mine Operation: 2866050

Total Capacity of Mine per day: 2866050/245 = 11698 TPD

Number of Shifts: 1

Effective Working Hours: 8 Output per hour = 1462 TPH

No. of Trippers required @ 10T: 146.2*2=292.4 says 292 (NH72-200, Thano Road-92)

Increase in PCU/Hr for NH 72- 600 Increase in PCU/Hr for Thano Road- 276

Table 3.16: Details of Vehicle PCU/Hr. on NH-72

S.No	Vehicle distribution	No. of Vehicles per day on	Passenger Car unit	Total No. of vehicle PCU/Hr on Village road
		Village road		
1	HMV	500	3	1500/24=62.5+600=662.5
2	LMV	494	1	494/24=20.54
3	Two-Wheeler	674	0.5	337/24=14.04
Total			Total	697.08

Table 3.17: Modified Traffic Scenario & LOS for NH-72

Road	V (Volume in	C (Capacity in	Existing V/C ratio	LOS
	PCU/hr)	PCU/hr)		
NH-72	697.08	3600	0.19	A

Table 3.18: TRAFFIC SCENARIO FOR THANO ROAD

Table 3.10. TRAFFIC SCENARIO FOR THANO ROAD									
TRAFFIC SCENARIO FOR THANO ROAD									
Locations									
Time (Hrs)	HMV	LMV	Two Wheeler	Total					
09:00-10:00	3	5	8	16					
10:00-11:00	2	5	8	15					
11:00-12:00	2	4	10	16					
12:00-13:00	3	4	11	18					
13:00-14:00	1	4	5	10					
14:00-15:00	2	1	8	11					
15:00-16:00	2	1	7	10					
16:00-17:00	1	2	11	14					
17:00-18:00	2	3	10	15					
18:00-19:00	1	2	11	14					
19:00-20:00	1	3	6	10					
20:00-21:00	1	1	4	6					
21:00-22:00	2	0	5	7					
22:00-23:00	0	4	4	8					
23:00-24:00	0	3	3	6					
24:00-01:00	0	0	0	0					
01:00-02:00	0	0	0	0					
02:00-03:00	0	0	0	0					
03:00-04:00	0	1	0	1					
04:00-05:00	0	1	0	1					
05:00-06:00	0	3	4	7					
06:00-07:00	1	4	6	11					
Total	24	51	121	193					

Traffic data was collected continuously for 24 hours by visual observation and counting of vehicles under three categories viz., heavy motor vehicles, light motor vehicles and two/three wheelers. As traffic densities on the roads are high, two skilled persons were deployed for counting the traffic. At the end of each hour, fresh counting and recording was undertaken.

Table 3.19: Calculation for PCU/hr (Thano Road)

S.No	Vehicle Distribution	No. of Vehicles per day on Village road	Passenger Car unit	Total No. of vehicle PCU/Hr on Village road
1		on vinage roau	Cai unit	on vinage roau
1	HMV	24	3	12
2	LMV	51	1	51
3	Two Wheeler	121	0.5	60.5
	Total		Total	185.5/24=7

Table 3.20: Existing traffic scenario & LOS (Thano Road)

Road	V (Volume inPCU/hr)	C (Capacity in PCU/hr)	Existing V/C ratio	LOS
Thano Road	7	900	0.007	Α

Table 3.21: Details of Vehicle PCU/Hr. on Thano Road

Sl. No	Vehicle distribution	No. of Vehicles per day onVillage road	Passenger Car unit	Total No. of vehicle PCU/Hr on Thano Road
1	HMV	24	3	72/24=3+309=312
2	LMV	51	1	51/24=2.1
3	Two-Wheeler	121	0.5	60.5/24=2.52
Total			Total	316.62

Table 3.22: Modified Traffic Scenario & LOS For Thano Road

Road	V (Volume inPCU/hr)	C (Capacity	y in PCU/hr)	Existing V	/C ratio	LOS
Thano Road	31	6.62	3600		0.08		A

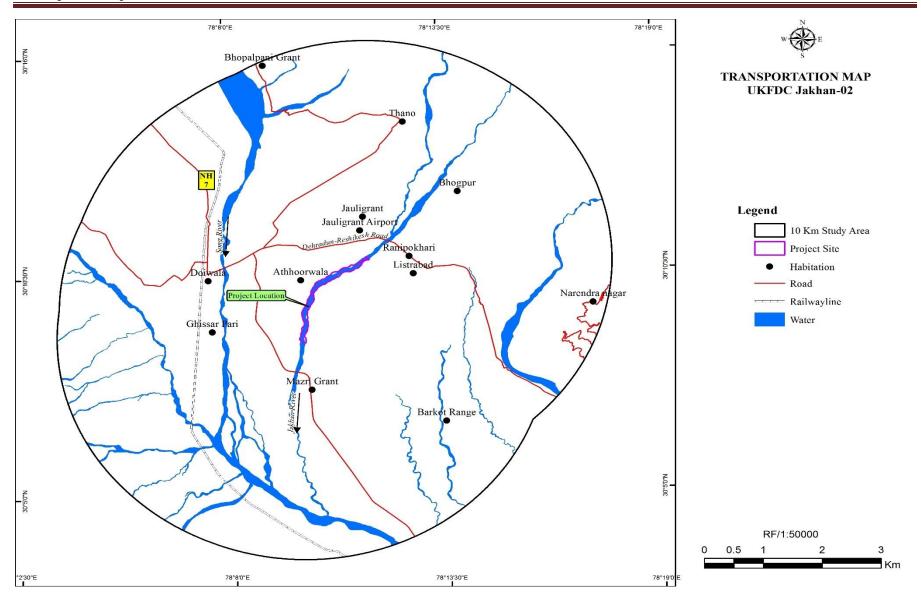


Figure 3-13: Transportation Map

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3.11 BIOLOGICAL ENVIRONMENT

Ecosystem shows complex inter-relationships between biotic and abiotic components leading to dependence, competition and mutualism. Biotic components comprise both plant and animal communities, interacting not only within and between themselves but also with the abiotic components of the environment.

Generally, biological communities are good indicators of climatic and edaphic factors because of their strong relationships with them. The studies on the biological aspects of the ecosystem are important in Environment Impact Assessment studies for the suitability of natural flora & fauna. Information on the impact of environmental stress on the community structure serves as an inexpensive and efficient early indicator and warning system to check the damage on a particular ecosystem.

The biological environment includes mainly terrestrial and aquatic ecosystem. A change in the composition of biotic communities under stress is reflected through a change in the distribution pattern, density, diversity, frequency, dominance and abundance of natural species of flora and fauna existing in the ecosystem. These changes over a span of times can be quantified and co-related with the environmental stress. This section describes the biological environment of the project site and its surrounding study areas.

3.11.1 OBJECTIVES OF BIOLOGICAL STUDIES

The objectives of biological study are outlined as follows:

- To characterize the flora and fauna to assess present bio-diversity
- To conduct detailed studies for floral and faunal composition and collect Baseline data of the existing terrestrial and aquatic ecosystems in the study area of project site.
- Identification of rare and endangered species of plants and animals and their status under The Wildlife (Protection) Act, 1972 and to define ecological/conservation status of species as per IUCN categories (Red Data List).
- Identification of ecologically sensitive areas within the study area.
- Assessment of migratory route of wildlife (if any).

3.11.2 Study Area

The proposed mine site is located near Majri Grant village in Doiwala Block Dehradun District of Uttarakhand State, India. It is located at a distance of about 27 km towards South from District Headquarters, Dehradun and 5km from Doiwala.

The mine site Jakhan -II falls in the Thano and Barkot range in the Jakhan stream which merges in the Song River. There is no water flow in non-rainy seasons in the river. Majri Grant village's settlement with its agricultural fields exists on the left side whereas on the right side, there is very sparse and dry deciduous forest of Khair-Sissoo with abundance of the *Opuntia* sp. and behind that Jolly Grant Airport is located.

As per the Bio-geographical provinces, the project site falls under the category 2B- West Himalayan. The study area is located in the lower Himalayan region of the Indian Bio-geographical Zones (*Rodger, Panwar and Mathur, 2000*).

3.11.3 Methodology of Assessment of the Biological Environment

The primary baseline survey was conducted to assess the nature of the existing habitat and species composition. Ecology and Biodiversity study was carried out during Dec. 2019 to Feb. 2020 in 10 km radius of the mine site. The plant species were identified with the help of plant taxonomy manual, published literatures and reports and Websites (BSI, ZSI and State/District Forest Departments). In addition, information was also collected with vernacular names of plant species from local inhabitants.

The Phyto-sociology study was carried out using square quadrats technique through random sampling procedure. All the plots sampled were representative of most common types of forest area.

Quadrats of 10m x 10m for tree species, 5m x 5m for shrub species and 1m x 1m for herb species were used for sampling purpose. Following parameters were recorded:

- Name of the species.
- Number of the occurrence of each species in each quadrat.
- ➤ Diameter (DBH) of species.

Different sampling techniques were employed for documenting different faunal groups. For herpetofauna (Amphibians and Reptiles), visual encounter survey; for birds, point count and transect methods and for mammals direct, indirect sightings (signs like tracks, pellets and pugmarks) were adopted. The water bodies in the area were also assessed for the status of the aquatic life and fishes.

During field survey, discussions with the forest officers and local people were also carried-out to collect information related to local biodiversity in and around the study area.

The Sampling location are presented in Table 3.14 and depicted in Figure 3.13.

Table 3.23: EB Sampling location in 10 km radius study area

S.No.	Sampling	Direction	Distance	Environment	Coordinates	
S.NO.	Code	Direction	(Km)	Sensitive Type	Latitude	Longitude
1	S1	-	-	Project Site	30.17038	78.17000
2	S2	N	6.63 km	Thano RF	30.24133	78.19712
3	S3	NW	9.15 km	Saura RF	30.25420	78.14902
4	S4	NW	5.63 km	Lachhiwala RF	30.20398	78.12584
5	S5	Е	2.31 km	Barkot RF	30.15470	78.19084
6	S6	E	8.06 km	Kushraila RF	30.17670	78.27738

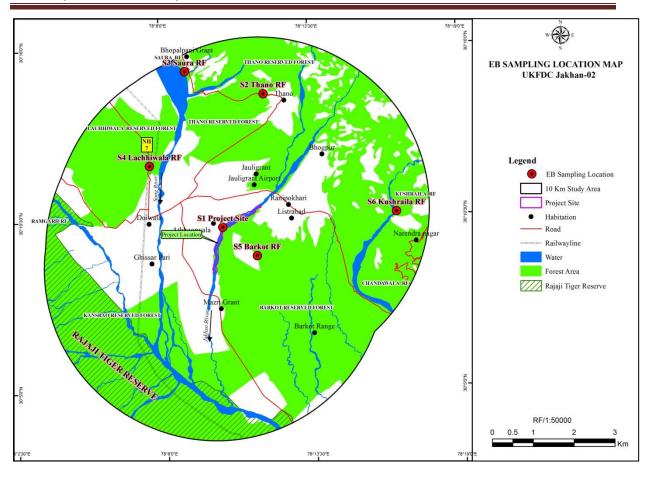


Fig 3.14: EB Sampling locations in 10 km radius study area

Ecological sensitivity along with critical habitats (National Park, Wildlife Sanctuary, Ecological Sensitive Area, Migratory Corridor, habitat of endangered and vulnerable and rare species, *etc*) in the study area has also been worked out.

Identification and classification of species recognized as critically endangered, endangered, threatened *etc* has also been carried out as per IUCN Red List and Scheduled Species as per WPA (1972). Moreover, authentic secondary sources of the information *i.e.* Govt. publications and published research papers and web search have also been referred which are given below in the Table 3.15.

Table 3.24 Authentic Secondary Sources Consulted for Biodiversity Study

- BSI (2016). State wise Distribution of Endemic and Threatened plant texa of India. http://www.bsienvis.nic.in/Database/E_3942.aspx.
- ENVISThreatenedFauna;http://wiienvis.nic.in/Database/ScheduleSpeciesDatabase_7969.a spx
- http://gbpihedenvis.nic.in/ENVIS%20Bullitin/ENVIS%20Bulletin,%20Vol.%2026,%2020 18/Forests_Uttarakhand_V.P._Sati.pdf
- https://bsi.gov.in/page/en/flora.
- http://cpcbenvis.nic.in/scanned%20reports/PROBES-75%20Guidelines%20For%20Developing%20Greenbelts.pdf
- http://utrenvis.nic.in/data/medicinal%20plant%20abstract.pdf
- http://faunaofindia.nic.in/PDFVolumes/hpg/052a/index.pdf

- Champion, H.G. and Seth (1968). A revised survey of the forest types of India. Govt. of India Press, Nasik, India.
- http://www.utrenvis.nic.in/data/flora%20and%20fauna%20oct%202013.pdf
- IUCN 2010. "IUCN Red List of Threatened species" Version 2010.2 http://www.iucnredlist.org. Cited at 13 July 2010.
- Mishra, R. (1968). Ecology Workbook. Oxford and IBH Publishing Inc., Calcutta, India.
- Philips, E.A. (1959). Methods of Vegetation Study. Henry Holt Co. Inc., New York, USA., Pages: 107.
- https://fsi.nic.in/isfr19/vol2/isfr-2019-vol-ii-uttarakhand.pdf
- $\bullet \ https://www.prepdata.org/dashboards/uttarakhand-agriculture-dashboard-d7603478-1c73-40f5-a87f-68f11aed3c7d$
- http://www.frienvis.nic.in/Database/District-Wise-Forest-Cover-of-Uttarakhand_2476.aspx
- http://faunaofindia.nic.in/PDFVolumes/sfs/062/index.pdf
- http://faunaofindia.nic.in/PDFVolumes/hpg/039/index.pdf
- DistrictWiseForestCoverofUttarakhand(2017)http://www.frienvis.nic.in/Database/Distric t-Wise-Forest-Cover-of-Uttarakhand_2476.aspx.
- SFRI (2015). State Forest Report of India, Ministry of Environment & Forest, Dehradun. Champion HG, Seth SK (1968). A revised survey of the forest types of India, Government of India Publications, New Delhi.
- https://forest.uk.gov.in/pages/display/99-medicinal-aromatic-plants
- Kumar A, Ram J (2005). Anthropogenic disturbances and plant biodiversity in forests of Uttaranchal, Central Himalaya. Biodiversity Conservation, 14(1): 309-331.
- http://www.frienvis.nic.in/Database/Medicinal-Plants-Uttarakhand_2150.aspx
- http://www.utrenvis.nic.in/data/flora%20and%20fauna%20oct%202013.pdf
- https://forest.uk.gov.in/pages/view/19/40-protected-area-network
- http://cpcbenvis.nic.in/scanned%20reports/PROBES-75%20Guidelines%20For%20Developing%20Greenbelts.pdf

3.11.4 Eco-Sensitive zone in the Study Area

The major environment sensitive areas have been studied in 10 km radius of the mine site using Google earth images. The study area fall in Thano Reserve Forest, Barkot Reserve Forest, Lachchiwala Range RF (5.63 km NW), Saura Reserve Forest (9.15km NW) and Kushraila Reserve Forest (8.06km E) and Rajaji Tiger Reserve. The Rajaji Tiger Reserve is situated at a distance of 5.40 km in SW direction from project site. The riverbed project area itself falls in the forest area.

The Environmental sensitivity map has been shown as Figure No. in 3.14 section 3.11.2.3

3.11.5 Forest types and natural vegetation at regional level and in the study area

The state of Uttarakhand is renowned for its unique bio-diversity. Due to geographic and climatic diversity in different areas of the state, different forest types are found spanning from the Himalayas to the plains of the Terai. Due to biodiversity present in the state, 12 percent of total geographical area is protected areas which includes 6 National Parks, 7 Wildlife Sanctuary, 4 Conservation Reserves and 1 Biosphere Reserve. Rajaji National Park/Tiger Reserve is

present at a distance of approx. 5.40km from project site which is an eco-sensitive area (Figure 3.15).

Major forest types occurring in the state are Tropical Moist Deciduous, Tropical Dry Deciduous, Sub Tropical Pine, Himalayan Moist Temperate, Himalayan Dry Temperate, Sub Alpine, Dry Alpine and Moist Alpine Scrub. Forests are largely distributed throughout the state with conifers and Sal being major forest formation. Following ten forest sub-types are present in Dehradun district as per Champion and Seth, 1968 Classification systems.

- 1. Moist Siwalik Sal Forest (3C/C2a)
- 2. Northern Dry Mixed Deciduous Forest (5B/C2)
- 3. Dry Deciduous Scrub (5/DS1)
- 4. Subtropical Euphorbia Scrub (9/C1/DS2)
- 5. Moru Oak Forest (12/C1b)
- 6. Moist Deodar Forest (12/C1c)
- 7. Western Mixed Coniferous Forest (Spruce, Blue Pine, Silver Fir) (12/C1d)
- 8. Himalayan Temperate Secondary Scrub (12/C1/DS2)
- 9. Low Level Blue Pine Forest (12/2S1)
- 10. Khair-Sissu Forest (5/1S2)

Major part of study area falls under Northern Dry Mixed Deciduous Forest (5B/C2) subtype.

Forests present in Study area are as follows:

- 1. Thano Reserve Forest
- 2. Lachhiwala Reserve Forest
- 3. Barkot Reserve Forest
- 4. Saura Reserve Forest
- 5. Kushraila Reserve Forest

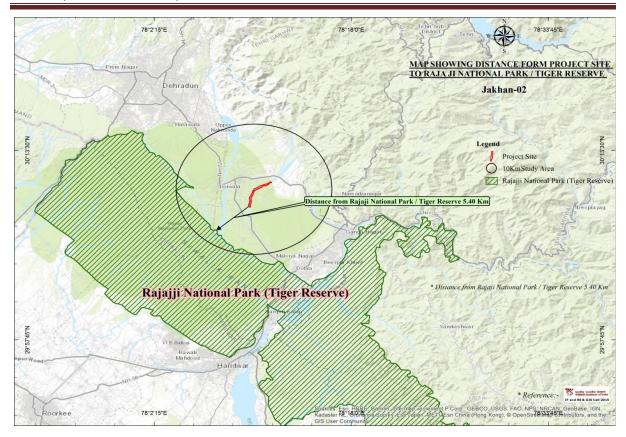


Figure: 3.15 Map Showing Distance from Project site to Rajaji Tiger Reserve

Rajaji National Park (Tiger Reserve)

Rajaji National Park is located in the Shivalik range near the foothills of the Himalayas. The National Park has recently been notified as Rajaji Tiger Reserve. It is spread over in an area of 820 km2 in three districts of Uttarakhand *i.e.* Haridwar, Dehradun and Pauri Garhwal. In 1983, three wildlife sanctuaries in the area namely, Chilla, Motichur and Rajaji sanctuaries were merged into one.

Rajaji National park is predominantly covered by the Sal Forest and a number of other forest types which include the Western Gangetic Moist and Northern dry Deciduous and Khair-Sissoo forests. Low Alluvial Savannah Woodlands cover the drier southern margins of the park, in contrast to the Shiwalik Chir-Pine on the high reaches of the hills. Broad leaved deciduous forests, riverine vegetation, scrub land, grass lands and pine forests form the range of flora in this park.

It is the second tiger reserve in the state after the Corbett Tiger Reserve and 48th Tiger Reserve of India. As per directions of the Tiger Conservative Authority of India, the Rajaji National Park is the core area of the Rajaji Tiger Reserve, while about 300 km² of Shyampur range of the Haridwar forest division and parts of Kotdwar and Laldhang forest division, which function as a buffer zone, is also be included in the Tiger Project, augmenting the total area to 1150 km².

3.11.6 Floral composition of the study area based on Field Observation

Uttrakhand is bestowed with rich and diversified forest resource with their high economic viability, in spite of being economically viable and a substantial option of livelihoods of the rural

people. The region is immensely rich in floral species. The Based upon primary observation, the project study area fall in forest land *i.e* Thano range RF and Barkot range RF.

Most dominant species observed during site survey of the study area are *Shorea robusta* (SaI), Lannea coromandelica (Indian Ash Tree), Azadirachta indica (Neem), Dalbergia sisso (Shisham), Acacia catechu (Khair), Adina cordifolia (Haldu), Syzygium cumini (Jamun), Mallotus philippensis (Rohini), Mitragyna parvifolia (Kadamb), Populus sp. (Poplar), Terminalia sp., Ficus spp., Euclyptus sp., Macaranga pustulata (Blistery Macaranga), Schleichera oleosa (Gum lac Tree) and Anogeissus latifolia (Axle Wood Tree) etc. The shrubby vegetation is represented by Opuntia sp., Carissa opaca, Clerodendrum viscosum, Jasminum multiflorum, Solanum sp., Phlogacanthus thyrsiformis, Jatropha curcas, Rhus parviflora and Lantana camara etc.

A list of floral species has been prepared based on primary survey (site observations) and discussion with local people. The total number of different plant life forms under trees, shrubs, herbs and climbers is shown in Table 3.26 and their % distribution is shown in Figure 3.15.

S. No.	Plant Life Form	Number of Species
1	Trees	48
2	Shrubs	18
3	Herbs	30
4	Climbers	7
Total No. of Species		103
Total N	lo. of Family	52

Table 3.25: Number of floral life forms in the Study Area

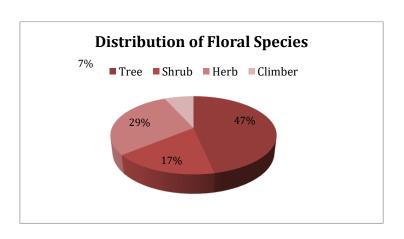


Figure 3.16: Pie diagram showing % distribution of floral life forms

The floral composition along with common name, family, life form and IUCN status of the study area is listed below in Table: 3.26

Table: 3.26 List of Floral species observed during primary survey

S.No	Family	No. of Sp.	Scientific Name	Common /Local name	Life form	IUCN Status
1	Amaranthaceae	1.	Achyranthes aspera	Aghara	Н	-
		2.	Pupalia lappacea	Chirchitta	Н	-
2	Annonaceae	3.	Polyalthia longifolia	False Ashok	Т	-
		4.	Miliusa velutina	Dom-Sal	Т	-
3	Acanthaceae	5.	Justicia adhatoda	Arusa	Н	-
		6.	Xanthium strumarium	Ghaghra	Н	-
		7.	Eclipta prostrata	Bhringaraj	Н	-
	Asteraceae	8.	Ageratum conyzoides	Jangli Pudina	Н	-
4		9.	Bidens biternata	Chirchitta	Н	-
		10.	Parthenium hysterophorus	Carrot Grass	S	•
5	Asparagaceae	11.	Asparagus racemosus	Satawari	Н	-
		12.	Rauwolfia sp.	Sarpagandha	S	-
		13.	Vallaris solanacea	Ramsur	Cli	-
6	Apocynaceae	14.	Calotropis procera	Aak	S	-
		15.	Carissa carandas	Karonda	S	-
		16.	Ichnocarpus frutescens	Irgha-Mula	Cli	-
7	Anacardiaceae	17.	Lannea coromandelica	Mohin	Т	-
,	Allacal diaccac	18.	Mangifera indica	Mango	T	-
8	Aquifoliaceae	19.	Ibex dipyrena	Himalayan Holly	Т	-
9	Boraginaceae	20.	Ehretia sp.	Bakli	Т	-
		21.	Cordia dichotoma	Lasora	Т	-
		22.	Terminalia alata	Asan	Т	-
		23.	Terminalia bellirica	Bahera	Т	-
10	Combretaceae	24.	Anogeissus latifolia	Axle Wood Tree	Т	-

		25.	Bauhinia variegata	Kachnar	Т	-
		26.	Bauhinia purpurea	Kaniar	Т	-
11	Caesalpiniaceae		Cassia occidentalis	Kasunda	Н	-
			Cassia tora	Chakunda	S	-
		29.	Cassia fistula	Amaltas	Т	-
12	Cannabaceae	30.	Cannabis sativa	Gallow Grass	Н	-
13	Cyperaceae	31.	Cyperus rotundus	Motha	Н	-
14	Cactaceae	32.	Opuntia stricta	Erect Prickly Pear	S	-
		33.	Opuntia dillenii	Nagphana	S	-
15	Convolvulaceae	34.	Cuscuta reflexa	Amar Bel	Cli	-
		35.	Ipomoea carnea	Behaya	S	LC
16	Dioscoreaceae	36.	Dioscorea deltoidea	Shingli-Mingli	Cli	-
17	Dipterocarpaceae	37.	Shorea robusta	Sal	T	-
18		38.	Trewia nudiflora	Pindalu	T	-
	Euphorbiaceae	39.	Euphorbia hirta	Bara Dudhi	Н	-
		40.	Mallotus philippensis	Rohani	Т	-
		41.	Ricinus communis	Castor Bean	Т	-
		42.	Dalbergia sissoo	Shisham	Т	-
19.	Fabaceae	43.	Aeschynomene indica	Didhen	Н	-
		44.	Butea monosperma	Palash	Т	-
		45.	Anisomeles indica	Kala Bhangra	Н	-
20	Lamiaceae	46.	Colebrookea oppositifolia	Binda	S	-
21	Meliaceae	47.	Toona ciliata	Indian Mahogany	Т	-
		48.	Melia azedarach	Chinaberry Tree	Т	-
		49.	Azadirachta indica	Neem	Т	-
22	Myrtaceae	50.	Syzygium cumini	Jamun	Т	-
		51.	Sida cordifolia	Kharinta	Н	-
	Malvaceae	52.	Sida rhombifolia	Sahadeva	Н	-

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23		53.	Bombax ceiba	Silk Cotton Tree	Т	-
		54.	Urena lobata	Bachita	S	-
24	Menispermaceae	55.	Tinospora Cordifolia	Giloy	Cli	-
25	Myrsinoideae	56.	Ardisia solanacea	Dhan-Priya	S	-
		57.	Albizia procera	Safed Siris	Т	-
		58.	Acacia catechu	Khair	Т	-
26	Mimosaceae	59.	Mimosa pudica	Lajwanti	Н	LC
		60.	Pithecellobium dulce	Jangal Jalebi	Т	LC
		61.	Ficus benghalensis	Banyan Tree	Т	-
27	Moraceae	62.	Ficus racemosa	Goolar	Т	-
		63.	Ficus hispida	Kagsha	Т	-
28	Oleaceae	64.	Jasminum multiflorum	Balini	Н	-
		65.	Jasminum officinale	Chameli	S	-
29	Onagraceae	66.	Ludwigia sp.	Marshy jasmine	Н	-
30	Oxalidaceae	67.	Oxalis corniculata	Amrul	Н	-
31	Onagraceae	68.	Ludwigia sp.	Paddy clove	Н	LC
		69.	Cynodon dactylon	Doob	Н	-
		70.	Cenchrus ciliaris	Anjan	Н	-
32	Poaceae	71.	Chrysopogon zizanioides	Khas	Н	-
52		72.	Digitaria sanguinalis	Crabgrass	Н	-
		73.	Heteropogon contortus	Black Speargrass	Н	
		74.	Eleusine indica	Malankuri	Н	-
33	Phyllanthaceae	75.	Phyllanthus emblica	Amla	Т	-
34	Papaveraceae	76.	Argemone mexicana	Mexican Poppy	Н	-
35	Rutaceae	77.	Murraya paniculata	Kamini	Т	-
		78.	Aegle marmelos	Bel	Т	
36	Rubiaceae	79.	Adina cordifolia	Haldu	Т	-
		80.	Mitragyna parvifolia	Kaim	Т	-
37	Ranunculaceae	81.	Clematis montana	Garol	Cli	-

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38	Rhamnaceae	82.	Ziziphus mauritiana	Indian Plum	Т	-
			Casearia tomentosa	Chilla	Т	-
39	Salicaceae	84.	Populus sp.	Himalayan Poplar	Т	-
0,		85.	Salix tetrasperma	Indian Willow	Т	-
		86.	Solanum torvum	Bhurat	S	-
40	Solanaceae	87.	Solanum virginianum	Thorny Nightshade	Н	-
41	Smilacaceae	88.	Smilax aspera	Salsa	Cli	-
42	Sterculiaceae	89.	Helicteres isora	Marorphali	Т	-
43	Tiliaceae	90.	Grewia asiatica	Phalsa	Т	-
44	Urticaceae	91.	Boehmeria macrophylla	Bara-siauru	S	-
45	Ulmaceae	92.	Holoptelea integrifolia	Chilbil	Т	-
		93.	Callicarpa macrophylla	Bastara	S	-
46	Verbenaceae	94.	Clerodendrum infortunatum	Hill Glory Bower	S	-
		95.	Lantana camara	Raimuniya	S	
		96.	Tectona grandis	Teak	Т	-

Abbreviations: T=Tree, S= Shrub, H=Herb, Cli=Climber, LC= Least Concerned,

EN= Endangered

Source: Mantec Consultants Pvt Ltd, Ecology and Biodiversity team

3.11.7 Phtytosociological aspects of the Floral species in the Study Area

Phyto-sociological analysis of the vegetation helps in determining the relative importance of each species in the study area and to establish if any valuable species is threatened.

The phyto-sociological parameters such as density, frequency, basal area and importance value index of individual species were determined through random sampling using quadrats of different sizes in the study area. Relative frequency, density and Relative dominance were calculated and the sum of these represented Importance Value Index (IVI) for various tree species. For shrubs and herbs, the IVI was calculated by summing up relative frequency, relative density and relative abundance.

Sample plots were selected in such a way to get maximum representation of different types of vegetation and plots were laid out in different part of the study area of 10 km radius. Phyto-sociological analysis of tree species is shown in Table 3.17

Table: 3.27 Frequency, Density, Relative frequency, Relative Density and Importance Value Index of trees species

S.No	Scientific name	Family	Density (D/m2)	Frequency %	RF	RD	IVI
1	Adina cordifolia	Rubiaceae	0.80	40.00	1.83	1.36	7.26
2	Aegle marmelos	Rutaceae	0.70	50.00	2.29	1.19	5.45
3	Anogeissus latifolia	Combretaceae	1.40	70.00	3.21	2.38	9.04
4	Azadirachta indica	Meliaceae	1.00	60.00	2.75	1.70	6.91
5	Bauhinia variegata	Fabaceae	0.50	50.00	2.29	0.85	4.13
6	Bauhinia purpurea	Fabaceae	1.10	40.00	1.83	1.87	5.43
7	Cordia dichotoma	Boraginaceae	1.80	60.00	2.75	3.06	8.02
8	Casearia tomentosa	Salicaceae	0.90	70.00	3.21	1.53	5.97
9	Cedrela toona	Meliaceae	1.60	50.00	2.29	2.72	6.12
10	Cassia fistula	Fabaceae	1.50	60.00	2.75	2.55	6.78
11	Dalbergia sissoo	Fabaceae	3.20	80.00	3.67	5.43	12.92
12	Eucalyptus spp.	Myrtaceae	2.10	60.00	2.75	3.57	12.23
13	Ehretia laevis	Boraginaceae	1.30	60.00	2.75	2.21	5.94
14	Ficus benghalensis	Moraceae	0.40	20.00	0.92	0.68	9.73
15	Flacourtia indica	Salicaceae	0.80	30.00	1.38	1.36	3.60
16	Grewia asiatica	Tiliaceae	0.70	50.00	2.29	1.19	3.97
17	Holoptelea integrifolia	Ulmaceae	3.40	90.00	4.13	5.77	14.58
18	Helicteres isora	Sterculiaceae	0.60	40.00	1.83	1.02	3.96
19	Litsea glutinosa	Lauraceae	0.50	30.00	1.38	0.85	3.83

20	Lannea coromandelica	Anacardiaceae	0.80	50.00	2.29	1.36	6.85
21	Lagerstroemia parviflora	Lythraceae	0.40	40.00	1.83	0.68	4.24
22	Mallotus philippensis	Euphorbiaceae	3.30	80.00	3.67	5.60	13.21
23	Mitragyna parvifolia	Rubiaceae	0.10	10.00	0.46	0.17	6.67
24	Miliusa velutina	Annonaceae	0.90	40.00	1.83	1.53	4.22
25	Oroxylum sp.	Bignoniaceae	1.20	60.00	2.75	2.04	6.02
26	Ougeinia oojeinensis	Fabaceae	2.00	60.00	2.75	3.40	8.12
27	Phyllanthus emblica	Phyllanthaceae	0.60	40.00	1.83	1.02	7.29
28	Schleichera oleosa	Sapindaceae	2.20	70.00	3.21	3.74	10.64
29	Syzygium cumini	Myrtaceae	1.20	60.00	2.75	2.04	6.76
30	Shorea robusta	Dipterocarpaceae	3.90	90.00	4.13	6.62	17.40
31	Terminalia alata	Combretaceae	1.40	60.00	2.75	2.38	9.93
32	Terminalia bellirica	Combretaceae	1.60	70.00	3.21	2.72	9.50
33	Tectona grandis	Lamiaceae	3.20	80.00	3.67	5.43	11.20
34	Senegalia catechu	Fabaceae	1.60	60.00	2.75	2.72	6.58
	Total		48.7		86.18	82.74	264.5
Shanno	Shannon's-Wiener's Diversity Index (H) = 2.556						

Table: 3.28 Frequency, Density, Relative frequency, Relative Density and Importance Value Index of Shrubs and herbs species

S.No	Scientific name	Family	Density (D/m2)	Frequency %	RF	RD	IVI
1	Aerva sanguinolenta	Amaranthaceae	0.71	57.14	2.53	0.65	3.60
2	Adhatoda vasica	Acanthaceae	3.29	71.43	3.16	3.01	12.37
3	Abutilon indicum	Malvaceae	1.71	57.14	2.53	1.57	6.17
4	Asparagus racemosus	Asparagaceae	1.29	42.86	1.90	1.18	4.11

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5	Ageratum conyzoides	Asteraceae	1.71	57.14	2.53	1.57	4.12
6	Adiantum sp.	Pteridaceae	3.14	71.43	3.16	2.88	7.07
7	Achyranthes aspera	Amaranthaceae	4.00	57.14	2.53	3.66	6.61
8	Ambrosia artemisiifolia	Asteraceae	1.86	71.43	3.16	1.70	6.93
9	Cannabis spp.	Cannabaceae	4.57	85.71	3.80	4.18	10.05
10	Bauhinia vahlii	Fabaceae	1.71	71.43	3.16	1.57	10.94
11	Boerhavia diffusa	Nyctaginaceae	0.43	28.57	1.27	0.39	3.73
12	Cheilanthes sp.	Pteridaceae	0.29	14.29	0.63	0.26	2.96
13	Cassia occidentalis	Fabaceae	2.14	57.14	2.53	1.96	7.59
14	Calotropis procera	Apocynaceae	2.29	71.43	3.16	2.09	11.46
15	Clerodendrum infortunatum	Lamiaceae	3.71	85.71	3.80	3.40	13.40
16	Centella sp.	Apiaceae	2.00	28.57	1.27	1.83	11.37
17	Colebrookea oppositifolia	Lamiaceae	2.57	85.71	3.80	2.35	6.19
18	Cayratia trifolia	Vitaceae	0.29	57.14	2.53	0.26	9.00
19	Cynodon dactylon	Poaceae	8.86	57.14	2.53	8.10	10.84
20	Cissampelos pareira	Menispermaceae	1.71	42.86	1.90	1.57	3.49
21	Cyperus rotundus	Cyperaceae	6.57	42.86	1.90	6.01	8.12
22	Commelina benghalensis	Commelinaceae	4.57	28.57	1.27	4.18	5.47
23	Euphorbia hirta	Euphorbiaceae	1.71	42.86	1.90	1.57	4.09
24	Evolvulus nummularius	Convolvulaceae	1.14	14.29	0.63	1.05	1.70
25	Helicteres isora	Malvaceae	1.86	42.86	1.90	1.70	4.63
26	Ichnocarpus frutescens	Apocynaceae	2.00	28.57	1.27	1.83	3.30
27	Indigofera sp.	Fabaceae	4.71	42.86	1.90	4.31	6.63
28	Lactuca serriola	Asteraceae	0.57	14.29	0.63	0.52	1.36
29	Lantana camara	Verbenaceae	2.29	71.43	3.16	2.09	9.39
30	Mucuna pruriens	Fabaceae	0.43	28.57	1.27	0.39	1.86
31	Oplismenus burmannii	Poaceae	1.14	14.29	0.63	1.05	1.70
32	Oxalis corniculata	Oxalidaceae	8.86	85.71	3.80	8.10	12.11
33	Parthenium hysterophorus	Asteraceae	4.57	85.71	3.80	4.18	10.05
34	Phyllanthus niruri	Phyllanthaceae	1.71	71.43	3.16	1.57	6.39

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35	Pteris sp.	Pteridaceae	3.00	71.43	3.16	2.75	7.36	
36	Perilla frutescens	Lamiaceae	0.29	14.29	0.63	0.26	1.51	
37	Pogostemon benghalensis	Lamiaceae	1.14	42.86	1.90	1.05	5.01	
38	Ricinus communis	Euphorbiaceae	1.71	57.14	2.53	1.57	10.30	
39	Solanum sp.	Solanaceae	0.71	42.86	1.90	0.65	5.65	
40	Sida rhombifolia	Malvaceae	0.71	42.86	1.90	0.65	4.62	
41	Opuntia sp.	Cactaceae	4.43	71.43	3.16	4.05	15.49	
42	Vitis latifolia	Vitaceae	0.29	14.29	0.63	0.26	1.93	
43	Xanthium strumarium	Asteraceae	4.14	85.71	3.80	3.79	11.72	
	Total		106.83		98.71	96.78	292.38	
Shanno	Shannon's-Wiener's Diversity Index (H) =2.453							

Important Value Index is a measure to indicate dominance of a species in a given ecosystem area. From the above Quadrat study, it is observed that some species like *Shorea robusta*, *Tectona grandis, Mallotus philippensis, Schleichera oleosa, Dalbergia sissoo, Terminalia alata, Adhatoda vadica, Cannabis* spp., *Adiantum* sp., *Clerodendrum infortunatum, Opuntia sp. Bauhinia vahlii* and *Lantana camara* have high Importance Value Index and these are dominant in the project area.

3.11.8 Rare or endangered or threatened flora

There are no rare or endangered or threatened plant species in the study area as per IUCN category. The floral species found in the study area are common and have wide spread occurrence.

3.11.9 Medicinally important Floral Species

Ayurveda says "There is no plant on the earth, which does not possess medicinal property", this means that each plant is equally important for its biological activities, ecology and environment. The conservation of medicinal plants means every species of plants in its natural habitat should be protected and preserved. Conservation of invaluable biodiversity is a national and international agenda. Because of continuous exploitation of medicinal plants from their natural habitats, it is required to replant and regenerate them in other areas having similar habitat or environment. Due to over exploitation of natural resources many plant species have become extinct from the world.

Uttarakhand is a storehouse of a rich variety herbs and medicinal and aromatic plant species. The medicinal plants present in the study area with their common names and family are given in the Table 3.29.

Table: 3.29 Medicinally important floral species

S.No	Scientific Name	Common Name	Family	Parts Use
1	Aegle marmelos	Bel	Rutaceae	Fruit
2	Adenostemma lavenia	Jangli-jira	Asteraceae	Leaf

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3	Aesculus indica	Kanor	Sapindaceae	Seed			
4	Acacia nilotica	Gum Arabic	Mimosaceae	Stem			
5	Andrographis	Hara Chirayata,	Acanthaceae	Stem			
	paniculata						
6	Aloe vera	Gheekumari	Asphodelaceae	Leaf			
7	Azadirachta indica	Neem	Meliaceae	Whole plant			
8	Boerhavia diffusa	Satha	Nyctaginaceae	Leaf			
9	Berberis aristata	Indian Barberry	Berberidaceae	Root & stem			
10	Boswellia serrata	Shallaki	Burseraceae	Whole plant			
11	Carissa spinarum	Wild Karanda	Apocynaceae	Fruit			
12	Cardamine impatiens	Ban Laiyya	Brassicaceae	Leaf			
13	Commiphora wightii	Guggal	Brassicaceae	Whole plant			
14	Calotropis gigantea	Crown Flower	Apocynaceae	Root/Leaf			
15	Cassia fistula	Amaltas	Caesalpiniaceae	Whole plant			
16	Cassia tora	Chakvat	Caesalpiniaceae	Root/Leaf/Seed			
17	Ficus benghalensis	Banyan Tree	Moraceae	Whole plant			
18	Holarrhena	Indrajao	Apocynaceae	Root & Stem			
	antidysenterica						
19	Mentha arvensis	Ban pudina	Lamiaceae	Whole plant			
20	Ocimum sanctum	Holy Basil	Lamiaceae	Whole Plant			
21	Nyctanthes arbor-tristis	Coral Jasmine	Oleaceae	Leaf			
22	Phyllanthus emblica	Aonla	Phyllanthaceae	Fruit			
23	Rhamnus virgata	Chentuli	Rhamnaceae	Fruit			
24	Rauvolfia serpentina	Sarpagandha	Rhamnaceae	Whole plant			
25	Tribulus terrestris	Gokhuru	Zygophyllaceae	Seed			
26	Tamarindus indica	Tamarind	Caesalpiniaceae	Fruit			
27	Viola biflora	Yellow Wood	Violaceae	Flower			
		Violet					
28	Ziziphus mauritiana	Indian Plum	Rhamnaceae	Whole plant			
Source: S	Source: Secondary data						

3.12 Agricultural Crops (Species of Economic Importance)

Agriculture is the backbone of Uttarakhand and is practiced by many people especially those living in the hilly areas of Uttarakhand. Many hilly people of Uttarakhand have taken agriculture as their main occupation as it gives them bread and butter. Major crops grown in the state are rice, wheat, sugarcane, maize, soybean, pulses, oilseeds and a number of fruits and vegetables.

3.13 Faunal description based on Field Survey:

Faunal assessment provides a basis for determining relative abundance and rarity of each species which is important for assessing the diversity of fauna of a particular area. Since animals are capable of movements from one place to another, this makes their study entirely different. Different animals prefer different types of habitat for food and shelter. During survey species like Rhesus Macaque (*Macaca mulatta*), Spotted Deer (*Axis axis*), Common Langur (*Presbytis entellus*), Wild Boar (*Sus scrofa*), Five Striped Palm Squirrel (*Funambulus pennanti*) and Mangoose (*Herpestes edwardsi*) were observed in the study area.

During discussion with local people it was informed that some reptiles and amphibians like Asian Common Toad (*Duttaphrynus melanostictus*), Green Whip Snake (*Hierophis viridiflavus*), Indian Cobra (*Naja naja*) and Russell's Viper (*Vipera russelli*) are also observed in the study area.

The study area is dominated by Forest land which support higher vegetation of Faunal species. During discussion with forest officers and local people it was documented that Six Scheduled-I species are listed as per Indian Wildlife Protection Act, 1972, *i.e.* Asian Elephant (*Elephas maximus*), Leopard Cat (*Prionailurus bengalensis*), Bengal tiger (*Panthera tigris tigris*), Leopard (*Panthera pardus*), Indian Pangolin (*Manis crassicaudata*) and Indian peafowl (*Pavo cristatus*).

The list of faunal species i.e. (Mammals, Birds, Amphibians, Reptilians and Butterflies) reported in the study area (Core and Buffer Zone) is given in Table 3.21. The conservation status of listed species as per IUCN Red Data Book and Indian Wildlife Protection Act, 1972 has also been mentioned in the table.

Table 3.30: Faunal Species reported from the Study Area

S.	Scientific Name	Common	Family	WPA/IUCN	Core	Buffer
No.		Name		status	Zone	Zone
1	Axis axis	Spotted Deer	Cervidae	III/LC		
2	Boselaphus tragocamelus	Nilgai	Bovidae	III/LC	-	
3	Cervus unicolor	Sambar	Cervidae	III/VU		
4	Elephas maximus	Elephant	Elephantidae	I/EN		
5	Felis chaus	Jungle Cat	Felidae	II/LC	-	
6	Funambulus palmarum	Three Striped Palm Squirrel	Sciuridae	LC	-	
7	Funambulus pennanti	Northern Palm Squirrel	Sciuridae	IV/LC		
8	Herpestes auropunctatus	Javan Mongoose	Herpestidae	LC	-	
9	Herpestes edwardsii	Common Mongoose	Herpestidae	II/LC		
10	Hystrix indica	Indian Porcupine	Hystricidae	IV/LC	-	
11	Lepus nigricollis	Indian Hare	Leporidae	IV/LC	-	
12	Macaca mulatta	Rhesus Macaque	Cercopithecida e	II/LC		
13	Mus booduga	Indian Field Mouse	Muridae	IV/LC		
14	Mus musculus	House Mouse	Muridae	IV/LC	-	
15	Manis crassicaudata	Indian Pangolin	Manidae	I/EN	-	
16	Panthera pardus	Leopard	Felidae	I/VU	-	
17	Presbytis entellus	Grey Langur	Cercopithecida e	-		
18	Panthera tigris tigris	Bengal tiger	Felidae	I/EN	-	
19	Pteropus	Flying Fox	Pteropodidae	IV/LC	-	

	giganteus					
20	Prionailurus	Leopard Cat	Felidae	I/LC	-	
	bengalensis					
21	Rattus rattus	Black Rat	Muridae	LC	-	
22	Rousettus leschenaulti	Fruit Bat	Pteropodidae	IV/LC	-	
23	Suncus murinus	The Grey Musk Shrew	Soricidae	LC	-	
24	Sus scrofa	Wild Boar	Suidae	III/LC		
25	Vulpes	Indian Fox	Canidae	II/LC	-	
	bengalensis					
26	Viverricula indica	Small Indian Civet	Viverridae	II/LC	-	
Birds						
27	Aegithalos concinnus	Black-throated Bushtit	Aegithalidae	LC	-	
28	Alcedo atthis	Common Kingfishe	Alcedinidae	LC	-	
29	Ardea alba	Great White Egret	Ardeidae	LC		
30	Ardeola grayii	Indian Pond Heron	Ardeidae	LC	-	
31	Acridotheres fuscus	Jungle Myna	Sturnidae	LC		
32	Amandava amandava	Red Munia	Estrildidae	LC	-	
33	Amaurornis phoenicurus	White- Breasted Waterhen	Rallidae	LC	-	
34	Acridotheres tristis	Indian Myna	Sturnidae	LC	-	
35	Bubulcus ibis	Cattle Egret	Ardeidae	LC		
36	Copsychus saularis	Oriental Magpie-Robin	Muscicapidae	LC	-	
37	Chloris spinoides	Yellow- Breasted Greenfinch	Fringillidae	LC	-	
38	Corvus macrorhynchos	Large-Billed Crow	Corvidae	LC		
39	Columba livia	Rock Dove	Columbidae	IV/LC		
40	Corvus splendens	House Crow	Corvidae	LC		
41	Dendrocitta	Rufous	Corvidae	LC		
	vagabunda	Treepie		LC LC		
42	Dendrocitta formosae	Grey Treepie	Corvidae	LC		
43	Dicrurus macrocercus	Black Drongo	Dicruridae	LC	-	
44	Halcyon smyrnensis	White- Throated Kingfisher	Alcedinidae	LC	-	

45	Hirundo concolor	Dusky Crag Martin	Hirundinidae	LC	-	
46	Lonchura punctulata	Spotted Munia	Estrildidae	LC	-	
47	Lanius schach	Long-Tailed Shrike	Laniidae	LC	-	
48	Lanius vittatus	Bay-Backed Shrike	Laniidae	LC	-	
49	Merops orientalis	Green Bee- Eater	Meropidae	LC	-	
50	Motacilla cinerea	Grey Wagtail	Motacillidae	LC	-	
51	Motacilla alba	Pied Wagtail	Motacillidae	LC	-	
52	Nectarinia asiatica	Purple Sunbird	Nectariniidae	LC	-	
53	Orthotomus sutorius	Common Tailorbird	Cisticolidae	LC	-	
54	Ocyceros birostris	Indian Grey Hornbill	Bucerotidae	LC	-	
55	Pavo cristatus	Indian Peafowl	Phasianidae	I/LC	-	
56	Prinia sylvatica	Jungle prinia	Cisticolidae	LC		
57	Prinia hodgsonii	Grey-Breasted Prinia	Cisticolidae	LC		
58	Prinia inornata	Plain Prinia	Cisticolidae	LC	-	
59	Parus major	Great Tit	Paridae	LC	-	
60	Psittacula	Rose-Ringed	Psittaculidae	LC		
	krameri	Parakeet		LC		
61	Psittacula cyanocephala	Plum-Headed Parakeet	Psittaculidae	LC	-	
62	Pycnonotus cafer	Red-Vented Bulbul	Pycnonotidae	LC		
63	Pericrocotus flammeus	Orange Minivet	Campephagidae	LC	-	
64	Pycnonotus cafer	Red-vented Bulbul	Pycnonotidae	LC		
65	Passer domesticus	House Sparrow	Passeridae	LC		
66	Sturnus contra	Pied Myna	Sturnidae	LC	-	
67	Streptopelia chinensis	Spotted Dove	Columbidae	LC		
68	Streptopelia senegalensis	Laughing Dove	Columbidae	LC		
69	Seicercus xanthoschistos	Grey-Hooded Warbler	Phylloscopidae	LC	-	
70	Saxicola sp.	Grey Bush Chat	Muscicapidae	LC	-	
71	Saxicoloides fulicata	Indian Robin	Muscicapidae	LC		
72	Saxicola caprata	Pied Bush Chat	Muscicapidae	LC	-	
73	Turdoides striatus	Jungle Babbler	Leiothrichidae	LC		
74	Urocissa	Red-Billed	Corvidae	LC	-	

	erythrorhyncha	Blue Magpie				
75	<i>Upupa epops</i>	Hoopoes	Upupidae	LC	-	
76	Vanellus indicus	Red-Wattled Lapwing	Charadriidae	LC	-	
77	Zosterops palpebrosus	Oriental White-Eye	Zosteropidae	LC	-	
Reptil		i wince Lye				_
78	Ancistrodon	Himalayan Pit	Viperidae	-	-	
	himalayanus	Viper				
79	Bungarus caeruleus	Common Krait	Elapidae	-	-	
80	Bungarus fasciatus	Banded Krait	Elapidae	LC	-	
81	Calotes versicolor	Common Garden Lizard	Agamidae	-	-	
82	Eryx johnii	Red Sand Boa	Boidae	NT		
83	Hierophis viridiflavus	Green Whip Snake	Colubridae	LC		
84	Naja naja	Indian Cobra	Elapidae	II		
85	Ophiophagus		Elapidae	II/VU	_	
	hannah	King Cobra	-	,		
86	Ptyas mucosa	Rat Snake	Colubridae	II		
87	Vipera russelli	Russell's Viper	Viperidae	-		
	nibians	T		T		1
88	Acris crepitans	Northern Cricket Frog	Hylidae	LC	-	
89	Bufo bufo	Toad	Bufonidae	LC	-	
90	Bufo stomaticus	Indian Marbled Toad	Bufonidae	LC	-	
91	Duttaphrynus melanostictus	Asian Common Toad	Bufonidae	LC		
92	Duttaphrynus himalayanus	Himalaya Toad	Bufonidae	LC	-	
93	Fejervarya limnocharis	Rice Field Frog	Dicroglossidae	LC	-	
94	Fejervarya syhadrensis	Cricket Frog	Dicroglossidae	LC	-	
95	Hoplobatrachus tigerinus	Indus Valley Bullfrog	Dicroglossidae	IV/LC	-	
	Rana cascadae	Cascades Frog	Ranidae	LC		
Butter	I .	<u>. </u>		•	•	•
96	Catopsilia	Mottled	Pieridae	-	-	
	pyranthe	Emigrant				
97	Danaus chrysippus	Plain Tiger	Nymphalidae	-		
98	Junonia lemonias	Lemon Pansy	Nymphalidae	-		
99	Ixias pyrene	Yellow Orange Tip	Lycaenidae	-	-	
100	Leptosia nina	Psyche	Pieridae	-	-	
101	Pachliopta	Common Rose	Papilionidae	-	-	

	aristolochiae					
02	Papilio polyctor	Common Peacock	Papilionidae	-	-	
103	Papilio demoleus	Lime Butterfly	Papilionidae	-		
104	Parantica aglea	Glassy Tiger	Nymphalidae	-		
105	Peacock pansy	Junonia Almanac	Nymphalidae	-	-	

 $Abbreviations: LC=Least\ Concerned,\ CR=Critically\ Endangered,\ VU=Vulnerable,$

DD= Data Deficient, NT= Near Threatened, EN= Endangered.

Source: Primary survey, secondary sources and discussion with Forest officers

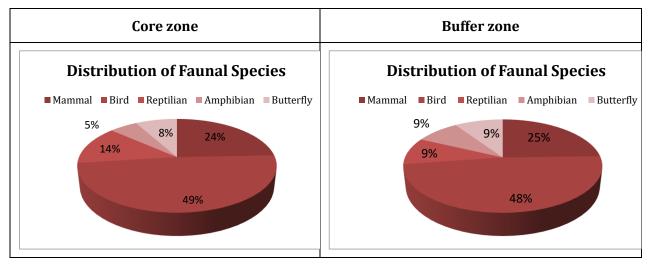
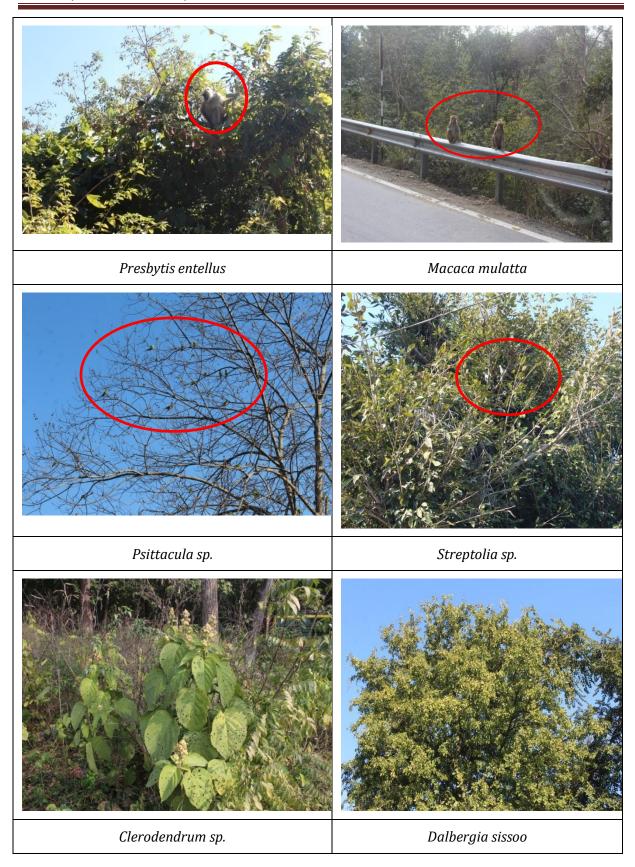


Figure 3.17: Pie diagram showing % distribution of faunal life forms

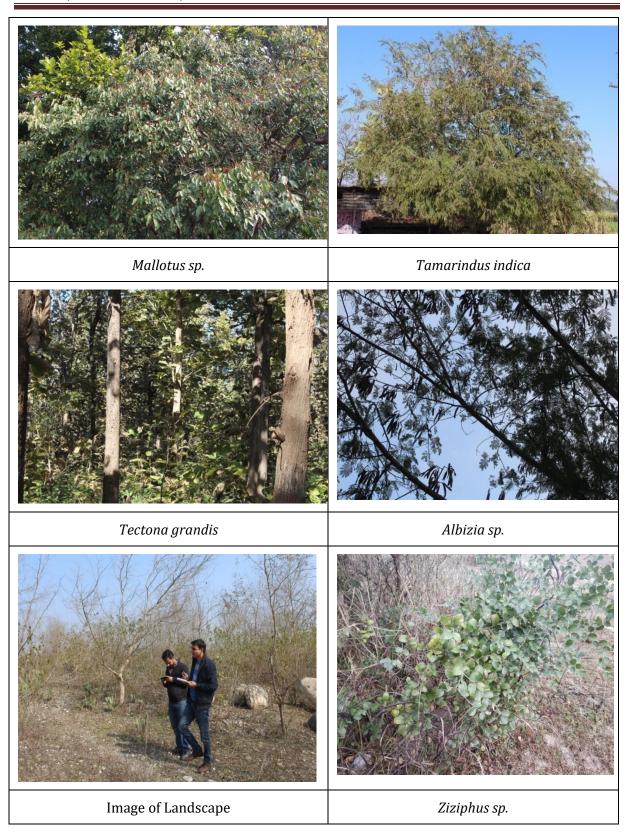
The visuals of the landscape and terrestrial ecosystem of the study area are depicted in the following Photographs.



Draft EIA/EMP Report for Mining of Minor Mineral (Sand, Bajri and Boulders) from the river bed of River Jakhan-2 by M/s Uttarakhand Forest Development Corporation, located in Dehradun Forest Division, District Dehradun, Uttarakhand over an area of 96.50 Ha



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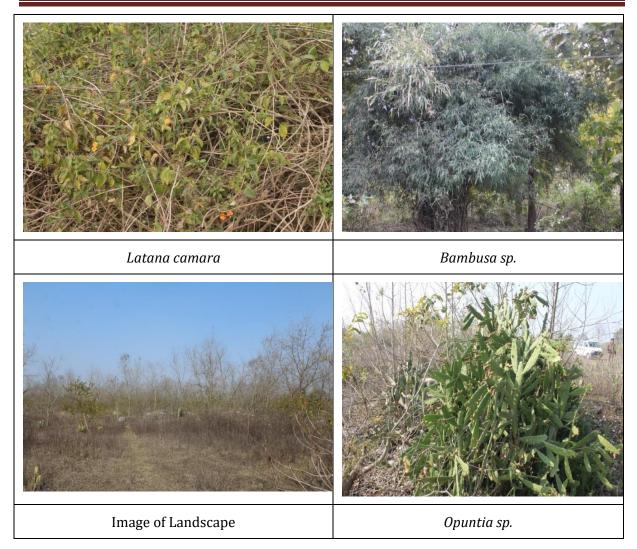


Figure 3.18: Photographs of Flora of the study area

3.14 Aquatic Life

Aquatic flora normally includes phytoplankton and macro-phytes (Plants that have adapted to living in aquatic environment such as River, Lakes, Ponds, Canal). Some aquatic plants which may be observed at random locations in submerged conditions in river or streams are *Typha elephanta, Photamogeton pectinatus, Ceratophyllum demersum* and *Eichhornia crassipes*. Phytoplankton and Macrophytic vegetation, collected from different rivers and streams present in the buffer area, are given in Tables 3.24

Aquatic fauna comprises of mostly Avifauna, Amphibians; and Fishes which cannot survive without aquatic ecosystem.

Zooplankton is commonly found in all types of aquatic habitats. These are recognized as secondary producers. The list of plankton species recorded from water bodies present in the buffer zone is given in the Table 3.25 below:

Table: 3.31 Phytoplanktons in the Buffer zone

Class	S.No	Genera
	1	Amphora sp.

Bacillariophyceae	2	Cyclotella sp.
	3	Nitzschia sp.
	4	Chroococcus sp.
	5	Anabaena sp.
Cyanophyceae	6	Gloeocapsa sp.
	7	Nostoc sp.
	8	Lyngbya sp.
	9	Merismopedia sp.
	10	Oscillatoria sp.
	11	Ankistrodesmus sp.
	12	Coelastrum sp.
Chlorophyceae	13	Scenedesmus sp.
	14	Tetraedron sp.
	15	Westella sp.
Chlamydomonadales	16	Volvox sp.
Trebouxiophyceae	17	Oocystis sp.
Zygnematophyceae	18	Cosmarium sp.
	19	Spirogyra sp.

Table:3.32 Aquatic vegetation in the Buffer zone

1 0					
S.No	Species	Family	IUCN Status		
1	Azolla pinnata	Salviniaceae	-		
2	Typha elephantina	Typhaceae	-		
3	Cryptocoryne sp.	Araceae	-		
4	Eichhornia crassipes	Pontederiaceae	-		
5	Potamogeton pectinatus	Potamogetonaceae	-		
6	Hydrilla sp.	Hydrocharitaceae	LC		
7	Ceratophyllum demersum	Ceratophyllaceae	-		
8	Ipomoea aquatica	Convolvulaceae	LC		
9	Typha angustifolia	Typhaceae	-		

Table: 3.33 Zooplankton Species in the Buffer zone

Class	S.No	Genera
Centropyxidae	1	Centropyxis sp.
Colpodea	2	Bursaria sp.
Brachionidae	3	Brachionus sp.
	4	Cyclops sp.
Cyclopidae	5	Mesocyclops sp.
	6	Thermocyclops sp.
Diaptomidae	7	Diaptomus sp.
Oligohymenophorea	8	Vorticella sp.
	9	Paramoecium sp.
Tubulinea	10	Arcella sp.
	11	<i>Difflugia</i> sp.

3.14.1 Fish Fauna

The Jakhan River is mainly rain-fed aquatic body system. A very lean water current flow in the non-rainy season and most of its width remains dry. No major fish stock is found in these streams but only a few small fish species are found *i.e Barilius barna, Barilius bendelisis*

(Angura), *Barilius tileo* (Tileo Baril), *Chagunius chagunio* (Chaguni), *Garra gotyla* (Pathorchata). There are some fish pockets where fish maintains their survival and breeding. The fish species which are commonly found in the nearby aquatic habitats of the study area are listed in the Table 3.28 below:

Table 3.34: Fish Species reported in the Buffer zone

				WPA/IUCN
S. No.	Scientific Name	Common Name	Family	Status
1	Bagarius bagarius	Gangetic Goonch	Sisoridae	NT
2	Barilius bendelisis	Angura	Cyprinidae	LC
3	Barilius tileo	Tileo Baril	Cyprinidae	LC
4	Catla catla	Catla	Cyprinidae	LC
5	Chagunius chagunio	Chaguni	Cyprinidae	-
6	Cirrhinus mrigala	Mrigal	Cyprinidae	LC
7	Garra gotyla	Pathorchata	Cyprinidae	LC
8	Heteropneustes fossilis	Stinging Catfish	Heteropneustidae	LC
9	Labeo rohita	Rohu	Cyprinidae	LC
10	Labeo calbasu	Orangefin Labeo	Cyprinidae	LC
11	Mystus seenghala	Kavasi	Bagridae	LC
12	Mystus tengara	Tengara Catfish	Bagridae	LC
13	Opsarius barna	Barna Baril	Cyprinidae	LC

Abbreviations: LC= Least Concerned, CR= Critically Endangered, VU= Vulnerable, DD= Data Deficient, NT= Near Threatened, EN= Endangered.

Conclusion:

The study area of the project is dominated by Reserve forests and natural vegetation. The vegetation of the study area is dominated by Sal forest and Khair-Sissoo etc. The species observed in the study area are generally found in abundance. Among faunal species, six species are falling under Schedule-I of Wildlife (Protection) Act, 1972; *i.e. Elephas maximus* (Asian Elephant), *Panthera tigris tigris* (Bengal Tiger), *Manis crassicaudata* (Indian Pangolin), *Prionailurus bengalensis* (Leopard Cat), *Panthera pardus* (Leopard) and *Pavo cristatus* (Indian Peafowl).

3.14.2 Impacts on the Biological Environment

The Jakhan-II mining project location is falling in the reserve forest areas. As per authenticated map provided by DFO, Dehradun, the project site is 5.40 km from Rajaji Tiger Reserve. Hence, it is essential that certain strict restrictions are followed during operation of the project. The trespassing of the labour, cutting of trees, chance of fire setting, disturbance to the fauna, accidents and human- animal conflicts are some major issues which require proper management and mitigations. Impact on air, water and soil pollution may occur due to the trucks and other vehicles movement. The noise generated due to movement of the vehicles may disturb the wild fauna. However, these impacts would be of lower magnitude which will be further minimized through careful mitigation measures.

The movement of birds and animals on the water stream in the mining area will be disturbed. However, the mining activities to excavate the RBM will be carried out only in the dry river beds.

Impacts on Aquatic Ecology:

The river Jakhan is a monsoon fed seasonal river which remains dry in most part of year. Hence, it does not harbor any significant aquatic life. More ever, the mining activity will remain confined in the dry part of the river bed. Therefore, the project is not likely to affect the aquatic ecology.

Impacts on Bird Fauna

The project does not involve any tree felling or removal of vegetation. Therefore, there may not be loss of nesting and roosting habitat of avian fauna. Plantation activities by the UKFDC will add to the shelter places to the birds. Further, the implementation of mitigation measures would reduce the impact on birds, if any.

Impacts on wildlife

Wildlife species live in communities that depend on each other. Survival of these species can depend on soil conditions, local climate, altitude, and other features of the local habitat. Many wildlife species are highly dependent on vegetation growing in natural drainages. This vegetation provides essential food, nesting sites, and cover for escape from predators. Any activity that destroys vegetation near water bodies reduces the quality and quantity of habitat essential for waterfowl, shore birds, and many terrestrial species. The habitat requirements of many animal species do not permit them to adjust to changes created by land disturbance. These changes reduce living space.

The most direct effect on wildlife is destruction or displacement of species in areas of excavation and mining. Mobile wildlife species, like game animals, birds, and predators, leave these areas. More sedentary animals, like invertebrates, many reptiles, burrowing rodents, and small mammals, may be more severely affected.

However, since this mining project does not involve any tree felling and ground vegetation clearance; there may not be habitat loss of faunal species due to mining activity. The plantation activities to be undertaken by UKFDC would add to the green cover around project side and improve the habitat of fauna of area.

3.14.3 Mitigation of Impacts on Biological Environment

The project may not directly affect any natural habitat, flora and fauna when a careful mining activity is carried out with all necessary control measures to minimize the air, water, noise and soil related impacts as recommended in the relevant sections. However, following mitigation measures should be adopted to further minimize the impact on biological environment:

- The mining activities should be carried out as per approved mining plan with hand tools only in order to lower the impact on river bed environment. No machinery should be used for mining purposes.
- Dry pit mining will be followed which means mining at all times will be above the water flow level of river. Mining activity will be immediately stopped when water comes in the mining pits.
- Mining will be carried out during the dry season when the project area remains completely dry. Hence, there will be no disturbance to the aquatic habitat.

- No mining will be carried out during the monsoon season to minimize impact on aquatic life which is mainly breeding season for many of the species.
- Mining will be restricted in the 25% from both sides of the river bank to avoid river bank erosion and consequent channel migration.
- Stream will not be diverted to form inactive channel.
- Mining at the concave side of the river channel will be avoided to prevent bank erosion.
- Mining will be done during day-time only; i.e. between sunrise to sunset only.
- The conservation plan prepared for the Schedule-I species should be implemented by the UKFDC.
- UKFDC shall ensure that their workers and other staff during operation phase shall not be involved in poaching and hunting activities of any wildlife around the project site.
- No resources from forest and its eco-sensitive zone shall be extracted (i.e. fuel wood, soil, etc.) by workers.
- The suggested air and water pollution control measures should be implemented to minimize impact on surrounding vegetation, forest area and downstream aquatic life.
- Dust is mainly generated due to unpaved roads. To mitigate the impact, regular water sprinkling should be carried out on unpaved roads.
- The speed limit for the trucks must be set with restriction on blowing horn to reduce noise due to vehicular movement. This will mitigate impact on wild fauna.
- Use of plastic bags shall be strictly prohibited in the project area.
- Awareness programme among the staff and labour must be propagated for conservation of the biodiversity.
- If wildlife are noticed crossing the area, they will not be disturbed at all.
- The project will support Forest department in raising awareness and anti-poaching law enforcement activities in the surrounding of project site.
- The UKFDC should ensure no tree felling or any other disturbance to the biological environment of the study area due the project activity.
- The UKFDC should undertake plantation in maximum available area.

Greenbelt Development Plan

Greenbelt means planting of special type of plants suitable for a particular agro-climate zone and soil characteristics in a place which will make the area cooler, reduce air pollution, prevent soil erosion and further improve the soil fertility status. A green belt around the periphery of project side and road side is created to avoid erosion of soil, prevention of landslides, minimize the air pollution and noise pollution in the project area. The green plants are capable of absorbing air pollutants and act as sinks for pollutants. Leaves with their vast area in a tree crown, absorb pollutants on their surface, effectively reducing their concentration and noise level in the ambient.

According to the CPCB guidelines, there are 15 Agro-climatic regions, each of these region is further divided in to 68 sub zones based on annual rain fall, Climatic condition and soil types. The species recommended for the Greenbelt are quite adapted to such climatic condition and grow well in the soil types of that zone.

Selection of Plant Species for Green Belt Development:

The selection of plant species for the green belt development depends on various factors such as climate, elevation and soil. The plants should exhibit the following desirable characteristics in order to be selected for plantation.

- ❖ The species should be fast growing and providing optimum penetrability.
- The species should be wind-firm and deep rooted.
- The species should form a dense canopy.
- ❖ As far as possible, the species should be indigenous and locally available.
- ❖ Species tolerance to air pollution like SO2 and NO2 should be preferred.
- ❖ The species should be permeable to help create air turbulence and mixing within the belt.
- ❖ There should be no large gaps for the air to spill through.
- ❖ Trees with high foliage density, leaves with larger leaf area and hairy on both the surfaces.
- ❖ Ability to withstand conditions like inundation and drought.
- Soil improving plants (Nitrogen fixing rapidly decomposable leaf litter).
- ❖ Attractive appearance with good flowering and fruit bearing.
- Bird and insect attracting tree species.
- Sustainable green cover with minimal maintenance.

Following tree species are recommended for plantation. However, UKFDC should take view of their internal expert in forestry during plantation.

Table 3.35: Floral Species recommended for Plantation and Greenbelt

S.No	Scientific Name	Common Name	Family	Abatement Property
1	Albizia lebbeck	Siris Tree	Mimosaceae	NOx, Dust, SOx
2	Ailanthus excelsa	Mahanimb	Simaroubaceae	Dust
3	Acacia catechu	Khair	Mimosaceae	Dust
4	Azadirachta indica	Neem	Meliaceae	Dust, NOx, SOx
5	Anogeissus latifolia	Dhau	Combretaceae	-
6	Aegle marmelos	Bel	Rutaceae	Noise
7	Anthocephalus cadamba	Kadam	Rubiaceae	Dust
8	Adina cordifolia	Karam	Rubiaceae	-
9	Bauhinia purpurea	Kaniar	Caesalpiniaceae	Dust
10	Bambusa sp.	Bamboo	Poaceae	-
11	Cassia fistula	Sonali	Caesalpiniaceae	Dust
12	Delonix regia	Flame Tree	Caesalpiniaceae	Dust
13	Dalbergia sissoo	Shisham	Fabaceae	Noise
14	Mangifera indica	Aam	Anacardiaceae	SOx, Dust
15	Nerium indicum	Kaner	Apocynaceae	SOx, Dust
16	Phoenix sylvestris	Sendhi	Arecaceae	Dust
17	Polyalthia longifolia	Ashok	Annonaceae	SOx, Noise, Dust
18	Pongamia pinnata	Pongam Tree	Fabaceae	Noise, Dust
19	Schleichera oleosa	Kusum	Sapindaceae	-
20	Syzygium cumini	Jamun	Myrtaceae	Dust
21	Tamarindus indica	Tamarind	Caesalpiniaceae	Noise

22	Terminalia arjuna	Arjun	Combretaceae	Dust
23	Tectona grandis	Sagun	Verbenaceae	Dust
24	Zizyphus mauritiana	Indian Jujube	Rhamnaceae	Dust

3.15 SOCIO-ECONOMIC ENVIRONMENT

3.15.1 Introduction: Socio-Economic Impact Assessment

Socio-Economic Impact Assessment (SEIA) refers to systematic analysis of various social and economic characteristics of human being living in a given geographical area (study area/impact area). The prime objective of SEIA is to identify and evaluate potential socio-economic and cultural impacts of a proposed development project on the lives & conditions of people, their families and communities. If the potential impacts are significant and adverse, SEIA assist the developers and other stakeholders to reduce, remove or prevent these impacts from happening. Also, it examined how a development project changes the lives of local residents. The outcome of the study relies on both quantitative and qualitative measure of impacts. The impacts are evaluated in terms of changes in community demographics, housing, employment, market effects, public services, retail business, standard of life of the community. Further, assessing proposed developments in socio-economic context help the community leaders and local people identify potential social issues, evaluate the adequacy of social services and determine whether the project has adverse effects on overall social well-being or not.

SEIA also provides a forum for planning how to maximize the beneficial impacts of a proposed development. Beneficial impacts can include a better standard of living due to increased access to employment, business opportunities, training, education and health.

3.15.2 Objectives of the Study

The objectives of Socio-Economic Impact Assessment of the project are as follows:

- a) To comprehend socio-economic status of the people living there in.
- b) To assess probable impact of the project on social and economic aspects.
- c) To measure the impact of the project on the standard of life of the people.
- d) To ensure sustainability of positive impacts.
- e) To suggest mitigation measures and agency responsible for taking action in case of adverse impact.

3.15.3 Steps taken to prepare the SEIA Report

- Literature review.
- Identification of the study area and important landmarks therein.
- Preparation of list of habitations located in the study area.
- Firming up of approach and methodology.
- Collection of secondary data from census report, district profile, published, administrative records etc.
- Data entry and data validation.
- Generation of tables.
- Data analysis and preparation of report.

3.15.4 Methodology

For Socioeconomic Impact Assessment of the proposed project, we recourse to systematic analysis by Geoinformatics application of village level dynamic studies in various socioeconomic

characteristics, both in terms of quality and quantity. Accordingly, both qualitative and quantitative data of the study area was collected through various sources.

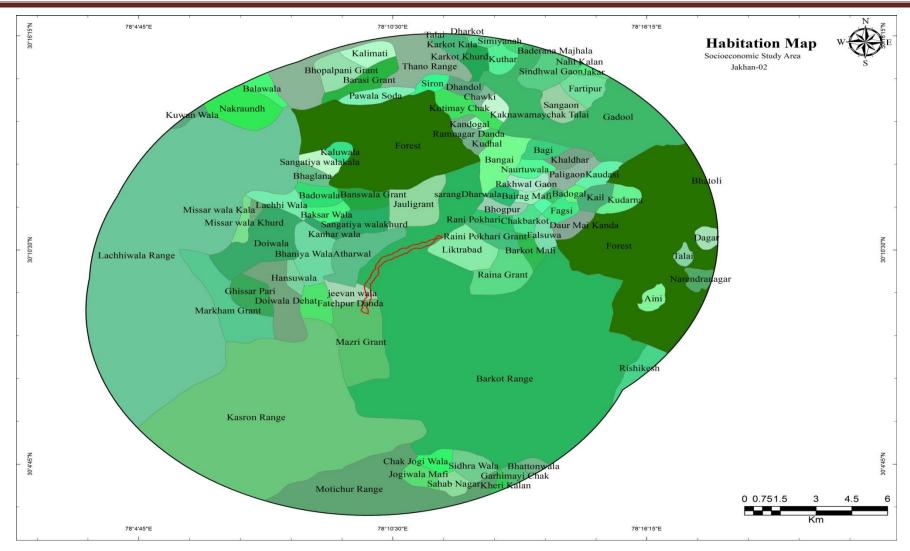
For collection of information, we approached Census of India for published data/information, visited state & district portals and referred to administrative records of the state & district administration.

3.15.5 Study Area

The study area defines 10 km circle radius around the mining site at Mazri Grant village, sub district Rishikesh, district Dehradun of Uttarakhand state. The study area habitations are spread over the sub districts Dehradun and Rishikesh of Dehradun district and sub district Narendranagar of Tehri Garhwal district of Uttarakhand state. The nearest railway station and airport to the project site is Doiwala Railway Station, 4.6 km and Jolly Grant Airport, 1.8 km of the mining site respectively.

The study area comprises of a total of 92 identified habitations out of which there are 89 villages and 3 are urban areas. There is 1 uninhabited village in the study area habitations. The habitations have been shown in the map and the table below:

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Habitations in the study area

Sl. No.	Village	Sl. No.	Village
1	Khairi Kalan	47	Khaldhar
2	Sahab Nagar	48	Kaluwala
3	Bhattowala	49	Bagi
4	Jogiwala Mafi	50	Bangai
5	Garhimay Chak	51	Ramnagar Danda
6	Motichur Range	52	Kudhal
7	Chak Jogi Wala	53	Kaknawamaychak Talai
8	Shiddar Wala	54	Kandogal
9	Kasron Range	55	Sangaon
10	Mazri Grant	56	Paw Wala Soda
11	Fatehpur Danda	57	Kotimay Chak
12	Jeevan Wala	58	Chauki
13	Rainapur Grant	59	Ghandol
14	Hansuwala	60	Jakar
15	Doiwala	61	Nakraunda
16	Ghissar Pari	62	Siron
17	Markham Grant	63	Farti
18	Barkot Mafi	64	Kuwan Wala
19	Bhaniya Wala	65	Barasi Grant
20	Rani Pokhari Grant	66	Sindhwal Gaon
21	Listrabad	67	Bhopalpani Grant
22	Athhoorwala	68	Kuthar
23	Falsuwa	69	Katkot Khurd
24	Chakbarkot	70	Kotala
25	Mauja Rani Pokhari	71	Lachhiwala Range
26	Kanhar Wala	72	Kalimati
27	Baksar Wala	73	Gadool
28	Bishan Garh	74	Katkot Kalan
29	Sangatiya Walakhurd	75	Dharkot
30	Bhogpur	76	Simiyanah
31	Sarangdharwala	77	Baderana Majhala
32	Lachhi Wala	78	Balawala
33	Badogal	79	Talai
34	Govind Wala	80	Nahi Kalan
35	Fagsi	81	Baderna Khurd
36	Badowala	82	Thano Range
37	Missar Wala Khurd	83	Aoni
38	Missar Wala Kala	84	Talai
39	Jauligrant	85	Dagar
40	Rakhwal Gaon	86	Daur Mai Kanda
41	Kaudasi	87	Kol
42	Barkot Range	88	Kudarna
43	Pali	89	Bhatoli

44	Bhaglana	90	Rishikesh (NPP) Urban Area
45	Naurtuwala	91	Doiwala (NP) Urban Area
46	Sangatiya Walakala	92	Narendranagar (NPP) Urban Area

Baseline Data

The baseline data with respect to population and amenities available in the study area has been worked out as under:

I. Demographic particulars/population details

S. No.	Description	Number	Percentage to Respective Total
	Total Population	142288	100
1	Male	74081	52.1
1	Female	68207	47.9
	Sex Ratio	920	
	Population (0-6) Age Group	17575	100
2	Male	9410	53.5
۷	Female	8165	46.5
	Sex Ratio	867	
	Population- Scheduled Caste	15222	100
2	Male	8020	52.7
3	Female	7202	47.3
	Sex Ratio	898	
	Population- Scheduled Tribe	1790	100
4	Male	946	52.8
4	Female	844	47.2
	Sex Ratio	892	•
	Total Literates	104315	100
_	Male	58484	56.1
5	Female	45831	43.9
	Gender Gap in Literates	12.2	
	Overall Literacy Rate	83.6	
	Male	90.4	
6	Female	76.3	
	Gender Gap in Literacy Rate	14.1	
	Total Workers	51193	100
7	Male	37803	73.8
7	Female	13390	26.2
	Gender Gap in Work Participation	47.6	'
0	Main Workers	38784	100
8	Male	30591	78.9

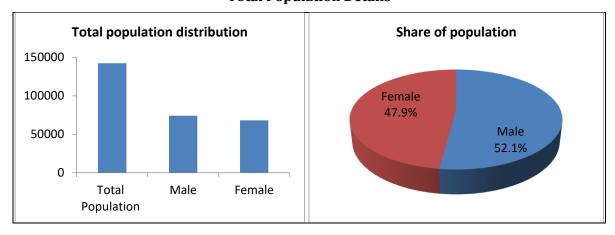
	Female	8193	21.1
	Gender Gap in Work Participation	57.8	
	Marginal Workers	12409	100
9	Male	7212	58.1
9	Female	5197	41.9
	Gender Gap in Work Participation	16.2	
	Household Industrial Workers	1757	100
10	Male	1181	67.2
	Female	576	32.8
	Total Agricultural Workers	9533	100
11	Male	6875	72.1
	Female	2658	27.9
	Cultivators	6982	100
12	Male	4765	68.2
	Female	2217	31.8
	Agricultural Labour	2551	100
13	Male	2110	82.7
	Female	441	17.3
	Other Workers	27494	100
14	Male	22535	82.0
	Female	4959	18.0

Source: Primary Census Abstract, 2011

3.15.6 Population Composition

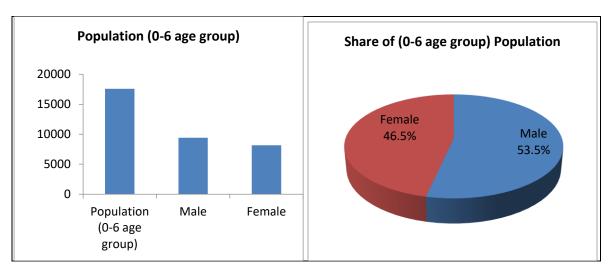
According to Census 2011, total population of the study area has been worked out to be 142288 in which 74081 (52.1 per cent) are males and remaining 68207 (47.9 per cent) are females. The overall sex ratio in the study area has been worked out to be 920 females per 1,000 males.

Total Population Details



Child Population Distribution

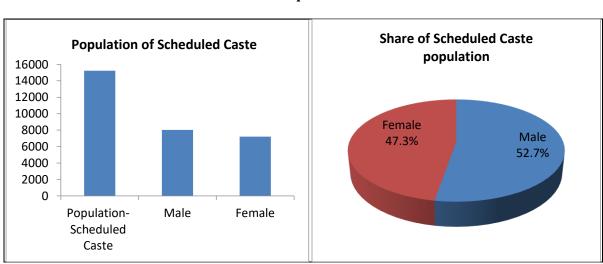
In the study area, the total population of age group of 0-6 year has been worked out to be 17575 which constitute about 12.4 per cent of the total population. Of the total (0-6) age group population, 53.5 per cent are boys and remaining 46.5 per cent are girls. In absolute terms, the number of males in the age group (0-6) population is 9410 whereas the number of females in this age group is 8165. The sex ratio of population in this age group (0-6 years) is 867 girls per 1,000 boys.



Age Group 0-6 Population Distribution

Social Group Population Distribution

In the study area, Scheduled Caste population is 15222 which constitute 10.7 per cent of the total population of the study area. In the total Scheduled Caste population, 52.7 per cent is male and the remaining 47.3 per cent is female. In absolute terms, the number of Scheduled Caste males is 8020 whereas the number of Scheduled Caste females is 7202. The sex ratio among Scheduled Caste population has been worked out to be 898 females per 1,000 males.



Scheduled Caste Population Distribution

In the study area, Scheduled Tribe population is 1790 which constitute 1.3 per cent of the total population of the study area. Of the total Scheduled Tribe population, 52.8 per cent is male and the remaining 47.2 per cent is female. In absolute terms, the number of the Scheduled Tribe males is 946 whereas the number of Scheduled Tribe females is 844. The sex ratio among Scheduled Tribe population has been worked out to be 892 females per 1,000 males.

Share of Scheduled Tribe population Population of Scheduled Tribe 2000 1500 Female 1000 Male 47.2% 52.8% 500 0 Population-Male Female Scheduled Tribe

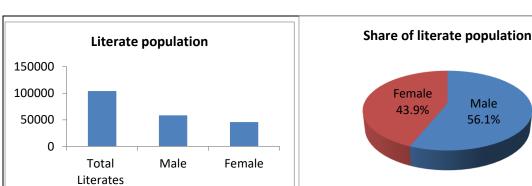
Scheduled Tribe Population Distribution

Household and Household Size

The entire population of the study area is distributed into 29205 households and the average household size has been worked out to be 5.

Literates, Literacy Rate and Gender Gap in Literacy Rate

In the study area, 73.3 per cent of the total population is literate. The total number of the literate population is 104315 in which the number of male literates is 58484 and the number of female literates is 45831. The male literates are 56.1 per cent and the female literates are 43.9 per cent. The gender gap among the literate population is 12.2 per cent. The overall literacy rate has been worked out to be 83.6 per cent. The literacy rate of the male is 90.4 per cent and the literacy rate of the female is 76.3 per cent which creates a gender gap in the literacy rate of 14.1 per cent.



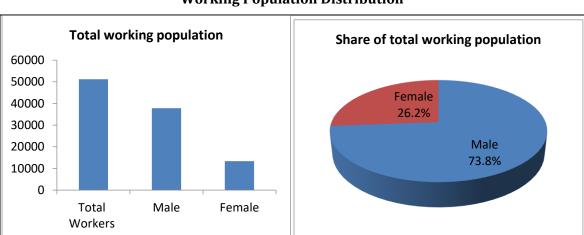
Literates Population Distribution

Male

56.1%

Working Population Details

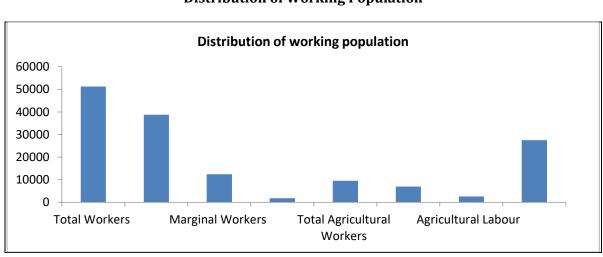
Based on Census 2011, total number of workers in the study area has been worked out to be 51193 which constitute 36.0 per cent of the total population. Of the total workers, 73.8 per cent are males and the remaining 26.2 per cent are females. In absolute term, the total number of male workers is 37803 and the total number of female workers is 13390. In the total working population there is a large gender gap of 47.6 per cent.



Working Population Distribution

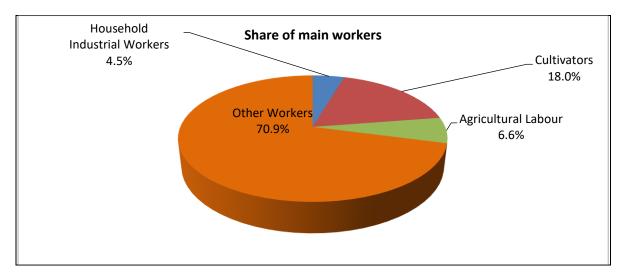
Details of the Working Population

In the total working population of the study area habitations is 75.8 per cent is main workers and the remaining 24.2 per cent is marginal workers. Of the total main workers 78.9 per cent are males and remaining 21.1 per cent are females which create a large gender gap in work participation of 57.8 per cent. In case of marginal workers, 58.1 per cent are males and 41.9 per cent are females that create a gender gap of 16.2 per cent in this segment of work participation. The main workers are further divided into cultivators, agricultural laborers, household industrial workers and other workers. The sum total of the cultivators and agricultural laborers has been termed as total agricultural workers.



Distribution of Working Population

Distribution of main workers



Of the main working population, 18.0 per cent are cultivators and 6.6 per cent are agricultural laborers. The population that belongs to the other workers category is 70.9 per cent while 4.5 per cent of the main workers belong to industrial household workers category. From the above distribution of workers it is clear that the economy of the study area is mainly dependent on other workers category and next is those involved in agricultural sector either as cultivators or agricultural laborers. The basic amenities present in the study area have been shown in the table below:

II. BASIC AMENITIES:

Table 3.36: Basic Amenities Available in the Study Area				
EDUCATION				
	Type of Educational Facilities	Number		
Pre Primary School (Pvt.)/ Primary School (Govt. & Pvt.)/ Middle School (Govt. & Pvt.)/ Secondary School (Govt. & Pvt.)/ Senior Secondary School (Govt. & Pvt.)/Degree College-Art Only (Govt.)/ Degree College-Science Only (Govt.)/ Degree College-Art and Science Only (Govt.)/ Degree College-Art and Commerce Only (Govt.)/ Degree College-Art, Science and Commerce (Govt.)		240		
HEALTH				
	Type of Facilities	Number		
Health Facilities	Community Health Centre/ Primary Health Centre/ Primary Health Sub Centre/ Maternity and Child Welfare Centre/ Hospital Allopathic/ Dispensary/ Mobile Health Clinic/ Family Welfare Centre/ Non Government Medical Facilities In And Out Patient	73		

WATER					
	Means of Drinking Water	No. of			
	T W T	Habitations			
	Tap Water Treated	90			
	Tap Water Untreated Covered Well	40			
		03			
Drinking Water	Uncovered Well	06			
	Hand Pump	29			
	Tube Wells/Borehole	24			
	Spring	04			
	River/Canal	33			
	Tank/Pond/Lake	11			
ELECTRICITY					
	Power Supply For Domestic Use	91			
Power Supply	Power Supply For Agriculture Use	38			
	Power Supply For Commercial Use	34			
ROAD					
	Black Topped (pucca) Road	59			
	Gravel (kuchha) Roads	38 34 59 71 70 91 43			
Approach Road	All Weather Road	70			
	Foot Path	91			
	Major District Road	43			
TRANSPORTATION					
D 1	Public Bus Service	31			
Road Transportation	Private Bus Service	32			
	Auto/Modified Autos	32			
DRAINAGE					
	Closed Drainage	25			
Drainage Facility	Open Drainage	44			
	Open Kuccha Drainage	60			
OTHER AMENITIES	OTHER AMENITIES				
	Post Office	15			
	Sub Post Office	19			
	Public Distribution System (PDS) Shop	15			
Other Amenities	Nutritional Centres-Anganwadi Centre	24			
	ASHA	29			
	Birth and Death Registration Office	29			

(Source: Desk Research & Census of India, 2011)

Socio-economic impact of the project

1. Impact on the demographic composition

Resulting of the proposed project, there will be no substantial increase in inclusive population of the study area as preferably inhabitant people will be recruited for employment. Hence, the chances of in-migration of people from outside the study area are remote. Accordingly, there will be no variation in the total population of the study area including that of sex ratio, when the mine starts operating. Since there will be no significant change in population, the overall sex ratio will remain more or less same.

2. Impact on employment opportunities

The project will generate 410 mandays employment opportunities per day and 100450 mandays employment opportunities in a year for the local people. Indirect employment is also expected due to the mining associated activities. It is a positive impact of the project since it will be providing employment opportunities to the local people. The benefits of employment to the job seekers are expected to include, at a household and individual level, with increase in socio-economic and health status, improvement in their standard of living condition, and the benefits from increase in household expenditure on education & healthcare resources.

3. Impact on law & order

No major law & order problem is envisaged due to the proposed project. It is expected that the workers will attend to their duties and return to their homes after the day's work.

4. Corporate Environmental Responsibility (CER)

As per the Office Memorandum **F.No. 22-65/2017-IA.III dated 30.09.2020** of the Ministry of Environment, Forest and Climate Change regarding "Corporate Environment Responsibility" (CER), the project proponents are required to allocate funds towards environment development activities as proposed by the project proponent or prescribed by EAC or SEAC, as the case may be, shall be a part of EMP and the commitments made by project proponent to address the concerns raised during Public consultation.

Conclusion

By following the environmental guidelines related to the project, this project would be beneficial for the people by generating employment opportunities. This project would lead to employment generation and improve the socio-economic status of the household in the study area habitations. The Corporate Environment Responsibility will prove beneficial for the study area habitants and will lead to improvement in their health and living conditions.

CHAPTER-4: ANTICIPATED ENVIRONMENTAL IMPACT AND ITS MITIGATION MEASURES

4.1 INTRODUCTION

The environmental parameters likely to be affected by mining are related to many factors, *i.e.* physical, social, economic, agriculture and aesthetic. The excavated minerals will be transported via trucks to outsiders. The operations may disturb environment of the area in various ways, such as removal of mass, change of landscape, flora and fauna of the area, surface drainage, and change in air, water and soil quality. While for the purpose of development and economic up-liftment of people, there is need for establishment of mining industries, but these should be environment friendly. Therefore, it is essential to assess the impacts of mining on different environmental parameters, before starting the mining operations, so that abatement measures could be planned in advance for eco-friendly mining in the area.

4.2 ENVIRONMENTAL IMPACT ASSESSMENT

Environment and development should be considered as mutually complementary, interdependent, and an instrument of reinforcing the quality of life. Environmental Impact Assessment (EIA) is the important aspect of overall environmental management strategy and an important tool for sustainable development. It identifies major impacts of mining and associated activities on environment and provides guideline to prepare the necessary control measure termed as Environmental Management Plan (EMP).

Alteration or modification of the above attributes may cause hazardous impact on ecological equilibrium of site. Besides this there will be some other reasons which will affect the environment viz. traffic network, and other vehicular movements, impacts on flora and fauna of that area, surface drainage, and change in air, water and soil quality. While for purpose of development and economic up-liftment of people, there is need for establishment of industries and mining, but these have to be environmental friendly. Therefore, it is essential to assess the impacts of mining on different environmental parameters, before starting the mining operations, so that abatement measures could be planned in advance for eco-friendly mining in the area. The increasing awareness among the people about ecological imbalance and environmental degradation has raised many apprehensions.

Table 4-1: Impact Identification Matrix

		Mining, Storage and handling and allied activity					
Aspects Impacted Attributes	Open Cast- Operation	Mineral Transportation	Mining Mineral Storage /stacking	Maintenance Workshop	Greenbelt Development	Employment	
Ambient Air	•	•	•		*		
Water Resource	•						
Water Quality	•		•				
Ambient Noise	•	•		•	*		
Vibration	•						
Flora and Fauna	•				*		
Soil and Land-use	•		•		*		
Infrastructure	•	*		*			
Traffic		•					
Health & Safety	•		•				
Socio-economic	•					*	

The impacts on different environmental parameters due to this mining project are discussed below:

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4.2.1 CONSTRUCTION PHASE

This is a sand, bajri and boulder mining project in riverbed. There will be no impacts as no construction stage is envisaged in this project.

4.2.2 OPERATION PHASE

Some of the impacts identified in various phases of operation are insignificant and do not warrant much attention whereas some others are important especially with respect to the present context. Therefore objective is to identify those impacts, which are significant and require a detailed analysis for decision making or formulating adequate management measures. This section deals with an assessment of impact of various mining activities on the existing environmental conditions. The methodology of assessment is based upon identification and description of the existing project activities as well as environmental components followed by evaluating the impact of mining and associated activities on the environment. The environmental components that are likely to be influenced or modified by the continuation of project activities are:

- Air Environment,
- Noise and Vibration Environment,
- Water Environment,
- Land use
- Soil Environment
- Hydrology
- Geology
- Biological Environment,
- Socio-economic status of the area,
- Solid Waste/overburden

4.3 AIR ENVIRONMENT

The air quality in the mining area depends upon the nature and concentration of emissions and meteorological conditions.

4.3.1 Anticipated Impact

Mining Operation carried out by opencast manual & semi mechanized method generate dust particles due to various activities like Loading & Unloading of sand, and Transportation. The impact on ambient air quality in the area surrounding the mining area depends upon the pollutant emission rate and prevailing meteorological conditions. As it is an open cast manual mine, particulate Matter (Dust) of various sizes is the only pollutant of any significance.

4.3.2 Impact through mathematical modelling for mining projects

Mining Operation will be carried out by opencast manual method. The impact on ambient air quality in the surrounding area of the mine lease depends upon the pollutant emission rate and prevailing meteorological conditions. The major sources of air pollution in the proposed mine is dust generation due to extraction, loading and haulage of mineral (sand/bajri/boulder) and wind erosion of exposed material. In this present study, United States Environmental Protection Agency (USEPA–42 series) approved mathematical equations have been used to predict concentrations for different operations in mining including the mineral transportation. The operations considered for determining source strength for dispersion modeling are as follows:

- Excavation,
- Loading, and
- Haulage

4.4 Air Pollution Modeling

Impact assessment is an important part of Environmental Impact Assessment Study. There are various techniques available to predict the impacts. Mathematical modeling is an established and accepted technique to predict the impacts. The open cast mines are potential sources of air pollution.

4.5 Mining Data for Source Strength Estimation

An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. The general equation for emissions estimation is:

 $E = A \times EF \times (1-ER/100)$

Where: E = emissions; A = activity rate; EF = emission factor, and ER = overall emission reduction efficiency in %

The proposed mining activity includes various activities like excavation, handling and transport of limestone.

These activities have been analyzed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 4.1

Table 4-2: Estimated Emission rate of PM₁₀, PM_{2.5}, SO₂, NO₂

Emission source	Details
Mineral excavation	
1. Production capacity of the mine, TPA	2866050
2. Operational days	245
3. Activity rate, TPD	11698
4. Activity rate (A), T/second	0.135395408
5. Emission factor (EF), kg/MT	0.94021669
6. Emission rate (A*EF*1000), g/second	127.3010225
7. Area of activity, m2	482500
8. Uncontrolled emission rate, g/m2	0.000263836
9. Controlled emission rate, g/m2	2.63836E-05
Mineral Loading	
1. US EPA emission factor, kg/MT	0.00434373
2. Emission rate, g/s	0.588121096
3. Area of activity, m2	482500
4. Uncontrolled emission rate, g/m2	1.2189E-06
5. Controlled emission rate, g/m2	1.2189E-07
Haulage emission	
1. Truck capacity, MT	10
2. No. of truck trips	2340

3. Road length travelled, km	0.5
4. Emission factor, g/VkmT	0.0097
5. Emission rate, g/s	1.313335459
6. Activity area of haulage, m2	3000
5. UnControlled emission rate, g/m2	0.000437778
6. Controlled emission rate, g/m2	4.37778E-05
Emmission rate of haulage emmission PM2.5	2.62667E-05
Mineral excavation and loading emmission rate	7.02834E-05
PM10, g/m2	
Mineral excavation and loading emmission rate	4.217E-05
PM2.5, g/m2	

SO2 emission calculation	
Diesel consumption, lpd	865.8
Diesel consumption, kg/d (@0.82kg/l)	709.956
Sulphur content in HSD, %	0.05
Sulphur contained in HSD used, kg/d	0.354978
Sulphur dioxide emission, kg/day	0.709956
Sulphur dioxide emission, g/sec	0.008217083
Activity area, m2	3000
Emission rate, g/sec.m2	2.73903E-06
NOx emission calculation	
NOx emission for HSD combustion, g/kg	16
Total HSD combsution, kg/day	865.8
NOx emission rate, g/day	13852.8
NOx emission rate, g/sec	0.160333333
Activity area, m2	3000
Emission rate, g/sec.m2	5.34444E-05

4.5.1 Modeling Procedure

Prediction of Ground Level Concentrations (GLC's) due to proposed mines has been made by Industrial Source Complex, Short Term (ISCST3) as per CPCB guidelines. ISCST3 is US-EPA approved model to predict the air quality. The model uses rural dispersion and regulatory defaults options as per guidelines on air quality models (PROBES/70/1997-1998). The model assumes receptors on flat terrain.

4.5.2 Model Options Used For Computations

- Plume rise has not been considered;
- Calms processing routine is used by default;
- Flat terrain is used for computations;
- It is assumed that the 0 do not undergo any physico-chemical transformation and that there is no pollutant removal by dry deposition;
- Washout by rain is not considered
- Meteorological inputs required are hourly wind speed and direction, ambient temperature, stability class, and mixing height.

4.5.3 Mixing Height

As site specific mixing heights were not available, mixing heights based on IMD publication, "Atlas of Hourly Mixing Height and Assimilative Capacity of Atmosphere in India", has been considered for Industrial Source Complex model to establish the worst case scenario.

4.5.4 Meteorological Data

Data recorded at the continuous weather monitoring station on wind speed, direction, and temperature at one hour interval for the monitoring period was used as meteorological input.

4.5.5 Presentation of Results

Model simulations have been carried out using the hourly Triple Joint Frequency data viz., stability, wind speed, mixing height and temperature. Short-term simulations were carried to estimate concentrations at the receptors to obtain an optimum description of variations in concentrations over the site in 10-km radius covering 16 directions. The maximum incremental GLCs for PM_{10} , due to mining are found to be 69 $\mu g/m^3$ respectively, within the mine lease area. The maximum incremental GLCs are superimposed on the maximum baseline PM_{10} concentrations recorded during monitoring period i.e. Post monsoon season 2019 to arrive at the likely resultant concentrations after implementation of the proposed mining. The cumulative concentrations (baseline + incremental) after implementation of the project are tabulated below in Table 4.3 to 4.6.

Table 4-3: Incremental Concentration of PM₁₀ in the Study Area

S.No	Site Name	PM ₁₀ concentration (μg/m³)			
		Baseline	Incremental	Cumulative	
AQ1	Project site (Mine Site)	69	6.29	75.29	
AQ2	Village Anthoorwala	56	5.40	61.40	
AQ3	Village Doiwala	56	4.24	60.24	
AQ4	Village Jolly Grant	55	4.20	59.20	
AQ5	Village Chhiderwala	56	3.00	59.00	
AQ6	Village Lal Tappad	63	2.29	65.29	
AQ7	Village Thano	62	2.29	64.29	
AQ8	Village Narender Nagar	67	1.00	68.00	

Table 4-4: Incremental Concentration of PM₂ in the Study Area

Table 4-4. Incremental concentration of 1 M2.5 in the Study Area						
S.No	Site Name	PM_{10} concentration ($\mu g/m^3$)				
		Baseline	Incremental	Cumulative		
AQ1	Project site (Mine Site)	38	3.78	41.78		
AQ2	Village Anthoorwala	31	1.00	32.00		
AQ3	Village Doiwala	38	2.19	40.19		
AQ4	Village Jolly Grant	38	1.20	39.20		
AQ5	Village Chhiderwala	36	1.20	37.20		
AQ6	Village Lal Tappad	36	0.78	36.78		
AQ7	Village Thano	36	0.67	36.67		
AQ8	Village Narender Nagar	36	1.10	37.10		

Table 4-5: Incremental Concentration of SO₂ in the Study Area

S.No	Site Name	SO ₂ concentration (μg/m ³)					
		Baseline	Incremental	Cumulative			
AQ1	Project site (Mine Site)	12	0.25	12.25			
AQ2	Village Anthoorwala	14	0.18	14.18			
AQ3	Village Doiwala	12	0.10	12.10			

AQ4	Village Jolly Grant	12	0.15	12.15
AQ5	Village Chhiderwala	14	0.04	14.04
AQ6	Village Lal Tappad	15	0.05	15.05
AQ7	Village Thano	09	0.08	09.08
AQ8	Village Narender Nagar	12	0.04	12.04

Table 4-6: Incremental Concentration of NO2 in the Study Area

S.No	Site Name	NO ₂ concentration (μg/m ³)		
		Baseline	Incremental	Cumulative
AQ1	Project site (Mine Site)	26	4.79	30.79
AQ2	Village Anthoorwala	25	3.20	28.20
AQ3	Village Doiwala	30	1.47	31.47
AQ4	Village Jolly Grant	24	2.70	26.70
AQ5	Village Chhiderwala	25	1.20	26.20
AQ6	Village Lal Tappad	23	2.00	25.00
AQ7	Village Thano	22	1.10	23.10
AQ8	Village Narender Nagar	28	0.79	28.79

The resultant concentrations of PM_{10} , $PM_{2.5}$, SO_2 , NO_2 at all locations are well within the NAAQS standard limits. Isopleths were drawn for the pollutant distribution in the area and are shown in Figure 4-1 to 4-4.

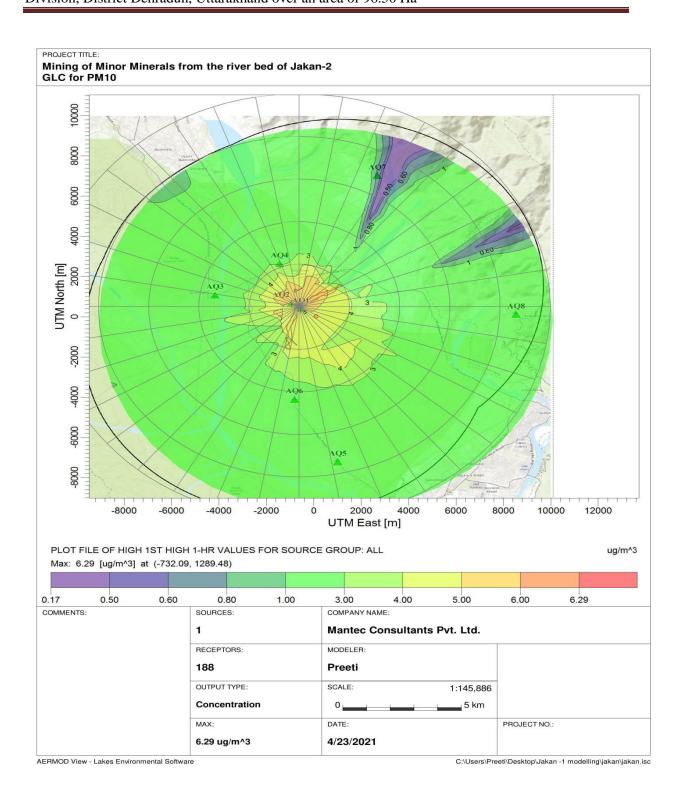


Figure 4-1: Isopleths for PM ₁₀ Concentration

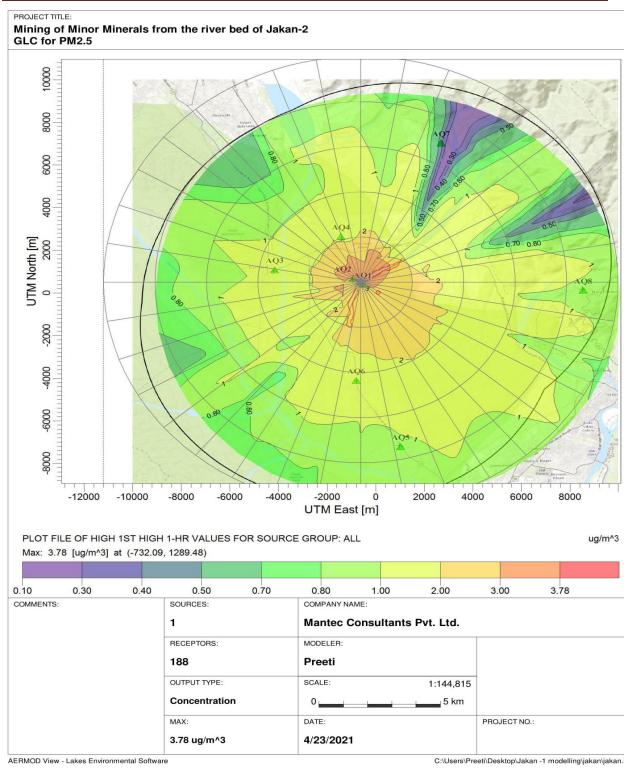


Figure 4-2: Isopleths for PM _{2.5} Concentration

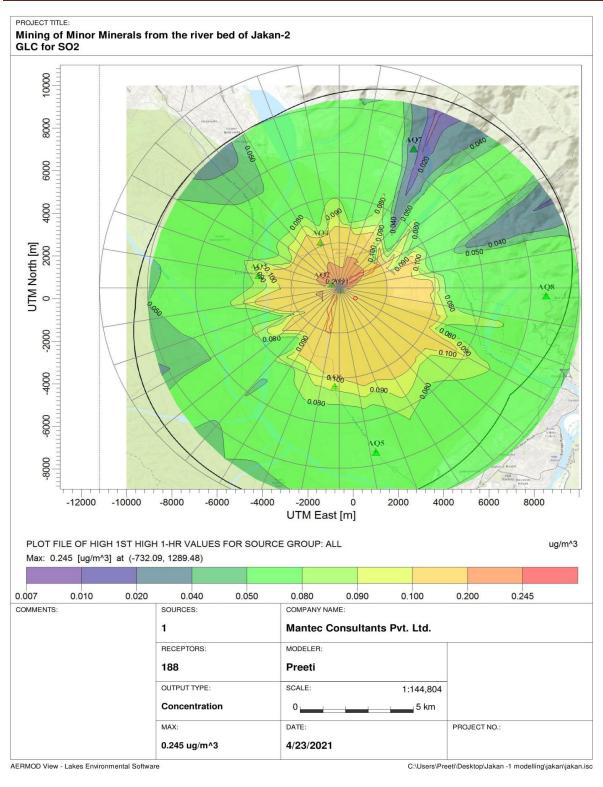


Figure 4-3: Isopleths for SO₂ Concentration

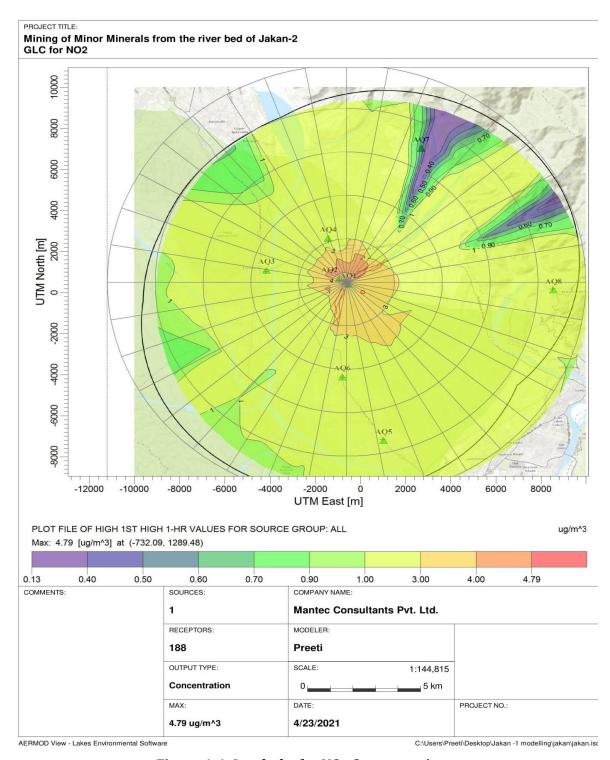


Figure 4-4: Isopleths for NO₂ Concentration

4.5.6 MITIGATION MEASURES

- The speed of trucks on haul road will be controlled as increased speed increases dust emissions. Overloading of transport vehicles will be avoided.
- Proper mitigation measures like water sprinkling will be adopted to control dust emissions.

- Masks will be provided to workers.
- To control the emissions regular preventive maintenance of equipment will be carried out on contractual basis.
- Green belt of adequate width will be developed.

4.6 IMPACTS OF NOISE/VIBRATIONS AND MITIGATION MEASURES

The area is general represents calm surroundings. There is no heavy traffic, industry or noisy habitation in the area except the existing mine. As the project is proposed for open cast manual mining method there will be no blasting or drilling activities.

4.6.1 Anticipated Impact

- The source of Noise pollution will be the vehicular movements.
- Noise generated by manual extraction of river bed material, using shovels, crowbars etc., will be negligible.

4.6.2 Mitigation Measures

- Proper maintenance of all transportation vehicles will be carried out which help in reducing noise during operations. No other equipment except the transportation vehicles will be allowed.
- Noise generated by hand equipment will be negligible and will not cause detectable adverse impact.
- Awareness will be imparted to the workers about the permissible noise levels and maximum exposure to those levels.

4.7 IMPACTS OF WATER POLLUTION AND ITS MITIGATION MEASURES

The impact of mining project on groundwater hydrology and surface water regime are site specific and depends upon the characteristics of the mineral, hydrogeology and requirement of groundwater for other uses.

4.7.1 Anticipated Impacts

- The Mining in the riverbed area may cause the groundwater contamination due to the intersection of the water table.
- Waste water disposed from the mining activity may contaminate the surface water.
- River recharges the ground water; excessive mining may be reduce the thickness of natural filter materials (Sediments), through which the ground water is recharged.

4.7.2 Mitigation Measures

- Mining will be done above the water table as well as river bed water level therefore much impact on water regime is not accepted.
- Proper analysis/Monitoring will be done to check the ground water
- No waste water will be generated.

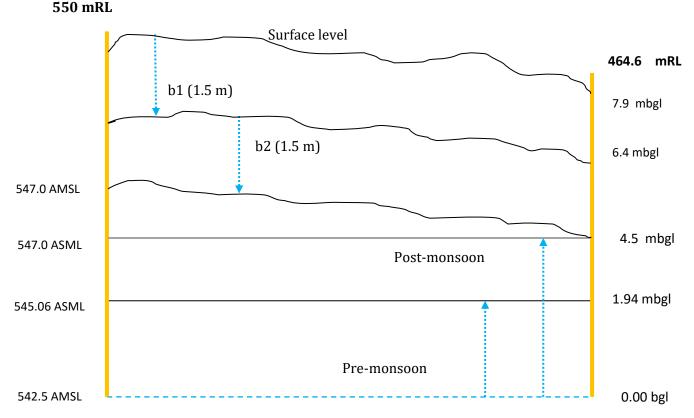


Figure 4-5: Schematic Diagram Indicating Ground Water Table

4.7.1 Rain Water Harvesting Introduction:

Rainwater harvesting is a technique of collection and storage of rainwater into natural reservoirs or tanks, or the infiltration of surface water into subsurface aquifers (before it is lost as surface runoff). Due to rapid urbanization, infiltration of rainwater into the sub-soil has decreased drastically and recharging of ground water has diminished.

Artificial Rechargage to Ground Water:

Artificial recharge to ground water is process by which the ground water reservoir is augmented at a rate exceeding that obtaining under natural conditions or replacement. Any man-made scheme of facility that adds water to an aquifer may be considered to be an artificial recharge system.

Benefits of Artificial Recharge in Urban Areas:

- Improvement in infiltration and reduction in run-off.
- Improvement in ground water levels and yields.
- Improvement in ground water quality.

Rain water Harnessing Life:

• Recharge of groundwater through storm run groundwater recharge, in a major way need to be launched with concerted efforts by various Governmental and Non-Governmental Agencies

and Public at large to build up the water table and make the groundwater resource, a reliable and sustainable source for supplementing water supply.

Proposed Mining activities:

The total mining lease area of 96.50 Ha will be operated in a pit concept as per the approved mining plan.

- The Total mining area is considered into two ultimate pits for effective operation namely Pit 1 and Pit 2.
- Pit 1 is further sub-divided into two pits namely North Pit and South Pit.
- Generally 50-60% of the quantity/rainfall occurs during monsoon season and the rainwater runs-off without much use. So, if we are able to collect this precious rainwater and use it during dry season, then we can conserve the ground –water and better utilize the surface run-off water. So, keeping this in mind, in our mining areas, we are adopting the methodologies to store and re-use the precious rainwater. Rainwater harvesting can be done in the way of collecting and storing the rainwater in the sump within the mine.

4.8 IMPACTS ON LAND USE AND MITIGATION MEASURES

Mining is being carried out by opencast manual method, it is expected to affect the land environment essentially. Impact assessment study on land environment can be done by considering land use pattern/land cover, topography, drainage pattern and geological features of the mine site as well as the study area.

4.8.1 Anticipated Impact

- Mining activity will impact river bed topography by formation of excavation voids.
- River bed mining may bring in some change in topography at the nearby area of the mine lease
- Stacks of solid waste generated from mining activity may hinder the flow of water in monsoon season.
- Undercutting and collapse of river banks.

4.8.2 Mitigation Measures

Adopting suitable, site specific mitigation measures can reduce the degree of impact of mining on land. Some of the land-related mitigation measures are as follows:-

- Excavated pits will get replenished annually in monsoon itself & will be restored to original.
- Mineral will be mined after leaving the 25% width as a safety zone on both sides of the riverbed.

The following Measures taken for prevention of illegal mining and piliferage of mineral

- Installation of required number of CCTV camera for monitoring entry and exit of movement of all the men and machinery.
- Adequate numbers of security personnel will be engaged round the clock with mobile facilities for effective communication and early prevention.
- Constitution of Illegal mining prevention committee comprising of mines personnel, surveyor, security head, land Tahsildar (Rtd.) and officials from P&A Dept.
- Making Patrolling arrangements periodically by illegal mining prevention committee.

- Appointing Public Relation Officer/Liaison to have cordial relation with Police department for prevention of illegal mining.
- Security drop gates provided at the entrance of the mines.

4.9 IMPACTS ON SOIL ENVIRONMENT AND MITIGATION MEASURES

4.9.1 Anticipated Impact

- Mining in the riverbed may change complete land use pattern including channel geometry, bed elevation, sediment transportation capacity which can reduce flow of the river and downstream erosion.
- Mining activity may increase the soil erosion and soil degradation which have adverse impact on soil fertility.

4.9.2 Mitigation Measures

- The mining is planned in non monsoon seasons only so that the excavated area will be replenished naturally during the subsequent rainy season for the river bed mining block.
- Mine lease area has been proposed a safety distance of 25% of each side from lease boundary which will protect the banks so channel geometry will not be disturbed.

4.10 IMPACTS ON HYDROLOGY AND MITIGATION MEASURES

4.10.1 Anticipated Impact

- The mining in the riverbed area may cause the ground water contamination due to intersection of the water table.
- Change in topography will divert the river flow.

4.10.2 Mitigation Measures

- The water table will not be intersected during mining in the riverbed.
- There is no proposal of any stream modification/diversion due to this mining activity hence there will be no any impact on flow of the river.

4.11 IMPACTS ON ECOLOGY & BIODIVERSITY AND ITS MITIGATION MEASURES

4.11.1 Impacts on the Biological Environment

The Jakhan-II mining project location is falling in the reserve forest areas. As per authenticated map provided by DFO, Dehradun, the project site is 5.40 km from Rajaji Tiger Reserve. Hence, it is essential that certain strict restrictions are followed during operation of the project. The trespassing of the labour, cutting of trees, chance of fire setting, disturbance to the fauna, accidents and human- animal conflicts are some major issues which require proper management and mitigations. Impact on air, water and soil pollution may occur due to the trucks and other vehicles movement. The noise generated due to movement of the trucks may disturb the wild fauna. However, these impacts would be of lower magnitude which will be further minimized through careful mitigation measures.

The movement of birds and animals on the water stream in the mining area will be disturbed. However, the mining activities to excavate the RBM will be carried out only in the dry river beds.

4.11.2 Impacts on Aquatic Ecology

The river Jakhan is a monsoon fed seasonal river which remains dry in most part of year. Hence, it does not harbor any significant aquatic life. More ever, the mining activity will remain confined in the dry part of the river bed. Therefore, the project is not likely to affect the aquatic ecology.

4.11.3 Impacts on Bird Fauna

The project does not involve any tree felling or removal of vegetation. Therefore, there may not be loss of nesting and roosting habitat of avian fauna. Plantation activities by the UKFDC will add to the shelter places to the birds. Further, the implementation of mitigation measures would reduce the impact on birds, if any.

4.11.4 Impacts on wildlife

Wildlife species live in communities that depend on each other. Survival of these species can depend on soil conditions, local climate, altitude, and other features of the local habitat. Many wildlife species are highly dependent on vegetation growing in natural drainages. This vegetation provides essential food, nesting sites, and cover for escape from predators. Any activity that destroys vegetation near water bodies reduces the quality and quantity of habitat essential for waterfowl, shore birds, and many terrestrial species. The habitat requirements of many animal species do not permit them to adjust to changes created by land disturbance. These changes reduce living space.

The most direct effect on wildlife is destruction or displacement of species in areas of excavation and mining. Mobile wildlife species, like game animals, birds, and predators, leave these areas. More sedentary animals, like invertebrates, many reptiles, burrowing rodents, and small mammals, may be more severely affected.

However, since this mining project does not involve any tree felling and ground vegetation clearance; there may not be habitat loss of faunal species due to mining activity. The plantation activities to be undertaken by UKFDC would add to the green cover around project side and improve the habitat of fauna of area.

4.11.5 Habitat loss

Wildlife species live in communities that depend on each other. Survival of these species can depend on soil conditions, local climate, altitude, and other features of the local habitat. Mining causes direct and indirect damage to wildlife. The impacts stem primarily from disturbing, removing, and redistributing the land surface. Some impacts are short-term and confined to the mine site; others may have far-reaching, long-term effects.

The most direct effect on wildlife is destruction or displacement of species in areas of excavation and piling of mine wastes. Mobile wildlife species, like game animals, birds, and predators, leave these areas. More sedentary animals, like invertebrates, many reptiles, burrowing rodents, and small mammals, may be more severely affected.

Many wildlife species are highly dependent on vegetation growing in natural drainages. This vegetation provides essential food, nesting sites, and cover for escape from predators. Any activity that destroys vegetation near water bodies reduces the quality and quantity of habitat essential for waterfowl, shore birds, and many terrestrial species.

The habitat requirements of many animal species do not permit them to adjust to changes created by land disturbance. These changes reduce living space. The degree to which animals tolerate human competition for space varies. Some species tolerate very little disturbance. In instances where a particularly critical habitat is restricted, such as a lake, pond, or primary breeding area, a species could be eliminated.

However, in the proposed mining project; there may not be loss of habitat loss due to mining activity. The plantation activities to be undertaken by UKFDC would add to the green cover around project side.

4.11.6 Mitigation of Impacts on Biological Environment

The project may not directly affect any natural habitat, flora and fauna when a careful mining activity is carried out with all necessary control measures to minimize the air, water, noise and soil related impacts as recommended in the relevant sections. However, following mitigation measures should be adopted to further minimize the impact on biological environment:

- The mining activities should be carried out as per approved mining plan with hand tools only in order to lower the impact on river bed environment. No machinery should be used for mining purposes.
- Dry pit mining will be followed which means mining at all times will be above the water flow level of river. Mining activity will be immediately stopped when water comes in the mining pits.
- Mining will be carried out during dry season only when the project site remains completely dry. Hence, there will be no disturbance to the aquatic habitat.
- No mining will be carried out during the monsoon season to minimize impact on aquatic life which is mainly breeding season for many of the species.
- Mining will be restricted in the 25% from both sides of the river bank to avoid river bank erosion and consequent channel migration.
- Stream will not be diverted to form inactive channel.
- Mining at the concave side of the river channel will be avoided to prevent bank erosion.
- Mining will be done during day-time only; i.e. between sunrise to sunset only.
- The conservation plan prepared for the Schedule-I species should be implemented by the UKFDC.
- UKFDC shall ensure that their workers and other staff during operation phase shall not be involved in poaching and hunting activities of any wildlife around the project site.
- No resources from adjoining forests shall be extracted (i.e. fuel wood, soil, etc.) by workers.
- The suggested air and water pollution control measures should be implemented to minimize impact on surrounding vegetation, forest area and downstream aquatic life.
- Dust is mainly generated due to unpaved roads. To mitigate the impact, regular water sprinkling should be carried out on unpaved roads.
- The speed limit for the trucks must be set with restriction on blowing horn to reduce noise due to vehicular movement. This will mitigate impact on wild fauna.
- Use of plastic bags shall be strictly prohibited in the project area.
- Awareness programme among the staff and labour must be propagated for conservation of the biodiversity.

- If wildlife are noticed crossing the area, they will not be disturbed at all.
- The project will support Forest department in raising awareness and anti-poaching law enforcement activities in the surrounding of project site.
- The UKFDC should ensure no tree felling or any other disturbance to the biological environment of the study area due the project activity.
- The UKFDC should undertake plantation in maximum available area.

4.12 SOCIO ECONOMIC IMPACT OF THE PROJECT AND SAFETY MEASURES

4.12.1 Impact on the Demographic Composition

Resulting of the proposed project, there will be no substantial increase in inclusive population. of the study area as preferably inhabitant people will be engaged for employment. Hence, the chances of in-migration of people from outside the study area are least. Accordingly, there will be no variation in the total population of the study area including that of sex ratio, when the mine starts operating. Since there will be no significant change in population, the overall sex ratio will remain more or less same.

• Impact on Employment Opportunities

The project will generate 410 mandays employment opportunities in aday and 100450 mandays employment opportunities in a year for the local people in the mining works. Indirect employment is also expected due to the mining associated activities. It is a positive impact of the project since it will be providing employment opportunities to the local people. The benefits of employment to the job seekers are expected to include, at a household and individual level. With increase in socio-economic and health status, improvement in the standard of living condition of local people will take place and increase in household income will result expenditure on education & healthcare resources.

• Impact on Law and Order

No major law and order problem is envisaged due to the proposed project. It is expected that the workers will attend to their duties and return to their homes after the day's work.

4.12.2 Demand & Supply of Sand, Bajri and Boulder in the Market

With the commencement of the proposed mining project the supply of sand, bajri and boulder will increase and the gap between demand and supply will decrease to some extent. In construction activities and expansion of highways (State/National) of the area raw materials like sand bajri and boulder can be accomplished from the proposed project. Therefore, there will be a good demand of the minerals in the domestic market and the proposed project will positively fulfill this demand and reduce the gap.

4.12.3 Impact on Agriculture

There will be no negative impact on agriculture as no cultivation is taking place on the proposed mining area. Since, scientific mining will be adopted in the proposed mining project the area is likely to be free from annual floods, which destroy standing crops land and property.

4.12.4 Impact on Industrial Activities

Owing to the mining activities, the study area may witness industrial rise in the area. It is expected that few crushing unit may come up in the area to convert the boulders into smaller particles viz. bajri and sand.

4.12.5 Impact on Road Development

Movement of tractors-trolleys and other vehicles to and fro the mining site is expected to increase substantially, when mining will start. Hence, there is a scope for road development in the mining area. Further, there are risks of accidents during loading of minerals into tractors-trolleys and transportation to market. However, possible accidents can be avoided by taking due care & precautions and proper maintenance of the road.

4.12.6 Impact on Health

There are no chances of occurring diseases, due to the mining of sand, bajri & boulder. To avoid respiratory problem during extraction, loading and unloading of sand, bajri and boulder, necessary protection shall be taken.

Few safety measures are outlined below:

- a) **Safe Working Environment**: The project proponent may ensure health & safety of all the employees at work. All efforts can be made to provide and maintain a safe work environment and ensure that the machinery and equipment in use is safe for employees. Further, it can be ensured that working arrangements are not hazardous to employees.
- b) **Provision of First Aid**: In case of any accidents arising out of the proposed mining operations, timely and prompt first aid treatment is, often, the most important tool. Suitable first aid arrangements can be made at the site for rendering immediate first aid in case of any injury.
- c) **Medical Examination:** For all mine workers, medical examination can be made on periodical basis.
- d) **Health Education:** Adequate health education and information related to the job can be provided to the workers so that their health & safety can be ensured.
- e) **Tie-up with the Nearest Hospital for Medical Assistance:** To meet the medical needs of the mine workers in case of accidents, tie-up with nearest hospitals can be made. Efforts can be made to reserve a few beds in the nearest hospitals for the workers of the mining project to meet any emergency. This can ensure timely medical aid to the affected persons.
- f) Supply of Mask and Gloves: The workers exposed to dust can provide with dust masks to prevent them from getting affected by respiratory diseases. Gloves can be provided to workers working with hand tools, to ensure safety of their hands.
- g) **Administration of Anti-venom Injections:** Provision of Anti-venom therapy can be made available for administration to the workers in case of snake, spider and insect bites, while working in the mine. Some persons in the mine can be given necessary training for the purpose.
- h) **Special Telephone Number:** A special telephone number can be made available to the workers in case of emergency so that they can dial the same in case of any accident.

4.13 IMPACTS DUE TO SOLID WASTE/OVERBURDEN AND MITIGATION MEASURES

4.13.1 Anticipated Impact

- As there is practically no soil cover observed in the river bed, this RBM project does not
 involve any waste generation. Thus, no waste dump sites are needed for the project.
 However, there will be 470 workers on site.
- No municipal waste other than domestic sewage shall be generated.
- Some food wastes can be expected to be generated which if not disposed properly will render the site dirty.

4.13.2 Mitigation Measures

- Only clayey soil generated during mining process, will be used for the plantation.
- Domestic sewage will be disposed off into septic tanks followed by soak pits
- Solid wastes generated from the personal habits of people such as used bidis, waste paper, food remains etc. cannot be ruled out. Dustbins shall be provided at the rest places.
- Sufficient number of bio- toilets will be provided to workers at safe places of mining site.

4.14 TRAFFIC ENVIRONMENT

4.14.1 Anticipated Impact

- The increase in traffic density will lead to the air pollution and it cause the effect on human health like damage to lung tissue, cancer, asthma etc.
- The movement of vehicles cause the noise pollution.
- Accidents may be occurring due to fast movement of vehicles.

4.14.2 Mitigation Measures

- Vehicles with PUC certificate will be hired. Regular maintenance of vehicles will be done to ensure smooth running of vehicles.
- Face masks will be provided to all workers involved in mining work.
- Regular health checkups camps will be organised for the safety purpose of the workers.
- Unnecessary blowing of horn will be avoided.
- To avoid accidents the speed of vehicles will be kept slow in mining area and near habitation areas.

4.15 IMPACTS ON GEOLOGY AND MITIGATION

4.15.1 Anticipated Impact

 Mining work can change the slope of mining area which will create soil erosion and divert rain water runoff channel.

4.15.2 Mitigation Measure

- The depth of the mining in the river bed will not exceed the limit of 3.0 meters which will get replenished every year during monsoon season.
- To protect the banks from erosion, mine lease area has been proposed leaving a safety zone of 25 % of each side from lease boundary.
- Plantation will be done along the mine lease area.

Water will be proposed for sprinkling on unpaved roads to avoid soil weathering.

4.16 MINE CLOSURE PLAN

4.16.1 General

Mine closure plan is one of the most important requirements in the environment management of mining projects. The closure operation is a continuous series of activities right from the commencement to decommissioning of the project. Therefore, progressive mine closure plan is specifically included in the mining plan, which is to be reviewed every five years in the scheme of mining. The primary aim is to ensure that the following broad objectives along with the abandonment of the mine can be successfully achieved:

- Creation of a productive and sustainable after-use for the site.
- Protection of public health and safety of the surrounding habitation.
- Minimization of environmental damage.
- Conservation of valuable attributes and aesthetics.
- Counter balancing the adverse socio-economic impacts.

4.16.2 Reason for Closure

The progressive mine closure plan has been prepared in compliance of Uttarakhand Minor Mineral Concession Rules 2001 under MMCR 1960. No immediate closure is planned as sufficient reserves are available to carry on the activities. There is market potential in domestic demands.

4.16.3 Statutory Obligations

- The mining contractor is bound to submit the Progressive mine closure plan either with Mining plan or Scheme of Mining.
- Mining contractor is bound to follow the terms and conditions as will be stipulated in the mining contract.
- In addition to it, the rules pertaining to the Protection of Environment *i.e.* Environment Act. Environment Rules and other associated rules for the protection of environment will have to be followed.
- During the course of mining, the rules stipulated in Mines Act, Mines rules Metalliferous Mines Regulation 1960 and UMMCR, 2001 will be followed.
- All other rules pertaining to the mining, existing at that time will be followed during the course of mining activities.

4.16.4 Disposal of Mining Machinery

The sand, bajri and boulders mine is manual open cast method. Hence mining Machineries and their disposal are not applicable.

4.16.5 Infrastructure

No permanent construction will be done at mining site. Only temporary constructions for office and rest place will be done. Kuchcha haul road having width of 3.0m and gradient 1:20 to 1:50 will be made for the advancement of mining faces for the transportation of RBM and waste material.

4.16.6 Safety and security

Each worker employed in the mine will be provided helmets, gloves, face masks and shoes for safety purposes. Safety belts will be used for working in the top of the benches. Therefore protective works like parapet walls, garland drains shall be provided before the mine/pit is abandoned.

4.16.7 Waste Management

The RBM containing sandy soil will be stacked separately and these dumps are temporary in nature. The dumping will be undertaken manually.

4.16.8 Air Quality Management

The lease area is situated in the river bed. The open cast manual mining without drilling and blasting has been proposed. Therefore the impact on air environment will be negligible. Mining and allied activities are going on a comparatively small scale.

4.16.9 Mined Out Land

Plantation is proposed along the slope on both bank of the river. The mining will commence from the lower levels and will advance towards the higher levels.

CHAPTER-5: Analysis of Alternatives (Technology & Sites)

5.1 INTRODUCTION

Consideration of alternatives to a project proposal is a requirement of EIA process. During the scoping process, alternatives to a proposal can be considered or refined, either directly or by reference to the key issues identified. A comparison of alternatives help to determine the best method of achieving the project objectives with minimum environmental impacts or indicates the most environmentally friendly and cost effective options.

5.2 ALTERNATIVE FOR MINE LEASE

- During monsoon season, when rivers reach high stage, Jakhan River also bears significant catchment area and it transports river bed material which gets accumulated at such stretch which widens river width and concave banks. Thus, it is evident that the proposed site will be mined for the purpose of preventing land cutting during heavy rainfall and floods.
- Sand, Bajri and Boulder (minor mineral) deposits are site specific. It is present in Jakhan river bed (96.50 Ha.). The mining of the material will be done by opencast manual method in riverbed. The mining will be done as per laid down procedures Uttarakhand Minor Mineral Concession, Stocking, Transportation of Minerals and Prevention of Illegal Mining Rules, 2005. The mined out area in river bed block will get replenished annually after monsoon. Therefore, no alternate site is suggested as existing land use of mine lease classified as "River Body" and will continue to be so even after the current mining project is over.

5.3 ALTERNATIVE FOR TECHNOLOGY AND OTHER PARAMETERS

Some alternatives considered during EIA study are discussed below:

S.No.	Particular	Alternative	Alternative	Remarks
		Option 1	Option 2	
1	Technology	Opencast	Opencast semi	Opencast manual for riverbed is
		manual	mechanized	preferred.
			mining	Benefits:
				No electric power required.
				 Minimal noise will be
				generated.
				Minimal air pollution will be
				generated.
				Overburden will not be
				generated.
2	Employment	Local	Outsource	Local employment is preferred.
		employment	employment	Benefits:
				 Provides employment to
				local people along with
				financial benefits.
				No residential
				building/housing is required.

3	Laborer transportation	Public transport	Private transport	Local labors will be deployed so they will either reach mine site by bicycle or by foot. Benefits: Cost of transportation for men will be negligible.
4	Material transportation	Private transport	Private transport	Material will be transported by local trucks/trolleys on the contract basis Benefits: It will give indirect employment to local people.
5	Water requirement	Tanker supplier	Ground water/surface water supply	Tanker supply will be preferred. Benefits: No change in the surface water or ground water quality
6	Road	Haul road	Metallic road	Only old Haul road will be used for transportation of minerals which will require only simple repairing. Cutting of trees will not require in repairing work. Benefits: Less distance, less fuel consumption, no tree felling required in repairing of old road.

5.4 Summary

We have analyzed all the option for alternatives of the proposed mine site. This project is sand, bajri and boulder specific project and existing land use of mine lease classified as River Body which will continue to be so even after the current mining project is over, hence no alternate site is suggested for this project.

CHAPTER-6: ENVIRONMENTAL MONITORING PROGRAM

6.1 INTRODUCTION

Regular monitoring of environmental parameters of immense importance to assess the status of environment during project operation. With the knowledge of baseline conditions, the monitoring programme will serve as an indicator for any deterioration in environmental conditions due to operations of the project, which will enable to take suitable mitigation steps in time to safeguard the environment.

Monitoring is important to measure the efficiency of control measures. An environmental impact assessment study is carried over for a specific period of time and the data generated for that specific period cannot bring out all variations induced by the natural or human activities. Therefore, regular monitoring programme of the environmental parameters is essential to take into account changes in the environmental quality. The objectives of monitoring are to:-

- Verify effectiveness of planning decisions;
- Measure effectiveness of operational procedures
- Confirm statutory and corporate compliance; and
- Identify Unexpected changes

6.2 Identify Unexpected changes, Environmental Monitoring and reporting Procedures

Monitoring will confirm that emissions are within prescribed limits. This will take the form of direct measurement and recording of quantitative information, such as quantity and concentrations of discharges, emissions and wastes for measurement against corporate or statutory standards, consent limits or targets. It may also require measurements of ambient environmental quality in the vicinity of a site using ecological/biological, physical and chemical indicators. Monitoring may include socioeconomic interaction, through local liaison activities or even assessment of complaints.

The preventive approach by management may also require monitoring of process inputs, for example, type and method used, resource consumption, equipment and pollution control performance etc. Monitoring will also be required to meet compliance with statutory and corporate requirements. Finally monitoring results will provide the basis for auditing.

6.3 Environment Monitoring Schedule

Post project monitoring will be carried out as per conditions stipulated in Environmental Clearance Letter issued by MoEF&CC, Consent issued by SPCB as well as according to CPCB guidelines. Details of the proposed environmental monitoring schedule, which will be under taken for various environmental components, are detailed below in **Table 6.1**

Table 6-1: Monitoring Schedule

Components	Schedule and duration of monitoring	Implementing agency	Approx. unit cost (per location)	Total cost (per year in Rs.)
Air	Twicea year except monsoon (at 5 stations) for PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂	UKFDC	5000	50000

Water	Twice in a year (at 5	UKFDC	3000	30,000
	stations)			
Noise	Twice in a year (at 5	UKFDC	3000	30,000
	stations)			
Soil	Twice in a year (at 5	UKFDC	3000	30,000
	stations)			
Total				140,000

6.4 MONITORING OF VARIOUS PARAMETERS

6.4.1 Monitoring Methods

The mine site is considered as core zone and the area lying within 10km radius from the mine site is considered as buffer zone.

6.4.2 Drainage

Local workers will be deployed for the project. Therefore no concrete based sewerage system will be constructed. Domestic sewage generated shall be disposed into the septic tanks followed by soak pits. No domestic water will be disposed off in to the river body or near area. Regular checking will be carried out to find any blockage due to silting or accumulation of loose material. The drain will also be checked for any damage in lining/stone pitching etc.

6.4.3 Slop Failure

The proposed mining for sand, bajri and boulder from the river bed of Jakhan river will be done by opencast manual method up to a depth of 3.0 meter from the ground level. There will be no slope formation as excavated pits will be backfilled by the solid wastes (Clayey soil) generated during the mining of sand, bajri and boulder and it will get replenished during monsoon. Hence there will be no slope failure.

6.4.4 Blasting Effects

The proposed project is for extraction of sand bajri and boulder and there is open cast manual method of mining. Hence Blasting is not required.

6.4.5 Air Quality Monitoring

Ambient air quality monitoring done in both upwind and downwind directions along with the adequate meteorological measurements for proper interpretation of data, PM_{2.5}, PM₁₀, SO₂, and NO₂. The number of monitoring stations, air pollutants and frequency of monitoring will be decided as per the CPCB guidelines in 2009. Meteorological stations will be monitored for wind directions and speed, rainfall, temperature, humidity and evaporation.

6.4.6 Water Quality Monitoring

Monitoring of surface run-off and ground infiltration will be done once in every season except monsoon. Quality of groundwater and surface water samples will be analyzed for all the parameters as per IS-10500 and IS-2296 respectively.

6.4.7 Noise Quality Monitoring

Noise level monitoring will be done at the work zone to assess the occupational noise exposure levels. Noise levels will also be monitored at the noise generating sources like mineral handling arrangements, vehicle movements and also nearby villages for studying the impact due to higher noise levels for taking necessary control measures at the source.

6.4.8 Occupational Health and Safety

Health check-up for the workers will be conducted at regular intervals of two months in a year. The health camps status will be monitored and the information will be furnished to the approving authority. Environment Management Cell will also coordinate with general public, regulatory authorities, local administration to appraise environmental performance of the mine.

6.5 REPORTING SCHEDULE AND MONITORING DATA

The frequency of reporting of monitored data will be on six monthly bases to the State PCB and to Regional Office of MoEF&CC, New Delhi. Compliance report will be submitted twice in a year for 6 months interval. The Environmental statement will be prepared for the entire year of operations and will be regularly submitted to regulatory authorities.

6.6 Hierarchy

UKFDC shall conduct all its operations in a manner that is protective of the environment and health and safety of employees, customers and the community. In fulfillment of this commitment, they shall maintain continuing efforts to:

- Comply with all applicable safety, health and environmental laws and regulations.
- Enhance Safety, Health and Environment (SHE) awareness among employees and associated stakeholders through effective communication and training.

Environmental Policy of UKFDC is attached as Annexure -V.

6.7 ENVIRONMENTAL MONITORING AND REPORTING PROCEDURE

Monitoring shall confirm that commitments are being met. This may take the form of direct measurement and recording of quantitative information, such as amounts and concentrations of discharges and wastes, for measurement against corporate or statutory standards, consent limits or targets. It may also require measurement of ambient environmental quality in the vicinity of a sit using ecological/biological, physical and chemical indicators. Monitoring may include socio-economic interaction, through local liaison activities or even assessment of complaints.

The key aims of environmental monitoring are:

- To ensure that results/ conditions are as forecast during the planning stage, and where they are not, to pinpoint the cause and implement action to remedy the situation.
- To verify the evaluations made during the planning process, in particular with risk and impact assessments and standards and target setting and to measure operational and process efficiency.
- Monitoring will also be required to meet compliance with statutory and corporate requirements.
- Finally, monitoring results provide the basis for auditing, *i.e.* to identify unexpected changes.

6.8 LOCATIONS OF MONITORING STATIONS

The location of the monitoring stations was selected on the basis of prevailing micro meteorological conditions of the area like; wind direction and wind speed, relative humidity, temperature. Locations for the post project monitoring shall be as under.

Table 6-2: Locations of Monitoring Stations

S. No.	Description	Location	
1.	Ambient Air Quality	Lease area, Villages in down-wind direction from the	
		Lease Boundary	
2.	Noise Level Monitoring	Lease Boundary, High noise generating areas	
3.	Water Level and Quality	Nearby Surface and Ground water sources	
4.	Soil Quality	Lease area and Villages within study area.	

6.8.1 Reporting Schedule during Operation of Mine

After completion of analysis, copies of all the analysis reports will be sent to MoEF&CC. Copies of the reports will be maintained in the office and will be made available to the concerned inspecting authorities.

CHAPTER-7: ADDITIONAL STUDIES

7.1 General

Mining are associated with several hazards that pose impacts on employees & surrounding area necessitating adequate implementation of Safety and health measures. Hence, mine safety is one of the most essential aspects of any working mine. It is necessary to consider specific issues as applicable to the individual projects to take precautions against these issues. A worker in a mine should be able to work under condition, which are adequately safe and healthy.

7.2 PUBLIC CONSULTATION

Public hearing is very significant part of the process of public participation envisaged under the guidelines issued by SPCB, Government of India. It facilitates involvement of all the stake holders of the project which is essential for ensuring smooth running of project and benefitting all sections of society in the process of economic development of the region. The Final EIA/EMP will include all the public issues after conducting the public hearing.

7.3 REPLENISHMENT STUDY

A study was undertaken by ICAR-Indian Institute of Soil and Water Conservation, Dehradun (Uttarakhand) under a consultancy project sponsored by Divisional Logging Manager (Khanan), Uttarakhand Forest Development Corporation, Dehradun (Uttarakhand) on 'Assessment of extractable river bed material from river Song I, II & III and Jakhan I & II at Dehradun for the year of 2019-2020" in the defined reach of the river.

Based on the survey, assessment of the sediment deposits, it is assessed that the safe limit for extraction/removal of deposited river material from Jakhan-2 in **2019-2020** is 372502.27 m³. This quantity has been arrived upon considering that hydrological profile of the river flow is guided to the centre of the river so as to minimize risk of steam bank erosion.

The following recommendations for future are also made for the assessment of permissible quantity of RBM to be made from the river and the methodology of extraction to be followed so as to maintain the hydrological profile of the river along with the extraction of the RBM.

- As the method and depth of extraction of RBM to be made will depend upon the pattern and quantity of RBM deposited during the monsoon, hence the quantity of RBM deposited during the monsoon, hence the quantity of RBM extraction is to be estimated by surveying the river preferably before the monsoon (after excavation of RBM is over i.e. in the month of June) and after the monsoon is over (before the excavation of RBM starts i.e. in the month of November/December)
- The extraction of RBM in the seasonal river Jakhan-2 may be kept from October to May.
- The very big boulders in the river should not be removed from the junction of the hilly area and plain area as these big boulders serve for dissipating the energy of the flowing water.
- The extraction may be carried out as per the methodology explained in the report.
- As explained to the staff present during survey, permanent pillars on both sides of the river at every one kilometre of length may be erected as permanent bench post. Further the pillars constructed to demarcate width of extraction leaving 25% of river width from the bank may be erected with a depth of 1.5m below the ground and 1.2 m above the ground. Probably this may not be carried over by river during monsoon and hence reduce the periodical construction of

pillars every year. However this year only 5-6 such pillars may be erected to observe its stability. While erecting the pillar, the corner of the pillar may face upstream.

- The four pillars are to be constructed to help in confining the extraction of RBM may please be marked from the right hand side of the river to the left hand side of the river as 1/1, 1/2, 1/3 and 1/4 starting from zero length of the river and then at the interval of about 1 km distance in the river length till the last of the river reach up to which the extraction of RBM is made. These will serve as the permanent bench mark for the survey of the cross section.
- It has been observed that Jakhan-2 reach from 0.5 km from upper portion to 2.0 km is having very low deposition of RBM and the agency responsible for extraction of RBM may be advised appropriately to avoid the disturbance of flow course.

7.4 HAZARD IDENTIFICATION AND RISK ASSESSMENT METHODOLOGY

Risk analysis is the systematic study of uncertainties and risk encountered in various areas in the proposed project. Risk analysis identifies the risks involved in the mining operations and related activities. River bed mines also have the risks which need to be addressed for which a disaster management plan has been formulated with an aim of taking precautionary steps to avert disasters. In this chapter the types of risk involved, risk potential and impact on environment, lives and property will discussed.

Risk assessments will help mine operators to identify high, medium and low risk levels. This is a requirement of the Occupational Health and Safety Act 2000. Risk assessments will help to prioritize the risks and provide information on the need to safely control the risks. In this way, mine owners and operators will be able to implement safety improvements. The possible risks in the case of riverbed mining project during the mining operation are given below:-

- 1. Accident due to Vehicular movement
- 2. Possibility of Earthquake as mine lease area falls in Seismic Zone-IV
- 3. Inundation of the mine lease if excessive rainfall takes place
- 4. Accident due to Failure of Pit Slope
- 5. Uneven/Irregular mining of sand, bajri and boulder.
- 6. Damage to River bank due to access of Ramps.
- 7. Sand, bajri and boulder storage stacks stability Failure.
- 8. Fires on large surface

Mitigation measures for Accident due to Vehicular movement

- ➤ The movement of vehicles within the mine lease area should be carried out directly under the supervision and control of the management.
- > The vehicles will be maintained in a good condition and checked thoroughly at least once in a month by the competent person authorized for the purpose by the management.
- Road Signs will be provided at each and every turning point up to the main road.
- > Regular training will be provided to the operators by the company or the contractors.
- A statutory provisions of the fences, constant education, training etc will go a long way in reducing the incidents of such accidents.

• Mitigation Measures for Earthquake as mine lease area falls in Seismic Zone-IV

Proper training will be provided to the labours for earthquake and the area will be evacuated as soon as there is any news or signal for earthquake.

• Mitigation Measures for Inundation

Mining will be done during the non-monsoon periods so there shall be no problem of inundation is likely to happen.

• Possible Risks Due to Failure of Pit Slope & Its Control

At present, the mining is proposed in a mild sloping forest land in river bed. Pits will be created of limited depth of 3.0 m only, thus the chance of failure of pit slope does not exist.

· Possible Risks Due to Uneven/Irregular mining of sand, bajri and boulder

Due to uneven/irregular thickness of the minerals, river bed mining may result in ponds to develop. Proper management of even excavation can overcome this. Mining will be done for ½ meter thick strip at a time in the direction of river, to avoid ponding effect and maintaining the uniform surface.

Possible Risks Due to Failure of waste Dump & Its Control

No waste dump is created therefore the question of failure of waste dump does not exist.

Possible Risks Due to Fire & Its Control

The operation does not anticipate any fire disaster.

7.4.1 Measures to Prevent Accidents Due to Trucks and Dumpers

- All transportation within the main working should be carried out directly under the supervision and control of the management.
- High speed driving of Trucks, Dumpers and Tractors will not be permissible inside the mine area or near habitation.
- The vehicles will be maintained in good condition and checked thoroughly at least once a month by the competent person authorized for the purpose by the management.
- Road signs will be provided at each and every turning point up to the main road (wherever required).
- To avoid danger while reversing the trackless vehicles, especially at the embankment and tipping points, all areas for reversing of trucks/ tippers should as far as possible be made man free.
- A statutory provision of the fences, constant education, training, etc. will go a long way in reducing the incidents of such accidents.
- Haul trucks should be oriented essentially perpendicular to the berm, while unloading.

7.5 Disaster Management Plan:

The possible risks in the case of river bed mining project are bank erosion, floods, accidents due to transportation etc. At present the mining is proposed in a mild sloping forest land in riverbed. Pits will be created of limited depth of 3.0m from first to fifth year or river water levels whichever less, thus the chance of failure of pit slope are negligible, so benches should be made with the aspect of angles of response in the light of cohesion and angle of friction.

When the mining will reach up to the optimum economical depth then backfilling will commence by action of replenishment to restore the topography of the area. The mining faces shall be dressed properly because any hanging boulders/loose material may create fatal accidents to the labourers while working in the pit. The mine shall be critically examined for its

proneness to any natural hazard and assessment regarding danger of hazard and precautions to be taken and should be reviewed so that chances of slope failure will be minimized.

7.5.1 Other Possible Measures to be taken to control Disaster Due to River Bed Mining

- Identification & determination of safe clearances by the height of river bed & thickness of sand, bajri and boulder to be extracted from the close vicinity of the bank.
- At least 5m mineral/bare bed should be left in situ while harvesting sand, bajri and boulder from the river bed.
- Collection of minerals/working shall be started from the center towards the bank periphery in ½ meter slice so that the river course could not get affected.
- The minerals will be mined out in a uniform way so that the river flow/course shall not get disturbed in its uniformity.
- River bank areas, under operation will be protected by avoiding unauthorized RBM excavation along rivers as that may cause instability to the river bank.
- River banks will not be excavated to form access ramps.
- Only excavated river gravel should be used to deposit against the river bank to form access ramps.

7.6 Natural Hazards in the Dehradun District

The following are the hazards that have a probability of occurrence in Dehradun, based on the history of their occurrence in the district and their probability:

- 1. Earthquake
- 2. Flood
- 3. Fire/Forest Fire
- 4. Landslide
- 5. Accidents
- 6. Industrial/Chemical Hazard
- 7. Lightening & Cloud Burst

7.7 Occupational Health and Safety in River Bed Mining

Occupational health and safety (OHS) is a cross disciplinary area concerned with protecting the safety, health and welfare of people engaged in work or employment. *DGFASLI* working under the Ministry of Labor provides assistance to the State enforcing agencies, training and educating them in the field of occupational health and safety in the industries.

A. Occupational Health

Pre Placement and Periodical Health Status

- Pre /post-employment checkup will be carried out and following test will be conducted:
- Hematological Test
- Biochemical Test
- Urine
- ECG
- Spirometer
- Audiometry Color Vision

- Health Review System
- Medical Fitness From FMO
- Medical Record of Each Employee will be maintained and updated with finding

B. Frequency of Medical Examination

- For Mines Employee= Once in three Years
- For Technical and non-Technical=Once in 6 Months

C. Personal Protective Devices and Measures

- Mask for prevention of dust
- Ear Muff
- Safety Helmets
- Safety Belts
- Leather Hand Gloves
- Safety Shoes/Gum boots

D. Anticipated Occupational & Safety Hazards

- Musculoskeletal disorder
- Noise Induced Hearing Losses
- The Health impact due to diesel particulates from emission of diesel operated vehicles and equipment
- Physical Activity
- Silicosis due to sand/Bajri mining
- Dehydration
- Skin Disorder
- Dust Exposure

7.7.1 The Occupational Health Surveillance Program:

A team of qualified doctors and nurses will visit periodically for health check up of all the workers, team and its record will be maintained properly.

7.7.2 Impact on Human Health

This project will have an impact on the human health due to Sand, Bajri and Boulder increased dust, creation of breeding grounds for disease vectors, population influx which might introduce new diseases in the area, and inadequate sanitation facilities may result in severe health Impact.

7.7.3 Implementation of Occupational Health and Safety Measures

Occupational Health & Safety measures result in improving the conditions under which workers will be employed and work. It will improves not only their physical efficiency, but also provides protection to their life and limb. Management will consider the following safety measures:

- Safety clauses in contract order
- Dedicated safety team
- Inspection and maintenance of equipment's and accessories
- Pre placement and periodic health check up
- Removal of unsafe conditions and prevention of unsafe acts
- Detailed analysis of each and every incident
- To provide standard PPEs and ensure its uses for mining safety

- Periodic inspection by internal and external safety experts
- Celebrations of various safety events for awareness
- Medical facilities & first aid boxes will be established in the mine premises.
- Pits, Sumps, openings in floor, etc. which may be a source of danger, will be either securely covered or securely fenced. Securely fencing a pit means covering or fencing it in such a way that it ceases to be a source of danger.

7.8 CORPORATE SOCIAL RESPONSIBILITY

The CSR activities to be undertaken for the local people have been identified. It is unexpected that this will improve the socio-economic status of the people and at the same time the popularity of the project proponent will enhance. The local community in the study area desired that the project proponent should take-up the following developmental initiatives for the betterment of the local people.

For each activity, the funds to be earmarked by the proponent will be decided after discussion with the local authority and the beneficiaries. It has been planned to undertake a concurrent evaluation of the activities to be taken up under the CSR programme.

Year wise payment details of financial assistance in citizen's					
welfare und	welfare under Uttarakhand Forest Development Corporation				
Year	Particulars Amount (In Lakhs)				
2015-16	Mahila Mangal Dal, Uttarkashi	85.00			
	Mahila Mangal Dal, Rudraprayag	100.00			
	Mahila Mangal Dal, Chamoli	100.00			
	Mahila Mangal Dal, Pithoragarh	85.00			
	Mahila Mangal Dal, Bageshwar	100.00			
	Total	470.00			
	For other work	42.25			
	Grand Total	512.25			
2016-17	For various public welfare	68.50			
2017-18		54.20			
2018-19		20.00			
2019-20		23.33			
2020-21		14.47			
	Grand Total	692.75			

7.9 Rehabilitation & resettlement

The existing mine lease area is designated as river body and has no human settlements in the mine lease area. Hence, no Rehabilitation and Resettlement (R&R) is envisaged.

CHAPTER-8: PROJECT BENEFITS

8.1 GENERAL

The proposed project brings overall improvement in the locality, neighbourhood and the state by bringing employment generation at local level and revenue to state government. Hence it will be helpful for the economic growth and support to enhance quality of life through employment.

8.2 PHYSICAL BENEFITS

The project will work for different aspect to improve physical infrastructure as following:

- There will be improved road communication due to the proposed project and maintenance as per EMP provisions.
- Generating useful economic resource for construction. Extracted mineral will provide a good market opportunity.
- Project will fulfil the demand of sand for infrastructure development.
- This project will enhance the opportunities of employment for the local villagers near the lease area due to which their economic status become better.
- Project Proponent will develop green belt nearby project site.

8.3 SOCIAL BENEFITS

The mining in the area will create rural employment. It has been observed that conditions of the villages around the mining areas are better than that of distant villages. The mining activity in the region will have positive impact on social economic conditions of the area by way of providing employment to the local inhabitants; wages paid to them will increase the per capita income.

The salient features of the programme are as follows:-

- Social welfare programme like provisions of medical facilities educational facilities, water supply for the employees.
- A well laid plan for employment of local people has been prepared by giving priority to local people.
- Development of facilities within villages like roads etc.

8.4 ECOLOGICAL BENEFITS

A green belt will be developed along the boundary of the mining lease area. The area for green belt plantation consists of undisturbed soil; hence plantation could be made as in any garden or road side plantation. Green belt is erected not from biodiversity conservation point of view but is basically developed as a screen to check the spread of dust pollution. It is proposed to plant approx.. 48,000 Nos. of native species in 5 consecutive years along with some fruit bearing and medicinal trees during the plan period and a budget of Rs. 28.80 Lakhs for plantation. Green belt plantation will be started with the beginning of the mining and will be completed within five years from the beginning.

8.5 IMPROVEMENTS IN THE SOCIAL INFRASTRUCTURE

The mining in the area will create rural employment. It has been observed that conditions of the villages around mining areas are better than that of distant villages. The mining activity in the region will have positive impact on the social economic condition of the area by way of providing employment to the local in-habitants; wages paid to them will increase the per capita income, housing, education, medical and transportation facilities, economic status, health and agriculture.

A detailed program for socio economic development of the area has been framed. The salient features of the programme are as follows:

- a. Social welfare program like provision of medical facilities educational facilities, water supply for the employees as well as for nearby villagers will be taken.
- b. A well laid plan for employment of the local people has been prepared by giving priority to local people.
- c. Supplementing Govt. efforts in health monitoring camps, social welfare and various awareness programs among the rural population.
- d. Assisting social forestry program.
- e. Adoption of villages for general development.
- f. Supply of water to village nearby villages.
- g. Development of facilities within villages like roads, etc.

8.6 SUMMARY

The management will recruit the semi-skilled and unskilled workers from the nearby villages. The project activity and the management will definitely support the local Panchayat and provide other form of assistance for the development of public amenities in this region. The company management will contribute to the local schools, dispensaries for the welfare of the villagers. A suitable combination of trees that can grow fast and also have good leaf cover will be adopted to develop the green belt. It is proposed to plant approx.. 48,000 no's of native species in 5 consecutive years along with some fruit bearing and medicinal trees during the mining plan period.

CHAPTER-9: ENVIRONMENTAL COST BENEFIT ANALYSIS

9.1 PROJECT COST

After making exhaustive study, it is considered desirable that this mining project may be implemented. Total Project cost is estimated as Rs. 5.15 Crores.

9.2 ENVIRONMENT COST ANALYSIS AND PROJECT IMPLEMENTATION

The Environment cost for this proposed mining includes Environmental Management Plan, Occupational Health and Safety & Wildlife Conservation Plan, etc. which is likely to come **Rs. 7.35 crores**. The detailed cost for Environmental Expenses is given below in the Table.

Table 9-1: Environmental Cost Benefit Analysis

S. No.	Major Heads	Expenses per annum (Lakhs)	
1.	Environmental Management Plan	Rs. 37.10 Lakhs	
2.	Wildlife Conservation Plan	Rs. 4.80 Lakhs	
3.	Corporate Social Responsibility	Rs. 692.75 Lakhs	
Total Rs. 734.65 Lakhs			

The estimated capital cost and financial viability of the present scheme has been worked out on the assumption that the above scheme shall be completed by the end of lease period. From the above financial analysis, it is clear that this sand, bajri & boulder mining project is financial and technically viable.

CHAPTER-10: ENVIRONMENTAL MANAGEMENT PLAN

10.1 INTRODUCTION

Environment Management Plan must be integrated into the process of mine planning so that ecological balance of the area is maintained and adverse effects are minimized. The Environmental Management Plan (EMP) consists of a set of monitoring programme, mitigation measures, and management control strategies to minimize adverse environmental impacts.

In order to minimize impacts of mining on different environmental parameters and to keep air and water quality within prescribed limits of CPCB, an EMP has been prepared which is to be implemented in the project and covers the following phases of the project.

- Air Environment
- Water Environment
- Noise Environment
- Biological Environment
- Land Use Planning and mine closure
- Occupational Safety and Health
- Socio-economic and Cultural Environment
- EMP budget

The mining in the area has been proposed with time bound Management Plan so that impacts on different environmental parameters are least at every stage of mining. Environment Policy a1.pproved by Board of Director of M/s Uttarakhand Forest Development Corporation has been proposed which will deal for the Environment Management cell under the supervision of Manager of Environment Health System.

UKFDC Shall conduct all its operations in a manner that is protective of the environment and health and safety of employees, customers and the community. In fulfillment of this commitment, they shall maintain continuing efforts to:

- Comply with all applicable safety, health and environmental laws and regulations.
- Enhance, Environment, Health & Safety (EH&S) awareness among employees and associated stakeholders through effective communication and training.

Environmental Policy of UKFDC is attached as Annexure V.

The hierarchy of Environment Monitoring cell is given below:

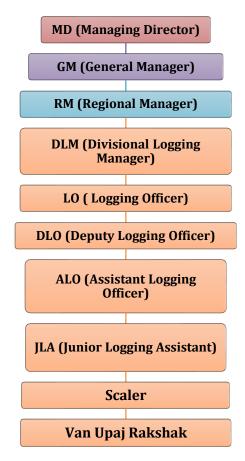


Figure 10-1: Flow Chart of EMP

10.2 AIR ENVIRONMENT

During the course of Sand, Bajri, Boulder mining, no toxic substances will be released into the atmosphere, so there seems to be no potential threat to health of human beings. In riverbed mining activities, dust will be generated during mining, loading and transportation. The only source of fugitive gaseous emission during mining will be vehicles which will be used for transportation. The environmental management for air pollution control includes:-

- The un-metalled haul roads should be adequately compacted before being put into use.
- Water should be sprinkled on the roads periodically every day (twice in a day), to wet the surface.
- Over loading of transport equipment should be avoided to prevent spillage.
- Transportation of sand should be in covered vehicles to prevent fugitive dust emission.
- Regular checking and maintenance of vehicles should be conducted once in every two
 months and pollution under control certificate be obtained.
- It will be ensured that all transportation vehicles carry a valid PUC certificate.
- Masks will be provided to workers daily, during working hours of the mine.
- Plantation will be taken up along the approach roads and vicinity of river bank.

10.3 WATER ENVIRONMENT

During the operational phase of mine, no waste water or industrial effluent will be generated. The environmental management for water pollution control includes:

- Water requirements for drinking, plantation and dust suppression will be met by tanker supply on the daily basis.
- Local people will be employed and no permanent housing will be done, so no permanent drainage pattern for sewerage system is required as domestic sewage shall be disposed off into septic tank followed by soak pits.

10.4 NOISE ENVIRONMENT

No drilling or blasting will be done in the proposed project of sand, bajri and boulder mining. Minimal noise will be generated during the operational phase of mine due to transportation and hand equipments to be used for mining purpose. The environmental management for noise pollution control includes:-

- Proper maintenance of hand equipments will be carried out every month, which will be helpful in reducing generation of noise during operation.
- Regular checking and maintenance of vehicles should be conducted once in every two month to avoid noise pollution.
- Ear plugs will be provided to workers during the operational hours of time.
- Periodical monitoring of noise will be done to adopt corrective actions wherever needed.
- Plantation will be taken up along the approach roads. The plantation minimize propagation of noise and also arrests dust.

10.5 BIOLOGICAL ENVIRONMENT

Although, there are no significant adverse impacts from the project, the following measures are proposed to minimize anticipated impacts:

Greenbelt Development Plan

Greenbelt means planting of special type of plants suitable for a particular agro-climatic zone and soil characteristics in a place which will make the area cooler, reduce air pollution, prevent soil erosion and further improve the soil fertility status. A green belt around the periphery of project side and road side will be created to avoid erosion of soil, prevention of landslides, minimize the air pollution and noise pollution in the project area. The green plants are capable of absorbing air pollutants and forming sinks for pollutants. Leaves with their vast area in a tree crown, absorb pollutants on their surface, effectively reducing their concentration and noise level in the ambient.

According to the CPCB guide line, there are 15 Agro-climatic regions, each of these region is further divided in to 68 sub zones based on annual rainfall, Climatic condition and soil types. The species recommended for the Greenbelt are quite adopted to such Climatic condition and grow well in the soil types of that zone.

Selection of Plant Species for Green Belt Development:

The selection of plant species for the green belt development depends on various factors such as climate, elevation and soil. The plants would exhibit the following desirable characteristics in order to be selected for plantation.

- ❖ The species should be fast growing and providing optimum penetrability.
- The species should be wind-firm and deep rooted.

- The species should form a dense canopy.
- ❖ As far as possible, the species should be indigenous and locally available.
- ❖ Species tolerance to air pollution like SO2 and NO2 should be preferred.
- ❖ The species should be permeable to help create air turbulence and mixing within the belt.
- ❖ There should be no large gaps for the air to spill through.
- ❖ Trees with high foliage density, leaves with larger leaf area and hairy on both the surfaces.
- ❖ Ability to withstand conditions like inundation and drought.
- Soil improving plants (Nitrogen fixing rapidly decomposable leaf litter).
- ❖ Attractive appearance with good flowering and fruit bearing.
- Bird and insect attracting tree species.
- Sustainable green cover with minimal maintenance.

Following tree species are recommended for plantation. However, UKFDC should take view of their internal expert in forestry during plantation.

S.No	Scientific Name	Common Name	Family	Abatement
1	Albizia lebbeck	Siris Tree	Mimagagaga	Property
2			Mimosaceae	NOx, Dust, Sox
	Ailanthus excelsa	Mahanimb	Simaroubaceae	Dust
3	Acacia catechu	Khair	Mimosaceae	Dust
4	Azadirachta indica	Neem	Meliaceae	Dust, NOx, Sox
5	Anogeissus latifolia	Dhau	Combretaceae	-
6	Aegle marmelos	Bel	Rutaceae	Noise
7	Anthocephalus cadamba	Kadam	Rubiaceae	Dust
8	Adina cordifolia	Karam	Rubiaceae	-
9	Bauhinia purpurea	Kaniar	Caesalpiniaceae	Dust
10	Bambusa sp.	Bamboo	Poaceae	-
11	Cassia fistula	Sonali	Caesalpiniaceae	Dust
12	Delonix regia	Flame Tree	Caesalpiniaceae	Dust
13	Dalbergia sissoo	Shisham	Fabaceae	Noise
14	Mangifera indica	Aam	Anacardiaceae	SOx, Dust
15	Nerium indicum	Kaner	Apocynaceae	SOx, Dust
16	Phoenix sylvestris	Sendhi	Arecaceae	Dust
17	Polyalthia longifolia	Ashok	Annonaceae	SOx, Noise, Dust
18	Pongamia pinnata	Pongam Tree	Fabaceae	Noise, Dust
19	Schleichera oleosa	Kusum	Sapindaceae	-
20	Syzygium cumini	Jamun	Myrtaceae	Dust
21	Tamarindus indica	Tamarind	Caesalpiniaceae	Noise
22	Terminalia arjuna	Arjun	Combretaceae	Dust
23	Tectona grandis	Sagun	Verbenaceae	Dust
24	Zizyphus mauritiana	Indian Jujube	Rhamnaceae	Dust

Table 10-1: Proposed Green Belt

Mine Lease Area (Ha.)	96.50	
33% Plantation area (Ha.)	31.8%	
Life of Mine (Yrs.)	Replenish every year	

Total no of plants to be planted @ 1500/ha	47,700		
Plantation on other sites i.e. Village Panchayat, Government Schools and Community centre			

Table 10-2: Budgetary outlets of greenbelt development for five years

Particulars	No. of plants	Capital Cost (in Rs.)	Recurring Cost (in Rs.)
Capital cost@60/ plant (The	48,000	28,80,000	2,88,000
budget includes cost of digging of pits, fertilizers, saplings and maintenance)	Total Cost	28,80,000	2,88,000

Total budget for the project=28.80 lakhs for 5 year

10.6 LAND USE PATTERN

River bed mining can lead to river bank erosion and sedimentation arising from changes in hydrology due to alteration in water depths and river bed morphology. Sand, Bajri and Boulder in lowland river landforms are biologically important and an economic asset. Keeping this in mind, the following management plans are suggested:

- The area under mining at a given time will be kept minimum and the area will be reclaimed by top soil.
- There will be no mining near the banks. This is to protect the bank erosion and river migration.
- Proper wide benches in the mining area will be created to prevent any erosion.
- Slopes of the sides in mine will be at least 45° to prevent any erosion.
- Grass/plants will be planted on the slopes and benches to prevent soil erosion.

10.7 OCCUPATIONAL HEALTH AND SAFETY

Occupational Health and Safety professionals develop and coordinate safety and health systems and strategies within organizations. They identify workplace hazards, assess risks to employee health and safety, and recommend solutions. Increasingly, Health and Safety Professionals are also responsible for many of the environmental aspects of their workplace. As this profession matures, there is an increased emphasis on risk management strategy and on the development of workplace culture.

Occupational Health and Safety professionals in the minerals industry may perform the following tasks:

- The collection of minor minerals from the mine does not cause any occupational ill effects.
- Except fugitive dust generation there is no source which can show a probability for health related diseases and proper dust suppression will control dust generation and dispersion.
- Dust masks will be provided to the workers working in the dust prone areas as additional personal protective equipment.
- Awareness program will be conducted about likely occupational health hazards so as to have preventive action in place.
- Any workers health related problem will be properly addressed.

- Periodical medical checkup will be conducted.
- Promote occupational health and safety within their organization and develop safer and healthier ways of working.
- Develop and implement training sessions for management, supervisors and workers on health and safety practices and legislation;

Project Proponent shall appoint an Occupational Health Specialist for Regular and Periodical medical examination of the workers engaged in the Project and records maintained for silicosis and other occupational diseases.

Table 10-3: Budget for Occupational Health and Safety of the workers (Lakhs)

Sl. No.	Items	Capital Cost	Recurring cost
1.	PPE and first aid kit to the worker	0	0.50
2.	Awareness camp	1.00	0.50
3.	Medical Examination camp	2.00	1
	Total	3.00	2.00

10.8 SOCIO-ECONOMIC ENVIRONMENT

10.8.1 Management Plan for Socio-Economic Environment

- In general, socio-economic environment will have positive impact due to the mining project in the area.
- The deployed laborers will be from nearby villages only as these people are mainly dependent upon such mining activities.
- In order to further improve the socio-economic conditions of the area, the management will contribute for development works in consultation with local bodies.

10.9 SOLID WASTE MANAGEMENT

The RBM contain the negligible amount of clayey soil which will be used for the plantation purpose. Waste management is an important facet of environment management. Thus, solid waste management is important from both aesthetics and environment view points. There are no toxic elements present in the mineral which may contaminate the soil or river water.

10.10 ENVIRONMENT MANAGEMENT SYSTEM

UKFDC shall conduct all its operations in a manner that is protective of the environment and health & safety of employees, customers and the community in fulfillment of this commitment, they shall maintain continuing efforts to:

- Comply with all applicable safety, health and environment laws and regulations.
- Enhance Safety, Health and Environment (SHE) awareness among employees and associated stakeholders through effective communication and training.
- Investigate all workplace incidents and illness in order to promptly correct any unsafe conditions or practices.

10.11 COST OF EMP MEASURES

Following provisions are proposed to be taken for improving, control and monitoring of environment protection measures.

Table 10-4: Budget for EMP (in lakhs)

Sl.No.	Item	Capital Cost	Recurring Cost
1.	Environmental Training/awareness campaign	0.50	1.0
2.	Pollution abatement-Water sprinkling	0	3.00
3.	Green belt development & Others	28.80	2.80
4.	Environmental Monitoring cost	0	1.40
5.	Occupational Health and safety	3.00	2.00
6.	Conservation of sch-I species	4.8	2.03
	Total	37.10	12.23

10.12 REHABILITATION AND RESETTLEMENT (R &R)

As the mining area is barren river bed area and replacement and relocation of people is not involved, hence Rehablitation and Resettlement (RR) works are not applicable. However Social development of village will be considered as per social activities.

10.13 Wildlife Conservation Plan

Introduction

Biodiversity Conservation and protection of the rare and endangered species is important for maintaining the ecological balance of the ecosystem. It is also statutorily mandatory to prepare and implement conservation plan for such faunal species found in the study area of any developmental project. This conservation plan has been developed to understand RET faunal species found in the study area and to provide appropriate measures for their conservation and protection.

The proposed Jakhan-2 mining location is falling in the reserve forests area. *i.e.* Thano RF, Barkot RF, Lachchiwala RF Kushraila RF, Saura RF. As per authenticated map provided by DFO, Dehradun, the project site is 5.40 km in SW direction from Rajaji Tiger Reserve.

A primary ecological survey of the project site and study area in 10km radius was carried out during the months of **Dec 2019 to Feb 2020** for assessment of Biodiversity. Based on field observations and discussion with forest officers, it has been found that six faunal species are falling in Schedule-I category in the study area, out of which five are mammals and one species is Avian. Name of these species are given below in **Table 10-5**.

Table 10.5 Faunal species falling in Schedule-I category (*As per Indian Wildlife Protection Act 1972***) in the study area**

S.No	Class	Scientific Name	Common Name	IUCN/WPAStatus
1	Mammalia	Elephas maximus	Asian Elephant	EN/I
2	Mammalia	Manis crassicaudata	Indian Pangolin	EN/I
3	Mammalia	Panthera tigris tigris	Bengal Tiger	EN/I
4	Mammalia	Prionailurus bengalensis	Leopard Cat	LC/I
5	Mammalia	Panthera pardus	Leopard	VU/I
6	Aves	Pavo cristatus	Indian Peafowl	LC/I

10.13.1 Wildlife Management Plan

This Wildlife Conservation Plan has been developed with particular reference to Schedule-I faunal species to understand their habit, habitat, feeding, breeding and the potential threat for planning and undertaking necessary action plan for their protection and conservation.

The plan would provide appropriate guidance to the UKFDC to undertake required measures for conservation and protection of the rare and endangered species of the area. Implementation of the Wildlife Conservation Plan should be carried out in consultation with State Forest Department.

The management plan comprises of a brief description of all these six species along with their conservation measures.

Description of Scheduled-I species

(A) Mammals

1. Local Name: Bengal Tiger

Scientific Name: Panthera tigris tigris

Kingdom: Animalia

Phylum: Chordata

Class: Mammalia

Order: Carnivora

Suborder: Feliformia

Family: Felidae

Subfamily: Pantherinae

Genus: Panthera

Species: *P. tigris*Subspecies: *P.t.tigris*



General Description of Species:

The morphology of the Bengal tiger is beautiful and imposing. It is a mammal with thick legs, strong teeth and jaws and coat with the characteristic coloration pattern. In this regard, its skin shows a yellow to light orange color that in the belly and the internal areas of the legs becomes white or cream. Tigers are solitary; the only long-term relationship is between a mother and her offspring. Tigers are most active at night, when their wild ungulate prey are most active, although they can be active at any time of the day. Tigers prefer to hunt in dense vegetation and along routes where they can move quietly. In snow, tigers select routes on frozen river beds, in paths made by ungulates, or anywhere else that has a reduced snow depth. Tigers have tremendous leaping ability, being able to leap from 8 to 10 meters. Leaps of half that distance are more typical. Tigers are excellent swimmers and water doesn't usually act as a barrier to their movement. Tigers can easily cross rivers as wide as 6-8 km and have been known to cross a width of 29 km in the water. Tigers are also excellent climbers, using their retractible claws and powerful legs.

Distribution: The Bengal tiger (*Panthera tigris tigris*) is sometimes known as the Royal Bengal tiger and is a subspecies of tiger. The Bengal tiger is the second largest and the most common tiger subspecies. The largest populations of Bengal tigers are in India, but there are some smaller groups in Bangladesh, Nepal, and Bhutan.

Habit and Habitat: The power of the Bengal tiger is evident when observing its effectiveness at the time of hunting. This carnivorous animal search for medium or large prey, mainly ungulate mammals. In their diet, predominates the gaur, water buffalo, sambar, chital or mottled deer, wild boar and other species of deer. They occasionally consume small prey such as rabbits and porcupines, and may also attack domestic livestock. This is a consequence of the invasion of their habitat. Bengal tigers can in-gest up to 40 kilograms of food on a single occasion, although they usually consume a smaller amount. The search for food is entirely individual, and both sexes are territorial unless food conditions become tough. Transient contacts are possible in these situations. To mark their terrain, they spray the trees and rocks with a mixture of urine and musk.

Home range sizes vary depending on the density of prey. Female Indian tigress (*P. t. tigris*) have home sizes ranges from 64 to 9252 km2; a male's home ranges averages between 2 to 15 times larger. Within their home range, tigers maintain several dens, often among dense vegetation or in a cave, cavity under a fallen tree, or in a hollow tree.

Body length: 1.98 to 3.7m

Weight: 91 to 423 kg

Breeding Season: Tigers can breed at any time of the year, but breeding is most common from November to April.

Threats: The Bengal Tigers are facing an increasing number of problems when it comes to surviving in the regions they have previously thrived in for thousands of years.

Poaching: Every single body part of the tiger is traded in illegal markets. It is used in traditional Asian medicine which has no medicinal value at all, making the deaths of these animals for this purpose unnecessary.

Habitat Loss: Tigers have lost 93% of their historical range as their habitat has been destroyed or degraded by human activity.

Human-Wildlife Conflict: With smaller forests to hunt in, tigers are forced to kill livestock and when they do the farmers often retaliate and kill the big cat.

Poaching and human conflict: As tigers continue to lose their habitat and prey species, they are increasingly coming into conflict with humans as they attack domestic animal and sometimes people. In retaliation, tigers are often killed by angry villagers.

Conservation Status:

The Bengal Tiger is an endangered animal and is listed in the Schedule - I of the Wildlife (Protection) Act, 1972. This act gives it protection against hunting/poaching and trade for skins, bones and body parts. Any person who commits such an offence is punishable with an imprisonment of not less than three years extending up to seven years along with a fine of not less than fifty thousand rupees which may extend up to two lakh rupees. In the event of a second or subsequent conviction, he can receive imprisonment for a term of not less than seven years and a fine which shall be not less than five lakh rupees and can vary up to a maximum of fifty lakh rupees.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) presently ratified by over 160 countries, makes international trade in tiger parts illegal. India has been a signatory of this convention since the year 1975.

Reference:

- https://www.wwfindia.org/about_wwf/priority_species/bengal_tiger/conservation_c hallenges/
- WWFhttps://www.wwfindia.org/about_wwf/priority_species/bengal_tiger/faq/
- https://animaldiversity.org/accounts/Panthera_tigris/
- https://www.tigers-world.com/bengaltiger/#:~:text=The%20morphology%20of%20the%20Bengal,legs%20becomes%20 white%20or%20cream.
- ADWhttps://animaldiversity.org/accounts/Pantheratigristigris/
- https://www.worldwildlife.org/species/bengal-tiger
- http://www.nationalgeographic.com/animals/mammals/b/bengal-tiger/
- https://www.wwfindia.org/about_wwf/priority_species/bengal_tiger/faq/

2. Local Name: Leopard

Scientific Name: Panthera pardus

Taxonomical Classification:

Kingdom: Animalia

Phylum: Chordata

Class: Mammalia

Order: Carnivora

Suborder: Feliformia

Family: Felidae

Subfamily: Pantherinae

Genus: Panthera

Species: *P. pardus*



General Description of Species:

The Indian leopard (*Panthera pardus*) is widely distributed in the Indian subcontinent. Its population has declined due to habitat loss and fragmentation, poaching for the illegal trade of skins and body parts, and persecution in conflict situations.

The Indian leopard is one of the big cats occurring in the Indian subcontinent, apart from the Asiatic lion, Bengal tiger, snow leopard and clouded leopard.

Its coat is spotted and rosette on a pale yellow to yellowish-brown or golden background, except for the melanistic forms; the spots fade toward the white underbelly and the insides and lower parts of the legs. Rosettes are most prominent on the back, flanks and hindquarters. The pattern of the rosettes is unique to each individual.

Male Indian leopards grow between 4 ft to 5 ft in body size with a 2ft to 3ft long tail and weigh between 50 kg to 77kg. Females are smaller, growing between 3ft to 4ft in body size with a 2.5ft to 3ft long tail. Sexually dimorphic, males are larger and heavier than females.

Distribution: The Indian leopard is distributed in India, Nepal, Bhutan and parts of Pakistan. It has also been recorded in Qomolangma National Nature Preserve in Southern Tibet.

Habit and Habitat: The leopard is elusive, solitary and largely nocturnal. It is known for its ability in climbing and has been observed resting on tree branches during the day, dragging & kills up trees and hanging from there and descending from trees headfirst. It is a powerful swimmer, although is not as disposed to swimming as the tiger. It is very agile and can run at over 58 kilometers per hour (36 mph), leap over 6 m (20ft) horizontally and jump up to 3 m (9.8 ft) vertically. It produces a number of vocalizations, including grunts, roars, growls, meows and purrs.

The leopard is a versatile, opportunistic hunter, and has a very broad diet. It is able to take large prey due to its massive skull and powerful jaw muscles. In Sariska Tiger Reserve, the dietary spectrum of the Indian leopard includes axis deer, sambar deer, nilgai, wild boar, common langur, Indian hare and peafowl. In Periyar Tiger Reserve, primates make up a large proportion of its diet.

Breeding Season: Leopards breed year-round, with a peak during the rainy season.

Threats: Hunting of Indian leopards for the illegal <u>wildlife trade</u> is the biggest threat to their survival. They are also threatened by loss of habitat and fragmentation of formerly connected populations, and various levels of human–leopard conflict in human–dominated landscapes.

Poaching and human conflict:

A significant threat to wild leopard populations is the <u>illegal trade</u> of poached skins and body parts between India, Nepal and <u>China</u>.

The frequency of Leopard attacks on humans varies by geographical region and historical period. While leopards generally avoid humans, they often come into conflict with humans when preying livestock. Leopard attacks have peaked in India during the late 19th and early 20th centuries, coinciding with rapid urbanization.

Conservation Status

The species *Panthera pardus* is listed as Vulnerable on the IUCN Red List. It is placed in Schedule -I of the Wildlife Protection Act 1972.

Reference:

- The book Man-Eaters of Kumaon is based on man-eating leopards and tigers in Kumaon.
- Kabir, M.; Awan, M. S.; Anwar, M. (2013). Distribution range and population status of common leopard (*Panthera pardus*) in and around Machiara National Park, Azad Jammu and Kashmir. Conservation Science. 4 (1): 107–118.https://wildlifeinindia.in/barda-wildlife-sanctuary/
- Shehzad, W.; Nawaz, M. A.; Pompanon, F.; Coissac, E.; Riaz, T.; Shah, S. A.; Taberlet, P. (2015). Forest without prey: livestock sustain a leopard *Panthera pardus* population in Pakistan. Oryx. 49(2): 248–253. doi:10.1017/S0030605313001026.

- Odden, M.; Wegge, P. (2005). Spacing and activity patterns of leopards *Panthera pardus*in the Royal Bardia National Park, Nepal (PDF). Wildlife Biology. 11 (2): 145–152.
- Mondal, K.; Gupta, S.; Bhattacharjee, S.; Qureshi, Q. & K. Sankar (2012). Prey selection, food habits and dietary overlap between leopard *Panthera pardus* (Mammalia: Carnivora) and reintroduced tiger Panthera tigris (Mammalia: Carnivora) in a semi-arid forest of Sariska Tiger Reserve, Western India. Italian Journal of Zoology. 79 (4): 607–616.
- Eaton, R.L. (1977). Reproductive biology of the leopard. Zoologischer Garten. 47 (5): 329–351.
- Borah, J.; Sharma, T.; Das, D.; Rabha, N.; Kakati, N.; Basumatary, A.; Ahmed, M. F.; Vattakaven, J. (2013). Abundance and density estimates for common leopard *Panthera pardus* and clouded leopard Neofelisnebulosa in Manas National Park, Assam, India. Oryx. 48: 149–155.
- Nabi, D. G.; Tak, S. R.; Kangoo, K.A.; Halwai, M. A. (2009). Increasing incidence of injuries and fatalities inflicted by wild animals in Kashmir. Injury. 40 (1): 87–89.
- Karanth, K. K.; Nichols, J. D.; Hines, J. E.; Karanth, K. U.; Christensen, N. L. (2009). Patterns and determinants of mammal species occurrence in India. Journal of Applied Ecology. doi:10.1111/j.1365-2664.2009.01710.x.
- Banks, D. (2004). The Tiger Skin Trail. Environmental Investigation Agency.
- Kumar, P., Chandel, S., Kumar, V. and Sankhyan, V. (2017). Leopard–Human Conflict Led Casualties and Conservation Awareness Campaign in Shivalik Hills of Northern India. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences. 87 (3): 893–898. doi:10.1007/s40011-015-0653-3.
- Athreya, V. (2012). Conflict resolution and leopard conservation in a human dominated landscape (Ph.D.). Manipal University. Retrieved 29 March2013.
- Champion, F.W. (1934). What is the Use of Leopards? In: The Jungle in Sunlight and Shadow. Natraj Publishers, New Delhi.
- Man-Eaters of Kumaon (1944), Jim Corbett, Oxford University Press, Bombay.

3. Local Name: Asian Elephant

Scientific Name: Elephas maximus

Taxonomical Classification:

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Proboscidea
Family: Elephantidae

Genus: *Elephas*Species: *maximus*



General Description of Species:

The Asian elephant (*Elephas maximus*), also known as the Asiatic elephant, is the only living species of the genus *Elephas* and is distributed throughout the Indian subcontinent and

Southeast Asia, from India in the west, Nepal in the north, Sumatra in the south, and to Borneo in the east. The Asian elephant has several behaviors related to thermoregulation. They live in a hot climate and have a large body size, which causes the elephants to heat up quickly. During the hottest hours of the day, they are less active and spend time in shady areas. Asian elephants bathe frequently and submerge themselves in water to cool down. *Elephas maximus* has matriarchal social organization. The females and offspring live together in a group, while the males live in smaller groups or alone.

Distribution: In India, they are found in foot planes of the Himalayas in Uttaranchal, Northern West Bengal, foothills of Nagaland, Garo Hills, Khasi Hills, Arunachal Pradesh, Lower Brahmaputra, Barak Valley, Western Assam, Mishmi Hills, Karbi Plateau, Jharkhand, Chhattisgarh, Tripura, Barak Valley, Western Ghats, Bhadra- Malnad, Eastern Ghats, South India, Nilambur-Silent Valley and Nilgiri hills.

Habit and Habitat: They inhabit a wide range of grasslands and forest types, including scrub forest, rainforest and semi-cultivated forests, preferring areas that combine grass with low woody plants and trees. They are usually found in thick forests and moist deciduous lush green and semi-green forests.

Breeding Season: Mating occurs year round.

Body length: 2000 to 6000 kg

Weight: 550 to 640 cm

Threats: The greatest threats to *E. maximus* include loss and fragmentation of habitat, humanelephant conflicts, and poaching. Asian elephants are being affected by the loss of their natural habitat due to the expanding human population. Poaching male elephants for their tusks is another major issue affecting *E. maximus*. Since only males have tusks, poaching leads to imbalanced sex ratios, creating a problem with inbreeding since there aren't enough breeding males. The elephants are also hunted for skins and tusks. Poor elephant management in captivity is also a major issue as elephants are chained and kept separately whereas elephants are very social and it affects them very badly.

Conservation Status: *Elephas maximus* is listed as Endangered on the IUCN Red List. The subspecies *Elephas maximus* is endangered. Asian Elephants are included as Endangered on the US Federal list. *Elephas maximus* is listed under Appendix -I in CITES, with the most endangered species. To provide direct protection legally, this species is listed in Sch-I of WPA, 1972.

References:

- Choudhury, A. (2004). Human–elephant conflicts in Northeast India. Human Dimensions of Wildlife, 9(4), 261-270.
- Haynes, G. (1993). Mammoths, Mastodonts, and Elephants: Biology, Behavior and the Fossil Record. Cambridge University Press. ISBN 978-0521456913.
- Elephas maximus, Biodiversity of India. https://www.biodiversityofindia.org.
- *Elephas maximus*, ADW. https://animaldiversity.org.
- WWF https://www.worldwildlife.org/species/asian-elephant.
- Daniel, J. (1998). The Asian Elephant: A Natural History. New Delhi: Natraj Publish.
- Mumby, H., Courtiol A., Mar K., Lummaa V. (2013). Birth seasonality and calf mortality in a large population of Asian elephants. Ecology and Evolution, 3: 3794–3803.

4. Local Name: Leopard Cat

Scientific Name: Prionailurus bengalensis

Taxonomical Classification:

Kingdom: Animalia

Phylum: Chordata

Class: Mammalia

Order: Carnivora

Suborder: Feliformia

Family: Felidae

Subfamily: Felinae

Genus: *Prionailurus*

Species: *P.bengalensis*



General Description of Species:

In India the leopard cat is the most common small cat after the jungle cat from which it can be instantly differentiated apart by its longer leaner appearance and long legs. The coat is brownish buff to ochre and the muzzle has some white in it. Two black streaks are present between the eyes and ears, and two white ones between the nose and eyes. At one glance it looks like a miniature leopard. Unlike leopards, however, this cat does not have rosettes on its buff coat. Instead, it has solid black spots or patches throughout the body which merge into two broad streaks at the shoulders. Its limbs are longer than those of other cats which gives it a graceful appearance. The tail is ringed and has a black tip. The feet are lean and show webbing.

Distribution: Leopard cat is present in Jammu & Kashmir, Uttarakhand, Himachal Pradesh, west of the river Satluj, in the Himalayas and Terai.

Habit and Habitat: Leopard cat is found in grass land, scrub and moist deciduous forests. It lives with ease in a variety of forests and even close to human habitation. Leopard cats are small ambush predators that prefer forested habitat close to water. Although classified as nocturnal, they are occasionally sighted during the day.

Body length: 45-75 cm.

Weight: 3-4 kg

Breeding Season: *Prionailurus bengalensis* can breed yearly depending on environmental

conditions.

Threats: Very little is known on the status of the Asia's most common wild cat species – the leopard cat (*Prionailurus bengalensis*) in India. The much understudied leopard cats face severe threats from habitat loss and fragmentation, as well as commercial exploitation for their skins, as well as for pet trade. Despite protective regulations in many countries, these felines are often trapped or hunted for their striking fur. Farmers and rural residents also occasionally kill them to defend domestic poultry, which are a tempting target for predators living close to human

settlements. Natural leopard cat populations are declining in many areas, but are still considered of least concern in conservation status priority.

Conservation Status: Leopard cats are widespread and abundant throughout their geographic range and are classified as a species of "least concern" on the IUCN's Red List of Threatened Species and it is notified under the Sch-I of WPA, 1972.

References:

- https://rajaji-nationalpark.co.in/fauna-of-rajaji-national-park.html
- ADWhttps://animaldiversity.org/accounts/Prionailurus_bengalensis/
- https://a-z-animals.com/animals/leopard-cat/
- https://www.atree.org/journal-articles/ecology-driving-genetic-variation-comparative-phylogeography-jungle-cat-felis-chaus
- Biodiversity India https://indiabiodiversity.org/species/show/238448.
- Mukherjee, S., A. Krishnan, K. Tamma, C. Home, N. R, S. Joseph, A. Das, U. Ramakrishnan. (2010). Ecology Driving Genetic Variation: A Comparative Phylogeography of Jungle Cat (*Felischaus*) and Leopard Cat (*Prionailurus bengalensis*) in India. PLoS One, 5/10: 1-16

5. Local Name: Indian pangolin

Scientific Name: Manis crassicaudata

Taxonomical Classification:

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Pholidota
Family: Manidae
Genus: Manis

Species: *crassicaudata*



General Description of Species:

Indian pangolin (*Manis crassicaudata*) is one of the eight living species of pangolins of the world. They are toothless mammals with 11–13 rows of large overlapping horny scales, long protrusible tongue, and prehensile tail with a terminal scale on its ventral side. They are solitary, fossorial, nocturnal, and insectivorous. Indian pangolin occurs throughout peninsular India. The Indian pangolin is a poorly known species. Males are typically larger and weigh more than females, but this can be highly variable. *Manis crassicaudata* is a medium-sized mammal, with a streamline elongated body and tailcovered with large overlapping scales rather than fur. Various anatomical adaptations enable it for an exclusive myrmecophagous diet.

Distribution: There are several species of the pangolin distributed throughout the Asian and African countries. In India, distribution of Indian Pangolin is recorded up to 1,540 m elevation. Indian Pangolin is found in different kinds of habitats such as grasslands, rainforest and arid

zones as well. Rajasthan and Gujarat are two states where it is found in the wild arid/semi-arid habitats.

Habit and Habitat: The species is understood to occur in various types of tropical forests as well as open land, grasslands and degraded habitats, including in close proximity to villages. The species can well adapt to modified habitats, provided its ant and termite prey remains abundant. Pangolin has very long and narrow tongue that can come out and go back with a very fast pace and using this, it eats on the eggs, larvae and adults of ants and termites and other small insects.

Body length: 30 to 43cm

Weight: 8 to 17 kg

Breeding Season: November to December

Threats: There are several reasons behind the dwindling population and the foremost is its low offspring producing rate as it produces only a single offspring per year that cannot replenish the loss from poaching as a part of international trade. This species is harvested for local consumption and medicinal purposes by trapping, netting and snaring. Habitat loss and degradation due to expansion of agriculture, alteration of habitat due to plantations, non-timber plantations, and increase in human settlements and construction of dams, forest fires and pest control practices are other causes that do not allow this species to flourish well in wild.

Conservation Status: The Indian Pangolin is categorized as "Endangered" according to IUCN Red List of Threatened Species and listed in Appendix-I of (The Convention on International Trade in Endangered Species of Wild Fauna and Flora). The Indian Pangolin is also a scheduled-I species in WPA, 1972 and completely prohibited for hunting by law and punishable.

References:

- Mohapatra, R. K.; Panda, S. (2013). "Behavioural sampling techniques and activity pattern of Indian Pangolin Manis crassicaudata (Mammalia: Manidae) in captivity". Journal of Threatened Taxa.5 (17): 5247–5255.
- Mohapatra, R. K.; Panda, S. (2), (2014) "Husbandry, behaviour and conservation breeding of Indian pangolin," Folia Zoologica 63.
- Latafat, K.; Sadhu, A. (2016). "First Photographic Evidence of Indian Pangolin (Manis crassicaudata, E. Geoffroy, 1803) in Mukundara Hills Tiger Reserve (MHTR), Rajasthan, India". Journal of the Bombay Natural History Society.113 (21–22).
- WWFhttps://www.wwfindia.org/about wwf/priority species/threatened species/indian pangolin/
- https://animaldiversity.org/accounts/Manis-crassicaudata/
- https://www.sciencedirect.com/science/article/pii/B9780128155073000058

(B) Bird

1. Local Name: Indian Peafowl Scientific Name: *Pavo cristatus*

Taxonomical Classification:

Kingdom: Animalia

Phylum: Chordata

Class: Aves

Order: Galliformes

Family: Phasianidae

Genus: Pavo

Species: *P. cristatus*



General Description of Indian Peafowl:

The Indian Peafowl (*Pavo cristatus*) is a resident breeder in the Indian subcontinent. The bird was justifiably declared as the national bird of India in year 1963 due to its flagship value founded on its glorious position in mythology and its widespread distribution in the country. The species is found in dry semi-desert grasslands, scruband deciduous forests.

Peafowl uses agriculture and various rural habitats as a feeding ground during day time while during night time they take shelter on the trees as well as on the roof of the houses. It clearly indicates peafowl normally uses ecosystem or habitats adjacent to village.

It forages and nests on the ground but roosts on top of trees. It eats seeds, insects, fruits, small mammals and reptiles. The Indian Peafowl is a ground nesting bird and it lays a clutch of 4-8 eggs which take 28 days to hatch. The eggs are light brown and are laid every other day usually in the afternoon. The male does not assist with the rearing, and is polygamous.

Distribution: The Indian peafowl is a resident breeder across the Indian subcontinent and is found in the drier lowland areas of Sri Lanka. It is found in moist and dry-deciduous forests, but can adapt to live in cultivated regions and around human habitations and is usually found where water is available.

Body length: 180-230 cm **Weight:** 2750-6000 gm

Breeding Season: Mostly breed in rainy season from April to August.

Threats: There is no major or direct threat to the peafowl in India. These species are commonly found in the field of central India. These species are facing problems due to habitat loss, specially the shortage of tall trees in and around the villages for roosting and for shade during hot summer month and shortage of drinking water during the hot summer days.

Conservation Status: Peafowl is the National Bird of India. In India, it is notified under the Sch-I of WPA, 1972 which protects these birds from killing and illegal trade. Now this bird is considered flourishing well.

References:

- Bird Life International (2012). *Pavo cristatus* .https:// india biodiversity.org/species/show/238924
- IUCN Red List of Threatened Species. Version (2013). International Union for Conservation of Nature.
- Petrie M, Krupa A, Burke T (1999). <u>Peacocks lek with relatives even in the absence of social and environmental cues</u>. *Nature*. 401 (6749): 155–157. <u>Bibcode</u>, <u>Natur.401.155P</u>. <u>doi:10.1038/43651</u>.
- Pavo cristatus, ADW. https://animaldiversity.org/accounts/
- IndianPeafowl, RedList. https://www.iucnredlist.org/species/22679435/92814454.

10.14 Conservation and Protection Measures

A total of 6 Schedule-I species is reported from the study area. As per the description and status of these species, there are common threats to these species of which important ones are habitat loss, particularly the removal of the full grown trees, illegal hunting and less awareness towards the conservation and importance of the endangered species.

Following recommendations are suggested for their conservation and protection:

- Identification of green pockets with the presence of *Elephas maximus* (Asian Elephant), *Panthera pardus* (Indian Leopard), *Panthera tigris tigris* (Bengal Tiger), *Manis crassicaudata* (Indian Pangolin), *Prionailurus bengalensis* (Leopard Cat) and *Pavo cristatus* (Indian Peafowl). Such patches must be demarcated and protected from any kind of disturbance. Moreover, the greenery in these patches must be enhanced by plantation of the native wild trees and shrubs. This will provide the enhance shelter and prey availability to the concerned species.
- Tree groves in surrounding villages along with barren lands or degraded forest patches in the buffer zone may be improved with plantation work. Local species of trees and shrubs are recommended for this purpose. These small green patches provide shelter and habitat for all kind of wild birds, reptiles, amphibians, butterflies and mammals.
- Creation of water pits and renovation of existing water bodies in the study area for wild animals.
- > The mining area shall be strictly done only in the areas where mine activities are permitted. The boundary of the leased area will be marked prior to start of work at the site.
- Awareness program among the local people to make them understand the importance of wildlife and not to perform any poaching or killing of animals. People must be educated to protect plants and animals. Villagers should be made aware regarding protection of the endangered species.
- ➤ Celebration of 'Wildlife Week', 'Van Mahotsav' and 'Environment Day' etc. must be popularized and organized with various public participation activities.
- ➤ People must be educated and made aware that speed of the vehicles must be in limit to avoid accidents/killing while passing such roads where wild animals usually cross sides.
- ➤ The people living in the surrounding area and employee of the company would be motivated towards the protection of the animals. The concerned authorities must be

informed immediately if any illegal poaching, illegal trade or human- wild life conflict in the area is noticed. Local trackers and wildlife guards should be appointed for this purpose.

- Project activities must not be carried out in night time as animals are sensitive to noise and lights. Measures for the dustsuppression and noise control should also be practiced to avoid disturbance to the wild life. Honking in the project area and internal roads should be restricted.
- No workers camps shall be established within the surrounding forest area or the Wildlife Sanctuary. This shall be instructed to the workers and staff in advance.
- ➤ No resources (*i.e.* fuel wood, stones, sand, soil etc.) from the Rajaji Tiger Reserve, its surrounding forest area and its eco-sensitive zone shall be extracted or collected by staff or workers. This shall be instructed to the workers and staff in advance.
- ➤ The project authorities can complement Forest protection activities by including a forest watch duties in the code of conduct of the project employees and more specifically in the security men of the mines to also keep watch over any wildlife offences \ illicit felling \ illicit removal of forest produce \ animals in distress \ forest fires etc.
- No workers or staff members shall be involved in poaching or killing of any wild animals throughout the project life cycle. This shall be instructed to the workers and staff in advance and sign boards to this effect within project area should be displayed.
- > The natural existing Water holes should not be used for project activities. UKFDC should create and maintain additional water holes for wild animals and avian fauna. The ponds in the study area should be cleaned, repaired and filled periodically.
- ➤ UKFDC shall support forest department in raising wildlife conservation awareness in the study area through organizing nature awareness camps in surrounding villages.
- ➤ Local forest department should be actively involved in Wildlife Conservation and protection activities.

10.15 Estimated Budget

The estimated budget for wildlife protection and conservation plan is given in the Table 10.6. However, the plan including budget should be finalized and implemented in consultation with Forest Department.

Table 10.6: Budget Estimate for Wildlife Conservation Plan

S. No.	Activities	Capital Cost in lakh (Rs)	Recurring Cost in lakh (Rs)
1.	Plantation and extensive forestation in green pockets with the presence of Schedule-I species Capital cost @Rs. 60/ plant (The budget includes cost of digging of pits, fertilizers, saplings) for 5000 trees.	0.30	0.03
2.	Creation of five water pits of 6*6*1/2 m, renovation of water bodies/ponds in the study area	3.0	1
3.	Awareness program in the neighboring villages for protection & conservation of the wildlife	1.5	1
	Total	4.80	2.03

CHAPTER-11: SUMMARY & CONCLUSION

11.1 GENERAL

The chapter discuses about the summary of whole EIA/EMP report along with recommendation and conclusion. The proposed mining lease area falls in Survey of India Toposheet (OSM) No. 53J/4. The lease area is located in Village- Majri Grant, Tehsil & District- Dehradun, State-Uttarakhand.

Table 11.1 Details of the Project

S. No.	Particulars	Details			
A.	Nature and Size of the	Mining of Minor Minerals (Sand, Bajri and			
	Project	Boulders) from the riverbed of River Jakha		f River Jakhan-2 by	
		M/s Uttarakhand Forest Developmen			
		Corporation, located in Dehradun Fores			
		Division, District Dehradun, Uttarakhand over an			
		area of 96.50 ha with Production Capacity of			
		2866050	.00 TPA.		
B.	Location	I -	T		
Geographical	Latitude and Longitude	Pillar	Latitudes	Longitudes	
Coordinates	of	No.			
		S. No	Lat	Long	
		A	30°10'53.91" N	78°11'32.03" E	
		В	30°10'50.36" N	78°11'37.87" E	
		С	30°10'32.99" N	78°11'09.04" E	
		D	30°10'24.86" N	78°10'47.51" E	
		Е	30°10'11.19" N	78°10'19.44" E	
		F	30°10'07.55" N	78°10'15.64" E	
		G	30°09'42.73" N	78°10'04.71" E	
		Н	30°09'15.14" N	78°10'00.41" E	
		I	30°08'47.09" N	78°09'56.21" E	
		J	30°08'52.56" N	78°09'46.82" E	
		K	30°09'16.28" N	78°09'54.78" E	
		L	30°09'45.33" N	78°09'58.96" E	
		M	30°10'11.12" N	78°10'11.06" E	
		N	30°10'16.18" N	78°10'13.48" E	
		0	30°10'32.63" N	78°10'43.35" E	
		P	30°10'39.79" N	78°11'05.62" E	
	Toposheet (OSM) No.	53 J/4			
C.	Lease Area Details				
	Lease Area	96.50 ha			
	Topography		d (Riverbed)		
	Site Elevation Range	464.6m amsl to 550.0m amsl (Source: Mining Plan)			
D.	Cost Details				
	Cost of the project	Rs. 5.15 Crores			
	Cost for EMP	Rs. 37.10 Lakhs/Yr (Capital Cost) Rs. 12.23 Lakhs/Yr (Recurring Cost)			

	OH&S	Rs. 3.00 Lakh/Yr (Capital Cost)	
	ones	Rs 2.00 Lakhs/Yr (Recurring Cost)	
	Cost For Biodiversity	Rs. 4.8 Lakhs (Capital Cost)	
	Conservation	Rs. 2.03 Lakhs (Recurring Cost)	
E.	Environmental Settings of		
	Ecological Sensitive Areas (National Park, Wild Life Sanctuary, Biosphere Reserve, Reserve/ Protected Forest etc.) within 10 Km radius	 Rajaji Tiger Reserve~5.40 Km, SW Lachhiwala Range Reserve Forest~5.1 Km, NW Barkot Range Reserve Forest~1.4 Km, ES Rishikesh Reserve Forest~3.7 Km, N 	
	Inter-state boundary within 5 Km radius	None	
	Nearest Town/ Major City	Dehradun~17.46 Km, N	
	Nearest Railway Station	Doiwala Railway Station~4.6 Km, W	
	Nearest State Highway/ National Highway	NH 7 Haridwar Dehradun Road ~2.27 km, W	
	Nearest Airport	Jolly Grant Airport ~1.8 km, N (Aerial distance)	
	Nearest Post Office	India Post Office Ranipokhri~4.12 Km, N	
	Nearest Police Station	Jolly Grant Police Station~1.18 kms in NNW	
	Medical Facilities	Himalayan Hospital~2.46 Km, N	
	Education Facilities	Swami Rama Himalayan University~ 2.4 Km, N CNS High School~0.73Km, N	
	Seismic Zone	Zone-IV (As per 1893:2002)	
	Water Body	Song River ~ 3.6 kms in W Chandrabhaga River ~ 8.4 kms in E	

11.2 INTRODUCTION

As per MoEF, New Delhi Gazette dated 14th September 2006 and amended thereof, the proposed mining project is categorized as category 'A', The project involves extraction of Sand, Bajri and Boulder from River bed of Jakhan-2 river of Village- Majri Grant, Tehsil & District-Dehradun, State-Uttarakhand. The letter of intent (LoI) has been issued by the Director of Mines & Geology department, Uttarakhand vide No 536/खनन/ आशय पत्र / ব৹বি৹নি০/ भू० खनि० ई º/2018-19 dated 24/07/2018 in favour of M/s Uttarakhand Forest Development Corporation, for mining of Sand, Bajri and Boulder (Copy of LOI has been enclosed as Annexure-III).

11.3 PROJECT DESCRIPTION

The proposed project is for mining of Sand, Bajri and Boulder (Minor Mineral) by open manual method in riverbed over an area of 96.50 Ha. with proposed production capacity of 2866050 TPA. The total geological reserve is 5730420.42 TPA and total mineable reserve is 3184500.00 TPA. Ultimate depth of a bench will be 3.0 m. Riverbed block will be further replenished during rainy season. Minerals will be transported by trucks. It is widely used in construction, buildings, bridge, roads and other infrastructure. It is free from clay and is non-sticky in nature. Total

water requirement for the project is 35.7 KLD. Total manpower requirement for the project is 410 numbers. The site facilities like canteen, rest-shelter, first aid facility, water and electricity supply etc. will be provided as per requirement. There is no litigation pending against this project.

11.4 DESCRIPTION OF THE ENVIRONMENT

Environmental data has been collected in relation to proposed mining for Air, Noise, Water, Soil, Ecology and Biodiversity. The generation of primary data as well as collection of secondary data and information from the site and surroundings was carried out during post monsoon season i.e. . **December 2019 to February 2020.**

The EIA study is being done for the Mine Lease (core zone) and area within 10 Km distance from mine lease boundary (buffer zone), both of which together comprise the study area.

Table 11-2: Baseline Status

Attribute	Baseline Status		
1. Ambient Air Quality	Ambient Air quality Monitoring was carried out in total 8 locations and the maximum value for PM_{10} is observed as 69 $\mu g/m^3$ at mine site and minimum value of 39 $\mu g/m^3$ at Doiwala.		
	Ambient Air Quality Monitoring was carried out in total 8 locations and the maximum value for $PM_{2.5}$ is observed as 38 $\mu g/m^3$ at mine site and minimum value of 21 $\mu g/m^3$ observed at Chidderwala		
	Ambient Air Quality Monitoring was carried out in total 8 locations and the maximum value for SO_2 is observed as 15 $\mu g/m^3$ at Lal Tappad & Narendra Nagar and minimum value 5 $\mu g/m^3$ is observed at Thano,		
	Ambient Air Quality Monitoring was carried out in total 8 locations and the maximum value for NO_2 is observed as 30 $\mu g/m^3$ at Doiwala and the minimum value of 14 $\mu g/m^3$ is observed at Jolly Grant.		
2. Noise Levels	Noise Monitoring was carried out in total 8 locations and the noise levels recorded during the day time were from 46.7 Leq dB to 58.6 Leq dB respectively and level of noise during night time were from 37.5 Leq dB to 43.8 Leq dB respectively.		
3. Water Quality	Analyses of Ground water and Surface water was taken in the Post Monsoon Season December 2019 to February 2020.		
	Ground Water- Ground water monitoring was carried out in total 6 locations.		
	 The value of pH varies from to 7.11 to 7.56 Total Hardness varies from 167 to 282 mg/L. Total Dissolved Solids varies from 261 to 375 mg/L. Fluoride varies from 0.56 to 0.72 mg/L Chloride varies from 58.0 to 96.0 mg/L Surface Water - Surface Monitoring was carried out in 2 		

	 pH varies from to 7.33 to 7.48 Total Hardness varies from 102 to 118 mg/L. Total Dissolved Solids varies from 192.0 to 212.0 mg/L. Fluoride varies from 0.31 to 0.63 mg/L Chloride varies from 36.0 to 54.0 mg/L COD varies from 18.0 to 54 mg/L BOD varies from <4.0 to 8 mg/L
4. Soil Quality	 Soil Monitoring was carried out in total 8 locations. The value of pH ranges from 7.14-7.63. Chidderwala village shows maximum conductivity of 384 µmhos/cm, Thano village shows minimum conductivity of 315 µmhos/cm. Magnesium values ranges from 2.48 meq/100g as lowest at Anthoorwala and Narendra Nagar and 3.41 meq/100g as highest at Mine Site. The average concentration of Nitrogen, Phosphorus and Potassium in the soil samples varies from 9.4 to 11.3 mg/100gm, 0.41 to 0.72 mg/100gm and 4.2 to 5.2 mg/100gm

11.4.1 Socio Economic Environment

Socio-Economic Impact Assessment (SEIA) refers to systematic analysis of various social and economic characteristics of human being living in a given geographical area (study area/impact area). The prime objective of SEIA is to identify and evaluate potential socio-economic and cultural impacts of a proposed development project on the lives & conditions of people, their families and communities.

The demographic profile of the study area is given below:-

S. No.	Description	Number	Percentage to Respective Total
1	Total Population	142288	100
	Male	74081	52.1
	Female	68207	47.9
	Sex Ratio	920	
	Population (0-6) Age Group	17575	100
2	Male	9410	53.5
	Female	8165	46.5
	Sex Ratio	867	
	Population- Scheduled Caste	15222	100
3	Male	8020	52.7
	Female	7202	47.3
	Sex Ratio	898	
	Population- Scheduled Tribe	1790	100
4	Male	946	52.8
	Female	844	47.2

	Sex Ratio	892	
	Total Literates	104315	100
5	Male	58484	56.1
	Female	45831	43.9
	Gender Gap in Literates	12.2	
6	Overall Literacy Rate	83.6	
	Male	90.4	
	Female	76.3	
	Gender Gap in Literacy Rate	14.1	
	Total Workers	51193	100
	Male	37803	73.8
7	Female	13390	26.2
	Gender Gap in Work	47.6	
	Participation	20=04	1400
	Main Workers	38784	100
0	Male	30591	78.9
8	Female	8193	21.1
	Gender Gap in Work Participation	57.8	
	Marginal Workers	12409	100
	Male	7212	58.1
9	Female	5197	41.9
	Gender Gap in Work Participation	16.2	11.7
	Household Industrial Workers	1757	100
10	Male	1181	67.2
	Female	576	32.8
	Total Agricultural Workers	9533	100
11	Male	6875	72.1
	Female	2658	27.9
	Cultivators	6982	100
12	Male	4765	68.2
12	Female	2217	31.8
	Agricultural Labour	2551	100
13	Male	2110	82.7
	Female	441	17.3
	Other Workers	27494	100
14	Male	22535	82.0
	Female	4959	18.0
	1 Ciliaic	TJJJ	10.0

11.4.2 Biological Environment

The study area falls in the Forest land. The list of total number of different plant species (trees, shrubs, herbs and climbers) has been prepared based on the site observations and along with consultation with local peoples. The most common floral species are *Bombax ceiba, Lannea coromandelica, Mallotus philippensis, Dalbergia sissoo, Aegle marmelos, Melia azadirachta, Tectona grandis, Shorea robusta, Trewia nudiflora, Adhatoda vasica, Boehmeria macrophylla,*

Callicarpa macrophylla, Carissa carandas, Cassia occidentalis, Commelina benghalensis, Jasminum pubescens, Lantana camara, Solanum torvum, Urtica dioica etc. Whereas common herbs are Achyranthes aspera, Ageratum conyzoides, Artemisia nilagirica, Chenopodium album, Euphorbia hirta, Justicia procumbens, Oxalis corniculata, Rauvolfia sp. Sida cordifolia, and Xanthium strumarium etc.

There are no Rare or Critically Endangered and Threatened plant species in the study area as per IUCN category. The floral species found in the study area are common and wide spread occurrence.

Various kinds of birds are found flying across the project area. There are no species- specific major nesting sites near the project site. The site is also not known for any migratory bird halt. Snakes such as **Cobra** (*Naja naja*) and Common **green whip snakes** (*Hierophis viridiflavus*) have been spotted in the study area.

Amphibians such as **Cascades frog** (*Rana cascadae*), **Common Asian Toad** (*Duttaphrynus melanostictus*) are more frequent along the river during the peak season. Small fish species are found in the river.

Around 102 faunal species are reported from this area (24 mammals, 51 birds, 9 reptilians, 8 amphibians and 10 butterflies species). The major animals reported from surrounding forest areas include Elephant (*Elephas maximus*), **Leopard** (*Panthera pardus*), **Leopard Cat** (*Prionailurus bengalensis*), Bengal Tiger (*Panthera tigris tigris*), **Indian Pangolin** (*Manis crassicaudata*) and **Indian Peafowl** (*Pavo critatus*) some of which are endangered and accorded protection under the Wildlife Protection Act, 1972. All the listed species were compared with IUCN Red Data Book and Indian Wildlife Protection Act, 1972.

11.5 ANTICIPATED ENVIRONMENT IMPACT AND MITIGATION MEASURES

11.5.1 AIR ENVIRONMENT

The air quality in the mining area depends upon the nature and concentration of emissions and meteorological conditions.

11.5.2 Anticipated Impact

- Mining Operation carried out by opencast manual method generates dust particles due to various activities like loading & unloading of sand and transportation.
- The impact on ambient air quality in the area surrounding the mining area depends upon the pollutant emission rate and prevailing meteorological conditions. As it is an open cast mine, particulate Matter (dust) of various sizes is the only pollutant of any significance.

11.5.3 Mitigation measures

- The speed of trucks on haul road will be controlled as increased speed increases dust emissions. Overloading of transport vehicles will be avoided.
- Proper mitigation measures like water sprinkling will be adopted to control dust emissions.
- Masks will be provided to workers.
- To control the emissions, regular preventive maintenance of equipment will be carried out on contractual basis.
- Green belt of adequate width will be developed.

11.6 NOISE ENVIRONMENT

The area in general represents calm surroundings. There is no heavy traffic, industry or noisy habitation in the area except the mine lease. As the project is proposed for open cast manual mining method, there will be no blasting or drilling activities.

11.6.1 Anticipated Impact

- The source of Noise pollution will be the vehicular movements.
- Noise generated by manual extraction of river bed material, using shovels, crowbars etc.,
 will be negligible.

11.6.2 Mitigation Measures

- Proper maintenance of all transportation vehicles will be carried out which help in reducing noise during operations. No other equipment except the transportation vehicles will be allowed.
- Noise generated by hand equipment will be negligible and will not cause detectable adverse impact.
- Awareness will be imparted to the workers about the permissible noise levels and maximum exposure to those levels.

11.7 WATER ENVIRONMENT

The impact of mining project on groundwater hydrology and surface water regime are site specific and depends upon the characteristics of the mineral, hydrogeology and requirement of groundwater for other uses.

11.7.1 Anticipated Impacts

- The Mining in the riverbed area may cause the groundwater contamination due to the intersection of the water table.
- Waste water disposed from the mining activity may contaminate the surface water.
- River recharges the ground water; excessive mining may reduce the thickness of natural filter materials (sediments), through which the ground water is recharged.

11.7.2 Mitigation Measures

- Mining will be done above the water table as well as river bed water level therefore much impact on water regime is not accepted.
- Proper analysis/Monitoring will be done to check the ground water.

11.8 LAND ENVIRONMENT

Impact assessment study on land environment will be done by considering land use pattern/land cover, topography, drainage pattern and geological features of the mine site as well as the study area.

11.8.1 Anticipated Impact

- Mining activity will impact river bed topography by formation of excavation voids.
- River bed mining may bring in some change in topography at the nearby area of the mine lease
- Stacks of solid waste generated from mining activity may hinder the flow of water in monsoon season.

11.8.2 Mitigation Measures

Adopting suitable, site specific mitigation measures can reduce the degree of impact of mining on land. Some of the land-related mitigation measures are as follows:-

- Excavated pits will get replenished annually in monsoon itself & will be restored to original
- Mineral will be mined after leaving the 25% width as a safety zone on both sides of the riverbed.

11.9 SOCIO ECONOMIC

11.9.1 Anticipated Impact

- Impact on the Demographic Composition
- Impact on Employment Opportunities

11.10 Solid Waste

11.10.1 Anticipated Impact

- As there is practically no soil cover observed in the river bed, this RBM project does not involve any waste generation. Thus, no waste dump sites are needed for the project. However, there will be 410 workers on site.
- No municipal waste other than domestic sewage shall be generated.

11.10.2 Mitigation Measures

- Only clayey soil generated during mining process which will be used for the plantation.
- Domestic sewage will be disposed off into septic tanks followed by soak pits.

11.11 TRAFFIC ENVIRONMENT

11.11.1 Anticipated Impact

- The increase in traffic density will lead to the air pollution and it will cause the effect on human health like damage to lung tissue, cancer, asthma etc.
- The movement of vehicles cause the noise pollution.

11.11.2 Mitigation Measures

- Vehicles with PUC certificate will be hired.
- Regular maintenance of vehicles will be compelled to ensure smooth running of vehicles.
- Regular health checkup camps will be organised for the safety purpose of the workers.
- Unnecessary blowing of horn will be avoided.

11.12 Analysis of alternatives

No alternative site had been considered since proposed project is in existing sand, bajri & boulder mine and hence it is site specific.

11.13 ENVIRONMENT MONITORING PROGRAMME

UKFDC has formulated well laid-out Environmental Policy, wherein preservation of environment has been accorded a most strategic and prime position. The various protocol procedures in connection with communication channels upwards and downwards for dealing with violations or departures in environmental standards involvement of Board of Directors as well as shareholders about such incidences, etc, have been described in detail in chapter VI.

Regular monitoring of environmental parameters of immense importance to assess the status of environment during project operation. With the knowledge of baseline conditions, the monitoring programme will serve as an indicator for any deterioration in environmental conditions due to operations of the project, which will enable to take suitable mitigation steps in time to safeguard the environment.

11.14 ADDITIONAL STUDIES

The possible risks in the case of river bed mining project are bank erosions, floods, accidents due to the transport etc. At present, the mining is proposed in a mild sloping forest land in river beds. Pits will be created of limited depth 3.0 m from first to fifth year or river water levels whichever less, thus the chance of failure of pit slope not seems to be appeared,

11.15 PROJECT BENEFIT

The proposed project brings overall improvement in the locality, neighbourhood and the state by bringing employment generation at local level and revenue to state government. Hence it will be helpful for the economic growth and support to enhance quality of life through employment.

11.16 ENVIRONMENTAL COST BENEFIT ANALYSIS

It is considered desirable that the mining project may be implemented. Project cost for the proposed Mining project having area of 96.50 Ha. falling in Village-Majri Grant, Tehsil & District-Dehradun, Uttarakhand is Rs. 5.15 Crores.

11.17 ENVIRONMENTAL MANAGEMENT PLAN

As per above discussion, there is no major impact on the environment due to mining except fugitive emission in the form of dust generated during handling of mineral. The adequate preventive measures will be adopted to contain the various pollutants within permissible limits. Plantation development will be carried out along the approach roads, around Govt. buildings etc. It will prove an effective pollution mitigation technique and help avoid soil erosion during monsoon season. Employment opportunities will be provided to the locals only as providing extraction of minerals from the mine site is the only prevailing occupation for them for their livelihood. A budget of Rs. 3.00 Lakhs (Capital Cost) & Rs.2.00 Lakhs (Recurring Cost) for Occupational Health and Safety and budget of Rs. 37.20 Lakhs (Capital Cost) & Rs.12.24 Lakh (Recurring Cost) under EMP head are incurred by Project Proponent.

11.18 CONCLUSION

The proposed project will provide the employment to local people in different activities such as mining, transportation and plantation activities. The project activity will not have any major impact on the environment. At post mining stage of proposed project, the existing land use will remain same i.e. riverbed, and it will get replenished yearly during monsoon season. Also the extracted sand, Bajri and Boulder will be used in construction activities like building, infrastructure facilities.

The Corporate Social Responsibility initiatives will have a positive impact on socio economic environment of the region.

CHAPTER-12: DISCLOSURE OF CONSULTANT ENGAGED

12.1 INTRODUCTION OF ORGANIZATION

Mantec Consultants Pvt. Ltd., established in 1979, is a multi-disciplinary consulting firm offering infrastructural, environmental, management, technical and IT services.

Our team consists of technical and management experts coming from the top echelons of various professional services. The in-house capabilities are augmented and strengthened by our panel of associates who are well known experts in their respective fields.

We provide a complete range of environmental and social impact assessment services with an expert In-house team of professionals and associates. Mantec is an ISO 9001:2015 & OHSAS certified company, having a full-fledged Environmental Laboratory duly recognized by the Ministry of Environment Forest & Climate Change (MoEF&CC) and accredited by NABL (National Accreditation Board for Testing Calibration Laboratory). We are accredited by NABET/QCI for conducting the EIA studies.

Commitment to excellence has been the company's credo since the day of its inception and forms the central emphasis in all our operations.

12.2 SERVICES OFFERED

We Mantec is providing various environmental services in more than 15 industries/sectors including infrastructure, mining, irrigation, river valley projects, power plants, refineries, ports, airports, highways, residential colonies, hazardous waste sites, forestry and rural development projects etc.

- 1. Environmental Impact Assessment Studies
- **2.** Environment Management Plans
- 3. Social Impact Assessment Studies
- 4. Rehabilitation and Resettlement Studies and Resettlement Action Plans
- 5. Safety Audits & Environmental Audits
- **6.** Risk Analysis and Disaster Management Plans
- 7. Environmental Monitoring of Air, Water, Noise, Soil, Solid and Wastes
- **8.** Environmental Monitoring of Industrial emissions, industrial effluents, ambient air etc.
- 9. Waste Water Management Both domestic (sewage) and industrial
- **10.** Ground & Surface Water Treatment and Supply
- **11.** Design and implementation of Wastewater Treatment Plants as well as Common Effluent Treatment Plants
- 12. Studies on River, Lake and Forest ecosystems
- 13. Watershed and Waste land management
- 14. Solid Waste Management including Hazardous and Biomedical Waste Management
- 15. Oil Spill Response
- 16. Rehabilitation of Mines
- 17. Remote sensing and GIS survey

12.3 LABORATORY FACILITIES AND EQUIPMENTS

Mantec Environmental Laboratory (Recognized by MoEF&CC and Accredited by NABL)

Monitoring & Analytical Capabilities for;

- Ambient Air
- Stack Gas emissions
- Process and work zone
- Indoor Air
- Volatile organic compounds (VOC's)
- PAH's in Ambient Air
- Hydrocarbon in Ambient Air and Stack
- Heavy metals in Ambient Air, water, Soil
- Ultimate and proximate analysis. (C.H.N.S.O)
- Air Modeling
- Drinking Water, Raw Water and Process Water Analysis
- ETP and STP Water Analysis
- Soil, Sludge and Hazardous Waste Analysis

Lab Equipments

- Dust Samplers and PM_{2.5} Sampler
- Stack Monitoring Kit
- Organic Vapor Sampler
- Non Dispersive Infrared Spectrophotometer (NDIR)
- Atomic Absorption Spectrophotometer
- Gas Chromatograph
- UV Spectrophotometer
- Flame Photometer
- Mercury Analyser
- COD Digester
- Micro meteorological Station
- ICP OES
- ORSAT
- CO Analyzer
- Bacteriological Chamber
- Digital Ultrasonic
- Multigas Analyzer

12.4 ADDRESS & CONTACTS

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E-Mail: envmantec@yahoo.co.in

Environment Division,

D-36, Sector-VI, Noida-210 301

Email: mantec@vsnl.com,

Ph: 0120 - 4215804, 4215000, Fax: 0120 - 4215809

12.5 ESTEEMED CLIENTELE

- 1. BHARAT HEAVY ELECTRICALS LIMITED
- 2. BHARAT ELECTRONICS LIMITED
- 3. FCI ARAVALI GYPSUM AND MINERALS INDIA LIMITED
- **4.** HINDUSTAN PETROLEUM CORPORATION LIMITED
- 5. INDIAN OIL CORPORATION LIMITED
- **6.** NTPC LIMITED

- 7. NATIONAL HYDROELECTRIC POWER CORPORATION
- **8.** INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION
- **9.** ISHIKA FERTILIZER LIMITED
- 10. JAI PRAKASH ASSOCIATES
- **11.** JUBILANT AGRI AND CONSUMERS PVT. LTD.
- 12. TATA CHEMICALS LIMITED

- 13. NATIONAL HIGHWAY AUTHORITY OF INDIA
- 14. NATIONAL FERTILIZERS LIMITED
- **15.** PUNJAB ALKALIES AND CHEMICALS LTD.
- **16.** RAJASTHAN STATE MINES AND MINERALS INDIA LIMITED
- 17. MYSORE MINERALS LIMITED
- 18. KANDLA PORT TRUST
- 19. KARNATAKA POWER CORPORATION LIMITED
- **20.** KUMAON MANDAL VIKAS NIGAM LIMITED
- **21.** SAURASHTRA CHEMICALS LIMITED. GUIARAT
- 22. UTTARAKHAND FOREST DEVELOPMENT CORPORATION
- 23. SUMAN ENTERPRISES
- 24. JAI YAMUNA JI DEVELOPERS
- 25. MARKANDESHWAR CONSTRUCTION COMPANY
- **26.** M.P. STATE MINING CORPORATION LTD.
- 27. JINDAL MECTEC PVT. LTD.
- 28. HARYANA MINING CO.
- 29. ELDECO INFRASTRUCTURE
- **30.** ANSAL PROPERTY & INFRASTRUCTURE
- **31.** DELHI STATE INDUSTRIAL AND INFRASTRUCTURE DEVELOPMENT CORPORATION (DSIIDC)
- 32. EXOTICA HOUSING LTD.
- 33. LOUIS BERGER GROUP
- 34. AMBUJA CEMENT
- 35. WAPCOS LTD.
- **36.** INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION
- **37.** IL&FS TRANSPORTATION NETWORK LTD.
- 38. THDC INDIA LTD.
- **39.** MADHYA PRADESH ROAD DEVELOPMENT CORPORATION
- **40. VEDANTA RESOURCES**
- **41.** RAVI TAWI IRRIGATION COMPLEX, GOVT. OF J&K
- **42.** INSTITUTE OF CHEMICAL TECHNOLOGY
- 43. JHARKHAND ISPAT PVT LTD
- **44.** KARNATAKA VETERINARY ANIMAL AND FISHERIES SCIENCES UNIVERSITY
- 45. ESSAR STEEL INDIA LTD.
- **46. WELCOME FOOTWEAR**

- 47. COIM INDIA PVT. LTD.
- **48.** HARYANA STATE ROADS AND BRIDGES DEVELOPMENT CORPORATION LIMITED
- 49. ULTRATECH CEMENT LTD.
- **50.** AXISCADES ENGINEERING TECHNOLOGIES LTD.
- **51.** INVESTIGATION DESIGN & RESEARCH BOARD (IDRB), KERALA
- **52.** WATER RESOURCE DEPARTMENT, RAJASTHAN
- **53.** BHARAT PETROLEUM CORPORATION LIMITED
- **54.** ADOR FONTECH LTD.
- **55.** PUBLIC WORKS DEPARTMENT DELHI
- **56.** THE INDIAN EXPRESS
- **57.** WATER RESOURCES DEPARTMENT, GOVT. OF JHARKHAND
- 58. SUN PETRO CHEMICALS PVT.LTD.
- **59.** TANCEM
- **60.** FCI ARAVALI
- 61. SATLUJ JAL VIDYUT NIGAM (SJVN)

12.6 OUR CRENDENTIALS



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26.02.2018

25.02.2023

26.02.2018

25.02.2023

