Greenko Energies Private Limited
CIN: U40109TG2000FTC034990

GEPL/MoEFCC/EDS/SPSP/231215 **Dated 15.12.2023**

To

Deputy Conservator of Forests
Baran Territorial Forest Division
Rajasthan

Sub: Diversion of 407.8227 Ha forest land for the development of Shahpur (1800 MW) Pumped Storage Project by M/s Greenko Energies Private Limited (GEPL) in Baran Territorial Forest Division, Baran District of Rajasthan State (Online Proposal No. FP/RJ/HYD/121439/2021)-reg

Ref: 1. MoEF & CC EDS letter dated 17.10.2023.
2. Your Office Letter dated 22-11-2023

Dear Sir,

With reference to above mentioned subject matter, as directed vide ref (2), reply to the observations of MOEF & CC EDS letter dated 17.10.2023 is herewith submitted for your kind consideration and further necessary action.

Thanking you,
Yours faithfully,

For **Greenko Energies Pvt. Ltd.**

Authorized Signatory

Encl: As above

Reply to EDS (Addl Details) Sought by MoEF & CC vide letter dated 17-10-2023

S.No	Condition	Reply
i	The CAT Plan for the total catchment area of both the reservoir of 6.48 Sq.Km and Wildlife Conservation Plan for Schedule-I species have been prepared towards instant proposal by R S Envirolink Technologies Pvt. Ltd. But it is not clear whether these plans have been approved by the competent authority as per prescribed guidelines or not. Therefore, this needs to be clarified and copy of approval of the competent authority needs to be submitted.	• MoEF&CC/EAC (IA division), while granting ToR vide letter dated 13.04.2020 (Copy enclosed at **Annexure-1)** has *inter-alia* observed that instant project being the Pump storage project and standalone in nature and upper reservoir is located away from the existing natural water systems and have no/negligible catchment area. Therefore **CAT Plan**, RIM treatment, L-section of river and Environmental flow study will not be required. • However, for an area of about 6.48 Sq. Km, Soil Erosion Treatment Plan was prepared as a precautionary reclamation measure in consultation with DFO, Baran for control of soil erosion, if required. This plan was duly approved by the State Govt. (Copy of Soil Erosion Treatment Plan is enclosed at **Annexure-2**).
ii	Satellite imagery of the proposed diversion shows that the plantation work was carried out in the past at the Segment-7 (3.82 ha.) and there is presence of Agriculture land in the forest area proposed for diversion. The same needs clarification.	• M/s Greenko Energies Private Limited hereby affirm and undertake to bear the cost of plantation, if any incurred by the Dept, which comes under proposed forest land to be diverted. Necessary undertaking in this regard is enclosed at **Annexure-3.** • Regarding presence of Agriculture land in the forest area proposed for diversion, DCF, Baran/State Govt to reply.
iii	Satellite imagery of proposed CA area over Non-forest land of Ekalpar and Kolu Tala villages in patch No 12 & 16 under Jaisalmer District shows the presence of settlements. Also, Satellite imagery of the RDF patches for CA under Baran district are showing the encroachment for Agriculture land having few built-up areas as well. The State Govt. shall ensure that the area proposed for CA is free from all encumbrances.	• It is submitted that the Non-forest land (Pvt Land) proposed by the UA towards CA in Jaisalmer shall be acquired and registered in the name of UA before transferring/mutated to the State Govt. • All encroachments, if any shall be removed and shall be handover to the State Govt free from all encumbrances. • Regarding issue of encroachment in RDF and providing of CA land free from all encumbrances, DCF, Baran/State Govt to reply.
iv	The State Govt. has not provided the complete KML file of non-forest land	• As desired, the complete KML file of Forest/non-forest land involved in the project is enclosed herewith for ready reference in CD.

S.No	Condition	Reply
	involved in the project. The same needs to be furnished	
v	In the component wise break-up, an area of 57.225 ha forest land has been proposed for the WCS & Powerhouse which is a huge area and no breakup of the same has been given. Therefore, the details of each component involved in the said area with justification may be provided.	• Several fragmented patched with small extents are getting honeycombed within the project and the compactness of the left-over forest area in the project area is getting compromised. To avoid this, small fragments left between penstocks have been included in the diversion case. • Justification note for an area of 57.225 ha forest land proposed for the WCS & Powerhouse is enclosed at **Annexure-4.** • Further, it is pertinent to submit that out of 57.225 ha, an area of 9.756 Ha forest land in WCS/PH shall be surrender to the State Govt after completion of the Construction activity. Necessary Undertaking in this regard is enclosed at **Annexure-5.**
vi	The suitability certificates for CA area proposed over the NFL and DFL located under the Jaisalmer District are given. However, the proposed CA area appears to be in sand dunes, which may not be suitable for raising plantation and its survival. Therefore, the State Govt. shall re-examine the suitability of the NFL provided for CA and ensure that the area proposed is suitable for raising plantation.	• Site suitability certificate for Non-Forest Land (NFL) has been accorded by DFO, IGNP-II, Jaisalmer based on site inspection report and incorporated in the diversion proposal. Further, DFO, IGNP-II, Jaisalmer vide letter dated 10-11-2023 (copy enclosed at **Annexure-6**) has reiterated that proposed CA area is not in sand dunes and presently cultivation is being practiced in that area and confirmed that the identified NFL is suitable for CA plantations.
vii	State shall clarify as to how the requirement of electricity will be met by the user agency to run project and its components. The detail of forest area required for the purpose (if any) shall be submitted.	• For construction power requirement, the same will be met by the user agency from existing grid power available at the site.
viii	The detailed plan for evacuation and transmission of power so generated from this project shall be submitted	• Evacuation and transmission of power from Shahpur Pumped Storage Project is yet to be finalized. • The Company is discussion in PGCIL for allotment of suitable evacuation point. • Various alternate alignments for the transmission line will be studied in detail and optimal alignment will be chosen in such a way that proposed line shall pass

S.No	Condition	Reply
		through non-forest land or that the barest minimum forest land is involved for the transmission line.
ix	The status of muck disposal plan shall be submitted.	• A detailed plan indicating the manner in which the muck generation, their transportation from different components of the project and its disposal at the designated sites along with reclamation/management measures had been duly incorporated in EIA /EMP Report. • EIA/EMP reports were submitted to MoEF & CC (IA Division) for grant of Environmental Clearance and at present the EC proposal is under active consideration by MoEF & CC. • Mitigation Measures once approved in the EC letter shall be implemented during construction phase in to-to. • Copy of Muck Management Plan has been already uploaded in Part-I which is available at serial number 33 of Additional Information and the same is enclosed again herewith for ready perusal at **Annexure-7.**
x	The State Govt. has reported that the proposed forest land for diversion is located within the notified conservation reserve "Shahbad upreti". Moreover, King vulture is also reported in the area as per the site inspection report of CCF/DCF. Therefore, the comments of the CWLW in this regard needs submission.	• Considering the general flora & fauna of the project area, detailed wildlife management plan including management measures for fauna species as per the conditions of TOR issued by MoEF & CC (IA -Division) has been prepared and submitted to Chief Wildlife Warden, Govt of Rajasthan and it is under final approval (Copy of report is enclosed at **Annexure-8**)**.**
xi	In Part-1 of the application, many of the documents uploaded against the Copy of ownership proof of CA land and the Copy of MoU/agreement executed between the Present owner and the User Agency are either not legible or the same are not commensurate with the requirement. The State Govt shall therefore ensure to submit the legible copies of the ownership proof of CA land and the MoU/agreement	• Due to large file size which cannot be uploaded online, copies of MoU/agreement executed between the Present owner and the User Agency and the certified copy of Jamabandi (revenue record) & the copy of revenue documents and an abstract indicating the owner wise detail of non-forest land are provided in Hard Copy.

S.No	Condition	Reply
	executed between the Present owner and the User Agency. The copy of revenue documents and an abstract indicating the owner wise detail of non-forest land shall also be submitted.	
xii	Satellite imagery shows that, a road is passing through the forest land wherein a component i.e., Upper Reservoir has been proposed. The status of the same shall be submitted. Further, the connectivity of the local people may be hampered in case said road is submerged. In this regard, the comments of the State Govt. are required to be submitted	• Kutcha road visible in Satellite imagery from Kaloni village to nearby agriculture lands passes through forest is a temporary path/road being used by villagers. This is not a permanent road. After, the private land acquisition is done for the project, this road will no longer be required. • Further, based on requirements, alternate road access shall be provided for the villagers through the private land if required.

N. Gopi Krushna

Date: 15.12.2023
Place: Hyderabad

N. Gopi Krushna
Authorised Signatory

Gopi Krushna N
Deputy General Manager (DGM)
Authorised Signatory
Greenko Energies Private Limited

No. J-12011/02/2020-IA-I
Government of India
Ministry of Environment, Forest & Climate Change
(IA.I Division)

Indira Paryavaran Bhawan
3rd Floor, Vayu Wing
Jor Bagh Road
New Delhi-110 003

Dated: 13th April, 2020

To

M/s Greenko Energies Private Limited
Plot No. 1071, Road No. 44
Jubilee Hills, Hyderabad-500033
Telangana

Sub: Shahpur Pumped Storage Project (**2520 MW**) in District Baran, Rajasthan by M/s Greenko Energies Private Limited- reg. Terms of Reference (ToR).

Sir,

This has reference to online proposal No. IA/RJ/RIV/142374/2020 and letter no SHAHPUR/SPSP/MoEF&CC /ToR/ 20200210 Dated 10.02.2020 submitted to the Ministry for ToR to the project cited in the subject.

2. The above referred proposal was considered by the Expert Appraisal Committee (EAC) for River Valley & Hydroelectric projects in its 31st meeting held on 05.03.2020. The comments and observations of EAC on the project may be seen in the Minutes of the meeting which are available on the web-site of this Ministry.

3. Above proposal is for to develop Pumped Storage Project (PSP) in Shahpur (Village), Shahabad (Tehsil) of Baran (District) in the State of Rajasthan. Total capacity of the proposed PSP is 2520 MW (17640 MWH, based on 7-hour operation per day). Project involves creation of new upper reservoir and lower reservoirs consisting of rock fill embankment with central clay core. The geographical coordinates of the proposed upper reservoir are at Latitude 25°11'25.21"North and Longitude is 77°10'55.78" East and that of lower reservoir are at 25°11'40.00" North and 77°11'50.00" East.

4. The upper reservoir is proposed to be located on flat / gradually sloping land which is suitable for creating the desired gross storage capacity of 1.70 TMC. Out of 1.70 TMC, the live storage capacity is 1.63 TMC and the dead storage capacity is 0.075 TMC by keeping FRL & MDDL at EL 512.00m & EL 489.00m, respectively. For creating this storage, it is proposed to construct rockfill embankment for the average height of around 28 m (with maximum height of 30m) for the length of 6985m. Similarly, the lower reservoir is proposed to be located in the

flat / gradually sloping portion which is suitable for creating the desired gross storage capacity of 1.71 TMC in which the live storage capacity is 1.64 TMC and dead storage capacity is 0.07 TMC by keeping FRL and MDDL at EL 354.00m & EL 323.00m, respectively. For creating this storage, it is proposed to construct rockfill embankment for the average height of 34m (with maximum height of 42m) for the length of 3842 m.

5. Water conductor system consist of 52.20m high Power Intake Structure; 8 nos. each of 909 m long and 7.5m dia. surface circular steel lined Penstock / Pressure Shaft (i.e. consisting of 711 m long surface penstock, 121 m long vertical pressure shaft and 77 m long Horizontal pressure shaft) to feed 8 units of 315 MW; A surface Powerhouse having an installation of eight nos. reversible Francis turbine each of 315 MW capacity (6 units of fixed speed and 2 units of variable speed turbines) operating under a rated head of 157.00m in generating mode and 168.00m in pumping mode. 8 nos. 8.5 m diameter,190m long Tailrace Tunnel. 125 m wide and FSD of 5.5m is the Tail race channel of 953 m long joining with the proposed lower reservoir. As such, the proposed project will generate 2520 MW by utilizing design discharge of 1817.98 Cumec with rated head of 157.00 m. Upper and lower reservoir (both are to be constructed newly) and one-time water will be pumped from existing nearby Shahabad Kuno river to the proposed Shahpur Standalone PSP lower reservoir which is about 150 m away from the toe of the embankment of lower reservoir

6. Total land required for construction of various components, including infrastructure facilities and muck disposal area is estimated to be around 777.44 ha, involving 543.52 ha of forest land and 233.92 ha of non-forest land. An estimated cost of the project is Rs. 11736.73 Crores. As per the Form 1 there is no Protected Area notified under the Wild Life (P) Act, 1972; Critically Polluted areas as identified by the CPCB constituted under the Water (P) Act 1974; Eco Sensitive Areas as notified within 10 km of the project boundary.

7. The above proposal was appraised by the EAC in the 31st meeting held on 05.03.2020. EAC in the 31st meeting held on 05.03.2020 deliberated on the information submitted (Form 1, PFR, kml file, etc.) and as presented in the meeting and observed that in the instant project upper is located away from all existing natural water systems and have no/negligible catchment area therefore CAT Plan, RIM treatment, L-section of river and Environmental flow study for the upper and lower reservoir will not be required under EMP.

8. Based on recommendations of the EAC, the Ministry of Environment, Forest & Climate Change hereby **accords a fresh Terms of Reference (TOR)** as per the Standard ToR (Hydro projects) for the proposed activity as per the provisions of the Environmental Impact Assessment Notification, 2006 and as amended time to time along with the following additional ToR for preparation of EIA/EMP report:

Standard ToR

The EIA/EMP report should contain the information in accordance with provisions & stipulations as given in the **Standard ToR for hydro projects (***Please visit the following link to download the Standard ToR:*

http://environmentclearance.nic.in/writereaddata/standardtorreference.pdf.

Additional ToR

i. Land acquired for the project shall be suitably compensated in accordance with the law of the land with the prevailing guidelines. Private land shall be acquired as per provisions of Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.

ii. The project involves diversion of about **543.52 ha** of forestland. Forest clearance shall be obtained as per the prevailing norms of Forest (Conservation) Act, 1980.

iii. Application to obtain prior approval of Central Government under the Forest (Conservation) Act, 1980 for diversion of forest land required should be submitted as soon as the actual extent of forest land required for the project is known, and in any case, within six months of issuance of this letter.

iv. Funds allocation for Corporate Environment Responsibility (CER) shall be made as per O.M. No. 22-65/2017-IA.III dated 01.05.2018 for various activities therein.

v. The details of funds allocation and activities for CER shall be incorporated in EIA/EMP report.

vi. The EIA report should clearly mention activity wise EMP and CER cost details and should earmarked clear break-up of the capital and recurring cost along with the timeline for incurring the capital cost.

vii. Consolidated EIA/EMP report is to be submitted as per the generic structure (Appendix III & IIIA) given in the EIA Notification, 2006.

viii. Conservation plan for the Scheduled I species, if any, in the project study area shall be prepared and submitted to the Competent Authority for approval.

ix. Pre-DPR Chapters viz., Hydrology and Layout Map and Power Potential Studies duly approved by CWC/CEA shall be submitted.

x. Dam break analysis, Disaster Management Plan and Fisheries Management Plan be prepared and submitted in the EIA/EMP report.

xi. Environmental matrix during construction and operational phase needs to be submitted.

xii. Both capital and recurring expenditure under EMP shall be submitted.

xiii. Impact of developmental activity/project on the wildlife habitat, if any, within 10 km of the project boundary shall be studied.

xiv. The consultant engaged for preparation of EIA/EMP report has to be registered with Quality Council of India (QCI/ NABET) under the scheme of Accreditation & Registration of MoEF& CC. This is a pre-requisite.

xv. Consultant shall include a "Certificate" in EIA/EMP report regarding portion of EIA/EMP prepared by them and data provided by other organization(s)/ laboratories including status of approval of such laboratories. Declaration by the Consultant that information submitted in the EIA/EMP is factually correct and shall be submitted along with EIA/EMP reports.

xvi. An undertaking as part of the EIA report from Project proponent, owning the contents (information and data) of the EIA report with the declaration about the contents of the EIA report pertaining to a project have not been copied from other EIA reports.

xvii. The draft EIA/EMP report prepared as per the Generic Structure (Appendix III of EIA Notification, 2006) incorporating information as per the Standard ToR, should be submitted to the State Pollution Control Board concerned for conducting Public Consultation, district wise, as per the provisions stipulated in EIA Notification, 2006. Public Hearing, which is a part of Public Consultation, shall be held district wise at the site or in its close proximity as prescribed in Appendix (IV) of EIA Notification, 2006. The draft EIA/EMP report is to be submitted to SPCB sufficient before the expiry of the ToR validity so that necessary amendments in EIA/EMP can be undertaken based on public hearing and the same is to be submitted to MoEF&CC before expiry of validity.

xviii. All the tasks including conducting public hearing shall be done as per the provisions of EIA Notification, 2006 and as amended from time to time. Public hearing issues raised and compliance of the same shall be incorporated in the EIA/EMP report in the relevant chapter. Final EIA/EMP report should be submitted to the Ministry for Environmental Clearance only after incorporating these issues, before the expiry of validity of ToR.

xix. As per Ministry's Notification 17.02.2020, the ToR will remain valid for a period of 5 years from the date of issue of this letter for submission of EIA/EMP report along with public consultation. The ToR will stand lapsed after completion of 5 years in case final EIA/EMP is not submitted.

xx. Baseline data and public consultation shall not be older than 3 years, at the time of submission of the proposal, for grant of Environmental Clearance.

xxi. In case of any change in the scope of the project such as capacity enhancement, change in submergence, etc., fresh scoping clearance has to be obtained.

xxii. The PP should submit a copy of TEC of the DPR along with EIA/EMP report.

xxiii. Details of the name and number of posts to be engaged by the project proponent for implementation and monitoring of environmental parameters be specified in the EIA report.

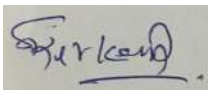
xxiv. The EIA/ EMP report must contain an Index showing details of compliance of all ToR conditions. The Index will comprise of page No. etc., vide which compliance of a specific ToR is available. It may be noted that without this index, EIA/ EMP report will not be accepted.

xxv. The PP should complete all the tasks as per the provisions of EIA Notification, 2006 and as amended time to time) and submit the application for final clearance within the stipulated time.

xxvi. Appropriate Biodiversity Conservation and Management plan for the Native, Rare & Endangered floral and faunal species getting affected due to the project shall be prepared.

This has approval of the Competent Authority.

Yours faithfully,

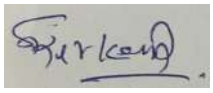


(Dr. S. Kerketta)
Director

Telefax: 011-24695314

Copy to:

1. The Secretary, Ministry of Water Resources, RD & GR, Sharm Shakti Bhawan, Rafi Marg, New Delhi-3.
1. The Secretary, Ministry of Power, Sharm Shakti Bhawan, Rafi Marg, New Delhi-110001.
2. The Pr. Secretary to Government Energy Department, Govt. of Rajasthan, Room No. 8340, SSO Building, Government Secretariat, Jaipur, Rajasthan
3. The Principal Chief Conservator of Forests, (HOFF), Rajasthan, Aranya Bhawan, Jhalana Institutional Area, Jaipur-302004, Rajasthan.
4. The Member Secretary, Rajasthan State Pollution Control Board, 4, Jhalana Institutioal Area, Jhalana Doongri, Jaipur, Rajastan-302004
5. The Chief Engineer, Project Appraisal Directorate, Central Water Commission, Sewa Bhawan R.K. Puram, New Delhi-110066.
6. The Deputy Director General of Forests (C), Regional Office (CZ), Ministry of Environment, Forest & Climate Change, Kendriya Bhawan, 5thFloor, Sector "H", Aliganj, Lucknow — 226020
7. Sr. PPS to JS(GM)
8. NIC Cell of MoEF&CC with a request to upload on MoEF&CC Website.
9. Guard File.



(**Director**)

SOIL EROSION TREATMENT PLAN

FOR

SHAHPUR STANDALONE PUMPED STORAGE PROJECT

Greenko Energies Pvt. Ltd.

Greenko Hub, # 13, Hitech City,

Madhapur, Hyderabad-500081

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 General

Shahpur Standalone Pumped Storage Project (PSP) with an installed capacity of 1800 MW / 10800 MWH storage capacity is located at Shahabad Tehsil, Baran District, Rajasthan. It envisages creation of upper reservoir & lower reservoir which are located away from all existing natural river systems and have negligible catchment areas. The project sites are accessible from NH-76 road close to Mahuri Khera from where Shahpur village road takes off; and is at a distance of approximately 6 Km. Nearest railhead is Baran Railway Station, about 77 kms from project site and nearest Airport is Gwalior Airport, about 200 km from project site The powerhouse is located near Shahpur village, which is in Shahabad Tehsil of Baran district.

This scheme envisages non-consumptive re-utilization of water by re-circulation. The water from the proposed lower reservoir will be pumped up and stored in the proposed upper Reservoir and will be utilized for power generation. The Geographical co-ordinates of the proposed upper reservoir are at longitude 77° 10' 55.78"E and latitude is 25° 11' 25.21"N and that of proposed lower reservoir are 25°11'40.00"N and 77° 11' 50.00"E. The project location map is enclosed as **Figure 1**.

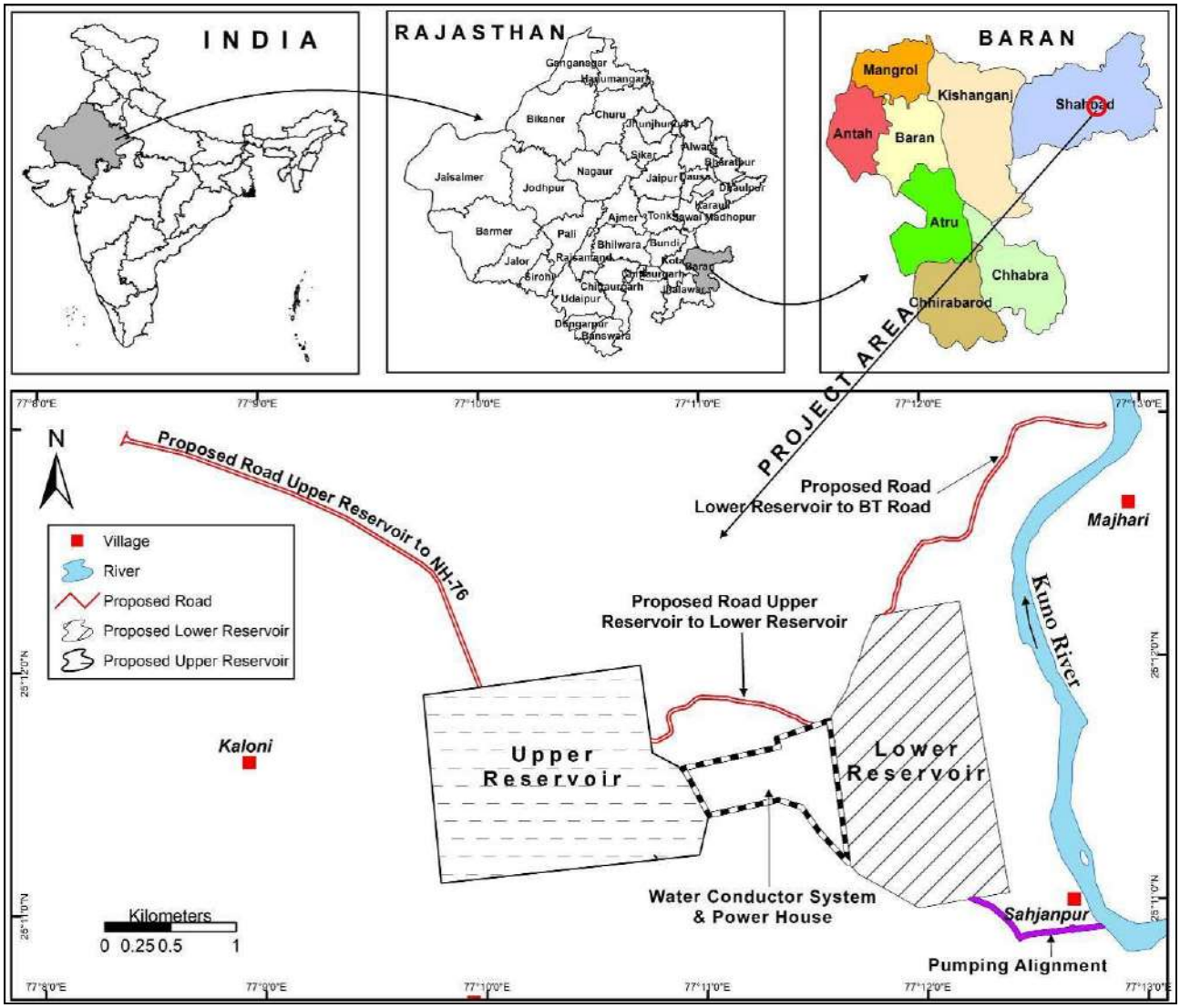


Figure 1: Location Map of Shahpur Standalone Pumped Storage Project

The Shahpur Standalone Pumped Storage Project envisages construction of both upper reservoir and lower reservoir in Baran district of Rajasthan and involves construction of rockfill embankment with avg. height of 24.5 m for the length of 5309 m for creation of Shahpur PSP upper reservoir with 1.21 TMC gross capacity and construction of rockfill embankment with avg. height of 26.5 m for the length of 2937 m for creation of Shahpur PSP lower reservoir with 1.05 TMC gross capacity. Total 6 numbers of Independent Head Race Pipe / Pressure Shaft with one pressure Tunnel bifurcating into two-unit pressure tunnel convey water between Lower and Upper reservoirs. Surface Power/Pump House will be located at about 830 m from the intake structure and shall be equipped with six vertical shaft reversible Francis type units composed each of a generator/motor and a turbine/pump having generating/pumping capacity of 300 & 150 MW/330 & 165MW.

1.2 Salient Features

The salient features of the proposed Shahpur Standalone Pumped Storage Project are given in **Table 1**.

Table 1: Salient Features of Shahpur Standalone Pumped Storage Project

		Feature	Description
1		Name of the Project	Shahpur Standalone Pumped Storage Project (5 x 300 MW + 2 x 150 MW)
2		**Location**	
	a	Country	India
	b	State	Rajasthan
	c	District	Baran
	d	Village near Powerhouse	Shahpur
3		**Geographical Co-Ordinates**	
	a	Shahpur Standalone PSP Upper Reservoir- (Now Proposed)	
		Latitude	25°11'25.21"N
		Longitude	77°10'55.78"E
	b	Shahpur Standalone PSP Lower Reservoir - (Now Proposed)	
		Latitude	25°11'40.00"N
		Longitude	77°11'50.00"E
4		**Access to Project Site**	
	a	Airport	Gwalior Airport – 200 km from project site
	b	Railway Station	Baran Railway Station, 77 km from project site
	c	Road	NH 76 – 6Kms
	d	Port	Kandla Port - 980 km from project site
5		**Project**	
	a	Type	Standalone Pumped Storage Project
	b	Storage Capacity	10800 MWH
	c	Rating	1800 MW
	d	Peak Operation Duration	6 hours
6		**Shahpur Standalone PSP - Upper Reservoir**	
	a	Live Storage	1.01 TMC (28.60 MCM)
	b	Dead Storage	0.20 TMC (5.66 TMC)
	c	Gross Storage	1.21 TMC (34.28 TMC)
7		**Upper Reservoir**	

		Feature	Description
	a	Full Reservoir level (FRL)	EL 507.00 m
	b	Min. Draw Down Level (MDDL)	EL 490.00 m
	c	Top Bund Level (TBL)	EL 510.00 m
	d	Type of Embankment	Asphalt Faced Rockfill Embankment
	e	Max. Height of Embankment	30 m
	f	Average Height of Embankment	24.5 m
	g	Length at the top of Embankment	5309 m
	h	Top width of the Embankment	10.0 m
	i	Type of Power Block	Gates with Concrete Breast Walls
	j	Top Level of Power Block	510.00 m
	k	Maximum Height of Power Block	38.5 m
	l	Length at the top of Power Block	162.0 m
	m	Top width of Road at Power Block	10.0 m
8		**Shahpur Standalone PSP - Lower Reservoir**	
	a	Live Storage	1.01 TMC (28.32 MCM)
	b	Dead Storage	0.05 TMC (1.42 MCM)
	c	Gross Storage	1.05 TMC (29.74 MCM)
9		**Lower Reservoir**	
	a	Full Reservoir level (FRL)	EL 349.00 m
	b	Min. Draw Down Level (MDDL)	EL 328.00 m
	c	Top Bund Level (TBL)	EL 352.00 m
	d	Type of Embankment	Asphalt Faced Rockfill Embankment
	e	Average Height of Embankment	26.5 m
	f	Length of Embankment	2937 m
10		**Intake Structure**	
	a	Type	Diffuser Type
	b	No. of Vents	3 nos.
	c	Size of Each Intake	24.00 m (W) x 11.2 m (H) including piers
	d	Length of each Intake	38.98 m (covered with RCC slab at top up to Intake Gate)
	e	Elevation of Intake center line	EL 476.30 m
	f	Elevation of Intake bottom	EL 472.55 m
	g	Design Discharge of each Intake (Turbine mode)	220.04 cumec for 300 MW Unit and 220.50 cumec for 150 MW Units
	h	Trash rack type	Vertical with inclination of 15°
	i	Size of Trash Rack	3 nos. of 7.00 m (W) x 11.60 m (Inclined Height) for each unit
	j	Numbers & Size of Intake Service Gate	6 nos. of 6.20 m (W) x 7.50 m (H)
	k	Numbers & Size of Intake Emergency Gate	1 set – 6.20 m (W) x 7.50 m (H) with Moving Gantry Crane
11		**Head Race Pipe /Pressure Shafts**	
	a	Type	Finished steel lined - circular
	b	Number of Head Race Pipe / Pressure Shaft	Total 6 No. of Independent Head Race Pipe / Pressure Shaft with one pressure Tunnel bifurcating into two-unit pressure tunnel
	c	Diameter of Horizontal Pressure Tunnel	7.5 m
	d	Diameter of unit Pressure Tunnel	5.3 m
	e	Length of Head Race Pipe /	830 m (6 nos.) Length of Head Race Pipe from Intake to Vertical Pressure Shaft - 663 m Length of Vertical Pressure Shaft - 72 m

		Feature	Description
		Pressure Shaft	Length of Horizontal Pressure Tunnel - 95 m
	f	Length of Unit Pressure Tunnel	About 50 m each
	g	Design Discharge of each Head race Pipe / Pressure Shaft	220.04 cumec for 300 MW unit and 220.50 cumec for 150 MW units
	h	Design Discharge of each unit Pressure Tunnel	110.25 cumec
	i	Maximum velocity in the Head Race Pipe / Pressure shaft	4.99 m/sec
	j	Maximum velocity in the Unit Pressure Tunnel	4.99 m/sec
12		**Powerhouse**	
	a	Type	Surface Pit Type Powerhouse
	b	Centre line of Unit	EL 298.0 m
	c	Dimensions (Excluding service bay)	196.166 m (L) x 28.5 m (W) x 61.5 m (H)
	d	Size of Service Bay	40 m (L) x 28.5 m (W)
	e	Service Bay Level	EL 313.72 m
	f	Size of Unloading Bay	25m (L) x 28.5 m (W)
	g	Unloading Bay Level	EL 336.70 m
13		**Tail Race Tunnel**	
	a	Type & Shape	Concrete Lined – Circular
	b	Number of Tunnels	7 Nos.
	c	Dia. of Tunnel for 300 MW Unit	8.50 m
	d	Dia. of Tunnel for 150 MW Unit	6.20 m
	e	Length of the Tunnel	179 m for 8.5 m dia as well as for 6.2 m dia
	f	Design Discharge for 300 MW Unit	220.04 cumec
	g	Design Discharge for 150 MW Unit	110.25 cumec
14		**Tailrace Outlet**	
	a	Type	Diffuser Type
	b	No. of Outlet	7 Nos.
	c	Size of each outlet	For 300 MW Unit - 24.00 m (W) x 12.50 m (H) including piers For 150 MW Unit - 18.00 m (W) x 9.0 m (H) including piers
	d	Length of each Outlet	31.40 m (covered with RCC slab at top up to Intake Gate)
	e	Elevation of outlet center line	For 300 MW Unit - EL + 315.30 m For 150 MW Unit - EL + 314.15 m
	f	Elevation of Outlet bottom	EL + 311.05 m for 300 MW as well as 150 MW unit
	g	Trash rack Type	Vertical with inclination of 15°
	h	Size of Trash rack	For 300 MW Unit - 3 sets of 7.0 (W) x 12.94 m (Inclined Height) for each unit For 150 MW Unit - 3 sets of 5.0 (W) x 9.32 m (Inclined Height) for each unit
	i	Tailrace outlet Service Gate	5 nos. of 6.00 m (W) x 8.50 m (H) and 2 nos. of 4.20 m (W) x 6.20 m (H)
	j	Tail Race outlet Emergency Gate	1 set - 6.00 m (W) x 8.50 m (H) 1 set - 4.20 m (W) x 6.20 m (H) with one common Gantry Crane
15		**Tailrace Channel**	
	a	Type	Trapezoidal shape with concrete lined
	b	Bed Width	140.0 m
	c	Length of channel	717 m
	d	Full Supply Depth	6.8 m

		Feature	Description
	e	Bed Slope	1:6400
	f	Side Slope	1H:6V
16		**Electro-Mechanical Equipment**	
	a	Pump Turbine	Francis type, vertical shaft reversible pump-turbine
	b	Total No of units	5 nos. (5 X 300 MW) + 2 nos. (2x150 MW)
	c	Total Design Discharge (Turbine Mode)	1320.70 cumec (5 x 220.04 cumec + 2 x 110.25 cumec)
	d	Rated Net Head in Turbine mode	154.73 m for 300 MW unit and 154.41 m for 150 MW unit
	I	**300 MW Turbines**	
	a	Total No of units	5 Units (All fixed Speed)
	b	Turbine Design Discharge	220.04 cumec
	c	Pump Capacity	330 MW
	d	Rated Pumping Head	162.56 m
	e	Rated Pump Discharge	190.96 cumec
	f	Synchronous Speed	187.50 rpm
	II	**150 MW Turbines**	
	a	Total No of units	2 Units (All Fixed Speed)
	b	Turbine Design Discharge	110.25 cumec
	c	Pump Capacity	165 MW
	d	Rated Pumping Head	163.21 m
	e	Rated Pump Discharge	95.10 cumec
	f	Synchronous Speed	250.00 rpm
	III	**Generator-Motor**	
	a	Type	Three (3) phases, alternating current synchronous generator motor semi umbrella type with vertical shaft
	b	Number of units	5 Units (5 x 300 MW) and 2 Units (2x150 MW)
	c	Rated Capacity	Generator – 300 MW & 150 MW Pump Input – 330 MW & 165 MW
	d	Rated Voltage	18.0 kV
	IV	**Main Power Transformer**	
	a	Type	Outdoor Single-Phase Power transformers with On Load Tap Changer (OLTC)
	b	Number of units	23 Nos. i.e., 3 nos. per unit & 2 no spare
	c	Rated Capacity of each unit	16 no. (3x5 Working +1 Spare) of Single Phase, 18 kV/400kV, 123 MVA and 7 no. (2 x 2 Working + 1 spare) of Single Phase, 18 kV/400kV, 62 MVA
	d	Rated Voltage	Primary – 18.0 kV; Secondary - 400 kV adjustable range of the secondary voltage: ±10% in steps of 1.25%
17		**400 KV Gas Insulated Switchgear**	
	a	Type of GIS	Indoor Type
	b	No. of GIS units	1 No.
	c	Location	Inside GIS building above ground
	d	Scheme	Double Bus Scheme with coupler and sectionaliser
18		**Power Evacuation**	
	a	Voltage Level (kV)	400 kV
	b	No. of Transmission Lines	One no. 400 kV double circuit transmission lines
	c	Conductor	Quad Moose

		Feature	Description
	d	Total Length	One 400 kV Double Circuit Transmission Line of length 75 km (approx.) from PSP will be connected to **400/765 kV PGCIL substation at New Shivpuri of Madya Pradesh State** for evacuation of stored power during generating mode and for supply of power during pumping mode.
19		**Estimated Cost**	
	a	Civil & Other works	4782.91
	b	E&M Works including Transmission	3096.20
	c	IDC & Others	1842.65
		Total Project Cost with IDC	9721.76

Source: Pre-Feasibility Report of Shahpur Standalone Pumped Storage Project

2.0 NEED FOR SOIL EROSION TREATMENT

It is a well-established fact that reservoirs formed by dams on rivers are subjected to sedimentation. The process of sedimentation embodies the sequential processes of erosion, entrainment, transportation, deposition and compaction of sediment. The steady erosion and sediment in reservoir reduce its capacity, and thus affecting the water availability for the designated use. Thus, a well-designed Soil erosion Treatment Plan is essential to ameliorate the above-mentioned adverse effects of soil erosion. Soil erosion can be defined as detachment, transportation and deposition of soil particles from one place to other by means of transporting agent like air, water or animals. Soil erosion is mainly affected by rainfall intensity and runoff, slope gradient and length, soil erodibility and vegetation cover (landuse pattern). Therefore, study of erosion and sediment yield from catchments are of great importance. Soil erosion leads to:

- loss in production potential
- reduction in infiltration rates
- reduction in water-holding capacity
- loss of nutrients
- increase in tillage operation costs
- reduction in water supply

To control the rate of soil erosion in the catchment, Soil erosion treatment is an ineluctable part. The Soil Erosion Treatment Plan pertains to preparation of a management plan for treatment of erosion prone areas through adequate preventive measures. An effective Soil Erosion Treatment Plan is a key factor to make the project eco-friendly and sustainable. Thus, a well-designed Soil erosion treatment plan is essential to ameliorate the above-mentioned adverse process of soil erosion. Soil Erosion Treatment Plan essentially consists of following steps.

1. Calculation of soil erosion using Revised Universal Soil Loss Equation (RUSLE), combined with Remote Sensing (RS) and Geographic Information System (GIS) technologies.
2. Prioritizing the areas for treatment using Silt Yield Index (SYI).
3. Planning of suitable erosion control measures.
4. Cost estimation for Soil Erosion Treatment Plan.

3.0 METHODOLOGY ADOPTED FOR THE STUDY

The various steps, covered in the study, are as follows:

- Defining study area
- Defining data requirement
- Data acquisition and preparation
- Output presentation

The above-mentioned steps are briefly described in the following paragraphs:

3.1 Defining Study Area

Purpose of the study is for preparation of Soil Erosion Treatment Plan for the erosion prone areas within catchment of Shahpur Standalone Pumped Storage Project. Since the project involves construction of two different reservoirs therefore catchment area of both the reservoirs has been considered as study area. The total catchment area of both the reservoirs is **6.48 sq km**. The catchment area of both the reservoirs falls in Survey of India Toposheet No. 54G/4. In order to plan watershed management and to formulate action plans it requires subwatershed delineation, therefore, catchment area was further delineated into subwatershed. For the delineation of subwatershed, Watershed Atlas of India prepared by Soil and Land Use Survey of India (SLUSI) has been referred.

Soil and Land Use Survey of India (SLUSI) has Watershed Atlas of India under digital environment using GIS and produced a Digital Watershed Atlas (DWA) where the delineation and codification of watersheds in the country has been undertaken in GIS environment. The delineation for DWS has been done in seven stages starting with Water Resource Regions and their subsequent division and subdivisions into Basins, Catchments, Subcatchments, Watersheds, Subwatersheds and Microwatersheds in decreasing size of the delineated hydrologic unit.

As per Watershed Atlas of India, catchment areas of both the reservoirs falls in a two subwatersheds. Catchment area of lower reservoir falls in a single subwatershed, coded as 2D1B5f. Whereas, catchment area of upper reservoir falls in two subwatersheds, coded as 2D1B5f and 2D1B5c. The nomenclature of the subwatersheds forming the catchment area has been assigned as follows: Region (2) “Ganges drainage”; Basin (2D) “Chambal”; Catchment (2D1) “Chambal up to Banas confluence”; Subcatchment (2D1B); Watershed (2D1B5) “Kunu”; Subwatershed 2D1B5c and 2D1B5f **(**refer **Figure 2)**.

3.2 Defining Data Requirement

Soil loss has been calculated through RUSLE (Revised Universal Soil Loss Equation) model which is computed by the following equation:

Soil Loss (A) = R*K*LS*C*P

Wherein;

A = Soil loss (Tons/ha/year)

R is Rainfall & Runoff Erosivity Factor (MJ mm/ha-1/h-1/year-1), which depends upon the annual average rainfall in mm. Data required for R factor is rainfall intensity.

K is Soil Erodibility Factor (Tons/ha/h/ha-1/MJ-1/mm-1), which depends on the organic matter, texture permeability and profile structure of the soil. Also, it is a constant value for each soil type. Data required for K factor is soil type.
LS is Topographic Factor (dimensionless) which depends upon flow accumulation and steepness and length of slope in the area. Data required for LS factor is slope length and slope gradient.

C = Vegetation Cover and Crop Management Factor (dimensionless), which is the ratio of bare soil to vegetation and non- photosynthetic material. It is a constant value for each land use category. Data required for C factor is land use/ land cover.

P is Conservation Supporting Practice Factor (dimensionless), which takes into account specific erosion control practices like contour bunding, bench terracing etc.

3.3 Data Acquisition and Preparation

The data on various aspects was collected from different sources. Soil map of the Catchment Area was prepared from soil map of Rajasthan procured from Regional Centre of National Bureau of Soil Survey & Land Use Planning (NBSS&LUP), New Delhi. For the preparation of DEM and preparation of Slope map, Shuttle Radar Topography Mission (SRTM) 3 Arc-Second Global Digital Terrain Elevation Data (DTED) has been used. For the preparation of land use/ land cover, forest cover map prepared by Forest Survey of India, map prepared by National Remote Sensing Centre (NRSC), Indian Space Research Organisation (ISRO) of Dept. of Space with Partner Institutions viz., State Remote Sensing Application Centre, Dept. of S&T, Govt. of Rajasthan has been used. The rainfall data in the Catchment Area has been sourced from Climatic Research Unit (CRU), a component of the University of East Anglia and one of the leading institutions concerned with the study of natural and anthropogenic climate change.

3.3.1 Rainfall Erosivity (R) Factor

R factor is a function of the falling raindrop and rainfall intensity and is estimated as the product of the kinetic energy (E) of the raindrop and the maximum intensity of rainfall (I30) over duration of 30 min in a storm. The erosivity of rain is calculated for each storm, and these values are summed up for each year. In this study, the storm wise rainfall data were not available for the computation of rainfall erosivity factor (R); therefore, the relationship between seasonal value of R and average rainfall has been used. The rainfall erosivity factor has been defined as R = 81.5 + 0.38X, where, R is the average seasonal erosivity factor (MJ mm/ha^{-1}/h^{-1}/year^{-1}), and X is the annual average rainfall (mm).

For the estimation of rainfall erosivity in the Catchment Area, average rainfall of 10 years has been taken from the High-resolution gridded CRU datasets. In the absence of site-specific periodic data, CRU data from the year 2011 to 2020 has been used for the calculation of R factor. In and around the Catchment Area, average rainfall of 10 years have been taken from the rain gauge station for the estimation of rainfall erosivity. The rainfall erosivity factor (R) has been calculated using equation R = 81.5 + 0.38X for annual average rainfall of observed and simulated data. The value of R i.e. 384.51 has been adopted in this study to calculate soil erosion using RUSLE.

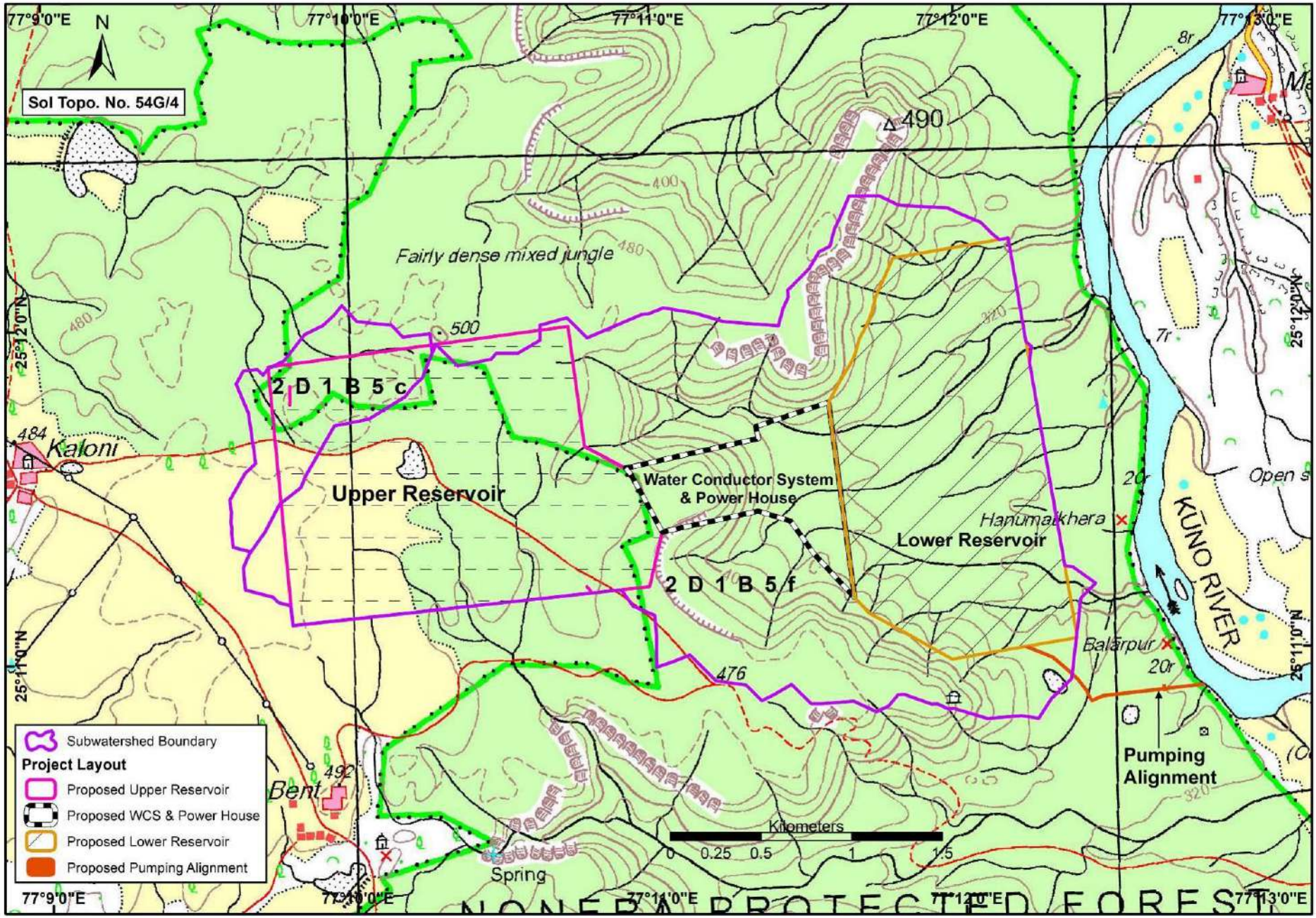


Figure 2: Sub-Watershed Area Map of Shahpur Standalone Pumped Storage Project

3.3.2 Soil Erodibility (K) Factor

The K factor is an expression of the inherent erodibility of the soil or surface material at a particular site under standard experimental conditions. It is a function of the particle-size distribution, organic-matter content, structure, and permeability of the soil or surface material. Prior to deciding the K values, soil map for the area is prerequisite. Soil map procured from NBSS & LUP, Nagpur was digitized. Mapping Unit 351, characterised by deep, moderately well drained, fine soils on very gently sloping plateau with clayey surface, slight erosion covers 71.73% of the catchment area. Rest 28.27% of the catchment area is covered by Mapping Unit 340, characterised by rock-outcrops; associated with: shallow, well drained, loamy-skeletal soil, on very gently sloping foot slopes, severely eroded. Soil map has been shown in **Figure 3**. The legend for soil mapping unit classes is given in **Table 2**. As per the soil map of the Catchment Area, the soil can be classified in two categories. Shallow with loamy skeletal texture and severe erosion have high K value i.e. 0.325, because they are less susceptible to particle detachment and they produce runoff at high rates. Deep with fine texture and slight erosion have low K value i.e. 0.15.

Table 2: Description of Soil Mapping Units in the Catchment Area

Mapping Unit	Description	Taxonomic Classification	Area (ha)	Area (%)
340	Rock-outcrops; associated with: Shallow, well drained, loamy-skeletal soil, on very gently sloping foot slopes, severely eroded.	• Rock-outcrops • Lithic Ustochrepts	183.18	28.27
351	Deep, moderately well drained, fine soils on very gently sloping plateau with clayey surface, slight erosion; associated with: Deep, well drained, fine soils, moderately eroded.	• Typic Chromusterts • Typic Chromusterts	464.82	71.73
	Total		**648.00**	**100**

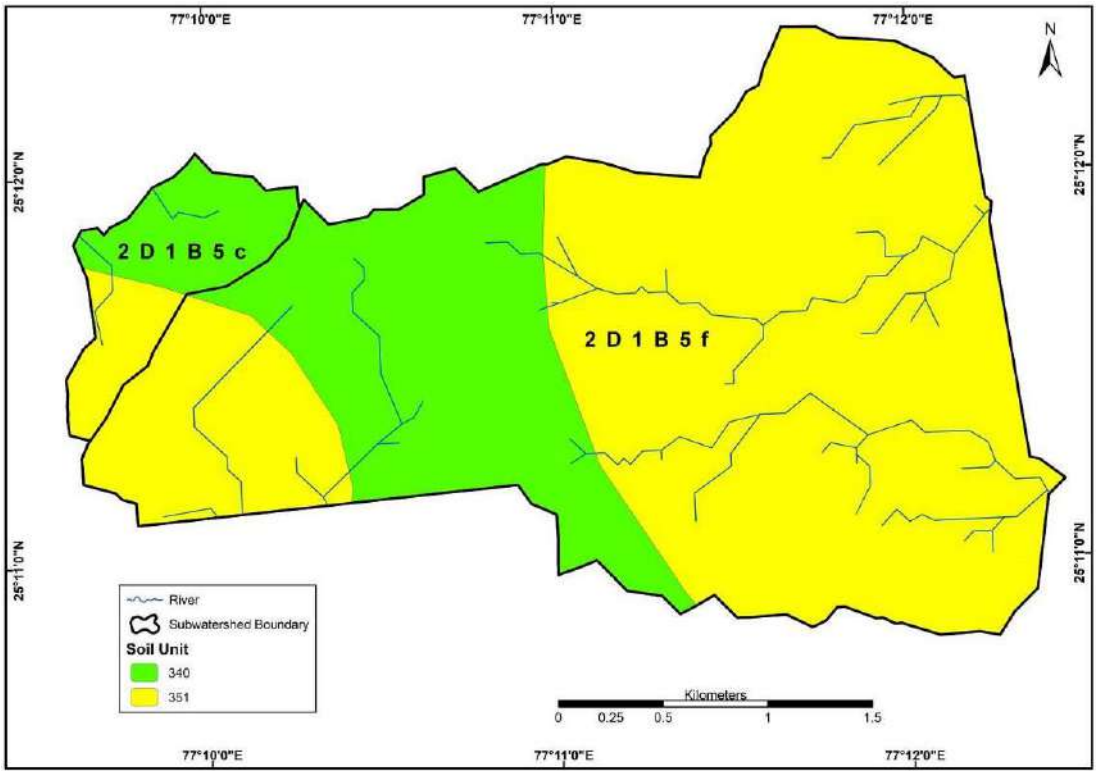


Figure 3: Soil Map of Catchment Area
(For details of Soil Unit legend refer Table 2)

3.3.3 Topographic (LS) Factor

The LS factor is an expression of the effect of topography, specifically hill slope length and steepness, on rates of soil loss at a particular site. The value of 'LS' increases as hill slope length and steepness increase, under the assumption that runoff accumulates and accelerates in the down-slope direction. Digital Elevation Model (DEM) and Slope of a particular area is prerequisite for LS factor. As already discussed, Shuttle Radar Topography Mission (SRTM) 3 Arc-Second Global Digital Terrain Elevation Data (DTED) has been used for DEM and the same DEM has been used for the preparation of slope map. The LS factor prepared for the Catchment Area is given at **Figure 4**.

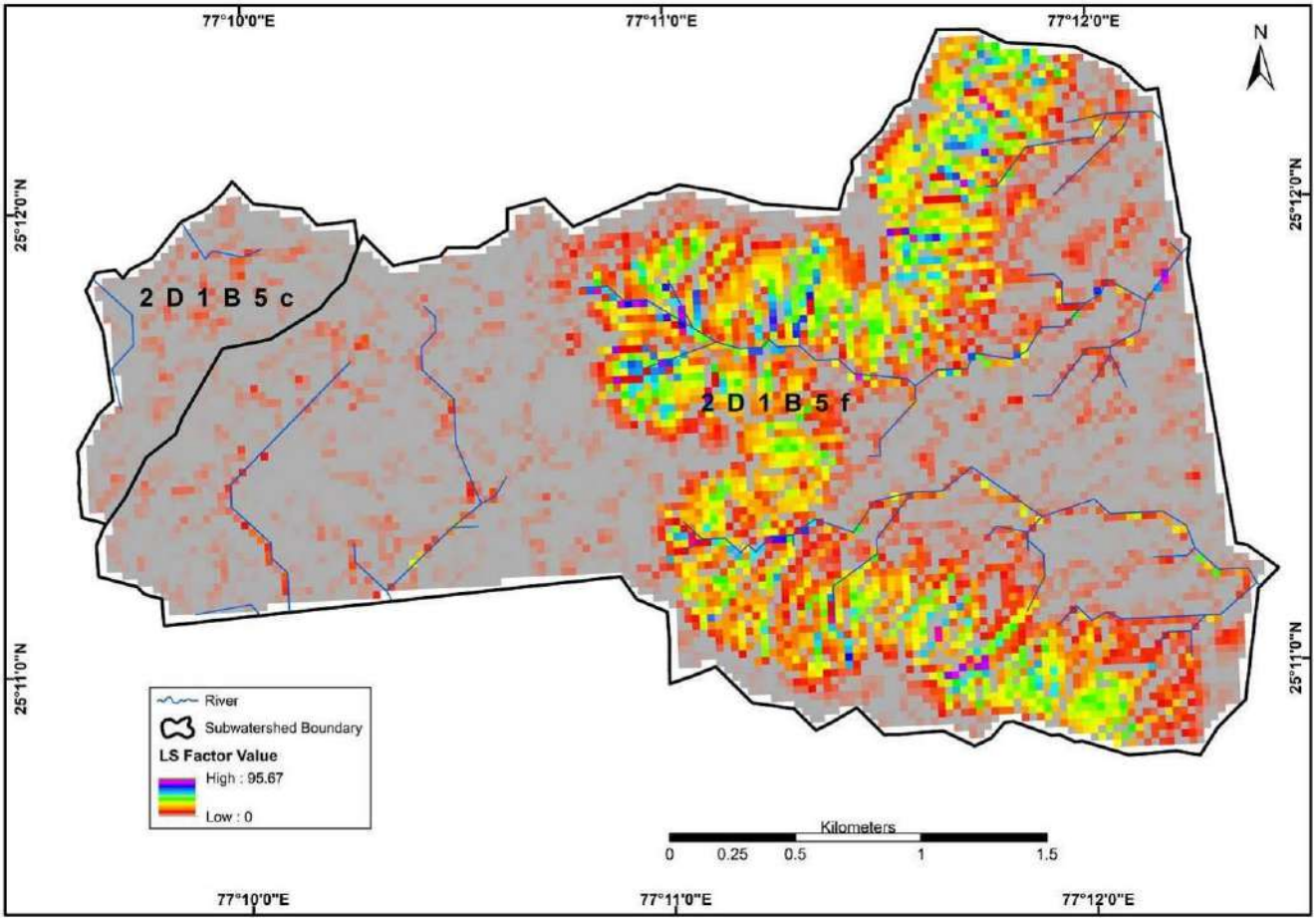


Figure 4: LS Factor Map of Catchment Area

3.3.4 Crop Management (C) Factor

The C factor is an expression of the effect of surface cover and roughness, soil biomass, and soil-disturbing activities on rates of soil loss at a particular site. The value of C decreases as surface cover and soil biomass increase, thus protecting the soil from rain splash and runoff. In the present study, forest cover map prepared by Forest Survey of India and land use/land cover map prepared by National Remote Sensing Centre (NRSC), Indian Space Research Organisation (ISRO) of Dept. of Space with Partner Institutions viz., State Remote Sensing Application Centre, Dept. of S&T, Govt. of Rajasthan has been used in the allocation of C factor for different land use classes.

The classified land use/ land cover map of the Catchment Area is shown as **Figure 5**. The land use/ land cover pattern of the Catchment Area has been given in **Table 3**. As can be seen from the map and table, the land use/ land cover pattern can be classified into six classes, out of

these, majority of the area i.e. 41.04% is covered by Open Forest, followed by Moderately Dense Forest, covering 27.38%. Fallow Land is covering 12.92% of the area. Scrub Land is covering 11.78% of the area. Agricultural Land is covering 6.84% of the area. Rest 0.04% of the area is covered by Waterbody.

Table 3: Area Falling Under Different Land Use/ Land Cover Classes

Land use/ Land cover Classes	Area (ha)	Area (%)
Moderately Dense Forest	177.43	27.38
Open Forest	265.93	41.04
Scrub Land	76.36	11.78
Agricultural Land	44.31	6.84
Fallow Land	83.70	12.92
Waterbody	0.27	0.04
Total	**648**	**100**

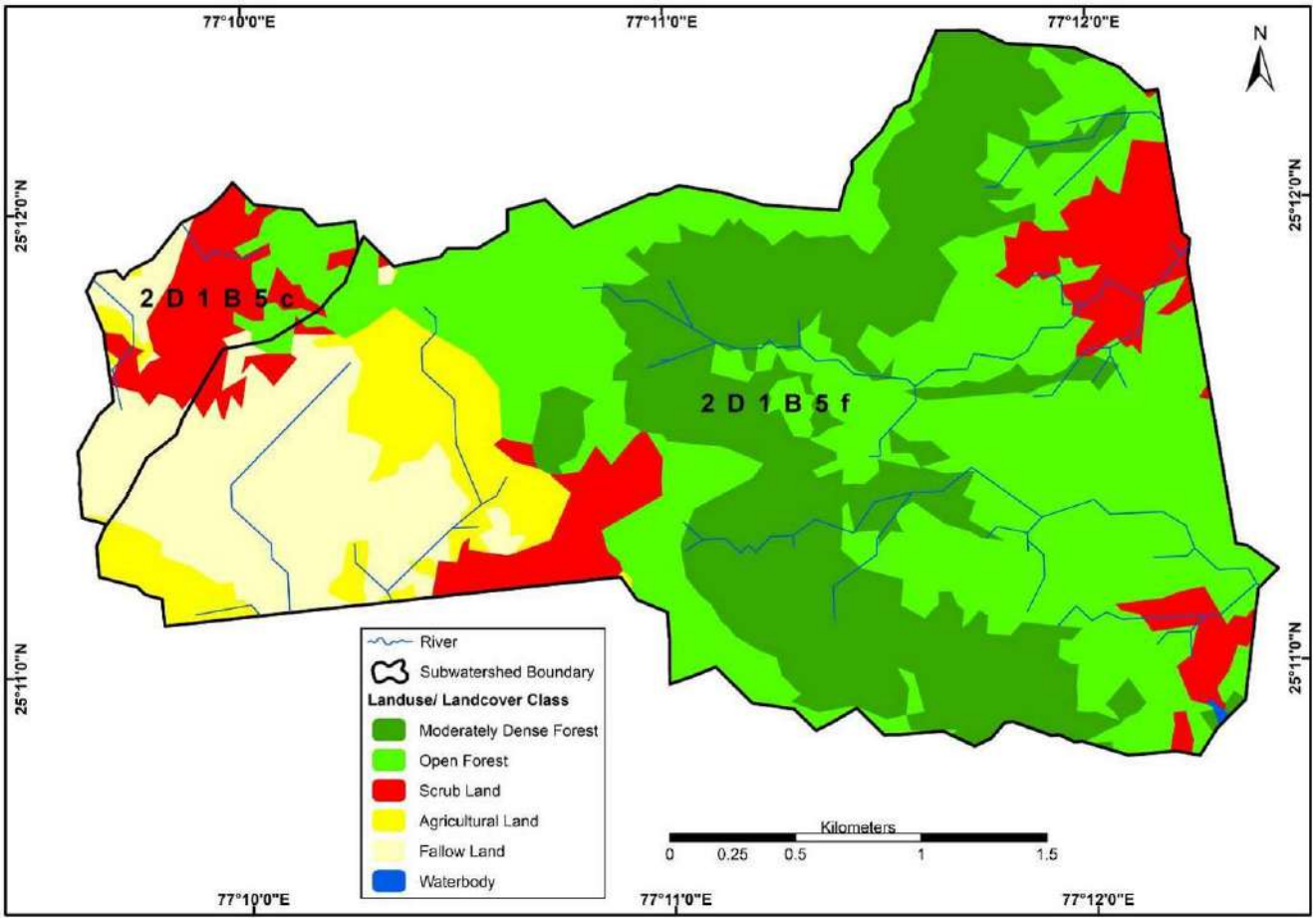


Figure 5: Land use/ Land cover Map of Catchment Area

3.3.5 Conservation Support Practice (P) Factor

The P factor is an expression of the effects of supporting conservation practices, such as contouring, buffer strips of vegetation, and terracing, on soil loss at a particular site. It is the ratio of soil loss with specific support practice to the corresponding loss with up-or down-slope cultivation. In the present study, the P factor has been considered as 1.

3.4 Output Presentation

A thematic map for soil loss of the Catchment Area has been prepared using RUSLE model mentioned in the above section. The Catchment Area was then demarcated into different soil

erosion intensity mapping units or classes based upon the extent of soil loss (see **Table 4 & Figure 6**). The Catchment Area under different Erosion Intensity categories is given in **Table 4**. As can be seen from the figure and table, around 44% of the catchment area is prone to less than 1 tons/ha/annum soil erosion, i.e. under negligible erosion intensity category and around 5% of its area is prone to Severe and Very Severe soil erosion.

Table 4: Area falling under different Erosion Intensity Categories

S. No.	Soil loss in tons/hectare/annum	Erosion Intensity Category	Area (ha)	Area (%)
1	<1	Negligible	283.58	43.76
2	1-5	Slight	120.02	18.52
3	5-10	Very Low	63.90	9.86
4	10-20	Low	72.83	11.24
5	20-40	Moderate	75.68	11.68
6	40-80	Severe	25.86	3.99
7	>80	Very Severe	6.12	0.95
Total			**648.00**	**100**

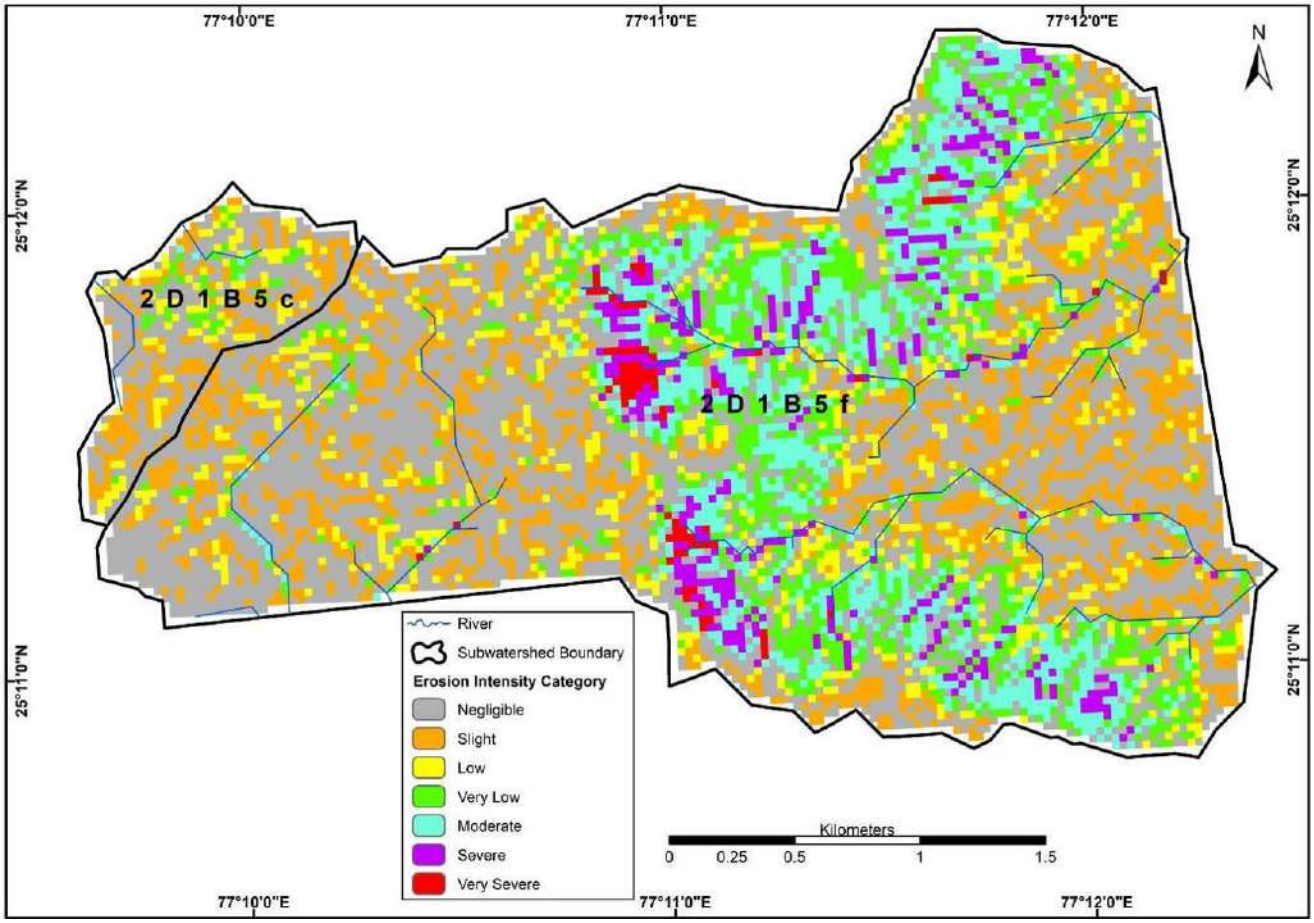


Figure 6: Erosion Intensity Map of Catchment Area

3.5 Prioritization

`Silt Yield Index' (SYI), method conceptualized by Soil and Land Use Survey of India (SLUSI) is being used for prioritization of smaller hydrologic units within river valley project areas. Since the catchment area is only 6.48 sq km and could be delineated into only two subwatersheds therefore, it is proposed to consider same priority for both the subwatersheds.

4.0 TREATMENT PLAN

4.1 Area to be taken up for Treatment.

Areas under severe and very severe erosion intensity category will be taken up for treatment. To arrive at such an area, first of all areas under severe and very severe erosion intensity category were extracted, which comes out to be **31.98 ha** (refer **Table 5**). Thereafter, areas under severe and very severe erosion intensity category falling within the proposed project components such as lower reservoir, upper reservoir, water conductor system, etc. were removed as once the project is constricted this area will not be available for treatment. The area thus arrived at and considered as treatable area comes out to be 25.91 ha (or say **26** ha).

From the map given at Figure 6 it can be seen that the areas under severe and very severe erosion intensity category falls under 2D1B5f subwatershed only. Further, the landuse and landcover classes falling inside this 25.91 ha of severe and very severe erosion intensity category area are Moderately Dense Forest (18.81 ha) and Open Forest (7.10 ha).

The period for implementing Soil Erosion Treatment Plan interventions including maintenance has been taken as 7 years. It is proposed to prepare micro plans, establish administrative setup and implement other entry point activities in the first year itself, followed by implementation of treatment measures in second year. Maintenance period (only for biological measures) will be for subsequent 5 years.

4.2 Treatment Measures

Watershed management is the optimal use of soil and water resources within a given geographical area so as to enable sustainable production. It implies changes in land use, vegetative cover, and other structural and non-structural action that are taken in a watershed to achieve specific watershed management objectives. The overall objectives of watershed management programme are to:

- increase infiltration into soil;
- control excessive runoff;
- manage & utilize runoff for useful purpose.

4.2.1 Biological Measures

The biological measures would comprise of planting under ANR model

4.2.1.1 Assisted Natural Regeneration

In moderately dense forests, conditions are conducive to natural regeneration provided some sort of assistance is provided. Such area shall be taken up under this component. The areas shall be closed to reduce biotic interference. Ground surface will be cleared of slash, debris and felling refuse to afford a clean seed bed to the falling seed. At certain places some soil raking may also have to be done to facilitate germination of seeds. Where natural regeneration is found deficient. It will be supplemented by artificial planting. Patch sowing in suitable areas may also be done. 200 plants per hectare will be planted under this scheme. The plantation will be maintained for subsequent four years. Effective fencing will be done in the plantation areas. Total Rs 44,46,500.00 Will be expenditure in five years. Rate area taken as per prevailing model rate of Forest Department.

4.2.2 Engineering Measures

Gullies in their upper reaches only must be treated to prevent further deepening and widening. The purpose of engineering measures is to reduce the gradient, reduce the flow velocity and protect the stream bank. The water is guided safely from a higher elevation to a lower elevation without causing erosion at the gully/nala bed and banks. The water pools behind the engineering promotes the percolation into the soils. Check dam is one such engineering measure. The other engineering measures proposed for soil & water conservation includes Gabion structures, Continuous Contour Trench (CCT), Mini Percolation Tank (MPT) etc. A lumpsum amount of **Rs. 6.00 lakh** has been kept for check dams and gabions and Rs. 4.00 lacs has been kept for various engineering measures like Continuous Contour Trench (CCT), Mini Percolation Tank (MPT) etc. Map showing the nalas on which check dams have been proposed and area for other engineering measures is given as **Figure 7**.

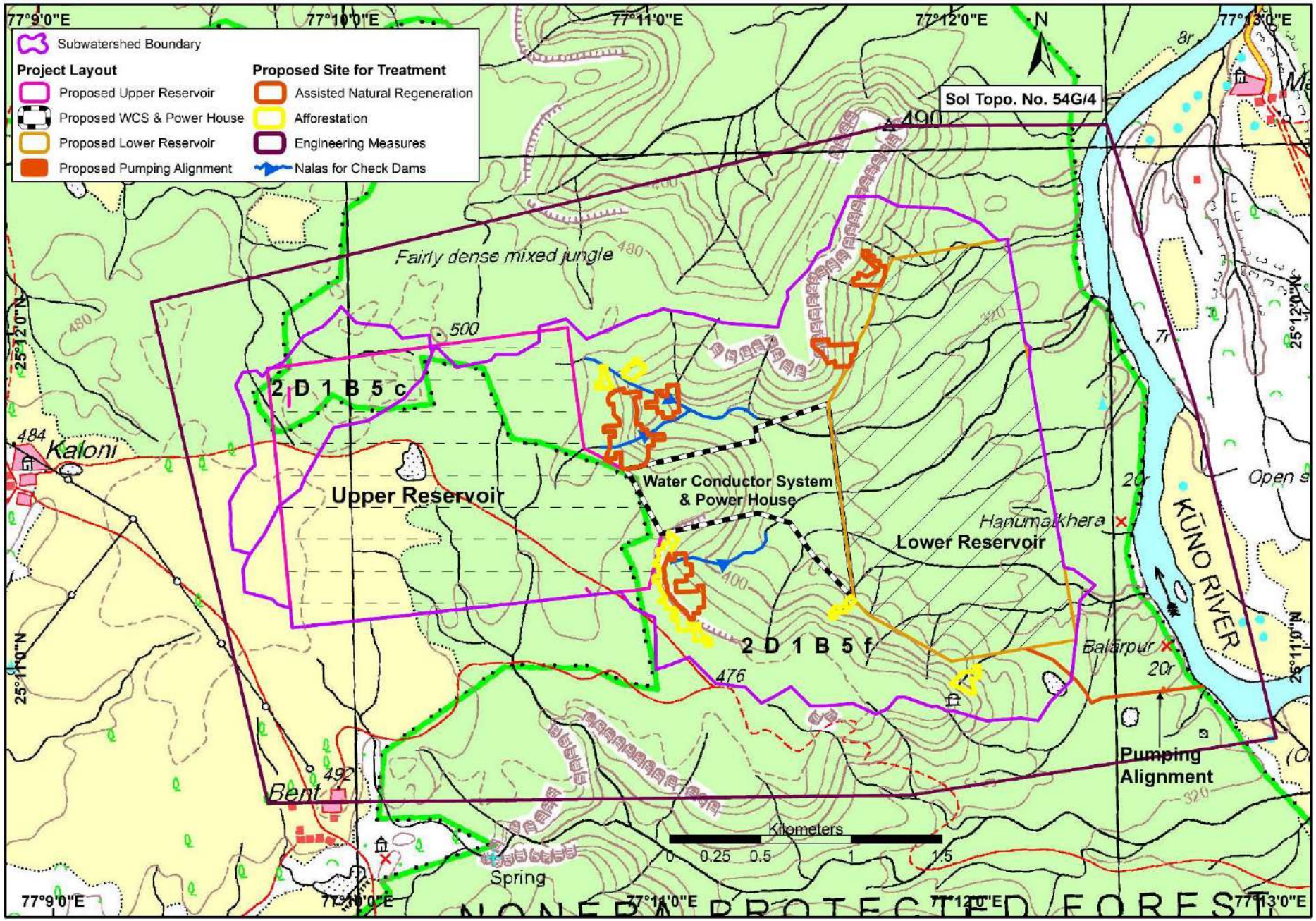


Figure 7: Map showing Areas proposed for Treatment Measures

5.0 OTHER COMPONENTS OF SOIL EROSION TREATMENT PLAN

Apart from the biological and engineering treatment measures in the Soil Erosion Treatment Plan there are other aspects of the Soil Erosion Treatment Plan to be addressed and their cost included in the overall cost estimate of the plan. The charges for operational support, forest protection, social mobilization, documentation and publication, monitoring and evaluation and providing environmental services are some of the integral ingredients which have to be considered and included while formulating the Soil Erosion Treatment Plans.

5.1 Administrative Charges

For an efficient management of forest resources, it is essential that operational support to the Forest Department is adequately developed. Similarly, in remote localities there are no places for shelter for the staff, people and trekkers. Therefore, a budgetary provision of **Rs. 593674.00** has been kept as administrative charges.

5.2 Provision for Micro Planning

The year-wise areas requiring treatment measures have been suggested but have not been marked. The spatial location of specific treatment to be carried out would require extensive detailing during the implementation of mitigation measures and a provision for micro-planning has been made in the total financial allocation. For this purpose, a provision of **Rs. 1.09 lakh** is being made.

5.3 Socio-economic

The following measures would help in rejuvenating the ecosystem and in reducing the soil erosion in the region. It shall be carried out for local villages near the catchment area.

i. Avenue plantation using fuel wood trees with suitable fencing in the villages.
ii. Establishment of training, awareness programmes for water and soil conservation in the village areas
iii. Awareness program for conservation of natural resource.

A budgetary provision of **Rs. 2.72 lakh** has been kept under this component.

5.4 Monitoring & Evaluation

Monitoring and evaluation will be undertaken as a part of project management. A process of self-evaluation at specified intervals of time will ensure the field level verification of suggested treatment measures and efficacy of the Soil Erosion Treatment plan.

The year-wise areas requiring treatment measures have been suggested but have not been marked. The spatial location of specific treatment to be carried out would require extensive detailing during the implementation of mitigation measures and a provision for micro-planning has been made in the total financial allocation. Thereafter, annual work plan would be prepared well in advance after undertaking initial ground surveys during micro-planning, specifying physical and financial targets, sites, locations and beneficiaries of each component of the project activity. Month-wise work schedule of various items of each component for the financial year would also be prepared in advance and its timely implementation would be ensured. Monthly progress report on all activities would be submitted by the Range Officers

to Divisional Forest Officer. The monitoring committee shall be constituted at the project level for this purpose which too would monitor on a regular basis the quality and quantity of works being carried out under the Soil Erosion Treatment Plan area. A provision of **Rs. 1.09 lakh** has been made for this component.

6.0 COST ESTIMATE

The estimated cost of implementation of Soil Erosion Treatment Plan as defined above is **Rs. 65.30 lakh** and is given at **Table 5**. Year wise physical and financial targets are given in **Table 6**.

Table 5: Estimated Cost of Soil Erosion Treatment Plan Implementation

S. No.	Item	Rate (Rs)	Unit	Target	
				Physical	Financial (Rs.)
I	**Biological Measures**				
1	Assisted Natural Regeneration				
	i) Creation	58315	Ha	2x25	29,15,750.00
	ii) Maintenance for 5 years	30616	Ha	2x25	15,30,800.00
	Sub Total I				**44,46,550.00**
II	**Engineering Measures**				
	Check Dams and Gabian		cmt	LS	6,00,000.00
	CCT, MPT etc				4,00,000.00
	Sub Total II				**10,00,000.00**
	Treatment Cost (Sub Total I + II)				**54,46,550.00**
	Socio-economic Activity @5% of Treatment Cost				272327.00
	Micro planning and preparation of DPR @2% of Treatment Cost				108931.00
	Monitoring & Evaluation of the works @2% of Treatment Cost				108931.00
	Total				**5936739.00**
	Administrative Charges @10% of Treatment Cost				593674.00
	Grand Total				**6530413.00**

Table 6: Year Wise Phasing of Physical and Financial Targets

Sr.N0.	Name of Activity	Year wise expenditure in Rs				
1		**2024-25**	**2025-26**	**2026-27**	**2027-28**	**2028-29**
1	Planting Activity: ANR plantation 2x25 ha =50 ha	2915750	849450	311000	185150	185150
2	Check Dams and Gabions	200000	200000	200000	0	0
3	CCT, MPT etc.	200000	100000	100000	0	0
4	Socio Economic Activity	200000	72327	0	0	0
5	Microplanning and preparation of DPR	108931	0	0	0	0
6	Monitoring and Evolution of works	0	0	0	108931	0
	Administrative Charges	450674	50000	45000	20000	20000
	Grand Total	**4075355**	**1271777**	**656000**	**314081**	**205150**

N. Gopi Krushna

Gopi Krushna N
Deputy General Manager (DGM)
Authorised Signatory
Greenko Energies Private Limited

कार्यालय प्रधान मुख्य वन संरक्षक, (हॉफ), राजस्थान, जयपुर

क्रमांक एफ 3(13)प्रमुवसं/ट्री/तक0/21–22/590–605 दिनांकः– 06/12/22

निमित,

1–परियोजना निदेशक, आर.एफ.बी.पी.–2 जयपुर।

2– समस्त सम्भागीय मुख्य वन संरक्षक जयपुर/अजमेर/भरतपुर/कोटा/उदयपुर/बीकानेर/जोधपुर/(वन्यजीव) जयपुर/कोटा/उदयपुर/सवाईमाधोपुर/सरिस्का/जोधपुर/विभागीय कार्य जयपुर

विषयः–नवीन मॉडल कॉस्ट नोर्म्स न्यूनतम श्रमिक दर रू. 259/- एवं सामग्री दर 2021

महोदय,

उपरोक्त विषयान्तर्गत निवेदन है कि श्रमिक दर 259/-रूपये प्रति दिन के आधार पर प्राप्त हुए वृक्षारोपण मॉडल राज्य स्तरीय मॉडल कमेटी की अनुशंषा पर प्रधान मुख्य वन संरक्षक, (हॉफ) राजस्थान, जयपुर के अनुमोदन उपरान्त संलग्न कर आवश्यक कार्यवाही हेतु प्रेषित किये जा रहे हैं।

(a) ANR (25 ha)
(b) RDF-I (25 ha)
(C) RDF-II (25 ha)
(d) Eco-restoration (25 ha)
(e) Eco-restoration (50 ha)
(f) Forest Guard Chowki
(g) Boundary Pillar

उक्त सभी मॉडल विभागीय वेबसाइट के निम्न लिंक पर उपलब्ध है।

http;//www.forest.rajasthan.gov.in/content/raj/forest/en/forest,-department/departmental-wings/forest-development/model-for-developmental activities.htm|

संलग्न–मॉडल की प्रति।

भवदीय

मुख्य वन संरक्षक (आयोजना)
राजस्थान, जयपुर।

Model Cost Norms
ANR (Assisted Natural Regeneration)

UNIT : 25 Ha
PERIMETER: 90 M/Ha.
LABOUR RATE: Rs.259. /Day
COST ESTIMATE: in Rs./Ha.

0 YEAR (ADVANCE ACTION)

S.No.	ITEMS	Unit	Qty.	Rate	LABOUR	MATERIAL	TOTAL
1	Collection of Data for Microplanning, preparation of microplan and management plan	Prorata			1208.66	101.22	1309.88
2	Survey of area, Layout of contour trenches/ furrows, Pits and marking of segments /plots	Prorata			694.14	77.12	771.26
3	Fencing by stone wall and or by ditch.						
	a). Stone wall fencing 1.20m high 0.80m at base & 0.60m at top(on an average 42 m/ha.)	meter	45	371.95	16737.75	0.00	16737.75
	b). Ditch fencing 1.20m deep,1.50m wide at top & 0.90m at bottom (on an average 42 m/ha.)	meter	45	280.69	12631.05	0.00	12631.05
4	Cost of raising 220 seedlings	Plant no.	220	9.02	1381.20	602.20	1983.40
5	**Digging up Trenches :**					0.00	
a.	Digging up 400 rmt Staggered Contour Trenches with cross section size: 0.45x0.45 Sqmt.	Meter	400	32.38	12952.00	0.00	12952.00
6	Digging of 200 pits size: 0.45x(0.4+0.5/2)	no.	200	20.27	4054.00	0.00	4054.00
7	Cost of collection and purchase of grass and other seeds of indegenous trees and shrubs	per ha	1	428.00	214.00	214.00	428.00
8	In situ Soil & Moisture Conservation measures like Check dam, Percolation Tanks, Earthen Bunds etc.	per ha	1	4965.17	4965.17	0.00	4965.17
9	Purchase or Construction of Water Storage tank	Prorata	1			150.00	150.00
10	Construction of Thatched cattle guard hut.	Prorata	1		518.00	72.98	590.98
11	Purchase of tools and plants	Prorata			0.00	90.63	90.63
12	Labour amenities	Prorata			95.94	70.62	166.56
13	Cattle guard wages for 4 months	Prorata			1077.44	0.00	1077.44
14	Restoration of Natural regeneration by cutback cultural operation, pruning and by making crescent shaped ridges on lower side of seedling and saplings	Prorata			1295.00	0.00	1295.00
15	Misc. and unforeseen expenses including running of vehicles	Prorata			490.57	99.23	589.80
	TOTAL YEAR 0				**58314.92**	**1478.00**	**59792.92**

उप वन संरक्षक (प्रशासन)
प्रधान मुख्य वन संरक्षक
प्रशिक्षण, अनुसंधान, शिक्षा एवं प्रसार
राजस्थान, जयपुर

सिंह गोठवाल)
वन संरक्षक (आयोजना),
राजस्थान, जयपुर

YEAR I (PLANTATION YEAR)

1	Maintenance of 220 seedling in nursery	Plant no.	220	2.17	376.92	100.90	477.82
2	Digging of 30cmx30cm cross section trench along inner side of stone wall fencing and seed sowing	meter	42	21.67	910.14	0.00	910.14
3	Sowing/dibbling of seeds of grass, trees and shrubs including seeds of medicinal plants on the mounds of trench/ditch fencing.	meter	442	0.58	256.36	0.00	256.36
4	Sowing of grass seeds including raking in the interspaces.	Prorata			587.07	0.00	587.07
5	Transportation of 200 plants from nursery to planting site	Plant no.	200	1.46	246.52	44.73	291.25
6	Planting of 200 seedlings including Refilling of pits	Plant no.	200	7.75	911.19	18.83	930.02
7	Purchase and application of insecticide and fertiliser in 200 plants	Plant no.	200	4.92	795.72	188.32	984.04
8	Making of 200 crescent shaped mounds below planted sapling after planting and dibbling of 3 seeds of throny tree species.	Plant no.	200	7.20	1440.00	0.00	1440.00
9	Weeding and Hoeing of 200 plants two times including repairing of plants mound	Plant no.	400	4.66	1864.00	0.00	1864.00
10	Weeding on contour trenches/ V-ditches and spacement / singling	Rmt	442	4.56	2015.52	0.00	2015.52
11	Restoration of Natural regeneration by cutback cultural operation, pruning and by making crescent shaped ridges on lower side of seedling and saplings	Prorata	1	1295.00	1295.00	0.00	1295.00
12	Raising of 10% Plants (20 plants) in Nursery for casualty replacement in year 2	Plant no.	20	9.02	125.56	54.75	180.31
13	Watch & ward charges for 12 months	Prorata			3230.82	0.00	3230.82
14	Construction of approach roads / inspection path	Prorata			441.27	0.00	441.27
15	Construction of gate and fixing of sign boards	Prorata			1174.14	138.88	1313.02
16	Misc. and unforeseen expences including (additional watering,hoeing, fencing and frost protection measures and running of vehicles etc.)	Prorata			1319.77	879.59	2199.36
	TOTAL YEAR 1		**2367**	**1358.99**	**16990.00**	**1426.00**	**18416.00**

YEAR 2 MAINTENANCE

1	Maintenance of 20 plants in nursery	Plant no.	20	2.17	34.27	9.17	43.44
2	Repair of fencing	Prorata			360.00	0.00	360.00
3	Casualty replacement of 20 plants (10%) including re-digging of pits, transportation, planting, watering and application of insecticides	Plant no.	20	13.42	259.00	9.42	268.42
4	Weeding and Hoeing in 200 plants two times	Plant no.	400	4.66	1864.00	0.00	1864.00
5	Watch & ward charges for 12 months	Prorata			3230.82	0.00	3230.82
6	Misc. and unforeseen expences including (additional watering, fencing and frost protection measures and running of vehicles etc.)	Prorata			472.20	128.12	600.32
	TOTAL YEAR 2				**6220.29**	**146.71**	**6367.00**

उप वन संरक्षक (प्रशासन)
प्रधान मुख्य वन संरक्षक
प्रशिक्षण, अनुसंधान, शिक्षा एवं प्रसार
राजस्थान, जयपुर

(अमर सिंह गोठवाल)
मुख्य वन संरक्षक (आयोजना)
राजस्थान जयपुर

	YEAR 3 : MAINTENANCE				3230.82	0.00	3230.82
1	Watch & ward charges for 12 months	Prorata			472.58	128.60	601.18
2	Expenditure on Maintenance including (Repair of fencing/Structures, Subsidiary silvicultural operations, Frost Protection, etc.)	Prorata					
	TOTAL YEAR 3.				3703.40	128.60	3832.00
	YEAR 4 : MAINTENANCE						
1	Watch & ward charges for 12 months	Prorata			3230.82		3230.82
2	Expenditure on Maintenance including (Repair of fencing / Structures, Subsidiary silvicultural operations, Frost Protection, etc.)	Prorata			472.58	128.60	601.18
	TOTAL YEAR 4.				3703.40	128.60	3832.00
	GRAND TOTAL				88932.01	3307.91	92239.92

Yearwise Cost Statement ANR (Assisted Natural Regeneration)

No.	Item of Works	Unit	Qty.	Rate (Rs.)	Labour Cost	Material Cost	Total Cost
1	YEAR 0 ADVANCE ACTION				58315	1478	59793
2	YEAR 1 - PLANTING YEAR				16990	1426	18416
3	YEAR 2 - MAINTENANCE I				6220	147	6367
4	YEAR 3 - MAINTENANCE II				3703	129	3832
5	YEAR - 4 MAINTENANCE III				3703	129	3832
	Grand Total				88932	3308	92240

नोट :– मॉडल्स कार्यस्थल विशेष पर कार्य सम्पादित कराने के लिये प्राक्कलन नहीं है वरन केवल मार्गदर्शक है। कार्यस्थल पर कार्य सम्पादित कराने के लिए कार्य स्थल की विशेषताओं/ परिस्थितियों के अनुसार प्राक्कलन के आधार पर कार्य कराये जावें।

उप वन संरक्षक (प्रशासन)
प्रधान मुख्य वन संरक्षक
प्रशिक्षण, अनुसंधान, शिक्षा एवं प्रसार
राजस्थान, जयपुर

(अमर सिंह गोठवाल)
मुख्य वन संरक्षक (आयोजना),
राजस्थान, जयपुर

Model Cost Norms RDF I

UNIT : 25 Ha
PERIMETER: 90 M/Ha.
LABOUR RATE: Rs.259. /Day
COST ESTIMATE: in Rs./Ha.

0 YEAR (ADVANCE ACTION)

S.No.	ITEMS	Unit	Qty.	Rate	LABOUR	MATERIAL	TOTAL
1	Collection of Data for Microplanning, preparation of microplan and management plan	Prorata			1208.66	101.22	1309.88
2	Survey of area, Layout of contour trenches/ furrows, Pits and marking of segments /plots	Prorata			694.14	77.12	771.26
3	Fencing by stone wall and or by ditch.						
	a). Stone wall fencing 1.20m high 0.80m at base & 0.60m at top(on an average 45 m/ha.)	meter	45	371.95	16737.75	0.00	16737.75
	b). Ditch fencing 1.20m deep,1.50m wide at top & 0.90m at bottom (on an average 45 m/ha.)	meter	45	280.69	12631.05	0.00	12631.05
4	Cost of raising 550 seedlings	Plant no.	550	9.02	3453.01	1505.49	4958.50
5	Raising of 240 plants in 10cmX15 cm bags for planting on mounds of trenches and V ditches(includes 20% extra)	Plant	240	2.29	361.85	187.68	549.53
6	**Digging up Trenches :**					0.00	
a.	Digging up 400 rmt Staggered Contour Trenches with cross section size: 0.45x0.45 Sqmt.	Meter	400	32.38	12952.00	0.00	12952.00
7	Digging of 300 pits size: 0.45x(0.4+0.5/2) cum	no.	300	20.27	6081.00	0.00	6081.00
8	Cost of collection and purchase of grass and other seeds of indegenous trees and shrubs	per ha	1	428.00	214.00	214.00	428.00
9	In situ Soil & Moisture Conservation measures like Check dam, Percolation Tanks, Earthen Bunds etc.	per ha	1	4964.85	4964.85	0.00	4964.85
10	Construction of Thatched cattle guard hut.	Prorata	1		518.00	72.98	590.98
11	Purchase or construction of water storage tank	Prorata	1			150.00	150.00
12	Purchase of tools and plants	Prorata			0.00	90.63	90.63
13	Labour amenities	Prorata			95.94	70.62	166.56
14	Cattle guard wages for 4 months	Prorata			1077.44	0.00	1077.44
15	Restoration of Natural regeneration by cutback cultural operation, pruning and by making crescent shaped ridges on lower side of seedling and saplings	Prorata			1295.00	0.00	1295.00
16	Misc. and unforeseen expenses including running of vehicles	Prorata			490.57	99.23	589.80
	TOTAL YEAR 0				**62775.26**	**2568.97**	**65344.23**

उप वन संरक्षक (प्रशासन)
प्रधान मुख्य वन संरक्षक
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राजस्थान, जयपुर

(अमर सिंह गोदारा)
प्रधान वन संरक्षक (आयोजना).
राजस्थान, जयपुर

YEAR I (PLANTATION YEAR)

1	Maintenance of 550 seedling in nursery	Plant no.	550	2.17	942.31	252.25	1194.56
2	Maintenance of 240 plants in 10cmX15 cm bags	Plant	240	1.37	241.80	86.69	328.49
3	Digging of 200 pits size 0.45X(0.4+0.5)/2 Cum	Pit	200	20.27	4053.56	0.00	4053.56
4	Digging of 30cmx30cm cross section trench along inner side of stone wall fencing and seed sowing	meter	42	21.67	910.14	0.00	910.14
5	Sowing/dibbling of seeds of grass, trees and shrubs including seeds of medicinal plants on the mounds of trench/ditch fencing.	meter	442	0.58	256.36	0.00	256.36
6	Purchase of fertilizers and insecticide and its application	Prorata			2029.52	444.05	2473.57
7	Sowing of pellets of grass seeds / pieces of seed mud cakes in between rows & pits	Prorata			586.52	0.00	586.52
8	Transportation of 500 plants from nursery to planting site	Plant no.	500	1.58	775.63	14.98	790.61
9	Planting of 500 seedlings including Refilling of pits	Plant no.	500	7.75	3875.00	0.00	3875.00
10	Transport 200 plants raised in 10 cmX15cm bags upto site including loading and unloading (upto 5 kms.)	Plant	200	0.95	189.11	0.00	189.11
11	Planting of 200 pre germinated plants, including local transport and watering	Plant	200	2.87	427.56	145.52	573.08
12	Restoration of natural regeneration by making crescent shaped mounds on the lower slope of 150 seedlings and saplings	Plant no.	150	4.73	709.85	0.00	709.85
13	Making of 500 crescent shaped mounds below planted sapling after planting and dibbling of 3 seeds of throny tree species.	Plant no.	500	7.20	3600.00	0.00	3600.00
14	Weeding and Hoeing of 500 plants two times including repairing of plants mound	Plant no.	1000	4.66	4660.00	0.00	4660.00
15	Weeding on contour trenches/ V-ditches and spacement / singling	Rmt	442	4.56	2015.52	0.00	2015.52
16	Restoration of Natural regeneration by cultural operations and by making crescent shaped ridges on lower side of seedlings	Prorata	1	1295.00	1295.00	0.00	1295.00
17	Raising of 10% Plants (50 plants) in Nursery for casualty replacement in year 2	Plant no.	50	9.02	314.59	136.41	451.00
18	Watch & ward charges for 12 months	Prorata			3230.82	0.00	3230.82
19	Labour hut etc				375.48	40.66	416.14
20	Construction of approach roads / inspection path	Prorata			441.27	0.00	441.27
21	Construction of gate and fixing of sign boards	Prorata			1174.14	138.88	1313.02
22	Misc. and unforeseen expences including (additional watering,hoeing, fencing and frost protection measures and running of vehicles etc.)	Prorata			3300.00	2199.07	5499.07
	TOTAL YEAR 1		**5017**	**1384.38**	**35404.18**	**3458.51**	**38862.69**

उप वन संरक्षक (प्रशासन)
प्रधान मुख्य वन संरक्षक
प्रशिक्षण, अनुसंधान, शिक्षा एवं प्रसार
राजस्थान, जयपुर

(अमर सिंह गोदारा)
वन संरक्षक (आयोजना).
राजस्थान, जयपुर

YEAR 2 MAINTENANCE

1	Maintenance of 55 plants in nursery	Plant no.	55	2.17	94.23	25.22	119.45
2	Repair of fencing	Prorata			360.00	0.00	360.00
3	Casualty replacement of 50 plants (10%) including re-digging of pits, transportation, planting, watering and application of insecticides	Plant no.	50	13.44	649.56	22.47	672.03
4	Weeding and Hoeing in 500 plants two times	Plant no.	1000	4.66	4660.00	0.00	4660.00
5	Watch & ward charges for 12 months	Prorata			3230.82	0.00	3230.82
6	Misc. and unforeseen expences including (if watering required, fencing and frost protection measures and running of vehicles etc.)	Prorata			472.20	128.12	600.32
	TOTAL YEAR 2				**9466.81**	**175.81**	**9642.62**

YEAR 3 : MAINTENANCE

1	Watch & ward charges for 12 months	Prorata			3230.82	0.00	3230.82
2	Expenditure on Maintenance including (Repair of fencing/Structures, Subsidiary silvicultural operations, Frost Protection, etc.)	Prorata			472.58	128.60	601.18
	TOTAL YEAR 3.				**3703.40**	**128.60**	**3832.00**
	YEAR 4 : MAINTENANCE						
1	Watch & ward charges for 12 months	Prorata			3230.82		3230.82
2	Expenditure on Maintenance including (Repair of fencing / Structures, Subsidiary silvicultural operations, Frost Protection, etc.)	Prorata			472.58	128.60	601.18
	TOTAL YEAR 4.				**3703.40**	**128.60**	**3832.00**
	GRAND TOTAL				**115053.05**	**6460.49**	**121513.54**

Year wise Cost Statement RDF I

No.	Item of Works	Unit	Qty.	Rate (Rs.)	Labour Cost	Material Cost	Total Cost
1	YEAR 0 ADVANCE ACTION				62775	2569	65344
2	YEAR 1 - PLANTING YEAR				35404	3459	38863
3	YEAR 2 - MAINTENANCE I				9467	176	9643
4	YEAR 3 - MAINTENANCE II				3703	129	3832
5	YEAR - 4 MAINTENANCE III				3703	129	3832
	Grand Total				115053	6460	121514

नोट :– मॉडल्स कार्यस्थल विशेष पर कार्य सम्पादित कराने के लिये प्राक्कलन नहीं है वरन केवल मार्गदर्शक है। कार्यस्थल पर कार्य सम्पादित कराने के लिए कार्य स्थल की विशेषताओं/ परिस्थितियों के अनुसार प्राक्कलन के आधार पर कार्य कराये जावें।

उप वन संरक्षक (प्रशासन)
प्रधान मुख्य वन संरक्षक
प्रशिक्षण, अनुसंधान, शिक्षा एवं प्रसार
राजस्थान, जयपुर

(आमर सिंह गोदारा)
मुख्य वन संरक्षक (आयोजना),
राजस्थान, जयपुर

Model Cost Norms RDF II

UNIT : 25 Ha
PERIMETER: 90 M/Ha.
LABOUR RATE: Rs.259. /Day
COST ESTIMATE: in Rs./Ha.

0 YEAR (ADVANCE ACTION)

S.No	ITEMS	Unit	Qty.	Rate	LABOUR	MATERIAL	TOTAL
1	Collection of Data for Microplanning, preparation of microplan and management plan	Prorata			1208.66	101.22	1309.88
2	Survey of area, Layout of contour trenches/ furrows, Pits and marking of segments /plots	Prorata			694.14	77.12	771.26
3	Fencing by stone wall and or by ditch.						
	a). Stone wall fencing 1.20m high 0.80m at base & 0.60m at top(on an average 45 m/ha.)	meter	45	371.95	16737.75	0.00	16737.75
	b). Ditch fencing 1.20m deep,1.50m wide at top & 0.90m at bottom (on an average 45 m/ha.)	meter	45	280.69	12631.05	0.00	12631.05
4	Cost of raising 220 seedlings	Plant no.	220	9.02	1381.20	602.20	1983.40
5	Raising of 240 plants in 10cmX15 cm bags for planting on mounds of trenches and V ditches(includes 20% extra)	Plant	240	2.29	361.85	187.68	549.53
6	**Digging up Trenches :**					0.00	
a.	Digging up 400 rmt Staggered Contour Trenches with cross section size: 0.45x0.45 Sqmt.	Meter	400	32.38	12952.00	0.00	12952.00
7	Digging of 200 pits size: 0.45x(0.4+0.5/2) cum	no.	200	20.27	4054.00	0.00	4054.00
8	Cost of collection and purchase of grass and other seeds of indegenous trees and shrubs	per ha	1	428.00	214.00	214.00	428.00
9	In situ Soil & Moisture Conservation measures like Check dam, Percolation Tanks, Earthen Bunds etc.	per ha	1	4965.17	4965.17	0.00	4965.17
10	Construction of Thatched cattle guard hut.	Prorata	1		518.00	72.98	590.98
11	Purchase or construction of water storage tank	Prorata	1			150.00	150.00
12	Purchase of tools and plants	Prorata			0.00	90.63	90.63
13	Labour amenities	Prorata			95.94	70.62	166.56
14	Cattle guard wages for 4 months	Prorata			1077.44	0.00	1077.44
15	Restoration of Natural regeneration by cutback cultural operation, pruning and by making crescent shaped ridges on lower side of seedling and saplings	Prorata			1295.00	0.00	1295.00
16	Misc. and unforeseen expenses including running of vehicles	Prorata			490.57	99.23	589.80
	TOTAL YEAR 0				**58676.77**	**1665.68**	**60342.45**

उप वन संरक्षक (प्रशासन)
प्रधान मुख्य वन संरक्षक
प्रशिक्षण, अनुसंधान, शिक्षा एवं प्रसार
राजस्थान, जयपुर

(अमर सिंह मीणा)
मुख्य वन संरक्षक (आयोजना),
राजस्थान, जयपुर

YEAR I (PLANTATION YEAR)

1	Maintenance of 220 seedling in nursery	Plant no.	220	2.17	376.92	100.90	477.82
2	Maintenance of 240 plants in 10cmX15 cm bags	Plant	240	1.37	241.80	86.69	328.49
3	In situ Soil & Moisture Conservation measures like Check dam, Nadis, Earthen Bunds etc.	Prorata			2935.33	201.16	3136.49
4	Digging of 30cmx30cm cross section trench along inner side of stone wall fencing and seed sowing	meter	42	21.67	910.14	0.00	910.14
5	Sowing/dibbling of seeds of grass, trees and shrubs including seeds of medicinal plants on the mounds of trench/ditch fencing.	meter	442	0.58	256.36	0.00	256.36
6	Sowing of grass seeds including raking in the interspaces.	Prorata			587.07	0.00	587.07
7	Transportation of 200 plants from nursery to planting site	Plant no.	200	1.46	246.52	44.73	291.25
8	Planting of 200 seedlings including Refilling of pits	Plant no.	200	7.75	911.19	18.83	930.02
9	Transport 200 plants raised in 10 cmX15cm bags upto site including loading and unloading (upto 5 kms.)	Plant	200	0.95	189.11	0.00	189.11
10	Planting of 200 pre germinated plants, including local transport and watering	Plant	200	2.87	427.56	145.52	573.08
11	Purchase and application of insecticide and fertiliser in 200 plants	Plant no.	200	4.92	795.72	188.32	984.04
12	Making of 200 crescent shaped mounds below planted sapling after planting and dibbling of 3 seeds of throny tree species.	Plant no.	200	7.20	1440.00	0.00	1440.00
13	Weeding and Hoeing of 200 plants two times including repairing of plants mound	Plant no.	400	4.66	1864.00	0.00	1864.00
14	Weeding on contour trenches/ V-ditches and spacement / singling	Rmt	445	4.56	2029.20	0.00	2029.20
15	Restoration of Natural regeneration by cutback cultural operation, pruning and by making crescent shaped ridges on lower side of seedling and saplings	Prorata	1	1295.00	1295.00	0.00	1295.00
16	Raising of 10% Plants (20 plants) in Nursery for casualty replacement in year 2	Plant no.	20	9.02	125.56	54.75	180.31
17	Watch & ward charges for 12 months	Prorata			3230.82	0.00	3230.82
18	Labour hut etc				375.48	40.66	416.14
19	Construction of approach roads / inspection path	Prorata			441.27	0.00	441.27
20	Construction of gate and fixing of sign boards	Prorata			1174.14	138.88	1313.02
21	Misc. and unforeseen expences including (additional watering,hoeing, fencing and frost protection measures and running of vehicles etc.)	Prorata			1319.77	879.59	2199.36
	TOTAL YEAR 1		**3010**	**1364.18**	**21172.96**	**1900.03**	**23072.99**

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(अमर सिंह)
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राजस्थान, जयपुर

YEAR 2 MAINTENANCE

1	Maintenance of 20 plants in nursery	Plant no.	20	2.17	34.27	9.17	43.44
2	Repair of fencing	Prorata			360.00	0.00	360.00
3	Casualty replacement of 20 plants (10%) including re-digging of pits, transportation, planting, watering and application of insecticides	Plant no.	20	13.42	259.00	9.42	268.42
4	Weeding and Hoeing in 200 plants two times	Plant no.	400	4.66	1864.00	0.00	1864.00
5	Watch & ward charges for 12 months	Prorata			3230.82	0.00	3230.82
6	Misc. and unforeseen expences including (if watering required, fencing and frost protection measures and running of vehicles etc.)	Prorata			472.20	128.12	600.32
	TOTAL YEAR 2				**6220.29**	**146.71**	**6367.00**

YEAR 3 : MAINTENANCE

1	Watch & ward charges for 12 months	Prorata			3230.82	0.00	3230.82
2	Expenditure on Maintenance including (Repair of fencing/Structures, Subsidiary silvicultural operations, Frost Protection, etc.)	Prorata			472.58	128.60	601.18
	TOTAL YEAR 3.				**3703.40**	**128.60**	**3832.00**
	YEAR 4 : MAINTENANCE						
1	Watch & ward charges for 12 months	Prorata			3230.82		3230.82
2	Expenditure on Maintenance including (Repair of fencing / Structures, Subsidiary silvicultural operations, Frost Protection, etc.)	Prorata			472.58	128.60	601.18
	TOTAL YEAR 4.				**3703.40**	**128.60**	**3832.00**
	GRAND TOTAL				**93476.82**	**3969.62**	**97446.44**

Year wise Cost Statement RDF II

No.	Item of Works	Unit	Qty.	Rate (Rs.)	Labour Cost	Material Cost	Total Cost
1	**YEAR 0 ADVANCE ACTION**				**58677**	**1666**	**60342**
2	**YEAR 1 - PLANTING YEAR**				**21173**	**1900**	**23073**
3	**YEAR 2 - MAINTENANCE I**				**6220**	**147**	**6367**
4	**YEAR 3 - MAINTENANCE II**				**3703**	**129**	**3832**
5	**YEAR - 4 MAINTENANCE III**				**3703**	**129**	**3832**
	Grand Total				**93477**	**3970**	**97446**

नोट :– मॉडल्स कार्यस्थल विशेष पर कार्य सम्पादित कराने के लिये प्राक्कलन नहीं है वरन केवल मार्गदर्शक है। कार्यस्थल पर कार्य सम्पादित कराने के लिए कार्य स्थल की विशेषताओं/ परिस्थितियों के अनुसार प्राक्कलन के आधार पर कार्य कराये जावें।

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प्रशिक्षण, अनुसंधान, शिक्षा एवं प्रसार
राजस्थान, जयपुर

([illegible])
मुख्य वन संरक्षक (आयोजना)
राजस्थान, जयपुर

MODEL COST ESTIMATE FOR ECO- RESTORATION

Unit : 25 Ha
PERIMETER: 90 M/HA
LABOUR RATE: 259/- DAY
COST ESTIMATES IN Rs./ha.
First Year

S.No	Item	Unit	Qty.	Rate	Labour	Material	Total Cost
1	Survey and demarcation of area, dividing of the area in sub plot and their semi permanent demarcation and also preparation of treatement map and accordingly prepare estimate of site	Ha.	1	484.47	379.47	105	484.47
							0
2	Fencing of Areas.						
	A. Ditch fencing 1.20m, Deep 1.50m Wide at top and 0.80m. At bottom (on an average 25m/ha.)	Rmt	25	280.69	7017.25	0	7017.25
	B. Loose stone wall fencing 1.50 m. height, 0.80 at base and 0.60m at top (on an average 25m/ha.)	Rmt	25	464	11600	0	11600
	C. Masonary pucca wall height 1.5m., width 0.45m. With pillar having width 0.6m. Length 0.45m. At the interval of 2.25m., At forest boundary where the forest area is encroachment or mininig pron (on an average 15m/ha.)	Rmt	15	3500	21000	31500	52500
	D. Barbed Wire fencing of Height 1.5 mtr with RCC pole of height 2.1 Mtr supported by welded mesh wire (jaali) of height 1.5 mtr (on an average 25m/ha.)	Rmt	25	218	1362.5	4087.5	5450
3	Treatement of nallas by construction series of loose stone check dams and dry random rubble/earthen/Dykes/silt detention dams/ small anicuts/nadis/ MPT/PT/ Gabion structure	Prorata			9819	1494.79	11314
4	Restoration of natural regeneration by cut back cultural operation of root stock,pruning and making crescent shaped ridges on lower side of seedling and saplings.	Prorata			1260	0	1260
5	Eradication of weeds like juliflora /Parthenium/Lantana etc.	Prorata			200	2300	2500
6	Digging of 400 rmt. of staggered / contionus contour trenches of cross section 45×45 cm	Meter	400	32.38	15064	1336	16400
7	Collection and purchage of seeds of indegenous trees and shurbs species & grasses and including the cost their sowing or dibbling . 4kg seeds/Ha.	No.	1		173	445	618
		No.	1		518	81	599
8	construction of Thatched cattele guard hut	No.	1		2030	268.57	2299
9	Construction of apporach road, inspection path and walking trails.	month	3	269.35	808	50	858
10	Watch and ward for 3 months	Prorata			60	540	600
11	Purchase of sign board ,gate & their flxing.	Prorata			228	104.86	333
12	Miscellaneous and unforeseen expend true.				**71519.22**	**42312.72**	**113832.7**
	Total						
13	Contigency charges- Labour aminities, mate, nurse, water, shade etc. 3% of total cost				0	1269.38	1269.38
	TOTAL				**71519.22**	**43582.1**	**115102.1**

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राजस्थान, जयपुर

मुख्य वन संरक्षक (आयोजना),
राजस्थान, जयपुर

Second year							
1	Eradication of weeds like juliflora /Parthenium/Lantana etc.	Prorata			100	1150	1250.00
	Repairing of Ditch fencing	Rmt	2.5	192	480	0	480
2	Collection and purchage of seeds of indegenous trees and shurbs species & grasses and including the cost their sowing or dibbling . 2kg seeds/Ha.	No.	1		86.5	222.5	309.00
3	Restoration of natural regeneration by cut back cultural operation of root stock,pruning and making crescent shaped ridges on lower side of seedling and saplings.	Prorata			630	0	630.00
4	Watch and ward for 12months	month	12	269.35	3232	100	3332
	Total				**4528.5**	**1472.5**	**6001.00**
Third Year							
1	Repairing of Ditch fencing	Rmt	2.5	192	480	0	480
2	Repairing Loose stone wall fencing		1.5	232	348	0	348
3	Repairing Barbed Wire fencing of Height		1.5	109	164	0	163.5
4	Watch and ward for 12months	month	12	269.35	3232	100	3332
	Total				**4224**	**100**	**4323.5**
FourthYear							
1	Watch and ward for 12months	month	12	269.35	3232	100	3332
	Total				3232	100	**3332**
Fifth Year							
1	Watch and ward for 12months	month	12	269.35	3232	100	3332
	Total				3232	100	3332
	Grand Total				86735.72	45354.6	132090.6

उप वन संरक्षक (प्रशासन)
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राजस्थान, जयपुर

(अमर सिंह गोठवाल)
संयुक्त वन संरक्षक (आयोजना)
राजस्थान, जयपुर

MODEL COST ESTIMATE FOR ECO- RESTORATION

Unit : 50Ha
PERIMETER: 60M/HA
LABOUR RATE: 259/- DAY
COST ESTIMATES IN Rs./ha.
First Year

S.No	Item	Unit	Qty.	Rate	Labour	Material	Total Cost
1	Survey and demarcation of area and also preparation of treatement map and accordingly prepare estimate of site	Ha.	1	484.47	379.47	105	484.47
2	**Fencing of Areas.**						0
	A. Ditch 1.20m, Deep 1.50m Wide at top and 0.80m. At bottom (on an average 15m/ha.)	Rmt	15	280.69	4210.35	0	4210.35
	B. Loose stone wall 1.50 m. height, 0.80 at base and 0.60m. At top (on an average 15m/ha.)	Rmt	15	464	6960	0	6960
	C. Masonary pucca wall height 1.5m., width 0.45m. With pillar having width 0.6m. Length 0.45m. At the interval of 2.25m., on the outer forest boundary (on an average 15m/ha.)	Rmt	15	3500	21000	31500	52500
	D. Barbed Wire fencing of Height 1.5 mtr with RCC pole of height 2.1 Mtr supported by welded mesh wire (jaali) of height 1.5 mtr (on an average 15m/ha.)	Rmt	15	218	817.5	2452.5	3270
3	Treatement of nallas by construction series of loose stone check dams and dry random rubble/earthen/Dykes/silt detention dams/ small anicuts/nadis/ MPT/PT/ Gabion structure	Prorata			9819	1494.79	11313.79
4	Restoration of natural regeneration by cut back cultural operation of root stock,pruning and making crescent shaped ridges on lower side of seedling and saplings.	Prorata			971	10.7	981.7
5	Eradication of weeds like juliflora /Parthenium/Lantana etc.	Prorata			200	2300	2500
6	Digging of 400 rmt. Of staggered / contionus contour trenches of cross section 45×45 cm and width as per requirement	Meter	400	32.38	15064	1336	16400
7	Collection and purchage of seeds of indegenous trees and shurbs species & grasses and including the cost their sowing or dibbling . 4kg seeds/Ha.	No.	1		173	445	618
8	construction of Thatched cattele guard hut	No.	1		259	40	299
9	Construction of apporach road, inspection path and walking trails.	No.	1		2030	268.57	2298.57
10	Watch and ward for 3 months	month	3	150	405	45	450
11	Purchase of sign board, gate & their fixing.	Prorata			30	270	300
12	Miscellaneous and unforeseen expend true.	Prorata			228	104.86	332.86
	Total				**62546.32**	**40372.4**	102918.74
13	Contigency charges- Labour amínities, mate, nurse, water, shade etc. 3% of total cost				0	1211.17	1211.17
	Total				**62546.32**	**41583.6**	**104129.913**

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(अमर सिंह गोठवाल)
मुख्य वन संरक्षक (आयोजना),
राजस्थान, जयपुर

Second year							
1	Eradication of weeds like juliflora /Parthenium/Lantana etc.	Prorata			100	1150	1250.00
	Repairing of Ditch fencing	Rmt	1.5	192	288	0	288
2	Collection and purchage of seeds of indegenous trees and shurbs species & grasses and including the cost their sowing or dibbling . 2kg seeds/Ha.	No.	1		86.5	222.5	309.00
3	Restoration of natural regeneration by cut back cultural operation of root stock,pruning and making crescent shaped ridges on lower side of seedling and saplings.	Prorata			485.5	0	485.50
4	Watch and ward for 12months	month	12	269.35	3232	100	3332
	Total				**4192**	**1472.5**	**5664.50**
Third Year							
1	Repairing of Ditch fencing	Rmt	1	192	192	0	192
2	Repairing Loose stone wall fencing		1	232	232	0	232
3	Repairing Barbed Wire fencing of Height		1	109	109	0	109
4	Watch and ward for 12months	month	12	269.35	3232	100	3332
	Total				**3765**	**100**	**3865**
FourthYear							
10	Watch and ward for 12months	month	12	269.35	3232	100	**3332**
	Total				3232	100	**3332**
Fifth Year							
10	Watch and ward for 12months	month	12	269.35	3232	100	**3332**
	Total				**3232**	**100**	**3332**
	Grand Total				**76967.32**	**43256.1**	**120323.41**

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(आमर सिंह गोदारा)
मुख्य वन संरक्षक (आयोजना),
राजस्थान, जयपुर

Model Estimate (Guard Chowki)

(Saintory Installation Work)

BSR : Jaipur (City Circle-2019)

S.No.	B.S.R	Particular	Qty	Unit	Rate	Amount
1	1.2.1	P & F Indian type white glazed vitreous china 1st quality W.C. orissa pan (IS :2556 Mark) with 100 mm vitreous china P or S trap including cutting and making good the wall and floor: Size 530x410mm.	1	No	2400	2400
2	1.36.2	WASH BASINS: 1.36 P & F WVC Wash basin (Ist quality IS:2556 Mark) of approved make with C.I. brackets duly painted 1 No. 15 mm C.P. Pillar cock (IS:8934 Mark) & 32 mm C.P. brass waste coupling of approved make, P.V.C Waste pipe with PVC nut 32 mm complete including cutting & making good the wall : Size 510 mm x 400 mm	1	No	2189	2189
3	1.38.9.2	KITCHEN & LAB. SINKS: 1.38 P & F Kitchen & Lab. Sink of approved make with C.I. brackets duly painted, 40 mm C.P. waste coupling, C.P. Brass chain with rubber plug, 40 mm G.I. waste pipe up-to floor level complete including cutting and making good the wall & floor : 1.0 mm thick stainless steel AISI -304 & IS 13983-1994 kitchen sink of approved make as per Engineer-in-charge with large waste coupling. Overall size Bowl size 22 x 18 x 7 20x16x7	1	No	3936	3936
4	1.23	P & F WVC (10 litres) low-level flushing cistern with cover.	1	No	753	753
5	1.44.1	P & F Bevelled edge Mirror/mirror with teak wood lipping around of special glass of approved make as per direction of Engineer-in-charge complete with 6mm thick commercial ply base fixed to wooden screws & washers. Size 600 x 450mm x 4 mm thick	1	No	523	523
6	1.47.1	P & F Towel Rail or Ring of approved quality/make: C.P. brass Towel Rail elbow type with concealed screws size 450mm (Heavy duty).	1	No	425	425
7	1.47.8	P & F Towel Rail or Ring of approved quality/make: C.P. Brass Towel Ring revolving type	1	No	231	231
8	1.52.2	P & F Soap Dish or Tray of approved quality/make C.P. brass heavy and superior quality.	1	No	142	142
9	1.55.2	P & F Bath Shower of approved quality/make. C.P. brass of Heavy & superior quality 150mm.	1	No	342	342
10	1.59	P & F Jet spray for water closet with C.P. Copper Tube flange of approved make.	15	No	346	5190
11	2.1.1	P & F G.I. pipes (Internal Work) with G.I. Fittings excluding union (IS:1239 Mark) & MS clamps including cutting and making good the walls and floors: (a) Exposed on wall 2.1.1 15 mm dia nominal bore 'B' Class	1	RMT	209	209
12	2.7.1	P & F Bib Cock (IS : 8931 Mark), Superior quality of approved make: Brass 400 gm,15mm nominal bore.	4	No	271	1084
13	2.15.1	P & F Full-way Valve (IS:778 Mark) or wheel valve of approved make : Gun-metal 15mm nominal bore.	2	No	206	412

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राजस्थान, जयपुर

(अमर सिंह गोदारा)
मुख्य वन संरक्षक (आयोजना),
राजस्थान, जयपुर

14	2.26.3	P & F PVC Storage Tank ISI Marked (IS : 12701) indicating the BIS license No), of approved make with cover, 25mm dia 1M long G.I. over-flow pipe & 25 Cm. long wash out pipe with plug & socket, including making connection etc., complete of approved design: 500 litres capacity.	1	No	3564	3564
15	3.16.2	RIGID PVC PIPE 3.16 P&F rigid PVC Pipe (IS:4985 mark) class II/ (4 Kg. /Cm2 .) approved quality /make including joining the pipe with solvent cement rubber ring and lubricant. 75 mm dia	3	RMT	161	483
16	3.16.3	RIGID PVC PIPE 3.16 P&F rigid PVC Pipe (IS:4985 mark) class II/ (4 Kg. /Cm2 .) approved quality /make including joining the pipe with solvent cement rubber ring and lubricant. 110 mm dia	6	RMT	256	1536
17	3.17.1	P&F rigid PVC pipe fittings (IS: 4985 mark) of approved quality /make including joining the pipe with solvent cement rubber ring and lubricant: Coupler (socket)				0
		75mm dia	3	No	79	237
		110mm dia	2	No	98	196
18	3.17.3	P&F rigid PVC pipe fittings (IS: 4985 mark) of approved quality /make including joining the pipe with solvent cement rubber ring and lubricant: Plain Tee				0
		75mm dia	1	No	104	104
		110mm dia	0	No	170	0
19	3.17.4	P&F rigid PVC pipe fittings (IS: 4985 mark) of approved quality /make including joining the pipe with solvent cement rubber ring and lubricant: Door Tee 110mm dia	1	No	194	194
20	3.17.9	P&F rigid PVC pipe fittings (IS: 4985 mark) of approved quality /make including joining the pipe with solvent cement rubber ring and lubricant: Bend 87 .5				0
		75mm dia	4	No	88	352
		110mm dia	1	No	146	146
21	3.17.23	P&F rigid PVC pipe fittings (IS: 4985 mark) of approved quality /make including joining the pipe with solvent cement rubber ring and lubricant: P- Trap 110mm dia	3	No	347	1041
22		VENT COWER	1	No	51	51
23	.3.24.1	Construction of Soakage well in all types of soil of approved drawing, top 90 Cm .Portion in 450mm thick masonry with CM 1:6, 80 mm thick stone slab covering, jointing of slab in CM 1:3 ,Ralthal, kharanja 40mm thick M-15 grade C.C flooring, earth work etc . complete including disposal of surplus earth within a lead of 50 mtr . Inner dia 90 Cm & 10 to 12 Mtr deep.	1	No	4948	4948
		Total				30688

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राजस्थान, जयपुर

(अजय सिंह गोदारा)
मुख्य वन संरक्षक (आयोजना),
राजस्थान, जयपुर

Model Estimate (Rain Water harvesting Structure/Water Tank)

BSR : Jaipur (City Circle-2019)

S.No.	B.S.R	Particular	No	L	B	H	Qty	Unit	Rate	Amount
1	1.6	Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means over areas (exceeding 30cm in depth. 1.5m in width as well as 10 sqm on plan) including disposal of excavated earth, lead upto 50m and lift upto 1.5 m , disposed earth to be levelled and neatly dressed: All kinds of soil	3.14	1.65	1.65	3.3	28.21	Cum	159	4485
2	3.1.6	Providing and laying in position cement concrete including curing, compaction etc. complete in specified grade excluding the cost of centering and shuttering - All work up to plinth level. 1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size).	3.14	1.65	1.65	0.2	1.71	Cum	3002	5133
3	3.1.3	Providing and laying in position cement concrete including curing, compaction etc. complete in specified grade excluding the cost of centering and shuttering - All work up to plinth level. M15 grade Nominal Mix 1: 2: 4 (1 cement : 2 coarse sand : 4 graded stone aggregate 40mm nominal size).	3.14	2.95	3	0.15	4.17	Cum	4131	17219
4	4.10.1	Centering & shuttering with plywood or steel sheets including strutting, propping bracing both ways with steel props and removal of formwork for upto floor five level for : Walls (any thickness) including attached pilasters, buttresses plinth and string course.	2	3.14	2.95	3	55.58	Sqm	263	14617
5	10.16	Stone slab roofing on ground floor with fine grained stone slab from approved quarry including filling of joints of parapet and slab on both sides in cement sand mortar 1:4, with ceiling pointing in cement sand mortar 1 : 3 complete as per specification and instruction of Engineer In Charge	1	3.14	1.5	1.5	7.07	Sqm	1498	10583
6	6.18.1	Supplying and fixing stone lintels/bed plates of approved quarry rough dressed in cement mortar 1:4 : Upto 15 cm. thick.	2	3	0.23	0.1	0.14	Cum	8746	1207
7		Supplying & Fixing R.C.C. Manholes covers with frame of approved make (Light duty). Size 450 X 450mm					1.00	No	290	290
		Total								53535

उप वन संरक्षक (प्रशासन)
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राजस्थान, जयपुर

(अमर सिंह गोदारा)
मुख्य वन संरक्षक (आयोजना)
राजस्थान, जयपुर

Model Estimate (Guard Chowki)

Based on BSR : Jaipur (City Circle-2019)

S.No.	B.S.R	Particular	No	L	B	H	Qty	Unit	Rate	Amount
1	1.6	Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means over areas (exceeding 30cm in depth. 1.5m in width as well as 10 sqm on plan) including disposal of excavated earth, lead upto 50m and lift upto 1.5 m , disposed earth to be levelled and neatly dressed. All kinds of soil								
			1	3.28	0.9	1.05	3.10			
			2	4.19	0.9	1.05	7.92			
			1	2.67	0.9	1.05	2.52			
			2	2.06	0.9	1.05	3.89			
			2	4.5	0.9	1.05	8.51			
			2	5.11	0.9	1.05	9.66			
			1	3.28	0.9	1.05	3.10			
			2	2.67	0.9	1.05	5.05			
			1	4.19	0.9	1.05	3.96			
			1	2.06	0.9	1.05	1.95			
		Total					49.65	Cum	159	7894
2	3.1.6	Providing and laying in position cement concrete including curing, compaction etc. complete in specified grade excluding the cost of centering and shuttering - All work up to plinth level. 1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size).								
			1	3.28	0.9	0.20	0.20			
			2	4.19	0.9	0.20	1.51			
			1	2.67	0.9	0.20	0.48			
			2	2.06	0.9	0.20	0.74			
			2	4.5	0.9	0.20	1.62			
			2	5.11	0.9	0.20	1.84			
			1	3.28	0.9	0.20	0.59			
			2	2.67	0.9	0.20	0.96			
			1	4.19	0.9	0.20	0.75			
			1	2.06	0.9	0.20	0.37			
		Total					9.07	Cum	3002	27219
3	6.1.6	Random Rubble stone masonry for with hard stone in foundation and plinth in Cement Sand mortar above 30 CM thick wall in: Cement Mortar 1:6 (1-Cement : 6-Sand).								
		steps-I	1	3.28	0.75	0.40	0.98			
			2	4.19	0.75	0.40	2.51			
			1	2.67	0.75	0.40	0.80			
			2	2.06	0.75	0.40	1.24			
			2	4.5	0.75	0.40	2.70			
			2	5.11	0.75	0.40	3.07			
			1	3.28	0.75	0.40	0.98			
			2	2.67	0.75	0.40	1.60			
			1	4.19	0.75	0.40	1.26			
			1	2.06	0.75	0.40	0.62			
		steps-II	1	3.28	0.60	0.45	0.89			
			2	4.19	0.60	0.45	2.26			
			1	2.67	0.60	0.45	0.72			
			2	2.06	0.60	0.45	1.11			
			2	4.5	0.60	0.45	2.43			
			2	5.11	0.60	0.45	2.76			
			1	3.28	0.60	0.45	0.89			
			2	2.67	0.60	0.45	1.44			
			1	4.19	0.60	0.45	1.13			
			1	2.06	0.60	0.45	0.56			
		steps-III	1	3.28	0.40	0.60	0.79			
			2	4.19	0.40	0.60	2.01			
			1	2.67	0.40	0.60	0.64			
			2	2.06	0.40	0.60	0.99			
			2	4.5	0.40	0.60	2.16			
			2	5.11	0.40	0.60	2.45			
			1	3.28	0.40	0.60	0.79			
			2	2.67	0.40	0.60	1.28			
			1	4.19	0.40	0.60	1.01			
			1	2.06	0.40	0.60	0.49			
		Steps	4	4.42	0.6	0.15	1.59			
		Total					44.15	Cum	2580	113903

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4	3.7.2	Providing and laying damp-proof course with cement concrete grade M-150 (1 : 2 : 4) mortar prepared with 1% solution of water-proof compound complete as per specification 75mm thick								
			1	3.28	0.23		0.75			
			2	4.19	0.23		1.93			
			1	2.67	0.23		0.61			
			2	2.06	0.23		0.95			
			2	4.5	0.23		2.07			
			2	5.11	0.23		2.35			
			1	3.28	0.23		0.75			
			2	2.67	0.23		1.23			
			1	4.19	0.23		0.96			
			1	2.06	0.23		0.47			
		Total					12.08	Sqm	496	5994
5	5.2.2	Brick work with F.P.S. bricks of class designation 75 in superstructure above plinth level upto floor V level in all shapes and sizes in : Cement mortar 1 : 6 (1 cement : 6 coarse sand)								
			1	3.28	0.23	3.20	2.41			
			2	4.19	0.23	3.20	6.17			
			1	2.67	0.23	3.20	1.97			
			2	2.06	0.23	3.20	3.03			
			2	4.5	0.23	3.20	6.62			
			2	5.11	0.23	3.20	7.52			
			1	3.28	0.23	3.20	2.41			
			2	2.67	0.23	3.20	3.93			
			1	4.19	0.23	3.20	3.08			
			1	2.06	0.23	3.20	1.52			
		Prepat	1	25.21	0.23	0.45	2.61			
		Total					41.28			
		Deduction								
		D1	4	1.07	0.13	2.13	1.19			
		D2	2	0.75	0.23	2.13	0.73			
		WINDOW	2	1.07	0.23	1.23	0.61			
			4	1.23	0.23	1.23	1.39			
		VENT	1	0.60	0.23	0.60	0.08			
		Total					4.00			
		Net Total					37.28	Cum	4536	169096
6	5.8.3	Half brick masonry in Superstructure , above plinth level upto floor V level using bricks of designation 75								
		Kitchan	3	0.60	0.75		1.35			
			1	8.70	0.45		3.92			
			2	0.61	0.45		0.55			
		Total					5.81	Sqm	478	2779
7	4.10.2	Centering & shuttering with plywood or steel sheets including strutting, propping bracing both ways with steel props and removal of formwork for upto floor five level for : Suspended floors, roofs, landings, staircases, balconies, girders, cantilevers, bands, coping bed plates, anchor blocks, sills, chhajjas, lintel, beam, plinth beam etc.								
		Outer	1	35	0.15		5.25			
			1	4.19	1.83		7.67			
			1	3.96	3.05		12.08			
			1	2.44	1.83		4.47			
			1	4.27	4.88		20.84			
			1	2.44	3.05		7.44			
			1	8.7	0.60		5.22			
		Bcam	3	4.42	0.23		3.05			
			3	1.83	0.23		1.26			
		Total					67.27	Sqm	309	20787
8	4.2	Providing and laying in position specified grade of cement concrete for RCC structural elements upto floor five level including curing, compaction, finishing with rendering in cement sand mortar 1:3 (1 cement: 3 coarse sand) and making good the joints and cost of plastizers (if required) excluding the cost of centering, shuttering and reinforcement for Walls (any thickness) including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. M20 grade Nominal Mix / Design Mix								
			1	8.92	5.94	0.120	6.36			
			1	2.67	2.06	0.120	0.66			
			1	3.28	2.67	0.120	1.05			
			1	4.42	0.23	0.23	0.23			
			1	1.83	0.23	0.23	0.10			
		Total					8.40	Cum	5099	42830

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9	4.13.3	STEEL REINFORCEMENT: 4.13 Providing and fabricating reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding (including cost of binding wire) all complete up to floor five level. ('Original producers' who manufacture billet directly from iron ores and roll the bilets to produce steel conforming to IS:1786) Thermo-mechanically Treated bars (Conforming of relevent IS code) (100 kg per cum of c.c.)					840.00	Kg	65	54600
10	12.2.2	Plaster on new surface on walls in cement sand mortar 1:4 including racking of joints etc. complete fine finish : 20mm thick								
		Kit	2	2.44		3.20	15.62			
			2	3.05		3.20	19.52			
		B/R	2	4.27		3.20	27.33			
			2	4.88		3.20	31.23			
		Toilet	2	2.44		3.20	15.62			
			2	1.83		3.20	11.71			
		Office	2	3.96		3.20	25.34			
			2	3.05		3.20	19.52			
		Veramda	1	4.19		3.20	13.41			
			1	1.83		3.20	5.86			
			2	0.45		3.20	2.88			
			2	0.23		3.20	1.47			
			1	3.80		0.60	2.28			
			1	1.50		0.60	0.90			
		Total					192.68			
		Deduction								
		W1	2	1.07	1.23		2.63			
		W1	4	1.23	1.23		6.05			
		VENT	1	0.60	0.60		0.36			
		D1	4	1.07	2.13		9.12			
		D2	2	0.75	2.13		3.20			
		Veramda	1	1.83	2.44		4.47			
			1	3.63	2.44		8.86			
		Total					34.68			
		Net Total					158.01	Sqm	188	29705
		Outer	2	11.81		3.80	89.76			
			2	7.40		3.80	56.24			
		Parapet Inner	1	25.21		0.45	11.34			
		Total					157.34	Sqm	168	26433
11	12.5	6 mm thick cement plaster to ceiling of mix 1:3 (1cement : 3-fine sand)								
			1	2.44	3.05		7.44			
			1	4.27	4.88		20.84			
			1	4.19	1.83		7.67			
			1	2.44	1.83		4.47			
			1	4.19	1.83		7.67			
			1	9.15	0.60		5.49			
		Total					53.57	Cum	116	6214
12	12.22.1	Providing and applying white cement based putty over plastered surface to prepare the surface even and smooth complete New Plastered Surface (three or more coats)					368.92	Sqm	76	
13	12.36	Distempering with dry distemper of approved brand and shade (two or more coats) and of required shade on new work, over and including, priming coat of whiting to give an even shade including all scaffolding.					211.58	Sqm	48	
14	12.41.1	Finishing wall with water proofing cement paint of approved brand and manufacture and or required shade to give an even shade including all scaffolding: New work (Two or more coats applied @ 3.84 kg/10 sqm).					157.34	Sqm	48	
15	12.45.1	PAINTING Applying priming coat : With ready mix pink or gray primer of approved brand and manufacture on wood work hard and soft wood.								
			21	0.6		2.05	25.83			
			8	0.95		2.05	15.58			
		Total					41.41	Sqm	26	1077
16	12.45.3	PAINTING Applying priming coat : With ready mixed red oxide zinc chromate primer of approved brand and manufacture on steel galvanised iron/steel works								
			4	1.07		1.23	5.26			
			8	1.23		1.23	12.10			
			1	0.6		0.60	0.36			
		Total					17.73	Sqm	21	372
17	12.46.1	Painting with synthetic enamel paint of approved brand and manufacture to give an even shade : Two or more coats on new work								
			21	0.6		2.05	25.83			
			8	0.95		2.05	15.58			
			4	1.07		1.23	5.26			
			8	1.23		1.23	12.10			
			1	0.6		0.60	0.36			
		Total					59.14	Sqm	63	3726

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18	6.18.1	Supplying and fixing stone lintels/bed plates of approved quarry rough dressed in cement mortar 1:4 : Upto 15 cm. thick. Windwo/D	14	1.50	0.23		4.83	Cum	8746	42243
19	6.16.2	Providing dab stone over Chajjas duly fixed in cement sand mortar 1:6 complete : 50mm thick.	7	1.80	0.23		2.90	Sqm	750	2174
20	6.15	Providing and fixing horizontal chajja of Red/ White sand stone 40 mm thick and upto 80 cm projection in cement mortar 1:4 (1 cement : 4 coarse sand) including pointing in white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment matching the stone shade.								
		Chaja	7	1.5	0.23		2.42			
			1	0.75	0.60		0.45			
		Kitchan	1	3.05	0.60		1.83			
			1	1.83	0.60		1.10			
		Total					5.79	Sqm	803	4652
21	1.25	Filling available excavated earth (excluding rock) in trenches, plinth side of foundation etc. in layers not exceeding 20 cm. in depth, consolidating each deposited layer by ramming and watering including lead up to 50 meter and with all lift.								
			1	2.30	2.90	0.60	4.00			
			1	2.30	1.70	0.60	2.35			
			1	4.13	4.73	0.60	11.72			
			1	4.00	1.70	0.60	4.08			
			1	3.50	2.90	0.60	6.09			
		Total					24.24	Cum	58	1406
22	11.26	Random rubble dry stone Kharanja under floor.								
			1	2.30	2.90	0.15	1.00			
			1	2.30	1.70	0.15	0.59			
			1	4.13	4.73	0.15	2.93			
			1	4.00	1.70	0.15	1.02			
			1	3.50	2.90	0.15	1.52			
		Total					6.06	Cum	847	5132
23	3.1.3	Providing and laying in position cement concrete including curing, compaction etc. complete in specified grade excluding the cost of centering and shuttering - All work up to plinth level. M15 grade Nominal Mix 1: 2: 4 (1 cement : 2 coarse sand : 4 graded stone aggregate 40mm nominal size). (Flooring)								
			1	2.94	3.05	0.05	0.45			
			1	2.44	1.83	0.05	0.22			
			1	4.27	4.88	0.05	1.04			
			1	3.96	3.05	0.05	0.60			
			1	4.19	1.83	0.05	0.38			
		Steps	4	4.30	0.30	0.05	0.26			
		Total					2.96	Cum	4131	12223
24	11.18.1	Kota stone slab flooring 25 mm thick over 20 mm (average) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab including rubbing and polishing complete with base of cement mortar 1 : 4 (1 cement : 4 coarse sand) For area of each slab from 901 to 2000 Sq.Cm : Sqm 864.00								
			1	2.64	3.25		8.58			
			1	4.47	5.08		22.71			
			1	4.16	3.25		13.52			
			1	4.39	2.03		8.91			
			4	4.30	0.30		5.16			
			4	4.30	0.15		2.58			
		Total					61.46	Sqm	864	53101
25	7.22.1	Providing and fixing 1st quality MAT & GLOSSY finished ceramic tile confirming to IS : 13755 and IS : 15622 colour such as white, grey, ivory, fume red brown, light green, light blue and other light shades in floors,steps, pillars etc. laid on a bed of neat cement slurry finished with flush pointing in the white cement mixed with pigment to match the shade of the tile complete (including the cost of cement mortar bed 1:4). Size 250mm x 375mm Sqm 661.00	1	2.4	1.83		4.39	Sqm	661	2903
26	7.23.1	P & F 1st qualityHeavy Duty Vitrified Polished Digital tiles on floor, skirting and steps etc.in different sizes (thickness minimum 10mm) with water absorption less than or equal 0.08% and conforming to IS 15622 of approved make in all colour and shade, laid with 20 mm thick CM 1: 4 including grounting the joints with white cement and matching pigment etc complete. Size 298mm x 298mm Sqm 641.00								
			2	2.44		2.10	10.25			
			2	1.83		2.10	7.69			
			2	3.05		1.20	7.32			
			1	0.6		1.20	0.72			
			1	2.44		1.20	2.93			
		Total					28.90			
		Deduction								
			2	0.75		2.10	3.15			
			2	1.07		1.20	2.57			
			1	1.07		1.20	1.28			
		Total					7.00			
		Net Total					21.90	Sqm	641	14038

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27	10.17.1	Grading roof for water proofing treatment with water proffing compound Cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)								
			1	8.92	5.94	0.05	2.65			
			1	2.67	2.06	0.05	0.28			
			1	3.28	2.67	0.05	0.44			
		Total					3.36	Cum	4075	13701
28	3.8	Providing & fixing precast cement concrete coping 1 : 2 : 4 mix 50mm thick complete as per specification :								
			1	25.21	0.30		7.56			
			1	10	0.15		1.50			
		Total					9.06	Sqm	334	3027
29	8.13.2.2	Providing and fixing external grade board solid core single leaf flush door shutters ISI 2202-67 marked using Phenol formal dehyderesin in glue both sides with approved steel fittings complete as per annexure 'A' : 30 mm thick Decorative teak veneer One side								
			4	0.95	2.00		7.60			
			2	0.6	2.00		2.40			
		Total					10.00	Sqm	1848	18480
30	9.28.1	Providing and fixing steel glazed window frame made out of 80x40 mm hollow sheet section of 16 gauge thickness, joint mitred welded and grinded including hold fast of steel lugs 13mm x 3mm and 15 Cm long embedded in C C block 15 x 10 x 10 Cm of 1:3:6 nominal concrete and including fixing of pivoted hinges of superior quality, window shutters made out of 50 x 25.0 mm hollow steel section 15 mm paitam of 18 gauge thickness, joint mitred and grinded including 10mm x 10mm square bars welded to frame for paitam fixing float glass 4mm thick panes with glazing clips and metal sash putty and fixing of shutters frames peg stay, U shape handle 100 mm long, tower bolts 100 mm long of steel powder coated superior quality including fixing and jointing with frame hinges priming coat with steel primer complete in all respect as per direction of Engineer-in –charge Window openable.								
			2	1.07	1.23		2.63			
			1	1.23	1.23		1.51			
			1	0.60	0.60		0.36			
		Total					4.51	Sqm	3457	15574
31	15.25.1	Providing and fixing in CM 1 : 4 double paitam (rebated) stone door window and ventilator frames of approved quarry : Size 100 x 75mm.								
			12	2.10			25.20			
			4	0.95			3.80			
			2	0.75			1.50			
		Total					30.50	mtr	180	5490
32	7.5.1	Providing and fixing Granite stone slab mirror polished and machine edge cut in walls, pillars, steps, Shelves, Sills Counters, Floors etc. laid on 12mm (Av.) thick base of cement mortar 1:3 (1 cement : 3 coarse sand) jointing with white cement mortar 1:2 (1white cement : 2 marble dust) with pigment to match the shade of the marble slab including grinding, rubbing and polishing complete. Jhunjhunu / Jalore (Red/Choclate/Black/Pink Colour) Up to 1500 Cm2 Tiles Sqm. 1812.00								
			2.44	3.05	0.6		4.47			
			3.05	1.83	0.075		0.42			
		Total					4.88	Sqm	1812	8849
33	6.17.1	Supplying and fixing in walls machine cut and polished stone shelves, tands and in CM 1:3 with machine cut edges : Sand or other approved stone 25mm thick.	3	3.05	0.6		5.49	Sqm	458	2514
34	7.8.2.1	Granite/Kota Stone Work Full Edge moulding	1	4.9			4.90	Mtr	212	1039
		Total								719175
		Sanitory Work								31000
		Electricity Fitting								50000
		Under Ground 15000 Litre Capicity Water Tank								53535
		G. Total								853710

उप वन संरक्षक (प्रशासन)
प्रधान मुख्य वन संरक्षक
प्रशिक्षण, अनुसंधान, शिक्षा एवं प्रसार
राजस्थान, जयपुर

मुख्य वन संरक्षक (आयोजना)
राजस्थान, जयपुर

Model Estimate (Range Office)

Based on BSR : Jaipur (City Circle-2019)

S.No.	B.S.R	Particular	No	L	B	H	Qty	Unit	Rate	Amount
1	1.6	Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means over areas (exceeding 30cm in depth. 1.5m in width as well as 10 sqm on plan) including disposal of excavated earth, lead upto 50m and lift upto 1.5 m , disposed earth to be levelled and neatly dressed: All kinds of soil								
			2	7.4	0.90	1.05	13.99			
			1	6.56	0.90	1.05	6.20			
			3	4.5	0.90	1.05	12.76			
			2	4.98	0.90	1.05	9.41			
			2	3.89	0.90	1.05	7.35			
			1	4.53	0.90	1.05	4.28			
			1	2.13	0.90	1.05	2.01			
			1	3.05	0.90	1.05	2.88			
			1	9.45	0.60	0.45	2.55			
		Total					**61.43**	Cum	159	9768
2	3.1.6	Providing and laying in position cement concrete including curing, compaction etc. complete in specified grade excluding the cost of centering and shuttering - All work up to plinth level. 1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size).								
			2	7.4	0.90	0.20	2.66			
			1	6.56	0.90	0.20	1.18			
			3	4.5	0.90	0.20	2.43			
			2	4.98	0.90	0.20	1.79			
			2	3.89	0.90	0.20	1.40			
			1	4.53	0.90	0.20	0.82			
			1	2.13	0.90	0.20	0.38			
			1	3.05	0.90	0.20	0.55			
		Total					**11.22**	Cum	3002	33670
3	6.1.6	Random Rubble stone masonry for with hard stone in foundation and plinth in Cement Sand mortar above 30 CM thick wall in: Cement Mortar 1:6 (1-Cement : 6-Sand).								
			2	7.4	0.75	0.40	4.44			
			1	6.56	0.75	0.40	1.97			
			3	4.5	0.75	0.40	4.05			
			2	4.98	0.75	0.40	2.99			
			2	3.89	0.75	0.40	2.33			
			1	4.53	0.75	0.40	1.36			
			1	2.13	0.75	0.40	0.64			
			1	3.05	0.75	0.40	0.92			
			2	7.4	0.60	0.45	4.00			
			1	6.56	0.60	0.45	1.77			
			3	4.5	0.60	0.45	3.65			
			2	4.98	0.60	0.45	2.69			
			2	3.89	0.60	0.45	2.10			
			1	4.53	0.60	0.45	1.22			
			1	2.13	0.60	0.45	0.58			
			1	3.05	0.60	0.45	0.82			
			2	7.4	0.40	0.90	5.33			
			1	6.56	0.40	0.90	2.36			
			3	4.5	0.40	0.90	4.86			
			2	4.98	0.40	0.90	3.59			
			2	3.89	0.40	0.90	2.80			
			1	4.53	0.40	0.90	1.63			
			1	2.13	0.40	0.90	0.77			
			1	3.05	0.40	0.90	1.10			
		Steps	5	1.5	0.35	0.3	0.79			
		Total					**58.74**	Cum	2580	151538

उप वन संरक्षक (प्रशासन)
प्रधान मुख्य वन संरक्षक
प्रशिक्षण, अनुसंधान, शिक्षा एवं [illegible]
राजस्थान, जयपुर

(अमर सिंह [illegible])
मुख्य वन संरक्षक (आयोजना)
राजस्थान, जयपुर

4	3.7.2	Providing and laying damp-proof course with cement concrete grade M-150 (1 : 2 : 4) mortar prepared with 1% solution of water-proof compound complete as per specification 75mm thick								
			2	7.4	0.40		5.92			
			1	6.56	0.40		2.62			
			3	4.5	0.40		5.40			
			2	4.98	0.40		3.98			
			2	3.89	0.40		3.11			
			1	4.53	0.40		1.81			
			1	2.13	0.40		0.85			
			1	3.05	0.40		1.22			
		Total					**24.92**	Sqm	496	12362
5	5.2.2	Brick work with F.P.S. bricks of class designation 75 in superstructure above plinth level upto floor V level in all shapes and sizes in : Cement mortar 1 : 6 (1 cement : 6 coarse sand)								
			2	7.4	0.23	3.20	10.89			
			1	6.56	0.23	3.20	4.83			
			3	4.5	0.23	3.20	9.94			
			2	4.98	0.23	3.20	7.33			
			2	3.89	0.23	3.20	5.73			
			1	4.53	0.23	3.20	3.33			
			1	2.13	0.23	3.20	1.57			
			1	3.05	0.23	3.20	2.24			
		Prepat	1	34.4	0.23	0.45	3.56			
		Total					**49.42**			
		Deduction								
		WINDOW	8	1.23	0.23	1.23	2.78			
		D1	5	1.07	0.23	2.10	2.58			
		D2	2	0.75	0.23	2.10	0.72			
		VENT	2	0.60	0.23	0.60	0.17			
		Total					**6.26**			
		Net Total					**43.16**	Cum	4536	195786
6	5.8.3	Half brick masonry in Superstructure , above plinth level upto floor V level using bricks of designation 75								
		Prepat	1	9.45	0.45		4.25			
			2	0.75	0.45		0.68			
			1	2.44	3.20		7.81			
			1	3.66	3.20		11.71			
			1	0.60	3.20		1.92			
		Kitchan	3	0.60	0.75		1.35			
		Total					**27.72**	Sqm	478	13249
7	4.10.2	Centering & shuttering with plywood or steel sheets including strutting, propping bracing both ways with steel props and removal of formwork for upto floor five level for : Suspended floors, roofs, landings, staircases, balconies, girders, cantilevers, bands, coping bed plates, anchor blocks, sills, chhajjas, lintel, beam, plinth beam etc.								
			1	14	8.23		115.22			
		Bcam	2	9.45	0.23		4.35			
		Bcam	6	1.50	0.23		2.07			
			2	4.72	0.23		2.17			
		Total					**123.81**	Sqm	309	38257
8	4.2	Providing and laying in position specified grade of cement concrete for RCC structural elements upto floor five level including curing, compaction, finishing with rendering in cement sand mortar 1:3 (1 cement: 3 coarse sand) and making good the joints and cost of plastizers (if required) excluding the cost of centering, shuttering and reinforcement for Walls (any thickness) including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. M20 grade Nominal Mix / Design Mix								
			1	14	8.23	0.120	13.83			
			1	9.45	0.23	0.230	0.50			
			3	2.1	0.23	0.230	0.33			
		Total					**14.66**	Cum	5099	74749

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राजस्थान, जयपुर

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राजस्थान, जयपुर

9	4.13.3	STEEL REINFORCEMENT: 4.13 Providing and fabricating reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding (including cost of binding wire) all complete up to floor five level. ('Original producers' who manufacture billet directly from iron ores and roll the bilets to produce steel conforming to IS:1786) Thermo-mechanically Treated bars (Conforming of relevent IS code) (100 kg per cum of c.c.)					1465.96	Kg	65	95287
10	12.2.2	Plaster on new surface on walls in cement sand mortar 1:4 including racking of joints etc. complete fine finish : 20mm thick								
			2	3.66		3.20	23.42			
			2	4.3		3.20	27.52			
			2	3.05		3.20	19.52			
			2	2.13		3.20	13.63			
			2	4.72		3.20	30.21			
			2	5.64		3.20	36.10			
			2	2.44		3.20	15.62			
			2	1.53		3.20	9.79			
			2	1.7		3.20	10.88			
			2	1.53		3.20	9.79			
			2	4.27		3.20	27.33			
			2	4.57		3.20	29.25			
		Veramda	1	9.45		3.20	30.24			
			2	1		3.20	6.40			
		Total					289.70			
		Deduction								
		D1	5	1.07	2.1		11.24			
			2	0.75	2.1		3.15			
		W	2	1.23	1.23		3.03			
		Total					17.41			
		Net Total					272.29	Sqm	188	51190
		Outer	1	14.77	3.75		55.39			
			2	7.9	3.75		59.25			
			1	4.05	3.75		15.19			
			2	0.85	3.75		6.38			
		Parapet Inner	1	45.35		0.75	34.01			
		Total					170.21	Sqm	168	28596
11	12.5	6 mm thick cement plaster to ceiling of mix 1:3 (1cement : 3-fine sand)								
			1	3.66	4.3		15.74			
			1	4.72	5.64		26.62			
			1	3.05	2.13		6.50			
			1	2.44	1.53		3.73			
			1	1.7	1.53		2.60			
			1	4.27	4.57		19.51			
			1	9.45	1.53		14.46			
			2	9.45	0.23		4.35			
			7	1.53	0.23		2.46			
		Total					95.97	Cum	116	11133
12	12.22.1	Providing and applying white cement based putty over plastered surface to prepare the surface even and smooth complete New Plastered Surface (three or more coats)					538.47	Sqm	76	
13	12.36	Distempering with dry distemper of approved brand and shade (two or more coats) and of required shade on new work, over and including, priming coat of whiting to give an even shade including all scaffolding.					368.26	Sqm	48	
14	12.41.1	Finishing wall with water proofing cement paint of approved brand and manufacture and or required shade to give an even shade including all scaffolding: New work (Two or more coats applied @ 3.84 kg/10 sqm).					170.21	Sqm	48	
15	12.45.1	PAINTING Applying priming coat : With ready mix pink or gray primer of approved brand and manufacture on wood work hard and soft wood.								
			10	0.95		2.05	19.48			
			4	0.61		2.05	5.00			
		Total					24.48	Sqm	26	636

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राजस्थान, जयपुर

(अमर सिंह गोदारा)
मुख्य वन संरक्षक (आयोजना).
राजस्थान, जयपुर

16	12.45.3	PAINTING Applying priming coat : With ready mixed red oxide zinc chromate primer of approved brand and manufacture on steel galvanised iron/steel works								
			16	1.23		1.23	24.21			
			4	0.61		0.61	1.49			
		Total					25.69	Sqm	21	540
17	12.46.1	Painting with synthetic enamel paint of approved brand and manufacture to give an even shade : Two or more coats on new work								
			10	0.95		2.05	19.48			
			4	0.61		2.05	5.00			
			16	1.23		1.23	24.21			
			4	0.61		0.61	1.49			
		Total					50.17	Sqm	63	3161
18	6.18.1	Supplying and fixing stone lintels/bed plates of approved quarry rough dressed in cement mortar 1:4 : Upto 15 cm. thick. Windwo/D	13	1.50	0.23		4.49			
			2	0.75	0.23		0.35			
		Total					4.83	Cum	8746	42243
19	6.16.2	Providing dab stone over Chajjas duly fixed in cement sand mortar 1:6 complete : 50mm thick.	7	1.80	0.23		2.90	Sqm	750	2174
20	6.15	Providing and fixing horizontal chajja of Red/ White sand stone 40 mm thick and upto 80 cm projection in cement mortar 1:4 (1 cement : 4 coarse sand) including pointing in white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment matching the stone shade.								
			1	1.53	0.60		0.92			
			1	3.05	0.60		1.83			
			7	1.50	0.60		6.30			
			2	0.90	0.60		1.08			
		Total					10.13	Sqm	803	8133
21	1.25	Filling available excavated earth (excluding rock) in trenches, plinth side of foundation etc. in layers not exceeding 20 cm. in depth, consolidating each deposited layer by ramming and watering including lead up to 50 meter and with all lift.								
			1	3.50	4.15	0.60	8.72			
			1	4.57	5.50	0.60	15.08			
			1	2.90	1.98	0.60	3.45			
			1	2.30	1.40	0.60	1.93			
			1	1.50	1.40	0.60	1.26			
			1	4.12	4.40	0.60	10.88			
			1	9.30	1.35	0.60	7.53			
		Total					40.13	Cum	58	2327
22	11.26	Random rubble dry stone Kharanja under floor.								
			1	3.50	4.15	0.15	2.18			
			1	4.57	5.50	0.15	3.77			
			1	2.90	1.98	0.15	0.86			
			1	2.30	1.40	0.15	0.48			
			1	1.50	1.40	0.15	0.32			
			1	4.12	4.40	0.15	2.72			
			1	9.30	1.35	0.15	1.88			
		Total					12.21	Cum	847	10343
23	3.1.3	Providing and laying in position cement concrete including curing, compaction etc. complete in specified grade excluding the cost of centering and shuttering - All work up to plinth level. M15 grade Nominal Mix 1: 2: 4 (1 cement : 2 coarse sand : 4 graded stone aggregate 40mm nominal size). (Flooring)								
			1	3.50	4.15	0.05	0.73			
			1	4.57	5.50	0.05	1.26			
			1	2.90	1.98	0.05	0.29			
			1	2.30	1.40	0.05	0.16			
			1	1.50	1.40	0.05	0.11			
			1	4.12	4.40	0.05	0.91			
			1	9.30	1.35	0.05	0.63			
		Total					4.07	Cum	4131	16814

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राजस्थान, जयपुर

(अमर सिंह [illegible])
मुख्य वन संरक्षक (आयोजना),
राजस्थान, जयपुर

24	11.18.1	Kota stone slab flooring 25 mm thick over 20 mm (average) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab including rubbing and polishing complete with base of cement mortar 1 : 4 (1 cement : 4 coarse sand) For area of each slab from 901 to 2000 Sq.Cm : Sqm 864.00								
			1	3.25	2.33		7.57			
			1	3.86	4.5		17.37			
			1	4.92	5.84		28.73			
			1	4.47	4.77		21.32			
			1	9.55	1.73		16.52			
			4	1.50	0.30		1.80			
			4	1.50	0.3		1.80			
		Total					95.12	Sqm	864	82183
25	7.22.1	Providing and fixing 1st quality MAT & GLOSSY finished ceramic tile confirming to IS : 13755 and IS : 15622 colour such as white, grey, ivory, fume red brown, light green, light blue and other light shades in floors,steps, pillars etc. laid on a bed of neat cement slurry finished with flush pointing in the white cement mixed with pigment to match the shade of the tile complete (including the cost of cement mortar bed 1:4). Size 250mm x 375mm Sqm 661.00	1	2.44	1.53		3.73			
			1	1.7	1.53		2.60			
		Total					6.33	Sqm	661	4187
26	7.23.1	P & F 1st qualityHeavy Duty Vitrified Polished Digital tiles on floor, skirting and steps etc.in different sizes (thickness minimum 10mm) with water absortion less than or equal 0.08% and conforming to IS 15622 of approved make in all colour and shade, laid with 20 mm thick CM 1: 4 including grounting the joints with white cement and matching pigment etc complete. Size 298mm x 298mm Sqm 641.00								
			2	2.44		2.10	10.25			
			1	1.53		2.10	3.21			
			1	0.75		2.10	1.58			
		Total					15.04	Sqm	641	9638
27	10.17.1	Grading roof for water proofing treatment with water proffing compound Cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)								
			1	14	8.23	0.05	5.76			
		Total					5.76	Cum	4075	23476
28	3.8	Providing & fixing precast cement concrete coping 1 : 2 : 4 mix 50mm thick complete as per specification :								
			1	34.4	0.30		10.32			
			1	11	0.15		1.65			
		Total					11.97	Sqm	334	3998
29	8.13.2.2	Providing and fixing external grade board solid core single leaf flush door shutters ISI 2202-67 marked using Phenol formal dehyderesin in glue both sides with approved steel fittings complete as per annexure 'A' : 30 mm thick Decorative teak veneer One side								
			2	0.61	2.05		2.50			
			9	0.95	2.05		17.53			
		Total					20.03	Sqm	1848	37013

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प्रधान मुख्य वन संरक्षक
[illegible], अनुसंधान, शिक्षा एवं प्रसार
राजस्थान, जयपुर

(आशीष मोदगील)
मुख्य वन संरक्षक (आयोजना),
राजस्थान, जयपुर

30	9.28.1	Providing and fixing steel glazed window frame made out of 80x40 mm hollow sheet section of 16 gauge thickness, joint mitred welded and grinded including hold fast of steel lugs 13mm x 3mm and 15 Cm long embedded in C C block 15 x 10 x 10 Cm of 1:3:6 nominal concrete and including fixing of pivoted hinges of superior quality, window shutters made out of 50 x 25.0 mm hollow steel section 15 mm paitam of 18 gauge thickness, joint mitred and grinded including 10mm x 10mm square bars welded to frame for paitam fixing float glass 4mm thick panes with glazing clips and metal sash putty and fixing of shutters frames peg stay, U shape handle 100 mm long, tower bolts 100 mm long of steel powder coated superior quality including fixing and jointing with frame hinges priming coat with steel primer complete in all respect as per direction of Engineer-in –charge Window openable.									
			8	1.23	1.23		12.10			
			2	0.61	0.61		0.74			
		Total					12.85	Sqm	3457	44413
31	15.25.1	Providing and fixing in CM 1 : 4 double paitam (rebated) stone door window and ventilator frames of approved quarry : Size 100 x 75mm.								
			7	2.10			14.70			
			7	1.07			7.49			
		Total					22.19	mtr	180	3994
32	7.5.1	Providing and fixing Granite stone slab mirror polished and machine edge cut in walls, pillars, steps, Shelves, Sills Counters, Floors etc. laid on 12mm (Av.) thick base of cement mortar 1:3 (1 cement : 3 coarse sand) jointing with white cement mortar 1:2 (1white cement : 2 marble dust) with pigment to match the shade of the marble slab including grinding, rubbing and polishing complete. Jhunjhunu / Jalore (Red/Choclate/Black/Pink Colour) Up to 1500 Cm2 Tiles Sqm. 1812.00								
			1	1.53	0.6		0.92			
			1	1.53	0.6		0.92			
			2	1.53	0.1		0.31			
		Total					2.14	Sqm	1812	3881
33	6.17.1	Supplying and fixing in walls machine cut and polished stone shelves, tands and in CM 1:3 with machine cut edges : Sand or other approved stone 25mm thick.	4	4.3	0.6		10.32			
			3	3.05	0.6		5.49			
		Total					15.81	Sqm	458	7241
34	7.8.2.1	Granite/Kota Stone Work Full Edge moulding	2	1.53			3.06	Mtr	212	649
		Total								**1022628**
		Sanitory Work								47500
		Electricity Fitting								73000
		Under Ground 15000 Litre Capicity Water Tank								53535
		G. Total								**1196663**

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प्रशिक्षण, अनुसंधान, शिक्षा एवं प्रसार
राजस्थान, जयपुर

(अमित [illegible])
मुख्य वन संरक्षक (आयोजना)
राजस्थान, जयपुर

Model Estimate (Range Office)

(Saintory Installation Work)

BSR : Jaipur (City Circle-2019)

S.No.	B.S.R	Particular	Qty	Unit	Rate	Amount
1	1.2.1	P & F Indian type white glazed vitreous china 1st quality W.C. orissa pan (IS :2556 Mark) with 100 mm vitreous china P or S trap including cutting and making good the wall and floor: Size 530x410mm.	1	No	2400	2400
2	1.3	P & F European type white glazed vitreous china 1st quality W.C pan (IS : 2556 Mark) with P or S trap including cutting and making good the wall and floor	1	No	2200	2200
3	1.7.2	P & F water closet Seat Covers with brass hinges complete : Solid PVC (IS 2548 marked) grade-I White for EWC	1	No	441	441
4	1.36.2	WASH BASINS: 1.36 P & F WVC Wash basin (Ist quality IS:2556 Mark) of approved make with C.I. brackets duly painted 1 No. 15 mm C.P. Pillar cock (IS:8934 Mark) & 32 mm C.P. brass waste coupling of approved make, P.V.C Waste pipe with PVC nut 32 mm complete including cutting & making good the wall : Size 510 mm x 400 mm	2	No	2189	4378
5	1.38.9.2	KITCHEN & LAB. SINKS: 1.38 P & F Kitchen & Lab. Sink of approved make with C.I. brackets duly painted, 40 mm C.P. waste coupling, C.P. Brass chain with rubber plug, 40 mm G.I. waste pipe up-to floor level complete including cutting and making good the wall & floor : 1.0 mm thick stainless steel AISI -304 & IS 13983-1994 kitchen sink of approved make as per Engineer-in-charge with large waste coupling. Overall size Bowl size 22 x 18 x 7 20x16x7	1	No	3936	3936
6	1.23	P & F WVC (10 litres) low-level flushing cistern with cover.	2	No	753	1506
7	1.44.1	P & F Bevelled edge Mirror/mirror with teak wood lipping around of special glass of approved make as per direction of Engineer-in-charge complete with 6mm thick commercial ply base fixed to wooden screws & washers. Size 600 x 450mm x 4 mm thick	2	No	523	1046
8	1.47.1	P & F Towel Rail or Ring of approved quality/make: C.P. brass Towel Rail elbow type with concealed screws size 450mm (Heavy duty).	2	No	425	850
9	1.47.8	P & F Towel Rail or Ring of approved quality/make: C.P. Brass Towel Ring revolving type	2	No	231	462
10	1.52.2	P & F Soap Dish or Tray of approved quality/make C.P. brass heavy and superior quality.	2	No	142	284
11	1.55.2	P & F Bath Shower of approved quality/make. C.P. brass of Heavy & superior quality 150mm.	2	No	342	684
12	1.59	P & F Jet spray for water closet with C.P. Copper Tube flange of approved make.	20	No	346	6920
13	2.1.1	P & F G.I. pipes (Internal Work) with G.I. Fittings excluding union (IS:1239 Mark) & MS clamps including cutting and making good the walls and floors: (a) Exposed on wall 2.1.1 15 mm dia nominal bore 'B' Class	1	RMT	209	209
14	2.7.1	P & F Bib Cock (IS : 8931 Mark), Superior quality of approved make: Brass 400 gm,15mm nominal bore.	7	No	271	1897

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15	2.15.1	P & F Full-way Valve (IS:778 Mark) or wheel valve of approved make : Gun-metal 15mm nominal bore.	3	No	206	618
16	2.26.3	P & F PVC Storage Tank ISI Marked (IS : 12701) indicating the BIS license No), of approved make with cover, 25mm dia 1M long G.I. over-flow pipe & 25 Cm. long wash out pipe with plug & socket, including making connection etc., complete of approved design: 500 litres capacity.	2	No	3564	7128
17	3.16.2	RIGID PVC PIPE 3.16 P&F rigid PVC Pipe (IS:4985 mark) class II/ (4 Kg. /Cm2 .) approved quality /make including joining the pipe with solvent cement rubber ring and lubricant. 75 mm dia	6	RMT	161	966
18	3.16.3	RIGID PVC PIPE 3.16 P&F rigid PVC Pipe (IS:4985 mark) class II/ (4 Kg. /Cm2 .) approved quality /make including joining the pipe with solvent cement rubber ring and lubricant. 110 mm dia	9	RMT	256	2304
19	3.17.1	P&F rigid PVC pipe fittings (IS: 4985 mark) of approved quality /make including joining the pipe with solvent cement rubber ring and lubricant: Coupler (socket)				0
		75mm dia	6	No	79	474
20		110mm dia	4	No	98	392
21	3.17.3	P&F rigid PVC pipe fittings (IS: 4985 mark) of approved quality /make including joining the pipe with solvent cement rubber ring and lubricant: Plain Tee				0
		75mm dia	2	No	104	208
		110mm dia	1	No	170	170
22	3.17.4	P&F rigid PVC pipe fittings (IS: 4985 mark) of approved quality /make including joining the pipe with solvent cement rubber ring and lubricant: Door Tee 110mm dia	2	No	194	388
23	3.17.9	P&F rigid PVC pipe fittings (IS: 4985 mark) of approved quality /make including joining the pipe with solvent cement rubber ring and lubricant: Bend 87 .5				0
		75mm dia	6	No	88	528
		110mm dia	1	No	146	146
24	3.17.23	P&F rigid PVC pipe fittings (IS: 4985 mark) of approved quality /make including joining the pipe with solvent cement rubber ring and lubricant: P- Trap 110mm dia	5	No	347	1735
25		VENT COWER	2	No	51	102
26	3.24.1	Construction of Soakage well in all types of soil of approved drawing, top 90 Cm .Portion in 450mm thick masonry with CM 1:6, 80 mm thick stone slab covering, jointing of slab in CM 1:3 ,Ralthal, kharanja 40mm thick M-15 grade C.C flooring, earth work etc . complete including disposal of surplus earth within a lead of 50 mtr . Inner dia 90 Cm & 10 to 12 Mtr deep.	1	No	4948	4948
		Total				47320

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Detailed Estimate of Coumpound Wall of Forest Chouki

Length of compound wall = 100 mtr and
Height of compound wall = 2.10mtr (1.20 stone wall + 0.90mtr Chain link fencing)
BSR - PWD Integrated BSR of Rajasthan 2022

Sr. No.	BSR Item No.	Item Description	Unit	Nos	Length	Width	Height/ Depth	Qty	Rate	Amount
1	2019/1.8	Earth work in excavation by mechanical means (Hydraulic Excavator)/ manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan) including dressing of sides and ramming of bottoms, lift upto 1.5 m, including taking out the excavated soil and depositing and refilling of jhiri with watering & ramming and disposal of surplus excavated soil as directed with in a lead of 50 meter. All kinds of soils	CUM	1.00	100.00	0.60	0.75	45.00	178.00	8010.00
2	2019/ 3.1.7	Providing and laying in position cement concrete including curing, compaction etc. complete in specified grade excluding the cost of centering and shuttering - All work up to plinth level. 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40mm nominal size).	CUM	1.00	100.00	0.60	0.10	6.00	2956.00	17736.00
3	2019/ 6.1.6	Random Rubble stone masonary for foundation and plinth in Cement Sand Mortar above 30 Cm. thick wall in : Cement Mortar 1:6 (1-Cement:6-Sand) **First Footing**								
		Pillars	CUM	20.00	0.60	0.60	0.38	2.74		
		Walls	CUM	1.00	88.00	0.53	0.38	17.72		
		Second Footing								
		Pillars	CUM	20.00	0.50	0.50	0.38	1.90		
		Walls	CUM	1.00	90.00	0.45	0.38	15.39		
								37.75	2838.00	107132.23
4	2019/ 6.2.6	Random Rubble stone masonary for superstructure above plinth level one storey height above 30 Cm. thick walls in : Cement Mortar 1:6 (1-Cement:6-Sand).								
		Pillars	CUM	20.00	0.45	0.45	1.20	4.86		
		Walls	CUM	1.00	91	0.38	1.20	41.50		
								46.36	3479.00	161272.52
5	2019/ 3.10	Providing and laying damp-proof course with cement concrete grade M-150 (1 : 2 : 4) mortar prepared with 1% solution of water-proof compound complete as per specification . 50mm thick.								
		Pillars	Sqm	20.00	0.45	0.45		4.05		
		Walls	Sqm	1.00	91	0.38		34.58		
								38.63	391.00	15104.33

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6	2019/ 12.3.1	Plaster on new surface on walls in cement sand mortar 1:6 including racking of joint etc. complete fine finish : 25mm thick.								
		Pillars	Sqm	80.00		0.035	1.20	3.36		
				40.00		0.45	1.20	21.6		
								24.96	211.00	5266.56
7	2019/ 12.31.2	Pointing on stone masonry in cement sand mortar 1:3 (1 cement : 3 sand) :								
		Wall	Sqm	2.00	91		1.20	218.4	233.00	50887.20
8	2019/ 9.36.1	Supplying and fixing of chain link fencing with angle iron posts 50x50x6mm placed at every 3 Mtr. apart 30cm in ground embedded in cement concrete 1:3:6 (30x30x45cm) corner and every tenth post to be strutted with (50 x 50 x 6cm) angle iron provided and fixed and fitted with posts including earth work in excavation etc. complete with chain link size.								
9		50mm x 50mm x 3.15mm.	Sqm	1.00	100.00		0.90	90	629.00	56610.00
	2019/ 12.37.1	Distempering with oil bound washable distemper of approved brand and manufacture to give an even shade including all scaffolding: New work (two or more coats) over and including scrapping and priming coat with cement primer.				p				
10			Sqm					17.65	75.00	1323.75
11										1657.41
									Total	**425000.00**

Per running meter cost = 4250.00

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Model Estimate

Construction of Tube well / Solar Pump Moter / Solar Light / Unfroseen & Miscellaneous

S.No.		Particulars	QTY	unit	Rate	Amount
1		Construction of tube well up to 100 metre depth and above from ground level to				
	1	Nominal bore 200mm dia. Depth uo to 100 mtr	175.00	Mtr	1464.00	256200.00
	2	Supply of strainer pipes made of ERW M.S. black pipe ISI mark of following sizes at the saite of work including required size of slotrring as per IS:8110-1985	50.00	Mtr	2630.00	131500.00
	3	Installation of solar pump motor with acessories 5 HP		Nos.	LS	450000.00
	4	Installation of solar Lighting system with 2 KW		Nos.	LS	150000.00
	5	Unfroseen and miscellaneous expenditure				12300
		Total				**1000000.00**

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Model Estimate

Construction of Septic Tank

S.No.	Particulars	QTY	unit	Rate	Amount
2	Construction of Septic Tank size 2.30 X 1.10 X 1.50 Mtr. In all types soil with 40 cm thick masonary in cm 1:6, 15 cm thick CC bed of 1:5:10, M - Floor, 50 mm thick stone slab partitio walls, Supply of Soling Stone 23cm, 15cm Stone Agg. 40 mm, 20mm, 6-12mm, PVC Pipe 110mm, Bend 45 degree, Plain Tee, 4 nos. stone Fotrest of approved design, two No. 450 mm dia each per approved drawing including desposal of surplus earth with in a lead of 50 mtr size 203 X 110 X 150 cm (for 20 users) with 1.15 mm thick RCC (M-20) slab with Tor steel reinforcement 10 mm @ 15cm CC bothways including shuttering complete in all respect.	LS	LS	LS	40,000.00

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Model Cost Norms for Boundary Pillar

Cost estimate – 9000/ unit .

S.No	Description of work	Bsr i.no	Unit	Quantity	Rate	Cost
1	2	3	4	5	6	7
1	Earth work in excavation in soil.foundation length 1.20m, width 1.20m, depth 0.30m per pillar volumn 0.432 cum.	PWD-BSR2019 Jaipur circle Item no-1.8 ch-B1	cum	0.432	162.00	69.98
2	Cement concrete in foundation & 40mm size aggregate 1:4:8 mixer.pillar size -1.20m.l x1.20m w x0.30m d.=0.432cum	PWD-BSR2019 Jaipur circle Item no-3.1.6 ch-B3	cum	0.432	3002/ p.cum	1296.86
3	Cement concrete in sub structure & 40mm aggregate 1:4:8 mixer cement concrete Lower size – 1.20 m.l x 1.20 m.w (A1) Upper size – 0.80 m.l x 0.80 m.w (A2) height – 1.00 m (H) volumn – (H/3)x(A1+A2+√A1xA2) = (1.00x3)(1.44+0.64+√1.44 x0.64 = 1.0133 cum Top 0.30x0.30x0.30 = 0.027 cum Total Qty = 1.04 cum	PWD-BSR2019 Jaipur circle Item no-3.2.4 ch-B3	cum	1.04	3927 /p.cu.m	4084.08

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4	Providing and fabricating reinforcement for R.C.C work including straightening, cutting, bending, placing in position and binding(including cost of binding wire) all complete for whole structure. Cold twisted deformed bars(IS:1786)4 x0.35=1.40m 2 x1.10=2.20m Total=3.60m (3.60 x 0.395=1.42kg or1.5 kg			1.5kg	77	115
5	Centering & shuttering to settle column and pillar. ground –4 x1.2 x.30= 1.44 middle- 4x0.80+1.20x1.02=4.08 2 Top-4x0.3x0.3=0.36	PWD-BSR2019 Jaipur circle Item no-4.10.3 ch-B4	Sq m	5.88	341 /p.sqm	2005
6	Plaster on 15mm thick as 1:6 1x4x1.20+.80x1.00=4.00 2 Top–1 x.80 x.80= 0.64 1x4x0.30x0.30=0.36 Total Plaster = 5.00 sq.m	PWD-BSR2019 Jaipur circle Item no-12.3.3 ch-B12	Sq m	5.00	133/ p.sq.m	665
7	Water Curing				Lum-sum	400
8	Paint and carving on pillar			on market price	Lum-sum	400
					Total	9035 Say-9000

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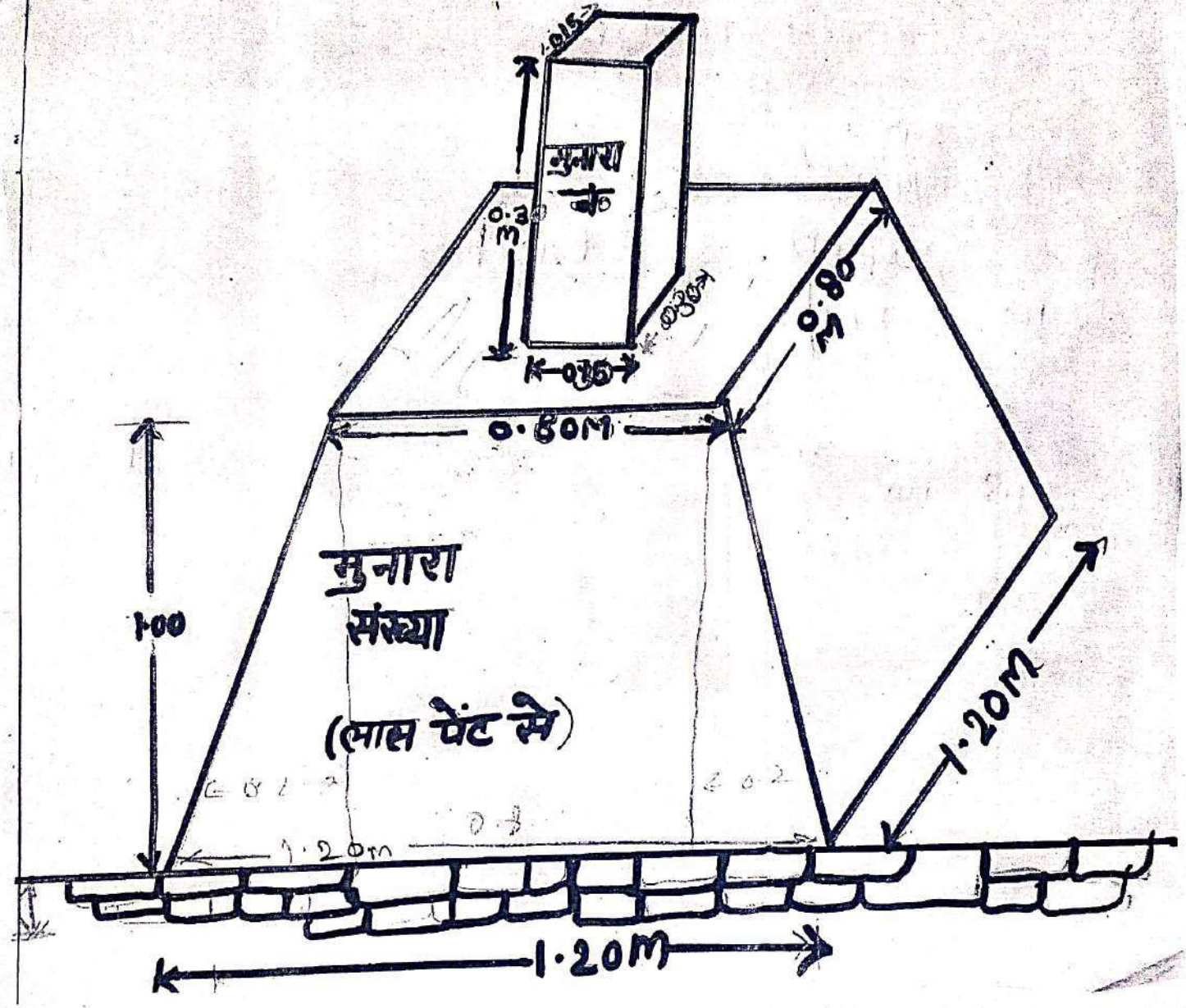

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ANNEXURE-3

Full title of the Project	:	Construction of Shahpur (1800 MW) Pumped Storage Project by M/s Greenko Energies Private Limited, in Hanumanthkhera, Mungawali villages, G.P-Subhdhara; Baint Village, G.P-Bichi; Sahjanpur Villages, G.P-Kasba Nonera; Kaloni, Shahpur Villages, G.P-Mundiyar; Tehsil-Shahbad; Baran District, Rajasthan.
Proposal no	:	FP/RJ/HYD/121439/2021
Date of Proposal	:	03-02-2021
Diversion Area	:	407.8227 Ha

UNDERTAKING TO BEAR THE COST OF PLANTATION

M/s Greenko Energies Private Limited hereby affirm and undertake to bear the cost of plantation, if any incurred by the Dept, which comes under proposed forest land to be diverted.

Date: 15.12.2023

Name: Gopi Krushna N

Gopi Krushna N
Deputy General Manager (DGM)
Authorised Signatory
Greenko Energies Private Limited

Place: Hyderabad

Authorized Signatory

Note on the requirement of Land near Water Conductor System (WCS) & Power House (PH) for Shahpur PSP (1800 MW)

A total land of 57.225 Ha has been identified for construction of project components in Water Conductor System (WCS) & Power House (PH). The above land requirement is identified based on spacing between penstocks, access to top of Vertical Pressure Shafts (VPS), lowering of Ferrules, excavation of Power house & its access, slope protection at top for VPS & PH, auxiliary power line (33 kV) and 400 kV line. The 57.225 Ha land has been divided in 4 segments namely "A-A, B-B, C-C & D-D" as shown in Map below.

Detailed breakup of the above land is given below.

1. **SEC A-A TO SEC B-B:** Total area of land is 17.09 Ha is identified. Out of which, 5.05 Ha land (Hatched in Blue color) shall be handed over after completion of the project.

2. **SEC B-B TO SEC C-C**: Total area of land 7.385 Ha is identified and is essential requirement.

3. **SEC C-C TO SEC D-D**: Total area of land 32.75 Ha is identified. Out of which, 4.706 Ha land (Hatched in Blue color) shall be handed over after completion of the project.

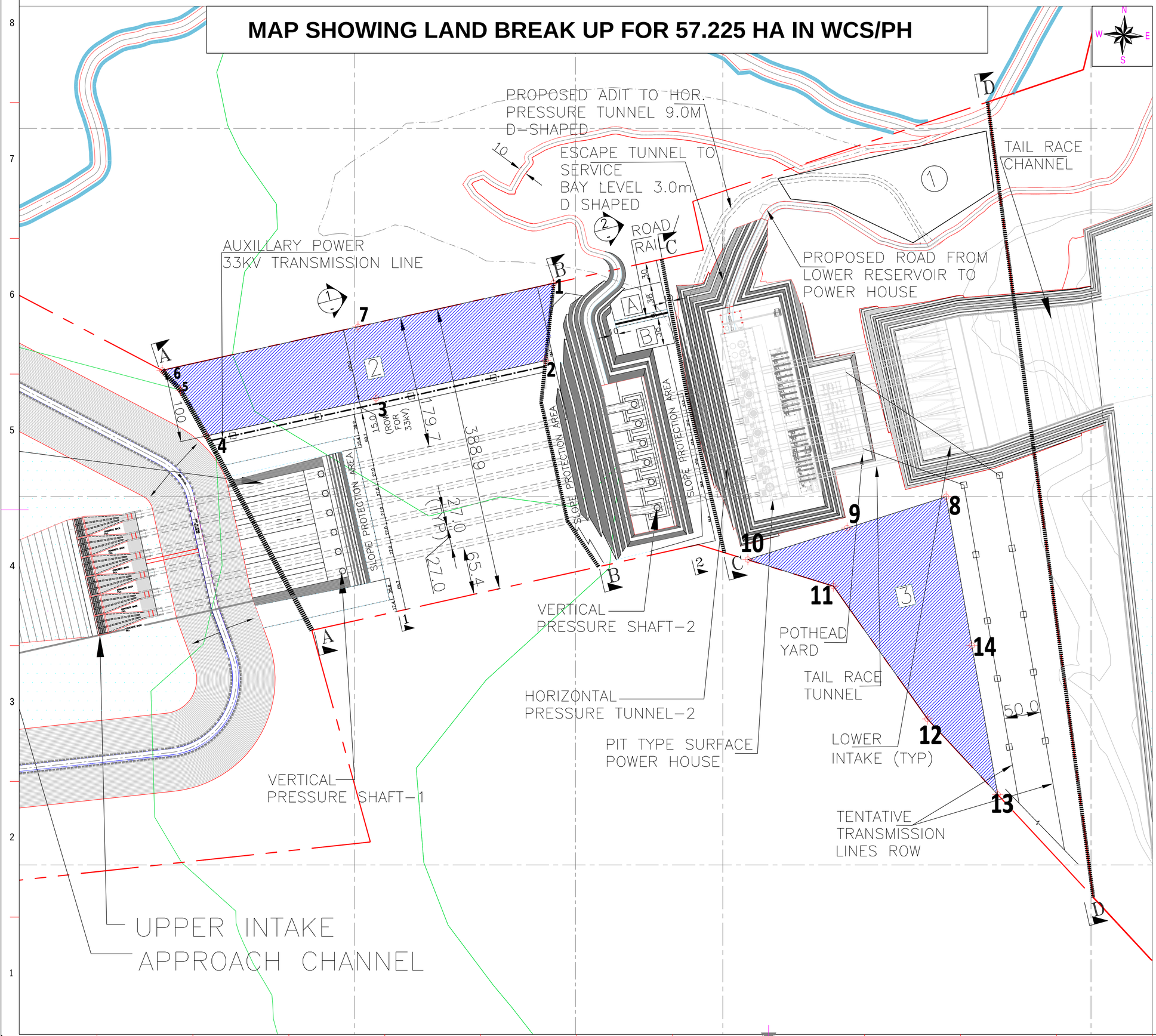
S.NO	SEGMENT	TOTAL AREA (HA)	COMPONENTS (WCS & PH)	AREA (HA) PROPOSED FOR SURRENDER AFTER CONSTRUCTION
1	SEC A-A TO SEC B-B	17.09	VPS-1 , PART OF HPS-1 & 33KV TL, STOCK PILING & FABRICATION OF PENSTOCKS MARKED AS (2)	5.05 Ha land (MARKED AS (2), HATCHED IN BLUE COLOUR)
2	SEC B-B TO SEC C-C	7.385	PART OF HPS-1, VPS-2, SPACE FOR LOADING & UNLOADING OF FERRULES (A), GANTRY ARRANGEMENT & FERRULES LOWERING IN VPS-2 (B)	-
3	SEC C-C TO SEC D-D	32.75	PH, POTHEAD YARD, D/S INTAKE, PART OF TRC & E&M EQUIPMENT(1), 400KV TL, BOP EQUIPMENT MARKED AS (3)	4.706 Ha land (MARKED AS (3), HATCHED IN BLUE COLOUR)
	TOTAL LAND (HA)	**57.225**		**9.756**

Hence, a total land of 9.756 Ha shall be handed over after completion of the project.

N. Gopi Krushna

Gopi Krushna N
Deputy General Manager (DGM)
Authorised Signatory
Greenko Energies Private Limited

MAP SHOWING LAND BREAK UP FOR 57.225 HA IN WCS/PH



NOTES:-

1. ALL DIMENSIONS, ELEVATIONS AND GRID ARE IN METERS.
2. NO DIMENSION SHALL BE SCALED FROM THE DRAWING, ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.

S.NO	MAP DETAILS	TOTAL AREA (Ha)	COMPONENTS(WCS & PH)	AREA PROPOSED FOR SURRENDER AFTER CONSTRUCTION
1	SEC A-A TO SEC B-B	17.09	VPS-1 , PART OF HPS-1 & 33KV TL, STOCK PILING & FABRICATION OF PENSTOCKS MARKED AS (2)	5.05 Ha land (MARKED AS (2), HATCHED IN BLUE COLOUR)
2	SEC B-B TO SEC C-C	7.385	PART OF HPS-1, VPS-2, SPACE FOR LOADING & UNLOADING OF FERRULES (A), GANTRY ARRANGEMENT & FERRULES LOWERING IN VPS-2 (B)	NIL
3	SEC C-C TO SEC D-D	32.75	PH, POTHEAD YARD, D/S INTAKE, PART OF TRC & E&M EQUIPMENT(1), 400KV TL, BOP EQUIPMENT MARKED AS (3)	4.706 Ha land (MARKED AS (3), HATCHED IN BLUE COLOUR)
TOTAL LAND		**57.225**		**9.756 Ha**

Proposed Surrender Forest Land Coordinate Point

S.No.	Latitude				Longitude			
	Degree	Minute	Second		Degree	Minute	Second	
1	25 °	11 '	37.4 ''	N	77 °	11 '	13 ''	E
2	25 °	11 '	34 ''	N	77 °	11 '	12.5 ''	E
3	25 °	11 '	32.5 ''	N	77 °	11 '	4.3 ''	E
4	25 °	11 '	30.9 ''	N	77 °	10 '	56 ''	E
5	25 °	11 '	33 ''	N	77 °	10 '	54.8 ''	E
6	25 °	11 '	33.9 ''	N	77 °	10 '	53.9 ''	E
7	25 °	11 '	35.6 ''	N	77 °	11 '	3.5 ''	E
8	25 °	11 '	27.7 ''	N	77 °	11 '	31.8 ''	E
9	25 °	11 '	26.4 ''	N	77 °	11 '	27 ''	E
10	25 °	11 '	25.1 ''	N	77 °	11 '	22.2 ''	E
11	25 °	11 '	23.9 ''	N	77 °	11 '	26.3 ''	E
12	25 °	11 '	17.9 ''	N	77 °	11 '	30.8 ''	E
13	25 °	11 '	14.5 ''	N	77 °	11 '	34.1 ''	E
14	25 °	11 '	21.1 ''	N	77 °	11 '	33 ''	E

INFRASTRUCTURE AREA

S. NO.	DESCRIPTION	LEGEND	LAND AREA (in ha)	REMARKS
1	E&M STORE EQUIPMENT	①	2.4	–
2	STOCK PILING AND FABRICATION OF PENSTOCK	2	5.05	LAND SHALL BE HANDED OVER BACK AFTER CONSTRUCTION OF THE PROJECT WITH GREENERY.
3	BOP EQUIPMENT	3	4.7	
4	SPACE FOR LOADING & UNLOADING OF FERRULES	A	0.6	
5	ROAD/RAIL	AREA BETWEEN A & B		
6	SPACE FOR GANTRY ARRANGEMENT & FERRULES LOWERING IN VPS-2	B		
7	CUT SLOPE PROTECTION AREA	–	1.8	–
		TOTAL	14.55	

LEGEND :-

- REQUIRED LAND BOUNDARY
- PROPOSED NON-FOREST AREA
- FOREST BOUNDARY
- PROPOSED ROAD IN FOREST AREA
- PROPOSED ROAD IN NON FOREST AREA
- TENTATIVE TRANSMISSION LINES

N. Gopi Krushna

Gopi Krushna N
Deputy General Manager (DGM)
Authorised Signatory
Greenko Energies Private Limited

SCALE 0 100.0 250.0 500.0 1000.0 M

ANNEXURE-5

Full title of the Project	:	Construction of Shahpur (1800 MW) Pumped Storage Project by M/s Greenko Energies Private Limited, in Hanumanthkhera, Mungawali villages, G.P-Subhdhara; Baint Village, G.P-Bichi; Sahjanpur Villages, G.P-Kasba Nonera; Kaloni, Shahpur Villages, G.P-Mundiyar; Tehsil-Shahbad; Baran District, Rajasthan.
Proposal no	:	FP/RJ/HYD/121439/2021
Date of Proposal	:	03-02-2021
Diversion Area	:	407.8227 Ha

UNDERTAKING TO SURRENDER 9.756 Ha FOREST LAND IN WATER CONDUCTOR SYSTEM (WCS) AND POWER HOUSE (PH)

M/s Greenko Energies Private Limited hereby affirm and undertake to surrender an area of 9.756 Ha forest land, out of 57.225 ha proposed in Water Conductor System (WCS) and Power House (PH) after completion of the Construction activity.

Date: 15.12.2023

Name: Gopi Krushna N

N. Gopi Krushna

Gopi Krushna N
Deputy General Manager (DGM)
Authorised Signatory
Greenko Energies Private Limited

Place: Hyderabad

Authorized Signatory

ANNEXURE-6

कार्यालय संभागीय मुख्य वन संरक्षक, जोधपुर

क्रमांक एफ ( )एफसीए/2023/एनएफएल ग्रीनको/7166 दिनांक : 10-11-23

निमित्त :

अति प्रधान मुख्य वन संरक्षक (एफसीए)
एवं नोडल अधिकारी, एफसीए, राजस्थान, जयपुर

विषय :– Diversion of 407.8227 Ha of Forest Land for the Construction of Shahpur Pumped Storage Project by M/s Greenko Energies Pvt Ltd, Shahbad Tehsil in Baran Dist Rajasthan (Proposal No FP/RJ/HYD/121439/2021)

संदर्भ :– श्रीमान का पत्रांक 8104–05 दिनांक 9–11–2023 एवं उप वन संरक्षक, इगानप स्टेज–II जैसलमेर का पत्रांक 6386 दिनांक 10–11–2023

महोदय,

उपरोक्त विषयान्तर्गत निवेदन है कि विषयांकित प्रकरण में भारत सरकार द्वारा पत्रांक 8–25–2023–एफसी दिनांक 17–10–2023 के द्वारा प्रकरण में अतिरिक्त सूचनायें/औचित्य की टिप्पणी चाही गई है। जिसमें बिन्दु संख्या (vi) के संबंध में टिप्पणी इस कार्यालय से चाही गई है। जिस पर टिप्पणी निम्नानुसार है :–

क्र स	आक्षेप	टिप्पणी/अनुपालना
1	The suitability certificates for CA area proposed over the NFL and DFL located under the jaisalmer district are given. However, the proposed CA area appears to be in sand dunes, which may not be suitable for raising plantation and its survival. Therefore, the State Govt. Shall re-examination the suitability of the NFL provided for CA and ensure that the area proposed is suitable for raising plantation.	उप वन संरक्षक इगानप स्टेज–।। जैसलमेर द्वारा प्रस्तुत अनुपालना रिपोर्ट अनुसार उक्त प्रकरण में प्रत्यावर्तन के एवज में प्राप्त होने वाली भूमि का मौका निरीक्षण दिनांक 24.02.2023 को उप वन संरक्षक, इगानप स्टेज–।। जैसलमेर द्वारा किया गया था। प्रस्तावित भूमि में मौके पर Sand dunes नहीं हैं एवं प्रस्तावित भूमि समतल भूमि है जो कि नहर से सिंचित हैं एवं वर्तमान में इस भूमि पर फसल बोई हुई है। यह भूमि वृक्षारोपण के लिए उपयुक्त हैं जिसमें सिंचाई के लिए पानी भी नहर/खाला से उपलब्ध हो सकेगा एवं पौध की जीवितता भी बहुत अच्छी रहने की संभावना है। इस संबंध में आवश्यक CA Land का Suitability Certificate भी पूर्व में प्रेषित कर दिया गया है।

आलौच्य प्रत्यावर्तन प्रकरण में उप वन संरक्षक, इगानप. स्टेज–।। जैसलमेर द्वारा प्रस्तुत अनुपालना से यह कार्यालय सहमत है एवं अनुपालना रिपोर्ट श्रीमान को संलग्न प्रस्तुत है।

संलग्न – उक्तानुसार।

भवदीय

(एस आर वी मूर्थी)
संभागीय मुख्य वन संरक्षक,
जोधपुर

क्रमांक एफ ( )एफसीए/2023/एनएफएल ग्रीनको/ दिनांक :

प्रतिलिपि निम्न को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित है :–

1. संभागीय मुख्य वन संरक्षक, कोटा
2. उप वन संरक्षक बारां/इगानप. स्टेज–।। जैसलमेर
3. ग्रीनको एनर्जी प्राइवेट लिमिटेड,

RajKaj Ref 5952582

Signature valid

Digitally signed by S R Venkateswara Murthy
Designation : Chief Conservator Of Forest
Date: 2023.11.10 16:37:49 IST
Reason: Approved

संभागीय मुख्य वन संरक्षक,
जोधपुर

कार्यालय उप वन संरक्षक इन्दिरा गांधी नहर परियोजना स्टेज–II जैसलमेर

क्रमांकः एफ ( )तकनीकी/उवसंइगानप/2023/ 6386 दिनांक : 10.11.23

निमित्त :

संभागीय मुख्य वन संरक्षक
वन भवन, न्यू पाली रोड़
जोधपुर।

विषय :– Proposal for diversion of 407.8227 ha. For Shahpur (1800MW) Pumped Storage Project by M/s Greenko Energies Private Limited, in Hanumanth khera, Mungawali villages, G.P.-Mundiyar, Tehsil-Shahbad, Baran Disitrict, Rajasthan. (Proposal No. FP/RJ/HYD/121439/2021)

प्रसंग :– अतिरिक्त प्रधान मुख्य वन संरक्षक प्रोटेक्शन एवं नोडल अधिकारी(एफ.सी.ए.) राजस्थान, जयपुर का पत्र क्रमांक 8104–05 दिनांक 09.11.2023।

महोदय,

उपर्युक्त विषयान्तर्गत निवेदन है कि उक्त प्रकरण में प्रत्यावर्तन के एवज में प्राप्त होने वाली भूमि का मौका निरीक्षण दिनांक 24.02.2023 को अधोहस्ताक्षरकर्त्ता द्वारा किया गया था। इस संबंध में आवश्यक CA Land का Suilability Certificate भी प्रेषित कर दिया गया था। प्रासंगिक पत्र के द्वारा बिन्दु संख्या VI के संबंध में रिपोर्ट चाही गई है जो निम्नानुसार है :–

उक्त भूमि मौके पर Sand dunes नहीं हैं प्रस्तावित भूमि समतल भूमि है जो कि नहर से सिंचित हैं एवं वर्तमान में इस भूमि पर फसल बोई हुई है। यह भूमि वृक्षारोपण के लिए उपयुक्त हैं जिसमें सिंचाई के लिए पानी भी नहर/खाला से उपलब्ध हो सकेगा एवं पौध की जीवितता भी बहुत अच्छी रहने की संभावना है।

रिपोर्ट सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित है।

भवदीय

(पंकज कुमार गुप्ता)
उप वन संरक्षक
इ.गां.न.प. स्टेज–II
जैसलमेर

Signature Valid
RajKaj Ref 5050980
Digitally signed by Pankaj Kumar
Designation: Deputy Conservator Of Forest
Date: 2023.11.10 11:17:52 IST
Reason: Approved

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
SHAHPUR PUMPED STORAGE PROJECT (1800 MW)

(Sector 1(c); Cat "A")

Draft Report

AUGUST -2022

Prepared for:

M/s GREENKO ENERGIES PRIVATE LIMITED, HYDERABAD

Prepared by:

R S Envirolink Technologies Pvt. Ltd.

403, BESTECH CHAMBER,
B-BLOCK, SUSHANT LOK-I, GURGAON
Ph: +91-124-4295383: www.rstechnologies.co.in

MUCK MANAGEMENT PLAN

Full title of the Project	:	Construction of Shahpur (1800 MW) Pumped Storage Project by M/s Greenko Energies Private Limited, in Hanumanthkhera, Mungawali villages, G.P-Subhdhara; Baint Village, G.P-Bichi; Sahjanpur Villages, G.P-Kasba Nonera; Kaloni, Shahpur Villages, G.P- Mundiyar; Tehsil-Shahbad; Baran District, Rajasthan.
Proposal No	:	**FP/RJ/HYD/121439/2021**
Date of Proposal	:	03-02-2021
Diversion Area	:	407.8227 Ha

10.1 MUCK MANAGEMENT PLAN

The muck generated from various project activities during the construction of the PSP may adversely affect the environment if not properly managed. The generated muck volume, if not properly disposed, can destroy the landscape and increase the atmospheric particulate matter. The Proposed Shahpur (1800 MW) Pumped Storage Project (PSP) is located at Baran District, Rajasthan is likely to generate large volume of muck of which some quantity will be utilizable and the remaining muck volume needs to be rehabilitated at appropriate dumping sites in a technically and ecologically sound manner.

Map showing location of Muck dumping site is given at **Figure 10.1.**

Figure 10.1: Location of Muck Disposal Site

10.1.1 Quantity of Material to be Excavated

The construction activities of the project would generate muck from excavation of various project structures. The total quantity of muck likely to be generated from excavation including construction of roads is about 15.61 Mcum. The component-wise quantity of muck to be generated is given at **Table 10.6** and Quantity of Muck to be disposed at **Table 10.7**. However, after the utilization of muck for different project components and considering the swell factor of 40% for excavated material, the total quantity of muck to be disposed is worked out as **7.54 Mcum**. The entire excavated material is proposed to be dumped at one location identified specifically for this purpose as shown above.

Table 10.1: Muck to be generated from various components of the project

S. No.	Project Component	Total Quantity of Muck to be generated (Million m^3)
1	Upper Reservoir	1.04
2	Upper Intake	0.19
3	Upper Reservoir Dam	0.61
4	Penstock & Pressure Shaft	0.77
5	Powerhouse	1.35
6	TRT	0.17
7	Lower Reservoir Dam	0.40
8	Lower Intake & Tailrace Channel	0.93
9	Lower Reservoir	8.50
10	Adit	0.015
11	Roads	1.64
	Total	**15.615**

Table 10.2: Quantity of muck to be disposed

S. No.	Description	Quantity in Million m^3
1	Total quantum of muck generated from the project components	15.615
2	Considering the swelling factor of 40% for the muck generated (1)	6.246
3	Total Dumpable Muck	21.861
4	Total consumption (in aggregates fine & Course, Road Development, Protection works and Embankment of upper & lower reservoirs etc	14.32
5	Net Quantity of muck to be disposed (3-4)	7.54
6	Muck disposal in MD site with 30 ha area	5.61
7	Muck disposal in Dead Storage part of Lower & Upper Reservoir	1.93

10.1.2 Muck Disposal Site

For the disposal 7.54 Mcum of muck an area of 30 Ha having capacity of 5.61 Mcum has been identified and the balance muck 1.93 Mcum shall be accommodated in the dead storage of the Upper and Lower Reservoirs. The disposal site was identified taking into consideration availability of suitable area, minimum distance from generation sites. Chainage wise area available and capacity of muck dumping site is given at **Table 10.2**

10.1.2.1 Criteria for Selection of Dumping Site

The following points were considered and followed as guidelines for finalization of the areas to be used as dumping sites:

i) The dumping sites have been selected as close as possible to the project area to avoid long distance transport of muck.
ii) The site is free from any landslides or creep and care has been taken that the sites do not have a possibility of toe erosion and slope instability.
iv) There is no active channel or stream flowing through the dumping sites.
v) The site is away from human settlement areas.

The identification of muck disposal areas was done in line with the topographic and site-specific conditions as specified above.

Table 10.3 Details of muck disposal site

S. No.	Chainage (m)	Area (Sqm)	Capacity (m^3)	Total Muck to be Dumped (Million m^3)
1	0 m	11177.06	0.00	0
2	150m	7754.9	2082515.60	-
3	300m	7940.9	1177185.00	-
4	450m	6629.46	1092777.00	-
5	600m	3670.89	1261792.88	
	TOTAL	37173.21	5614270.48	7.54

10.1.2.2 Methodology of Dumping

The muck that needs disposal would be piled at Ø (angle of repose) maximum of 30° at the proposed dumping site. The description regarding the stabilization of the stacked material along the proposed roads has been discussed in the following paragraphs.

The options like dumping muck in stages and allowing it to consolidate/settle through the monsoon, compacting the dumped muck with Bulldozer movement, zoning of the dump judiciously to ensure the stability of 30° slope under all superimposed conditions will be explored and utilised. The plan and cross-sections of the proposed muck dumping site is given at **Figures 10.2 and Figure 10.3**.

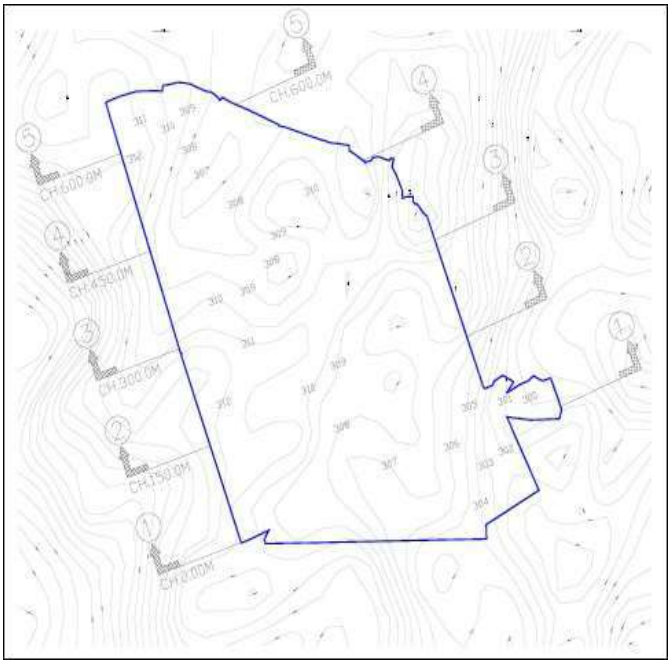


Figure 10.2 : Plan of Muck Dumping Site

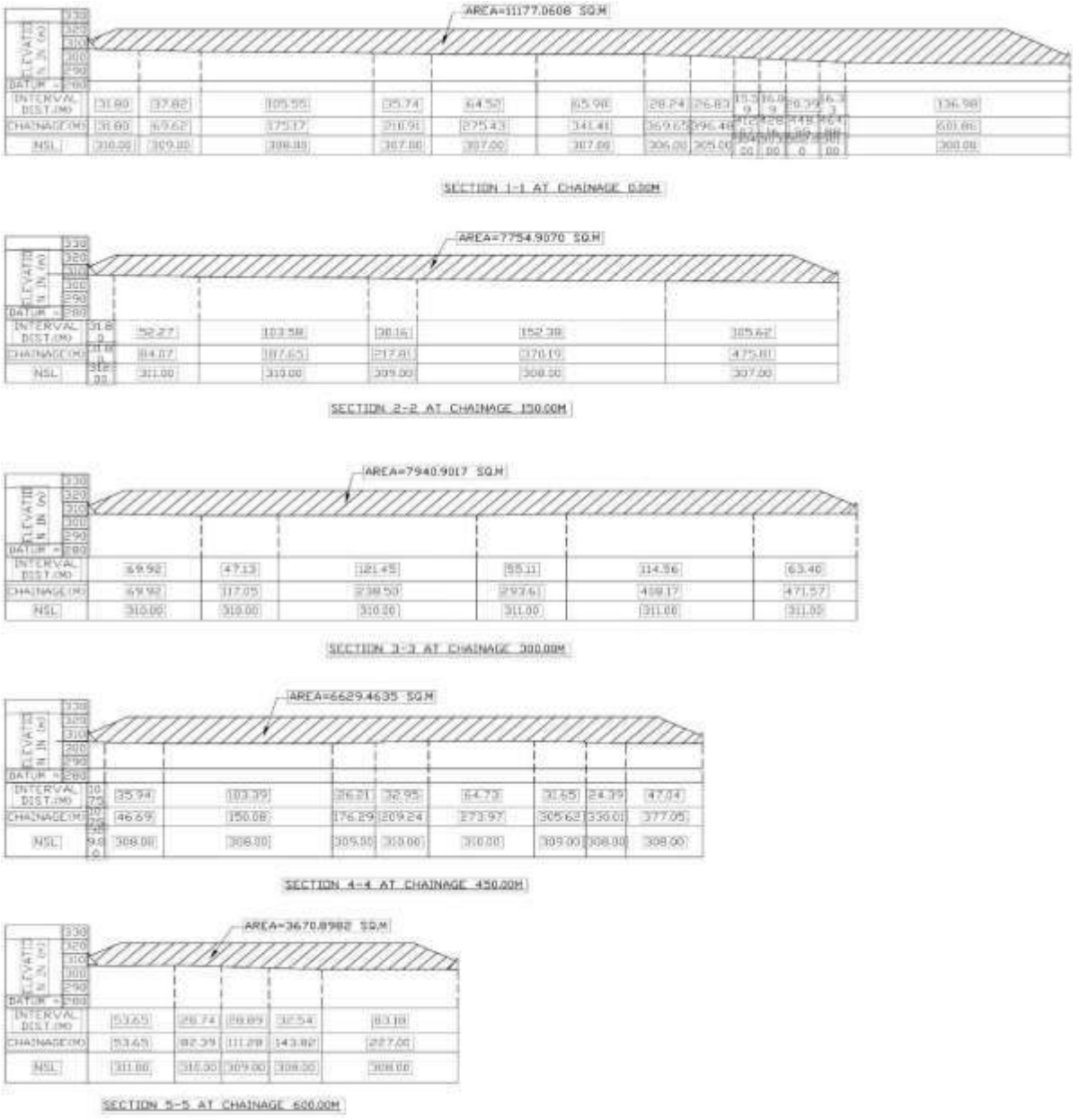


Figure 10.3 : Cross Section of Muck Dumping Site

The main objectives of process of muck dumping and restoration of these muck disposal sites are:

- to protect and control soil erosion;
- to create greenery in the muck disposal area;
- to improve and develop the sites into recreational site;
- to ensure maximum utilization of muck for the construction purpose;
- to develop the muck disposal site/ dumping yard to blend with the surrounding landscape; and

In Shahpur Pumped storage Project, a scientific approach and methodology was followed for identification of the dumping site. All possible alternate sites were inspected and examined before rejecting or selecting any site. The dumping site is characterized by:

i) no forest cover,
ii) the populated /settlement areas are away from the dumping site and therefore will have least impact on human settlements, and
iii) the identified muck site is close to the area of generation to avoid hazards related to transport of muck for long distances and minimizing traffic problems.

The generated muck will be carried in dumper trucks tightly covered in line with international best practices. All precautionary measures will be followed during the dumping of muck. All dumpers will be well maintained to avoid any chances of loose soil from being falling during the transportation. All unpaved routes will be periodically wetted with the help of sprinklers prior to the movement of dump trucks. Dumping would be avoided during the high-speed wind, so that suspended particulate matter (PM_{10}) levels could be maintained. After the dumping the surface of dumps will be sprayed with water with the help of sprinklers and then compacted.

As mentioned above, for disposal of 7.54 Mcum of muck, an area of 30 Ha having capacity of 5.61 Mcum has been identified and the balance muck 1.93 Mcum shall be accommodated in the dead storage of the Upper and Lower Reservoirs. The spare capacity has been earmarked for temporary storage of usable muck, traffic movement of dumpers and lifters. The spoil from various construction sites would be disposed of at designated site in a controlled and orderly manner. All measures would be adopted to ensure that the dumping of muck does not cause injury or inconvenience to the people or the property around the area. The general topography of the disposal area has a very mild slope. The spillage of muck will be prevented by making concrete retaining walls to retain the piled muck. The top surface would be leveled and graded after the capacity of any dumping site is exhausted. The top surface will be covered with soil and grass seeding will be ensured to promote vegetation cover.

Suitable retaining walls shall be constructed prior to dumping of muck, and terraces would be developed to support the muck on vertical slope and for optimum space utilization. Loose muck would be compacted layer-wise. The compacted muck will be ultimately covered with fertile soil, and suitable plants will be planted adopting suitable bio-technological measures (**see Figures 10.4**).

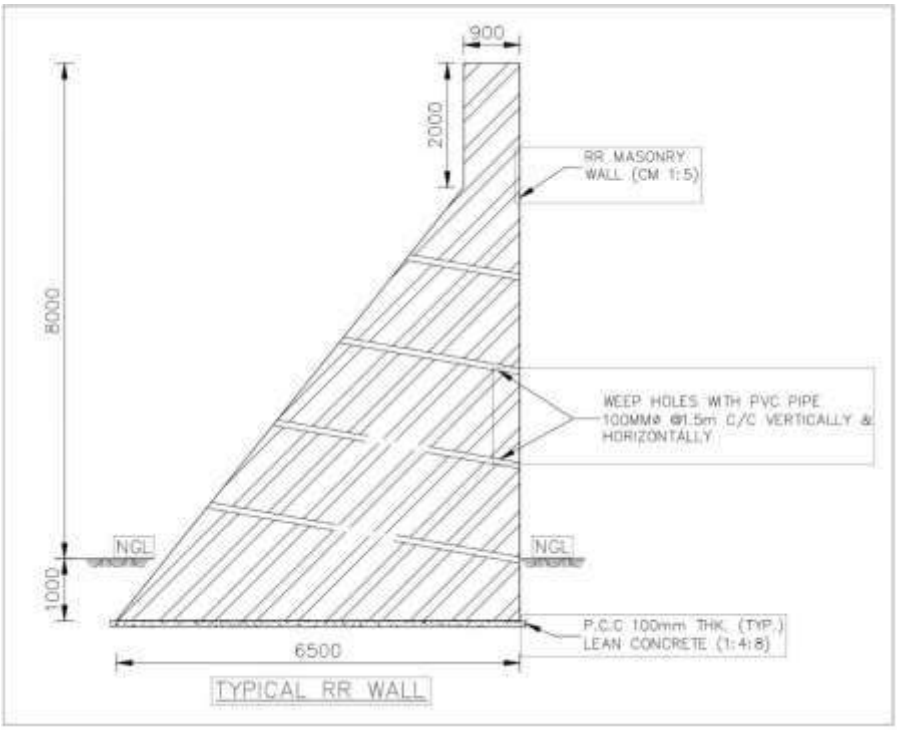


Figure 10.4 : Cross-section of Retaining Wall

10.1.3 Rehabilitation of Muck Disposal Site

The Rehabilitation plan of muck dumping site includes engineering and biological measures. The project authorities would ensure that the dumping yards blend with the natural landscape to develop the site with patches of greenery in and around it. The site can also be developed later as recreational park or any other purpose with sufficient greenery by planting ornamental plants. The muck dumping site would be developed as Eco-Park which would not only help in rehabilitation of disposed muck site but also help in propagating biodiversity conservations measures.

The following engineering and biological measures have been proposed for the development of spoiled areas.

10.1.3.1 Engineering Measures

For stacking of dumped material, RR masonry retaining wall is proposed to be built before dumping of any material on the site. The minimum length of dumping site is 2576 m and height of retaining wall is proposed to be 8 m. The retaining wall shall have PCC base of 100m thick and a width of about 6.5 m. The masonry wall is proposed with weeping pipes with PVC pipes of 100 mm for drainage. The leveling & Sloping would be done after dumping the material; after every cycle and simultaneously improving the drainage of the disposal site.

All the approach road to various project structures will be constructed with minimal environmental damage. The methodology consists in developing the formation width is half cutting and half filling, so that the materials obtained from cutting are utilized in filling. The excavation on hill side will be done to get a stable slope for the materials encountered. At places breast wall, gabion walls shall be done in natural slope to retain filled material, particularly where there is problem of retaining the slope.

i) Retaining Wall

Total area for the dumping of muck is 30 ha which can accommodate 5.61 Mcum. The height of the retaining wall will be approximately 8 m. A typical sketch of the retaining wall is given at **Figure 10.4**.

ii) Compaction

Compaction is an engineering measure, which would reduce bulk density of the muck thereby optimizing the use of muck disposal area and would make it suitable for the plantation and other biological measures. Top surface would be levelled and graded to make the alternative use. The muck will be spread in layers of 500-700mm thick layers. Top surface would be levelled and graded to make the alternative use. On top a layer of soil would be spread to make the land suitable for plantation. The total cost for the process of compaction is **Rs. 250.00 lakh**.

iii) Fencing

Fencing is a bio-engineering measure. After rehabilitation of muck the dumping area need protection for some time from disturbing by human and domestic animals. For this reason, fencing around the muck deposited is required. Barbed wire strands with two diagonal strands, clamped to wooden/ concrete posts placed at 3 m distance are proposed around the dumping piles. Project authorities will establish temporary wind barriers around 3 sides of dumps in close of settlement area.

Estimated cost of engineering measures is given at **Table 10.4.**

Table 10.4: Estimated Cost of Engineering Measures

S. No.	Particular	Volume	Rate in Rs./cum	Cost in Rs. Lakh
1	Earthwork for foundation (Cum)	3536	250	8.84
2	PCC 100 mm Thick M10 Grade Concrete (Cum)	1800	4500	81.00
3	R.R. Masonry	15000	3500	525.70
4	Weep Holes with PVC Pipe 100 mmØ @1.5m C/C Vertically & Horizontally (Rmt)	22000	150	33.00
5	Compacting and land leveling, etc.	LS	LS	250.00
	Total			**898.54**

10.1.3.2 Biological Measures

Top surface area of the dumping is about 30 ha. This area will be treated for the purpose of plantation. Vegetation cover controls the hydrological and mechanical effects on soils and slopes. Therefore, biological measures to stabilize the loose slope are essential. To implement the biological measures in dumping area the following activities would be taken into account. The biological measures include the following:

i) Soil treatment

Muck dumped at various sites is not considered to be nutrient rich as it is excavated from tunnels and other structures. In order to make it suitable for the plantation it will be provided bio treatment.

ii) Plantation

The selected species will be planted after their nurseries have been developed. The dumping areas are very small therefore; separate nursery would not be required. Saplings for planation should be procured from forest department nursery. Nearly 1-2 years old saplings would be used for the plantation. Grasses and herbaceous species would be used in the inter space of tree and shrub species. They will help in providing the continuous chain of support in retaining debris, reinforcing soil and increasing the infiltration capacity of the area.

After the process of compaction dumping site will be available for the plantation. In consultation with the horticultural department as well as forest department.

The afforestation with indigenous plant species of high ecological and economic value which can adapt to local habitat will be undertaken with 400-600 plants per hectare depending upon the canopy cover required. Major tree species which would be planted are listed in table below.

S. No.	Family	Scientific Name	Habitat
1	Anacardiaceae	*Mangifera indica*	Tree
2	Anonaceae	*Polyalthia longifolia*	Tree
3	Bignoniaceae	*Jacaranda mimosifolia*	Tree
4	Combretaceae	*Terminalia tomentosa*	Tree
5	Combretaceae	*Terminalia bellirice*	Tree
6	Fabaceae	*Albizia lebbeck*	Tree
7	Fabaceae	*Cassia fistula*	Tree
8	Fabaceae	*Dalbergia sissoo*	Tree
9	Fabaceae	*Dalbergia penniculata*	Tree
10	Fabaceae	*Acacia nilotica*	Tree
11	Fabaceae	*Acacia catechu*	Tree
12	Lamiaceae	*Tectona grandis*	Tree
13	Magnoliaceae	*Magnolia champaca*	Tree
14	Meliaceae	*Azadirachta indica*	Tree
15	Meliaceae	*Toona ciliata*	Tree
16	Myrtaceae	*Syzygium cumini*	Tree
17	Rubiaceae	*Anthocephalus Cadamba*	Tree
18	Rutaceae	*Aegle marmelos*	Tree
19	Sapotaceae	*Madhuca indica*	Tree
20	Acanthaceae	*Justicia adhatoda*	Shrub
21	Apocynaceae	*Nerium indicum*	Shrub
22	Euphorbiaceae	*Jatropha curcas*	Shrub
23	Poaceae	*Dendrocalamus strictus*	Shrub
24	Sapindaceae	*Dodonaea viscosa*	Shrub
25	Verbenaceae	*Vitex negundo*	Shrub

The estimated cost of these measures would be **Rs. 169.50 lakh**. This cost includes the cost of turfing of slopes, preparation of ground, spreading of manure, etc., providing 5 cm of soil cover and transportation and carriage. It also includes the cost of fencing, irrigation, watch and ward, etc. (**see Table 10.5**).

Table 10.5: Total financial outlay for the biological measures at dumping sites

S. No.	Particulars	Quantity	Rate (in Rs.)	Amount (Rs. in lakh)
1	Site preparation (Levelling and spreading of fertile soil)	30 ha	10,000	5.00
2	Pitting (size: 0.45 m x 0.45 m x 0.45 m)		Lumpsum	15.00
3	Manure and soil filling in pits including transportation		Lumpsum	12.00
4	Cost of plant material		Lumpsum	10.00
5	Transportation of Plant material from nursery	-	Lumpsum	5.00
6	Cost of RCC fence post and B/Wire	30 ha	25000.0	12.50
7	Planting of entire Plants raised in P/bag	30 ha	20,000	10.00
8	Maintenance for 5 years			50.00
9	Misc. (watering, transport, etc.)	-	Lumpsum	50.00
	Total			**169.50**

10.1.4 Financial Requirement

The estimated cost of the relocation and rehabilitation of excavated material is given in **Table 10.6**. The total cost of these measures will be **Rs. 1068.04 lakh.**

Table 10.6: Financial requirements for implementation of Muck Disposal Plan

S. No.	Item	Amount (Rs.in lakh)
1.	Engineering measures	898.54
2.	Biological measures	169.50
	Total	**1068.04**

Date: 20.06.2023 Name: Gopi Krushna N

Gopi Krushna N
Deputy General Manager (DGM)
Authorised Signatory
Greenko Energies Private Limited

Place: Hyderabad Authorized Signatory

ANNEXURE-8

Greenko Energies Private Limited
CIN: U40109TG2000FTC034990

GEPL/RJ01/CWLW/231206 **Dated:06-12-2023**

To
The Deputy Conservator of Forest
Baran Forest Division
District- Baran, Rajasthan

Sub: Development of Shahpur (1800 MW) Standalone Pumped Storage Project in Baran District, Rajasthan by M/s Greenko Energies Private Limited-**Submission of Wildlife Conservation Plan-reg**

Ref: **1. Your Office Letter vide ref no. FCA () DCF/2022-23/10249 dated 31/10/2023**
2. O/o PCCF (CWLW), Jaipur letter vide ref no 468 dated 20.10.2023

Sir,

With reference to the above subject matter, your office vide ref (1) above, has directed to update the Wildlife Conservation Plan as per instruction received from Chief Wildlife Warden (CWLW), Jaipur on dated 20.10.2023. Accordingly, the Wildlife Management and Conservation Plan has been updated as per the Schedule I of The Wild Life (Protection) Amendment Act, 2022.

Further, it is pertinent to mention that the project has been initially proposed for 2520 MW installed capacity. However, due to project optimization, the installed capacity was reduced to 1800 MW and with reduced forest land requirement of 407.8227 Ha & reduced project cost and environmental clearance proposal has been submitted to MoEFCC for grant of EC for the revised project capacity.

In view of the above, the Wildlife Conservation Plan has been updated with revised project capacity and as per the Schedule I of The Wild Life (Protection) Amendment Act, 2022 and submitted herewith for your kind approval.

Thanking You
Yours Sincerely
For **Greenko Energies Private Limited**

N. Gopi Krishna
Authorized Signatory

Greenko Energies Pvt. Ltd.

कार्यालय उप वन संरक्षक, बारां
क्रमांक 52
दिनांक 7/12/23

Enclosures: As above (6 sets)

WILDLIFE CONSERVATION AND MANAGEMENT PLAN FOR SCHEDULE-I (WPAA 2022) SPECIES

SHAHPUR PUMPED STORAGE PROJECT (1800 MW)

Prepared for:

Greenko Energies Pvt. Ltd.

District Baran, Rajasthan

Prepared by:

R. S. Envirolink Technologies Pvt. Ltd.

NABET/EIA/2225/RA 0274

403, Bestech Chamber Commercial Plaza,

B-Block, Sushant Lok-I, Gurugram

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

Executive Summary

I. Greenko Group has been in the process of evaluating suitable locations and has identified suitable location for Pumped Storage Project (PSP) near Kaloni, Baint and Mungawali villages (Near Shahpur), Shahabad Tehsil, Baran District, Rajasthan for the proposed 1800 MW Shahpur Pumped Storage Project (PSP).

II. The Shahpur Standalone Pumped Storage Project envisages construction of both upper reservoir and lower reservoir in Baran district of Rajasthan and involves construction of rockfill embankments. The water from the proposed lower reservoir will be pumped up and stored in the proposed upper Reservoir and will be utilized for power generation.

III. Land requirement for proposed project has been worked out as 624.17 ha. Out of which 407.82 ha is forest land, 216.35 ha is non-forest.

IV. The private land required for the project is proposed to be purchased through a voluntary sale with a willing buyer and seller process by following Section 2 and Part (a or क) of Sub-Section 3 of The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RFCTLARR), 2013.

V. Public Hearing was held on 22nd February 2021 at Anganbadi School Grounds, Kaloni Village, Tehsil Shahabad, District Baran, Rajasthan.

VI. As per land use land cover map of the study area forests comprised of Deciduous Forest and Scrub Forest combinedly constitute a major part of the study area accounting for 46.87% of the area. Agricultural land constitutes 31.27%.

VII. For the operation of proposed project water will be lifted one time from the existing nearby Kuno river. The Kuno river is a tributary of the Chambal River. Kuno river is 180 km long, the catchment area of the Kuno river up to Mungawali village near the proposed lifting point is 963.59 sq km.

VIII. The project area falls in Seismic Zone-I. No major earthquakes are reported/known from this area.

IX. The study area of the project lies in the Baran district, which experiences mostly hot summer and dry climate except in the monsoon season. The south-west monsoon rainfall occurs from June to September in the study area.

X. the predominant soils of the district have black soils of alluvial origin with clay loam to clay in texture and are generally non-calcareous.

XI. Most of the workers are dependent on agriculture practices and related activities for their livelihood. Irrigation of agriculture is mostly dependent on rainfall. Livestock's rearing is an important source of livelihood in the area.

XII. Villagers in the area also depend on forest resources for their day-by-day needs, mainly for fuelwood, fodder, timber, and medicinal purposes. Extraction of Tendu (Diospyros melanoxylon) leaves, from the forest area is one of the livelihood sources of the tribal population. Scrub forest and grassland in the area also used as grazing land for livestocks.

XIII. A total of 113 plant species belongs to 43 families were recorded during field survey in the core zone of the project. plants including grasses were reported from the study area.

XIV. The detail inventory of 203 plant species reported from the study area (Core and Buffer Zone) has been prepared based on primary survey and same has been supplemented with available secondary data.

XV. *Tectona grandis* and *Diospyros melanoxylon* was found dominant in the Dry deciduous forest associated with *Anogeissus pendula, Madhuca longifolia, Terminalia tomentosa, Terminalia bellirica, Lannea coromandelica, Boswellia serrata*, etc. *Acacia catechu* and *Ziziphus jujuba* were dominant in scrub forest.

XVI. According to the RED Data Book of Indian Plants and IUCN Red List of Threatened Species (Version 2022-1), none of the plant species found in the study area falls under any Threatened category.

XVII. Among the faunal species Mammals are represented by 20 species, 54 species of birds were recorded during survey. Herpetofauna (amphibians and reptiles) were represented by 14 species and 7 species of butterflies were recorded from the study area.

XVIII. 11 species of mammals, 4 species of birds and 7 species of herpetofauna are listed as Schedule I of WPAA (2022) reported from the study area.

XIX. Proposed project is located within newly declared Shahabad Conservation Reserve. The other nearest Protected Area to the project is in Madhya Pradesh i.e Kuno National Park having aerial distance more than 40 km from project site.

XX. About 84.20% working population is engaged in agricultural activities, out of which 42.36% are Cultivators and 41.84% are Agricultural Labours.

XXI. Villagers in the district depend on forest resources for their day by day needs mainly for fuelwood, fodder, timber, and medicinal purposes. In the study area extraction of Tendu (*Diospyros melanoxylon*) leaves, from the forest area is one of the main livelihood sources of the tribal population. The main timber species in the forest area are *Tectona grandis*.

XXII. With other published literature Forest Working Plan of Baran Division has also been consulted for preparation of check list of plants and animals in the study area.

XXIII. The major irreversible impact of construction of proposed project is change in land use pattern as 407.82 ha of forest land will be diverted for the construction of the project components.

XXIV. If proper mitigation mad management measures have not been implemented during construction, then construction activities also have impact on ambient air Quality, Ambient Noise Quality, Water Quality, terrestrial ecology and on socio economic environment in the surrounding of proposed project.

XXV. During operation phase, no major impacts are envisaged on air, noise, water and terrestrial ecology.

XXVI. Construction and operation of proposed project provide employment and new livelihood sources to the local people and project also strengthen the basic infrastructure facilities in the area.

XXVII. To minimize the impact of construction activities various mitigation and management measures has been proposed under Environmental Management Plan viz, Control of Air, Noise and Water Pollution, Monitoring of Air, Noise and Water quality during

construction, Muck Management Plan, Green Belt Development Plan, Public Health Delivery System, Energy Conservation Plan, Local Area Development Plan, Sanitation and Solid waste Management Plan, Labour Management Plan, etc.

XXVIII. As the project area lies with Shahabad Conservation Reserve and there is presence of faunal species listed under Schedule-I of WPAA 2022, Wildlife Conservation Plan has been formulated with financial provision following the guidelines issued by Office of Addl. Principal Conservator of Forest and Chief Wildlife Warden, Rajasthan, Jaipur issued by letter no. WCP/CWLW/2019/ 651-663 dated 24/05/2019.

XXIX. The main objectives of wildlife conservation Plan are:

- Conservation and management of natural habitat of faunal species in the area;
- Mitigation/ control of project induced biotic and/or abiotic pressures/ influences that may affect the natural habitats and
- Creating all round awareness regarding conservation by ensuring people's participation.

XXX. State Forest Department shall be the executing agency for implementation of the proposed mitigation measure under Wildlife Management Plan in the surrounding of proposed project site, therefore, a total amount of **Rs 3,13,91,135/-** will be deposited with the State Forest Department for taking up proposed activities within core and buffer zone of the proposed project.

CHAPTER - 1

1.1. BRIEF NOTE ABOUT THE PROJECT AND ITS UTILITY

Pumped Storage Projects (PSP) presents an optimal, economically viable & scalable solution to supply Schedulable Power On-Demand (SPOD) with both base load and peak load capabilities to the Nation. Pumped-storage hydroelectricity allows energy from intermittent sources (such as solar, wind) and other renewables, or excess electricity from continuous base-load sources (such as coal or nuclear) to be saved for periods of higher demand. The reservoirs used with pumped storage are quite small when compared to conventional hydroelectric dams of similar power capacity, and generating periods are often less than half a day. Along with energy management, pumped storage systems are also helpful in controlling electrical network frequency and provide reserve energy.

Greenko Group has been in the process of evaluating suitable locations and has identified suitable location for Pumped Storage Project (PSP) near Kaloni, Baint and Mungawali villages (Near Shahpur), Shahabad Tehsil, Baran District, Rajasthan for the proposed Shahpur Pumped Storage Project (PSP) that can supply Schedulable Power on Demand (SPOD) which is Dispatchable & Schedulable Renewable Energy to consumers across India.

1.1.1 Project Location

Proposed Shahpur Pumped Storage Project (PSP) is located near Kaloni, Baint, Mungawali, Hanumatkhera, Balarpur, Shahpur villages, Baran District of Rajasthan. It envisages creation of upper reservoir & lower reservoir which are located away from all existing natural river systems and have negligible catchment areas. The project sites are accessible from NH-76 road close to Mahuri Khera from where Shahpur village road takes off; and is at a distance of approximately 6 Km. Nearest railhead is Baran Railway Station, about 77 kms from project site and nearest Airport is Gwalior Airport, about 200 km from project site The powerhouse is located near Shahpur village, which is in Shahabad Tehsil of Baran district. The Geographical co-ordinates of the proposed upper reservoir are at longitude 77° 10' 55.78"E and latitude is 25°11'25.21"N and that of proposed lower reservoir are 25°11'40.00"N and 77°11'50.00"E (**refer Figure 1**).

Scoping clearance of Shahpur Pumped Storage Project in district Baran, Rajasthan was accorded by Ministry of Environment Forests and Climate Change (MoEF&CC), Government of India vide letter no. J-12011/02/2020-IA-I, dated: 13.04.2020.

1.1.2 Project Description

The Shahpur Standalone Pumped Storage Project envisages construction of both upper reservoir and lower reservoir in Baran district of Rajasthan and involves construction of rockfill embankment with avg height of 24.5 m for the length of 5309 m for creation of Shahpur PSP upper reservoir with 1.21 TMC gross capacity and construction of rockfill embankment with avg height of 26.5 m for the length of 2937 m for creation of Shahpur PSP lower reservoir with 1.05 TMC gross capacity. This scheme envisages non-consumptive re-utilization of water by re-circulation. The water from the proposed lower reservoir will be

pumped up and stored in the proposed upper Reservoir and will be utilized for power generation. Total 6 numbers of Independent Head Race Pipe / Pressure Shaft with one pressure Tunnel bifurcating into two-unit pressure tunnel convey water between Lower and Upper reservoirs. Surface Power/Pump House will be located at about 830 m from the intake structure and shall be equipped with six vertical shaft reversible Francis type units composed each of a generator/motor and a turbine/pump having generating/pumping capacity of 300 & 150 MW/330 & 165MW. The Layout map of proposed project is given at **Figure 2**.

1.1.3 Land Requirement

For the development of Shahpur Pumped Storage Project (PSP), Both Private & Forest land would be acquired for construction of project components, reservoir area, muck dumping, construction camps and colony, etc. Based on the final project layout (**Figure 1 & 2**), land requirement has been worked out as **624.1702 ha** (**Table 1**). Out of which **407.8227 ha** is forest land, **216.3475 ha** is Non-forest.

Table 1: Land Requirement of Shahpur Pumped Storage Project

S. No	Component	Forest Land	Non-Forest	Total
1	Road Upper Reservoir to NH-76	0.00	8.205	8.205
2	Upper Reservoir	110.2062	159.6100	269.8162
3	Job Facilities Area	0	15.00	15.00
4	Magazine (Explosive Storage Facility)	0	0.10	0.10
5	Road From Upper Reservoir to Lower Reservoir	3.7775	0.00	3.7775
6	WCS & Powerhouse	57.2250	0.00	57.225
7	Lower Reservoir	230.514	0.00	230.514
8	Pumping Alignment	2.28	0.00	2.28
9	Road from Lower Reservoir to BT Road	3.82	2.7375	6.5575
10	Approach Road Lower Reservoir to Muck Disposal Area	0.00	0.6950	0.695
11	Proposed Muck Disposal Area	0.00	30.0	30.00
Total		**407.8227**	**216.3475**	**624.1702**

a. Land Acquisition

The forest land required for the project falls in Baran Forest Division. For diversion of 407.8227 ha of forest land, online application has been submitted to MoEF&CC vide proposal No.: FP/RJ/HYD/121439/2021.

The private land required for the project is proposed to be purchased through a voluntary sale with a willing buyer and seller process. With reference to the private land purchase through private negotiations and the applicability of the provisions relating to rehabilitation and resettlement for the above Project as per Section **2 and Part (a or क) of Sub-Section 3** of The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RFCTLARR), 2013, the provisions of the Act shall apply in the cases, where:

(a) ***a private company purchases land, equal to or more than such limits in rural areas or urban areas, as may be prescribed by the appropriate Government,*** *through private negotiations with the owner of the land in accordance with the provisions of section 46;.*

In this context, it is to be noted that the total private land proposed to be purchased through private negotiations for the Shahpur Pumped Storage Project which falls in rural areas is about 216.35 ha only which is well within the prescribed limits as specified above.

b. Public Consultation

On completion of draft EIA report and its executive summary in English and vernacular language (Hindi), reports were submitted to Rajasthan State Pollution Control Board (RJSPCB) to initiate the process of Environmental Public Hearing (PH). PH was held on 22nd February 2021 at Anganbadi School Grounds, Kaloni Village, Tehsil Shahabad, District Baran, Rajasthan.

1.1.4 Project Benefits

Wind-Solar-Storage Hybrid Projects present a viable solution to the problem at hand and for future wherein large RE capacities are being planned to be added to National grid. Developing such integrated Wind-Solar projects along with Pumped Storage capacities independently, without impacting the existing natural water systems / irrigation systems is necessary to sustainably power the future needs of our country while maintaining grid stability.

With this in view, Greenko Group has undertaken feasibility studies to implement the 1800 MW Pumped Storage Energy which can act as a standalone power generator or act as an important component for Integrated Renewable Energy Projects (IREP).

Employment Generation

Typically, like all infrastructure projects, Shahpur PSP will generate employment opportunities during construction phase as well as operation phase. It is estimated that project would employ a workforce of about 3600 persons during the 3.0 years construction period and thereafter during project operation, permanent staff of about 300 persons will be employed.

In addition, the project would lead to creation of direct and indirect employment opportunities as new factories would come up in and around the project due to reliable power supply/availability, contract works for the locals during construction and operation phase, etc.

Local Area Development

An amount of **Rs. 15.00 crore** has been earmarked for local area development with a view to improve the quality of life of local residents in the project vicinity especially for those whose land will be acquired for the project construction. They will have opportunities for skill development, education, better medical and health care, improved local infrastructure, etc.

1.2. PROVISIONS OF ALL RELEVANT ACTS AND REGULATION

The Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India is the apex administrative body in the country for regulating and ensuring environmental protection and lays down the legal and regulatory framework for the same. The MoEF&CC and the pollution control boards Central Pollution Control Board and State Pollution Control Boards) together form the regulatory and administrative core of the sector.

The main environmental laws, including under which various key environmental permits (or consents) are being issued in India, include the:

- The Electricity Act, 2003
- The Forest (Conservation) Act, 1980
- Air (Prevention and Control of Pollution) Act of 1977
- Environment (Protection) Act of 1986,
- Air (Prevention and Control of Pollution) Act of 1981
- Water (Prevention and Control) Act, of 1974
- Wildlife (Protection) Amendment Act, 2022
- Hazardous Wastes (Management and Handling) Amendments Rules, 2003
- National Environment Tribunal Act, 1995

1.2.1. The Electricity Act, 2003

The act seeks to create a framework for the power sector development by measures conducive to the industry. Electricity Act does not explicitly deal with the environmental implications of activities related to power transmission. The applicable legal provision under this act is: Section 68 (1) – sanctions from the Ministry of Power (MoP) is a mandatory requirement for taking up any new project.

1.2.2. The Forest (Conservation) Act, 1980

The Act provides for the conservation of forests and regulating diversion of forestlands for non-forestry purposes. When projects fall within forestlands, prior clearance is required from relevant authorities under the Forest (Conservation) Act, 1980. State government cannot de-reserve any forestland or authorize it use for any non-forest purposes without approval from the Central government.

1.2.3. The Environment (Protection) Act of 1986

The Environment (Protection) Act of 1986 was introduced as an umbrella legislation that provides a holistic framework for the protection and improvement to the environment.

In terms of responsibilities, the Act and the associated Rules requires for obtaining environmental clearance for specific types of new / expansion projects (addressed under Environmental Impact Assessment Notification, 1994, 2006 and amendments 2009) and for submission of an environmental statement to the State Pollution Control Board annually.

1.2.4. Air (Prevention and Control of Pollution) Act of 1981

The objective of the Act is to provide for the prevention, control and abatement of air pollution, for the establishment, with a view to carrying out the aforesaid purposes, of Boards, for confirming on and assigning to such Boards powers and functions relating thereto and matters connected therewith.

Decisions were taken at the United Nations Conference on the Human Environment held in Stockholm in June 1972, in which India participated, to take appropriate steps for the preservation of the natural resources of the earth which, among other things, includes the preservation of the quality of air and control of air pollution.

1.2.5. Water (Prevention and Control) Act, of 1974

The objectives of the Water (Prevention and Control) Act are to provide the Prevention and Control of Water pollution and the maintenance or restoration of the wholesomeness of water for the establishment, with a view to carrying out the purposes aforesaid, of Boards for the prevention and control of water pollution, for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith.

1.2.6. Wildlife Protection Act, 1972

According to the Wildlife Protection Act, 1972 "wildlife" includes any animal, bees, butterflies, crustacean, fish and moths; and aquatic or land vegetation which form part of any habitat. In accordance with the Wildlife (Protection) Amendment Act, 2022 "no alteration of boundaries/National Park/ Sanctuary shall be made by the State government except on recommendation of the National Board for Wildlife (NBWL)".

Further, in terms of Supreme Court Order dated 13.11.2000 the State governments have to seek prior permission of Supreme Court before submitting the proposal for diversion of forest land in protected areas.

Whenever, any part of Wildlife Sanctuary/ National Park is getting affected by a hydro project the forest proposal in request of such project is entertained by MoEF&CC (earstwhile MoEF), GoI only after permission of de-reservation/ de-notification of Wildlife Sanctuary/ National Park has been accorded. After recommendation of Standing Committee of NBWL proposal for de-reservation/de-notification is ratified by Hon'ble Supreme Court.

1.2.7. Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016,

Hazardous Waste Management Rules are notified to ensure safe handling, generation, processing, treatment, package, storage, transportation, use reprocessing, collection, conversion, and offering for sale, destruction and disposal of Hazardous Waste. These Rules came into effect in the year 1989 and have been amended later in the years 2000, 2003, and with final notification of the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 in supersession of former notification. The Rules lay down corresponding duties of various authorities such as MoEF&CC, CPCB, State/UT Govts., SPCBs/PCCs, while State Pollution Control Boards/ Pollution Control Committees have been designated with wider responsibilities touching across almost every aspect of Hazardous wastes generation, handing and their disposal.

1.2.8. Solid Waste Management Rules, 2016

The Union Ministry of Environment, Forests and Climate Change (MoEF&CC) notified the new Solid Waste Management Rules (SWM), 2016, which will replace the Municipal Solid Wastes (Management and Handling) Rules, 2000, which have been in place for the past 16 years.

These rules are the sixth category of waste management rules brought out by the ministry, as it has earlier notified plastic, e-waste, biomedical, hazardous and construction and demolition waste management rules.

1.2.9. National Environment Tribunal Act, 1995

The Act provided strict liability for damages arising out of any accident occurring while handling any hazardous substance and for the establishment of a National Environment Tribunal for effective and expeditious disposal of cases arising from such accident, with a view to give relief and compensation for damages to persons, property and the environment and for the matters connected therewith or incidental thereto.

1.3. Villages and habitations within the area

For sustainable development, it is important to understand the social and economic conditions of the community in the area. The socio-economic profile of the project area is discussed in this section. The proposed Shahpur Pumped Storage Project is located in Shahbad tehsil of Baran district in the state of Rajasthan. The Baran district is situated at the south-eastern corner of the Rajasthan state and shares its boundaries with the Shivpuri, Shyopur, and Guna districts of Madhya Pradesh. The Baran district touches Kota district in the north-west and Jhalawar district in the south-west.

1.3.1. Socio-economic Profile of Villages in the Study Area

Socioeconomic profile of the study area is based upon Census of India, 2011 and Field Study/Survey. A major part of the study area of Shahpur PSP Project falls in Shahbad tehsil of Baran district in the state of Rajasthan whereas a very small part of the study area belongs to Guna and Bamori tehsils of Guna district in the state of Madhya Pradesh.

There is a total of 57 villages in the study area. Out of these, there are three project-affected villages namely **'Kaloni' 'Mungawali' and 'Baint'** of Baran district**.** Out of the total 57 villages, one village namely **'**Musredi' is in Guna Tehsil and one village namely **'Vithalpur'** is in Bamori tehsil of Guna district in Madhya Pradesh state. (refer to **Table 2)**.

Table 2: List of Villages of the Study Area

S. No.	Village Name	S. No.	Village Name
Tehsil: Shahbad, District: Baran			
1	Hanotiya	29	Biharipura
2	Haryanagar	30	Khanda Sahrol
3	Sahrol Taleti	31	**Baint**
4	Shubh Dhara	32	Balharpur
5	Kushalpura	33	Sangeshwar
6	Birmani	34	Ganna Kheri
7	Kripalpur	35	Beelampur
8	Mahuri Khera	36	Mandi Barwali
9	Shahpur	37	Baman Gawan
10	Shahbad	38	Chiroli
11	**Mungawali**	39	Bhanpur
12	Suwans	40	Mandi Bhonra
13	Doondabar	41	Amkhoh
14	Gurjara	42	Nandiya
15	Gangan	43	Majhera
16	Beel Kheramal	44	Bichi
17	Pajantori	45	Balharpur
18	Bhoyal	46	Ghensuwa

S. No.	Village Name	S. No.	Village Name
19	Boodhi Bhoyal	47	Rampura Upreti
20	Tilgawan	48	Mohanpur
21	Budha Nonera	49	Suhan
22	Guwari	50	Mandi Sahjana
23	Majhari	51	Nukarra
24	Kasba Nonera	52	Tiparka
25	Sahjanpur	53	Munsredi
26	**Kaloni**	54	Pureni
27	Moondiyar	55	Tanda Kachhiyan
28	Mamoni		
District: Guna			
Tehsil: Guna		**Tehsil: Bamori**	
56	Musredi	57	Vithalpur

a) Demographic Profile of the Study Area

Socio-economic profile of the study area covering aspects like demography, occupational pattern, literacy rate, and other important socio-economic indicators of the villages. The baseline socio-economic profile is based on the Census of India 2011.

Total 7794 households with an average household size of 5 with a total population of 38465 out of which 19999 (51.99%) are male and 18466 (48.01%) are female in the study area. The sex ratio is 923 females per 1000 males. About 18.25% of the total population belongs to the 0-6 year age group, out of which 52.28% are boys and 47.72% are girl child of the same age group.

In the study area villages, about 36.37% population belongs to the Scheduled Tribes (ST) community whereas 20.19% population belongs to Scheduled Caste (SC) community. Among the ST community, 50.77% are males and 49.23% are females with a sex ratio of 970. However, among the SC community, 52.78% are males and 47.22% are females with a sex ratio of 895.

The literacy rate in the study area has been worked out to 59.13%, among males it is 74.18% while among females is 42.87% creating a gender gap of 31.31% (see **Table 3**).

Table 3: Demographic Profile of Study Area

Particulars	Number	%
Total No. of Households	**7794**	**-**
Average Household Size	**5**	**-**
Total Population	**38465**	**-**
Male	19999	51.99
Female	18466	48.01
Sex Ratio	**923**	
Population (0-6 age group)	**7020**	**18.25**
Male	3670	52.28
Female	3350	47.72
Child Sex Ratio	913	
Scheduled Caste (SC) Population	**7768**	**20.19**
Male	4100	52.78
Female	3668	47.22
Sex Ratio	**895**	
Scheduled Tribe (ST) Population	**13990**	**36.37**

Particulars	Number	%
Male	7103	50.77
Female	6887	49.23
Sex Ratio	**970**	
Total Literates	**18593**	**48.34**
Male	12113	65.15
Female	6480	34.85
Literacy Rate	-	**59.13**
Male Literacy Rate	-	74.18
Female Literacy Rate	-	42.87
Gender Gap in Literacy Rate	-	**31.31**

About 50.46% of the population in the study area is engaged in different kinds of works. Out of the total working population, 54.32% are male and 45.68% are female, creating a gender gap in the work participation rate of 8.64%.

Of the total working population, 62.80% are 'Main Workers' and 37.20% are 'Marginal Workers'. Among 'Main Workers' the gender gap of work participation is 24.58% while among Marginal Workers it 18.26% in favour of females, (refer **Table 4**).

About 84.20% working population is engaged in agricultural activities, out of which 42.36% are Cultivators and 41.84% are Agricultural Labours. A small percentage of the population is engaged as household industrial workers (2.05%) while about 13.75% are in miscellaneous services.

Table 4: Profile of Working Population in the Study Area

S. No.	Description	Number	% to Respective Total
1	Total Workers	19409	50.46 (w.r.t. total population)
	Male	10543	54.32
	Female	8866	45.68
	Gender Gap in Work Participation Rate	8.64	
2	Main Workers	12188	62.8
	Male	7592	62.29
	Female	4596	37.71
	Gender Gap in Work Participation Rate	24.58	
3	Marginal Workers	7221	37.2
	Male	2951	40.87
	Female	4270	59.13
	Gender Gap in Work Participation Rate	(-) 18.26	
4	Household Industrial Workers	398	2.05
	Male	161	40.45
	Female	237	59.55
5	Cultivators	8222	42.36
	Male	4929	59.95
	Female	3293	40.05
6	Agricultural Labour	8121	41.84
	Male	3540	43.59
	Female	4581	56.41
7	'Other Workers'	2668	13.75
	Male	1913	71.7
	Female	755	28.3

b) Basic Amenities & Infrastructure Available in the Study Area

The basic amenities like education, health, drinking water, electricity, approach road, transportation, and other facilities available in the study area are given in **Table 5**.

Table 5: Basic Amenities & Available Infrastructure in the Study Area

AMENITIES & INFRASTRUCTURE	Number of Institutions
Educational Institutions	
Pre-Primary School (Pvt.)	14
Primary School (Govt.)	27
Primary School (Pvt.)	14
Middle School (Govt.)	15
Middle School (Pvt.)	12
Secondary School (Govt.)	8
Secondary School (Pvt.)	2
Senior Secondary School (Govt.)	3
Senior Secondary School (Pvt.)	2
Health Facilities/Institutions	
Primary Health Centre	1
Primary Health Sub-centre	8
Dispensary	1
Family Welfare Centre	1
Maternity & Child Welfare Centre	2
Veterinary Hospital	1
ASHA	38
Anganwadi Centre	38
Drinking-Water	**Availability in Number of Villages**
Tap Water (Treated)	11
Tap Water (Un-treated)	7
Well (Covered)	13
Well (Un-covered)	15
Hand Pump	47
Tube wells/Borehole	15
River/Canal	6
Tank	6
Electricity Supply	
Power for Domestic Uses	39
Power for Agriculture Uses	29
Power for Commercial or Industrial Uses	16
Roads	
Black Topped (Paved/Pucca) Road	10
Gravel (Mud/Kuccha) Road	57
Footpath Road	57
Banking & Finance Institutions	
Commercial Bank	3
Co-operative Bank	3
Agricultural Credit Society	2
Self-Help Groups	1

Educational Institutions: Educational facilities play an important role in the overall development of an area. These facilities enhance economic growth and employment.

- There are 41 Pre-primary schools in the study area villages.
- There are 29 Primary Schools in the study area as per the Census 2011 record.
- There are 27 Middle Schools available in the study area.
- There are 10 Secondary Schools available in the study area.
- In the study area, there are 5 Senior Secondary Schools available (refer to **Table 5**).

Health Institutions: As per Census 2011, the available medical/health facilities/institutions in the study area are given in **Table 5.**

- There are only one Primary Health Centre and eight Primary Health Sub-centers in the study area.
- There is only one dispensary available for medical help in the area which is situated in Shahbad village.
- There is one Family Welfare Center and one Maternity & Child Welfare Center in Shahbad village, however, one Maternity & Child Welfare Center is in Baman Gawan village in the study area.
- One Veterinary Hospital is available in the Shahbad village.
- ASHA is available in 38 villages of the study area.

Drinking-Water: Hand pumps and Wells (covered & uncovered) are the major sources of drinking water. Apart from this, Tube wells/boreholes, River water, tank, and tap water is also using in some villages of the study area.

Electricity Supply: As per Census 2011, Electricity for domestic use is available in only 39 villages of the study area, while electricity for agricultural use is available in only 29 villages. However, for Commercial or Industrial uses it is available only in 16 villages of the study area.

Road Network: In the study area, only 10 villages are connected by the Black-topped roads, but all the 57 villages are facilitated with Gravel road and footpath in the study area.

Banking & Finance Institutions:

- There is 3 commercial, and 3 co-operative banks are located in villages Shubh Dhara, Kushalpura, and Shahbad.
- There are 2 Agricultural Credit Societies available in the area, out of which one is in Shahbad village and another one is in Baman Gawan village.
- Self-help groups are operational in only one village namely Musredi of the study area.

1.3.2. Demographic Profile of Project Affected Villages, i.e., Kaloni, Baint and Mungawali

Kaloni Village: As per Census 2011, the total population of the affected village Kaloni located in Shahbad Tehsil in Baran district is 1927 spread over 388 households. Out of this total population, 1000 are males and 927 are females. The sex ratio of the village is 927 females per 1,000 males. About 15.04% population belongs to the 0-6 age group. 57.65% of people in Kaloni village are literate. Out of these, 66.70% are male literates and that of females are 33.30%.

The 26.62% of the total population of the affected villages was represented by Scheduled Tribes population and Scheduled Caste population in this affected village is constitutes about 32.12% of the total population of the affected village.

Baint Village: As per Census 2011, the total population of the affected village Baint located in Shahbad Tehsil in Baran district is 312 spread over 57 households. Out of this total population, 154 are males and 158 are females. The sex ratio of the village is 1026 females per 1,000 males.

About 22.44% population belongs to the 0-6 age group, of which 52.86% are boys and 47.14% are girl children of the same age group, as per Census 2011. In this affected village, 35.58% of people are literates. Out of these, 64.86% are male literates and that of females are 35.14%.

The total Scheduled Tribes population in the affected village Baint is 252 which represents 80.77% of the total population of the affected village. Out of this, 120 (47.62%) are males and 132 (52.38%) are females. The Scheduled Caste population in this affected village is only 42 which constitutes about 13.46% of the total population of the affected village. Out of this, 22 (52.38%) are males and 20 (47.62%) are females.

Mungawali Village: As per Census 2011, the total population of the affected village Mungawali located in Shahbad Tehsil in Baran district is 439 spreads over 87 households. Out of this total population, 228 are males and 211 are females. The sex ratio of the village is 925. About 15.26 % population belongs to the 0-6 age group, Literacy rate of Mungawali village was 63.44 % out of this 74.61 % are Male literates and that of Females are 51.40 %.

The Scheduled Caste population in this affected village is only 81 which constitutes about 18.45 % while Schedule Tribe (ST) were 10.93 % of the total population of the affected village.

1.3.3. Social Survey of Project Affected Village

Socio-economic survey was carried out by interacting with village heads, women's, youths and SC and ST community in the village in the affected villages. Discussions were carried out to understand the present socio-economic status of the village, socio-economic issues that need attention, their opinion/perception about the proposed project and expectations from the project, etc.

The project requires Land Acquisition of 624.17 Ha, out of which 407.82 ha of Forest Land and 216.35 ha of Private Land. Accordingly, the Rehabilitation & Resettlement (R&R) will be done following the "Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013". The details of affected land and families will be given in a separate section with Rehabilitation & Resettlement (R&R) Plan.

The key findings & observations made after the survey are enumerated below:

- It was observed that the people of the village mainly speak the Hindi language.

➢ **Scheduled Tribe Community in the Village:**

- The ST population belongs to the 'Sariya' ST community.
- The ST are mainly work as agricultural labors activities for livelihood and use forest wood for cooking.
- They are facing water scarcity for irrigation purposes.
- The community has shown its desire for better education facilities in the village for them.
- They get support from some special schemes/facilities like a Housing scheme, Land for Landless households, etc.

➢ **Education Facilities:**

- In the affected village, there is one Primary School, one Middle School, and one Secondary school.

- Higher Secondary Schools are not available in the village and for this, students have to go around 3 km outside the village where the facilities are available.
- For the college-level education and Technical Training, students of the village usually travel around 13 km each side where the college and training Institutes are available.

➢ **Drinking-Water Facilities:**

- Tube well and Wells are the main source of drinking water for the villagers.
- Tap water is also available through the government Bore well.
- Hand Pumps are also available for drinking water in the villages but in some cases, the hand pumps are not functioning due to Ground Water Level issues.

➢ **Health & Sanitation Facilities:**

- There is no Primary Health Centre (PHC) or Sub-centre in the village. The nearest CHC is available at a distance of 13 km from the affected village.
- The Allopathic Hospital is not available in the village, but for any such medical issue, villagers are bounded to move approx. 75 km far from the village.
- Trained ASHA Workers are available in the village.
- In the village, houses are facilitated with the In-door and out-door toilet facility. But, due to a lack of water for domestic uses, people prefer to use the outdoor toilet.

➢ **Electricity/Power Supply**

- Electricity is available in the village for domestic, agricultural well as commercial or industrial uses.
- The village is connected with paved road which is in a good condition. Also, there are mud and footpath roads available in the village.
- The village has no banking institutions. People usually travel about 13 km to avail of this facility.
- Agriculture and Dairy are the main occupations & sources of income for the villagers.
- For Irrigation purposes, villagers using bore wells and hand pumps which is inadequate.
- The main crops grown in the village are Wheat, Mustard, Gram, Soybean, Orange, Guava, Ajwain, white Muesli, etc.
- In the village, an agricultural society which provides supports to the farmers for seeds & fertilizers.
- For marketing & trading purpose, farmers/villagers visit Baran and Samariya villages.
- There is a Fair Price shop available in the village.
- During the survey, the villagers told that available facilities in the village are not adequate and there is ample scope for further development, especially Irrigation and drainage facilities which need improvement.
- During the village survey, the villagers showed keen interest in the project and expecting employment opportunities from proposed project the local people.
- Farmers/landowners are expecting respectful and judicious compensation in case of any loss (land/agriculture) due to the proposed project.

1.3.4. Main Agricultural Crops Grown in the Area

Agriculture is the important occupation in the study area. According to Agro-Ecological Sub Region (ICAR) classification, the study area falls under Central Highlands (Malwa), and the Kathiawar Peninsula, Semi-Arid Eco-Region (5.2) and according to Agro Climatic Zone (NARP), it falls in the Humid South Eastern Plain Zone (RJ-9).

Most of the workers are dependent on agriculture practices and related activities for their livelihood. Irrigation of agriculture is mostly dependent on rainfall. The major crops grown in the district in the Kharif season (July – Oct) are Jowar, maize, pulses, groundnut, and soybean. Rabi (Nov – Mar) crops are grown as wheat barley, gram, linseed, mustard, garlic, and coriander. Coriander and Soybean are the main crops of the district. The district is also rich in horticulture products like Guava, Lime, Amla, Chilly, Tomato, etc.

1.3.5. Livestock's

Livestock's/ cattle's rearing is common practice in the area. Livestock's rearing is an important source of livelihood as villagers the area depend on dairy based industry and supply milk and milk based products in nearby towns like, Shahabad and Shivpuri. Animals like cow, buffalo, goats, sheep, camel, etc are common in the area.

1.3.6. Dependency on Forest Resources

Villagers in the district depend on forest resources for their day by day needs. Plants are mainly used for fuelwood, fodder, timber, and medicinal purposes. The main timber species in the forest area are *Tectona grandis*. Other commonly used tree species in the area for timber are *Haldina cordifolia*, *Terminalia tomentosa*, *Toona ciliata*, *Anogeissus latifolia,* etc. In the study area extraction of Tendu (*Diospyros melanoxylon*) leaves, from the forest area is one of the main livelihood sources of the tribal population. It is the main resource for making '*bidis'*. Other minor forest products of commercial importance such as Bamboo, Behda (*Terminalia bellirica*)*,* Chironji (*Buchanania cochinchinensis*), Amla (*Phyllanthus emblica*), etc. are collected from the forest by the villagers. Scrub forest and grassland in the area also used as grazing land for livestock's.

1.3.7. Historical, Religious and Archaeological Importance Places

No site of national importance was notified by the Archaeological survey of India in the project area. Shahbad fort in Shahbad town is the historical site in the study area. Among the religious places there are temples in every village.

1.4. Physical Environment

1.4.1. Physiography

To understand the topography of the study are, Digital Elevation Map, a Relief map, and a slope map were prepared from the Digital Elevation Model (DEM) of Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM) Version 2 data was downloaded from https://earthexplorer.usgs.gov/ from which mask of the study was extracted to prepare above mentioned thematic maps. These maps are given in **Figures 4, 5, & 6.**

Accordingly, Digital Elevation Model (DEM) was generated from SRTM data and the same is given in **Figure 4** and according to it, the study area lies between 283 m and 551 m elevation. From the DEM, then relief map of the study area was prepared and according to it, about 44% of the project study area lies in 300m to 350 m elevation band (refer **Figure 5** and **Table 6**) and about 43% of the project components are restricted to 450m to 500m elevation band.

Table 6: Area under different elevation categories

S. No.	Elevation Band (m)	Area (Sq km)	Area (%)
1	Up to 300	8.14	1.74
2	300 – 350	208.06	44.39
3	350 – 400	21.57	4.60
4	400 – 450	26.62	5.68
5	450 – 500	203.42	43.40
	500 – 551	0.91	0.19
	Total	**468.71**	**100.00**

A slope map of the study area and data are given in **Figure 6** and **Table 7** it shows that most of the area is almost gently to moderately sloping except a few areas which are hilly tracts with a slope varying from 8 to 30 degrees.

Table 7: Area under different slope categories

S. No.	Slope Category (Degrees)	Area (Sq km)	Area (%)
1	Gently Sloping (0 – 2)	235.55	50.26
2	Moderately Sloping (2 – 8)	203.11	43.33
3	Strongly Sloping (8 – 15)	15.86	3.38
4	Moderately Steep (15 – 30)	14.06	3.00
5	Steep (30 – 45)	0.13	0.03
	Total	**468.71**	**100.00**

1.4.2. Drainage

The Shahpur PSP is an off-stream pumped storage project, which will comprise two reservoirs that are to be constructed newly. Water will be lifted one time from the existing nearby Kuno river to the proposed Shahpur PSP lower reservoir. The Kuno river is a tributary of the Chambal River, passing through districts like, Guna, Shivpuri, Baran, Sheopur and drains into the Chambal River in Morena at MP-Rajasthan border. Kuno river is 180 km long, the catchment area of the Kuno river up to Mungawali village near the proposed lifting point is 963.59 sq km.

1.4.3. Geology

Understanding geology is of prime importance for any environmental or natural hazard protection and for minimizing/managing the adverse impacts of the project. The Stability of the engineering structures depends on the basement rocks and active geological processes of the region where the project is being developed. The description of Geology is based upon PFR prepared by the project proponent. The description of Geology is based upon Pre-Feasibility studies of the project proponent. The brief of the geological aspects is detailed below in the following paragraphs.

a. Brief Regional Geology of the Project Area

i. Upper Reservoir, Intake, and Penstock Area:

The upper reservoir area is a hillock dominantly constituted of sandstone as a bedrock (**Photo 1**). Sandstone is well exposed along the periphery of the hillock proposed for the upper reservoir (**Photo 2**). Bedrock is light purple, strong, hard, compact, and un-weathered. Intake is proposed on exposed sandstone bedrock (**Photo 3**). Nature of overburden within the upper reservoir varies between clayey sand (in the vegetated area) – brown clay (active agricultural land) (**Photo 4**). The thickness of the overburden varies between 0.00m (along the hillock

periphery) and 2.00m (approx. within the core area of the proposed upper reservoir rim). The actual depth of overburden in the core area will be assessed upon exploratory drilling.

Photo 1: Upper Reservoir Hillock

Photo 2: Exposed Sandstone Bedrock in Upper Reservoir Hillock

Photo 3: Area for Intake and Penstock Alignment

Photo 4: Soil Cover on Underlying Sandstone Bedrock in Core Area – Reservoir

Primary bedding observed on the bedrock is tentatively having a strike in the East-West direction is revealed from distant periphery exposures (**Photo 5**). Apart from primary bedding, two other bedding planes were also observed. High spacing, open aperture, and long persistence of these two other beddings along with primary bedding followed by weathering effect resulting in the overturning of the exposed bedrock slab along the hill periphery.

Except for the hill periphery, bedrock within the proposed upper reservoir rim is overlain by soil cover therefore, wide, and open joints, which are observed along the periphery are unseen in the core area.

Photo 5: Bedding Plane in Bedrock

ii. Lower Reservoir, Powerhouse, and Pressure Shaft Area

Good sections of local litho-stratigraphic succession have been observed along the River Kuno (left and right bank) just beyond the downstream (northern limit) of the lower reservoir. These locations are detailed as below:

S. No.	Litho-Succession	Thickness (approx. "m")	Top
1	Brown Clayey Soil	1 – 1.5	↑
2	Pebbles & Cobbles intermixed in silty, clayey sand	6 - 8	
3	Limonitic layer	0.05	
4	Greenish-grey Shale	0.3	
5	Purple Shale	Exposed – sub-surface	Bottom

- **River Kuno Road Bridge Downstream (Left Bank):** Area out of Project Location (N 25012'56.16"/ E 77012'59.31"). Litho-stratigraphic succession at this location observed as shown (**Photo 6**). Structural features are observed as follows:

  Primary Bedding: $N070^0/ 3^0 - 5^0$ (Dip Direction/ Dip amount)

  Other Bedding: $N332^0/ 78^0 - 80^0$

  Other Bedding: $N221^0/ 78^0 - 80^0$

- **River Kuno Upstream of Road Bridge (Right Bank**): Light bank reveals the alternate bedding sequence of sandstone and shale. The thickness of sandstone varies between 8cm – 15cm whereas shale (grey & purple), lies in the range of 5cm – 6cm (**Photo 7**).

- **Start of Northern Limit of Lower Reservoir** ($N25^012'15.75"/ E77^012'14.03"$) - an area covered with sandy clayey silt (**Photo 8**).

Photo 6: Litho-Stratigraphic Succession Upstream of the Bridge on River Kuno – Left Bank

Photo 7: Alternate Shale & Sandstone Sequence along River Kuno - Right Bank

Photo 8: Surrounding in Lower Reservoir

- **Shale Exposure along Nala Section within Lower Reservoir** (N $25^0$12'10.08"/ E $77^0$12'10.07"): Natural Nala section at this co-ordinate reveals the existence of litho-succession of overburden material (pebble, cobbles intermixed in sandy clay matrix) followed by variegated shale (**Photo 9a & 9b**). Natural nala bed is synformal at places

resulting in the creation of natural small pondage with water. This reveals that the existing shale, which forms the base for the lower reservoir, is tight and firm in-situ and will act as a water seal to hold the reservoir water upon filling. The final assessment of reservoir tightness may assess based on proposed exploratory drill holes. The typical natural succession in Nala is as below:

S. No.	Litho-Succession	Thickness (approx. 'm')	Top
1	Pebble, Cobbles intermixed in Sandy Clay matrix (including surrounding)	6 - 8	↑
2	Purple Shale	0.5	
3	Greenish-grey Shale	0.10	
4	Purple Shale	Sub-surface	Bottom

Photo 9a: Typical Natural Litho-stratigraphy within Lower Reservoir

Photo 9b: Typical Nala Section Front View – Left Bank

- **Lower Reservoir Intake Area (N 25^{0}11'39.67"/ E 77^{0}11'48.87"):** Area is nearly flat with minor undulations. Entire area is covered with clayey sand (**Photo 10a & 10b**). Tentative soil/ overburden cover may vary in the range of 0.50m – 5.00m. A natural drain exists adjacent to the proposed lower intake in the NE-SW direction with a negligible flow. The width of the drain is about 2.00m. No bedrock exposure was available in the vicinity. Based upon the type of vegetation and its density, it is to infer that shale may exist as a bedrock in the area.

Photo 10a: Lower Intake Area with minor Undulations & Overburden Cover

Photo 10b: Natural Drain Adjacent to Proposed Lower Intake

- **Powerhouse Area and Pressure Shaft Alignment (N $25^0$11'32.66"/ E $77^0$11'20.79"):** Powerhouse axis is aligned in N-S direction and falls on the foothill slope and No bedrock exposure observed in the vicinity, which may be due to thick overburden cover and dense vegetation on the hill slope (**Photo 11a**). The thickness of the overburden varies between 8.00m – 10.00m and consists of gravels, pebbles, cobbles, and boulders of sandstone with clayey sandy matrix (**Photo 11b**). Nature of scree material spread in the area of proposed powerhouse and pressure shaft alignment reveals that litho-contact of sandstone (exposed in the upper reservoir area and along the penstock alignment) and variegated shale (exposed in dominance within the lower reservoir and its intake) may exist within the stretch of the powerhouse and proposed vertical pressure shaft alignment.

Photo 11a: Proposed Powerhouse Area on the Foothill Slope

Photo 11b: Overburden Material In & Around the Powerhouse and Pressure Shaft Alignment

b. Seismicity of the Project Area

Although no major earthquakes are reported/known from this area. As the project area falls in Seismic Zone-I (refer to **Figure 7**), therefore, appropriate coefficients together with suitable safety factors would be used in the design of the major project components.

1.4.4. Land use/Landcover

The land use/landcover classes were followed as per the NRSC classification. The land use/ land cover map of the study area is shown in **Figure 8**. Forests comprised of Deciduous forest and Scrub forest combinedly constitute a major part of the study area accounting for 46.87% of the area. Agricultural land constitutes 31.27%, Fallow land constitutes 10.40%. Scrub land in the study area comprises of 6.71%. Rest of the class constitutes 4.75% (**see Figure 8 & Table 8**).

Table 8: Area under different land use/ landcover classes

S. No.	Land use/ Landcover	Area (Sq km)	Area (%)
1	Deciduous Forest	124.97	26.66
2	Scrub Forest	94.73	20.21
3	Scrub Land	31.44	6.71
4	Grassland	11.86	2.53
5	Gullied	0.70	0.15
6	Agricultural Land	146.56	31.27
7	Fallow Land	48.74	10.40
8	Settlement	2.09	0.45
9	Waterbodies	7.62	1.63
	Total	**468.71**	**100**

1.4.5. Meteorology

The study area of the project lies in the Baran district, which experiences mostly hot summer and dry climate except in the monsoon season. The south-west monsoon rainfall occurs from June to September in the study area with maximum rainfall occurring between these months. The temperature in the command area starts rising in February and attains its maximum value in May and then decreases. May and January are the hottest and coldest months of the year, respectively. In summer, though day temperature remains high, nights are colder and pleasant. A brief account of different meteorological attributes is given in the succeeding paragraphs.

i. Temperature

The temperature of the study area recorded monthly data for the year from 2011 to 2020. In the study area, the average maximum temperature of 41.3°C was recorded during May. The average minimum temperature of 11.0°C was recorded during January (the reference year 2011-2020).

ii. Relative Humidity

The relative humidity is generally low throughout the year, except during monsoon months when the average humidity in the study area is close to 75% in August. The summer months are generally the dry months of the year with average humidity as low as 17% in the study area (the reference year 2011-2020).

iii. Rainfall

The area receives maximum rainfall during the south-west monsoon i.e. between June and September when about 89.0% of the annual average rainfall is received and 11% of the annual average rainfall occurs between October and November post-monsoon or retreating monsoon season. The mean annual average rainfall of Shahabad tehsil of Baran district was recorded as 604.05 mm. Maximum Rainfall in the area was recorded in 2019 with an annual rainfall of 1788.7 mm with 122 rainy days. Minimum annual rainfall was recorded in the year 2015 with an annual average of 294.99 mm.

iv. Wind Speed

The wind speed is higher during the monsoon period as compared to the post-monsoon period. The average maximum wind speed of 5.1 kmph is observed during June.

1.4.6. Soil

In general, the predominant soils of the district have black soils of alluvial origin with clay loam to clay in texture and are generally non-calcareous. Its colour varies from dark brown to black. This type of soil generally occurs in plains. Red gravelly loam hilly soils are found in the southern and eastern parts of the district.

Soil Taxonomic Classification

The soil taxonomic classification map of the study area was prepared from the map of Rajasthan published by the National Bureau of Soil Survey & Land Use Planning (NBSS&LUP) i.e. Soils of Rajasthan for Optimising Land Use, NBSS Publ.51b, 1995. For interpreting soil data Soil Taxonomic Classification System published by USDA, Washington DC (1999) was followed.

The soil map prepared from this data is given in **Figure 9**. As seen from **Figure 9 and Table 9,** the majority of the study area including the area around the lower reservoir and water conductor system fall under Soil unit 351 (78.47%) characterized as deep, moderately well-drained, fine soils on a very gently sloping plateau with the clayey surface, slight erosion; associated with: Deep, well-drained, fine soils, moderately eroded. 17.62% of the study area falls under Soil unit 340, characterized by rock-outcrops.

Table 9: Soil Taxonomic groups in the Study Area

Unit	Description	Taxonomic Classification	Area (sq km)	Area (%)
340	Rock-outcrops; associated with: Shallow, well-drained, loamy-skeletal soil, on very gently sloping foot slopes, severely eroded.	• Rock-outcrops Lithic Ustochrepts	82.58	17.62
351	Deep, moderately well-drained, fine soils on a very gently sloping plateau with a clayey surface, slight erosion; associated with: Deep, well-drained, fine soils, moderately eroded.	• Typic Chromusterts Typic Chromusterts	367.81	78.47
427	Very shallow, somewhat excessively drained, loamy soils on moderately steep sloping hills with escarpments with very severe erosion and moderately stony; *associated with*: Slightly deep, somewhat excessively drained, loamy soils on moderately sloping with severe erosion and slightly stony.	• Loamy, Kaolinitic, hyperthermic, Lithic Ustorthents Fine-loamy, Kaolinitic, hyperthermic, Typic Ustochrepts	10.84	2.31
453	Shallow, well-drained, loamy-skeletal soils on a moderately sloping undulating plateau (slightly dissected) with severe erosion and moderately stony; associated with: Very shallow, well-drained, loamy-skeletal soils on gently sloping with severe erosion and strongly stony.	• Loamy-skeletal, Kaolinitic, hyperthermic, Typic Ustochrepts Loamy-skeletal, Kaolinitic, hyperthermic, Lithic Ustorthents	4.93	1.05
482	Deep, moderately well-drained, calcareous, clayey soils on gently sloping flood plain (Ravenous, moderately dissected) with moderate erosion; associated with: Deep, moderately well-drained, clayey soils on very gently sloping with moderate erosion.	• Fine, mixed, (Cal.), hyperthermic, Udic Ustochrepts Fine, mixed, (Cal.), hyperthermic, Udic Haplusterts	2.55	0.54
TOTAL			**468.71**	**100**

1.5. Details of Linear Structure in Project Area

As seen from the Study area map shown below in **figure 2**. There is no linear structure like road, railway line, canal, water ways and other development structure in the project area. Hence no impact on any linear structure due to construction and operation of proposed project.

1.6. Description of Flora and Fauna of the Project Area

1.6.1. Floristic Diversity

i. Plant Species Recorded in the core zone and surrounding villages

As per data collected during field surveys, a list of 113 plant species belongs to 43 families is prepared and shown in **Table 10**. The list includes 39 tree species, 24 Shrub, 35 species of herbs, 7 species of grass/bamboo and 7 species of climbers.

Table 10: List of Plant Species recorded during field survey

S. No.	Botanical Name	Habit
	Acanthaceae	
1	*Achyranthes aspera*	Herb
2	*Achyranthes bidentata*	Herb
3	*Justicia adhatoda*	Shrub
4	*Barleria prionitis*	Shrub
5	*Rungia repens*	Herb
	Acoraceae	
6	*Acorus calamus*	Herb

S. No.	Botanical Name	Habit
	Anacardiaceae	
7	*Mangifera indica*	Tree
8	*Spondias pinnata*	Tree
9	*Lannea coromandelica*	Tree
	Apocynaceae	
10	*Calotropis gigantea*	Shrub
11	*Carissa spinarum*	Shrub
	Arecaceae	
12	*Phoenix acaulis*	Herb
13	*Phoenix sylvestris*	Tree
	Asparagaceae	
14	*Drimia indica*	Herb
15	*Asparagus racemosus*	Shrub
	Asteraceae	
16	*Artemisia annua*	Herb
17	*Bidens biternata*	Herb
18	*Bidens pilosa*	Herb
19	*Erigeron canadensis*	Herb
20	*Parthenium hysterophorus*	Herb
21	*Sonchus asper*	Herb
22	*Tridax procumbens*	Herb
23	*Xanthium strumarium*	Shrub
	Boraginaceae	
24	*Cordia dichotoma*	Tree
	Cactaceae	
25	*Opuntia stricta*	Herb
	Cannabaceae	
26	*Trema politoria*	Shrub
	Capparaceae	
27	*Capparis zeylanica*	Herb
28	*Capparis sepiaria*	Shrub
	Combretaceae	
29	*Terminalia bellirica*	Tree
30	*Anogeissus latifolia*	Tree
31	*Tephrosia purpurea*	Herb
32	*Terminalia chebula*	Tree
33	*Terminalia tomentosa*	Tree
	Convolvulaceae	
34	*Cuscuta reflexa*	Herb
35	*Ipomoea carnea*	Shrub
36	*Ipomoea pes-tigridis*	Herb
	Cyperaceae	
37	*Cyperus compressus*	Grass
	Dioscoreaceae	
38	*Dioscorea hispida*	Climber
	Euphorbiaceae	
39	*Mallotus philippensis*	Tree
40	*Euphorbia hirta*	Herb
41	*Ricinus communis*	Shrub
	Fabaceae	
42	*Abrus precatorius*	Climber
43	*Bauhinia racemosa*	Tree
44	*Bauhinia vahlii*	Climber
45	*Butea monosperma*	Tree
46	*Butea superba*	Climber
47	*Crotalaria medicaginea*	Herb
48	*Dalbergia paniculata*	Tree
49	*Desmodium oojeinense*	Tree

S. No.	Botanical Name	Habit
50	*Erythrina suberosa*	Tree
51	*Mimosa pudica*	Shrub
52	*Pterocarpus marsupium*	Tree
53	*Senegalia catechu*	Tree
54	*Senegalia pennata*	Climber
55	*Senna obtusifolia*	Shrub
56	*Senna siamea*	Tree
57	*Senna tora*	Herb
58	*Tamarindus indica*	Tree
59	*Vachellia nilotica*	Tree
	Lamiaceae	
60	*Ocimum basilicum*	Herb
61	*Ocimum sanctum*	Herb
62	*Tectona grandis*	Tree
	Liliaceae	
63	*Gloriosa superba*	Climber
	Lythraceae	
64	*Woodfordia fruticosa*	Shrub
	Malvaceae	
65	*Abutilon indicum*	Shrub
66	*Corchorus aestuans*	Herb
67	*Grewia hirsuta*	Shrub
68	*Grewia tiliifolia*	Tree
69	*Helicteres isora*	Shrub
70	*Sterculia urens*	Tree
71	*Thespesia lampas*	Shrub
	Meliaceae	
72	*Azadirachta indica*	Tree
73	*Melia azedarach*	Tree
	Moraceae	
74	*Ficus benghalensis*	Tree
75	*Ficus racemosa*	Tree
76	*Ficus religiosa*	Tree
	Myrtaceae	
77	*Syzygium cumini*	Tree
	Nyctaginaceae	
78	*Boerhavia diffusa*	Herb
	Papaveraceae	
79	*Argemone mexicana*	Herb
	Phyllanthaceae	
80	*Phyllanthus emblica*	Tree
81	*Phyllanthus reticulatus*	Shrub
	Plantaginaceae	
82	*Lindenbergia indica*	Herb
	Poaceae	
83	*Aristida setacea*	Grass
84	*Chrysopogon fulvus*	Grass
85	*Cymbopogon martini*	Grass
86	*Dendrocalamus strictus*	Grass
87	*Dichanthium annulatum*	Grass
88	*Eragrostis tenella*	Grass
89	*Heteropogon contortus*	Grass
90	*Saccharum munja*	Grass
	Primulaceae	
91	*Embelia robusta*	Shrub
	Rhamnaceae	
92	*Ziziphus nummularia*	Herb
93	*Ziziphus jujuba*	Tree
94	*Ziziphus xylopyrus*	Shrub

S. No.	Botanical Name	Habit
	Rubiaceae	
95	*Mitragyna parviflora*	Tree
96	*Gardenia latifolia*	Tree
97	*Haldina cordifolia*	Tree
	Rutaceae	
98	*Aegle marmelos*	Tree
99	*Chloroxylon swietenia*	Tree
100	*Murraya paniculata*	Shrub
	Salicaceae	
101	*Flacourtia indica*	Shrub
102	*Flacourtia indica*	Shrub
	Sapindaceae	
103	*Dodonaea viscosa*	Herb
104	*Schleichera oleosa*	Tree
105	*Smilax macrophylla*	Climber

S. No.	Botanical Name	Habit
	Solanaceae	
106	*Datura metel*	Herb
107	*Solanum virginianum*	Herb
	Symplocaceae	
108	*Symplocos racemosa*	Herb
	Ulmaceae	
109	*Holoptelea integrifolia*	Tree
	Verbenaceae	
110	*Gmelina arborea*	Tree
111	*Lantana camara*	Shrub
	Vitaceae	
112	*Leea macrophylla*	Herb
	Zygophyllaceae	
113	*Tribulus terrestris*	Herb

ii. Plant Species Reported from the Study Area (Core and Buffer Zone)

The detail inventory of Plant species reported from the study area has been prepared based on primary survey and same has been supplemented with available secondary data. An inventory of 203 species of plants belonging to angiosperms was compiled which includes plant species found in forested areas, scrub land, near agricultural fields and settlements, abandoned land, etc. List of plant species recorded from the area is given in **Annexure I.** This list includes 62 species of trees, 55 species of shrubs, 86 herbaceous plants including grasses and climbers. Most of the vegetation is found mainly in the forest area. Dominant families in the area are Fabaceae and Poaceae followed by Apocynaceae, Malvaceae, and Asteraceae.

iii. Rare, Endangered and Threatened (RET) Species

None of the plant species found in the study area falls under Threatened category of RED Data Book of Indian Plants. As per IUCN Red List of Threatened Species Version 2022-2, Majority of the species have not been evaluated or assessed yet by IUCN (2022-2). The majority of the species have not been assessed yet by IUCN, while out of 58 species that have been assessed, 57 species falls under the 'Least Concern' category (LC) and one species under the 'Data Deficient' category (DD) (see **Table 11** below).

Table 11: Conservation Status (IUCN Ver. 2022-2) of Plant Species

S. No.	Family/ Scientific Name	Conservation Status
	Acoraceae	
1	*Acorus calamus*	LC
	Anacardiaceae	
2	*Mangifera indica*	DD
	Annonaceae	
3	*Annona squamosa*	LC
	Anthericaceae	
4	*Chlorophytum tuberosum*	LC
	Apocynaceae	
5	*Carissa spinarum*	LC
6	*Holarrhena pubescens*	LC
7	*Nerium oleander*	LC
8	*Wrightia tinctoria*	LC
	Araceae	
9	*Colocasia esculenta*	LC

S. No.	Family/ Scientific Name	Conservation Status
	Asparagaceae	
10	*Asparagus racemosus*	LC
	Boraginaceae	
11	*Cordia dichotoma*	LC
	Cactaceae	
12	*Opuntia elatior*	LC
13	*Opuntia stricta*	LC
	Capparaceae	
14	*Capparis sepiaria*	LC
	Colchicaceae	
15	*Gloriosa superba*	LC
	Cornaceae	
16	*Alangium salviifolium*	LC
	Cucurbitaceae	
17	*Mukia maderaspatana*	LC

S. No.	Family/ Scientific Name	Conservation Status
	Cyperaceae	
18	*Cyperus rotundus*	LC
	Euphorbiaceae	
19	*Jatropha curcas*	LC
	Fabaceae	
20	*Acacia nilotica*	LC
21	*Acacia pennata*	LC
22	*Albizia lebbeck*	LC
23	*Albizia procera*	LC
24	*Bauhinia variegata*	LC
25	*Butea monosperma*	LC
26	*Caesalpinia decapetala*	LC
27	*Cassia fistula*	LC
28	*Dalbergia sissoo*	LC
29	*Delonix regia*	LC
30	*Hardwickia binata*	LC
31	*Mimosa pudica*	LC
32	*Parkinsonia aculeata*	LC
33	*Pithecellobium dulce*	LC
34	*Pongamia pinnata*	LC
35	*Tamarindus indica*	LC
36	*Tephrosia purpurea*	LC
	Lamiaceae	
37	*Vitex negundo*	LC
	Lythraceae	
38	*Woodfordia fruticosa*	LC
	Malvaceae	
39	*Bombax ceiba*	LC

S. No.	Family/ Scientific Name	Conservation Status
40	*Grewia tenax*	LC
41	*Kydia calycina*	LC
	Meliaceae	
42	*Azadirachta indica*	LC
43	*Melia azedarach*	LC
	Moraceae	
44	*Ficus hispida*	LC
45	*Ficus racemosa*	LC
	Myrtaceae	
46	*Corymbia citriodora*	LC
47	*Syzygium cumini*	LC
	Phyllanthaceae	
48	*Bridelia retusa*	LC
49	*Phyllanthus emblica*	LC
50	*Phyllanthus reticulatus*	LC
	Plantaginaceae	
51	*Lindenbergia indica*	LC
	Poaceae	
52	*Brachiaria eruciformis*	LC
53	*Cynodon dactylon*	LC
54	*Echinochloa colona*	LC
55	*Saccharum spontaneum*	LC
	Rhamnaceae	
56	*Ziziphus jujuba*	LC
	Rubiaceae	
57	*Gardenia gummifera*	LC
	Rutaceae	
58	*Aegle marmelos*	LC

1.6.2. Faunal Diversity

a) Mammals

A list of 20 species of mammals with their conservation status reportedly found in the study area was compiled and the same is given in **Table 12**.

Table 12: List of Mammalian Species Reported in the Study Area

S. No.	Order/ Family	Common Name	Scientific Name	Conservation Status	
				IUCN 2022-2	WPAA, 2022
	CARNIVORA				
1	Canidae	Bengal Fox	*Vulpes bengalensis*	LC	I
2	Canidae	Golden Jackal	*Canis aureus*	LC	I
3	Canidae	Indian Wolf	*Canis lupus*	LC	I
4	Mustelidae	Honey Badger	*Mellivora capensis*	LC	I
5	Felidae	Common Leopard	*Panthera Pardus*	VU	I
6	Herpestidae	Indian Grey Mongoose	*Herpestes edwardsii*	LC	I
7	Ursidae	Sloth Bear	*Melursus ursinus*	VU	I
8	Hyaenidae	Striped Hyena	*Hyaena hyaena*	NT	I
9	Viverridae	Small Indian Civet	*Viverricula indica*	LC	I
	CETARTIODACTYLA				
10	Bovidae	Nilgai/Blue Bull	*Boselaphus tragocamelus*	LC	II
11	Cervidae	Sambar	*Rusa unicolor*	VU	I
12	Cervidae	Chital	*Axis axis*	LC	II
13	Suidae	Wild Boar	*Sus scrofa*	LC	II

S. No.	Order/ Family	Common Name	Scientific Name	Conservation Status	
				IUCN 2022-2	WPAA, 2022
	LAGOMORPHA				
14	Leporidae	Common Hare	*Lepus nigricollis*	LC	II
	PRIMATES				
15	Cercopithecidae	Rhesus macaque	*Macaca mulatta*	LC	II
16	Cercopithecidae	Northern Plain Gray Langur	*Semnopithecus entellus*	LC	II
	RODENTIA				
17	Hystricidae	Indian Crested Porcupine	*Hystrix indica*	LC	I
18	Sciuridae	Five-striped Palm Squirrel	*Funambulus pennantii*	LC	-
	CHIROPTERA				
19	Pteropodidae	Leschenault's Rousette	*Rousettus leschenaulti*	NT	-
	EULIPOTYPHLA				
20	Soricidae	House Shrew	*Suncus murinus*	LC	-

IUCN Ver.2022-2- *International Union for Conservation of Nature; LC - Least Concern; NT – Near Threatened; VU: Vulnerable; WPAA – Wildlife (Protection) Amendment Act, 2022*

b) Avifauna

Birds sighted during the survey were identified using the field guide of birds by Ali & Ripley (1983), Grimmett *et al.* (1998, 2011), Inskipp *et al.* (1999), and Kazmierczak (2000). The classification and nomenclature of bird species are as per https://avibase.bsc-eoc.org. During the field surveys, 54 species of birds belonging to 16 Orders were recorded from the study area. A list of bird species composition and their conservation status has been described in **Table 13.**

Table 13: List of birds reported from the study area with their conservation status

S. No.	Family	Common Name	Scientific name	Residential Status	Conservation Status	
					IUCN (2022-2)	WPAA, 2022
	Order: Accipitriformes					
1	Accipitridae	Asian King vulture (Red headed vulture)	*Sarcogyps calvus*	R	CR	I
	Order: Anseriformes					
2	Anatidae	Indian Spot-billed Duck	*Anas poecilorhyncha*	R	LC	II
	Order: Bucerotiformes					
3	Upupidae	Common Hoopoe	*Upupa epops*	R	LC	II
	Order: Charadriiformes					
4	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	R	LC	II
5	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	R	LC	II
6	Scolopacidae	Wood Sandpiper	*Tringa glareola*	WV	LC	II
	Order: Apodiformes					
7	Apodidae	Little Swift	*Apus affinis*	R	LC	II
	Order: Columbiformes					
8	Columbidae	Laughing Dove	*Streptopelia senegalensis*	R	LC	II
9	Columbidae	Spotted Dove	*Spilopelia suratensis*	R	LC	II
10	Columbidae	Eurasian Collard-Dove	*Streptopelia decaocto*	R	LC	II
11	Columbidae	Rock Dove	*Columba livia*	R	LC	II
	Order: Coraciiformes					
12	Alcedinidae	Common Kingfisher	*Alcedo atthis*	R	LC	II
13	Alcedinidae	Pied Kingfisher	*Ceryle rudis*	R	LC	II
14	Alcedinidae	White-throated Kingfisher	*Halcyon gularis*	R	LC	II
15	Coraciidae	Indian Roller	*Coracias benghalensis*	R	LC	II

S. No.	Family	Common Name	Scientific name	Residential Status	Conservation Status	
					IUCN (2022-2)	WPAA, 2022
16	Meropidae	Asian Green Bee-eater	*Merops orientalis*	R	LC	II
	Order: Cuculiformes					
17	Cuculidae	Western Koel	*Eudynamys scolopaceus*	R	LC	II
18	Cuculidae	Greater Coucal	*Centropus sinensis*	R	LC	II
	Order: Passeriformes					
19	Alaudidae	Rufous-tailed Lark	*Ammomanes phoenicura*	R	LC	II
20	Cisticolidae	Common tailorbird	*Orthotomus sutorius*	R	LC	II
21	Cisticolidae	Rofous-Fronted Prinia	*Prinia buchanani*	R	LC	I
22	Cisticolidae	Graceful Prinia	*Prinia gracilis*	R	LC	II
23	Cisticolidae	Grey-breasted Prinia	*Prinia hodgsonii*	R	LC	II
24	Cisticolidae	Ashy Prinia	*Prinia socialis*	R	LC	II
25	Corvidae	Large-billed Crow	*Corvus macrorhynchos*	R	LC	II
26	Corvidae	House Crow	*Corvus splendens*	R	LC	II
27	Corvidae	Rufous Treepie	*Dendrocitta vagabunda*	R	LC	II
28	Dicruridae	Black Drongo	*Dicrurus macrocercus*	R	LC	II
29	Estrildidae	Scaly-breasted Munia	*Lonchura punctulata*	R	LC	II
30	Hirundinidae	Wire-tailed Swallow	*Hirundo smithii*	R	LC	II
31	Laniidae	Long-tailed Shrike	*Lanius schach*	R	LC	II
32	Leiothrichidae	Jungle Babbler	*Turdoides striata*	R	LC	II
33	Motacillidae	White Wagtail	*Motacilla alba*	WV	LC	II
34	Motacillidae	Western Yellow Wagtail	*Motacilla flava*	WV	LC	II
35	Muscicapidae	Brown Rock Chat	*Oenanthe fusca*	R	LC	II
36	Muscicapidae	Oriental Magpie-Robin	*Copsychus saularis*	R	LC	II
37	Muscicapidae	Indian Robin	*Saxicoloides fulicatus*	R	LC	II
38	Passeridae	House Sparrow	*Passer domesticus*	R	LC	II
39	Ploceidae	Baya Weaver	*Ploceus philippinus*	R	LC	II
40	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	R	LC	II
41	Sturnidae	Common Myna	*Acridotheres tristis*	R	LC	II
42	Sturnidae	Asian Pied Starling	*Gracupica contra*	R	LC	II
43	Sturnidae	Brahminy Starling	*Sturnia pagodarum*	R	LC	II
	Order: Pelecaniformes					
44	Ardeidae	Grey Heron	*Ardea cinerea*	R/WV	LC	II
45	Ardeidae	Indian Pond-Heron	*Ardeola grayii*	R	LC	II
46	Ardeidae	Cattle Egret	*Bubulcus ibis*	R	LC	II
47	Ardeidae	Little Egret	*Egretta garzetta*	R	LC	II
	Order: Piciformes					
48	Ramphastidae	Coppersmith Barbet	*Psilopogon haemacephalus*	R	LC	II
	Order: Psittaciformes					
49	Psittaculidae	Rose-ringed Parakeet	*Psittacula krameri*	R	LC	II
	Order: Suliformes					
50	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	R	LC	II
	Order: Gruiformes					
51	Rallidae	Common Moorhen	*Gallinula chloropus*	R	LC	II
52	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	R	LC	II
	Order: Galliformes					
53	Phasianidae	*Pavo cristatus*	Indian Peafowl	R	LC	I
	Order: Strigiformes					
54	Strigidae	Eurasian Eagle-owl	*Bubo bubo*	R	LC	I

IUCN Red List of Threatened Species. Version 2022-2.; LC - Least Concern; WPAA – Wildlife (Protection) Amendment Act, 2022, LC: Least Concern; CR – Critical Endangered; R: Resident; WV Winter Visitor

c) Herpetofauna

During the surveys, 2 reptiles viz; Northern House Gecko and Garden lizard were sighted in the study area. Based on the sighting and information available in the Forest Working Plan a list

of herpetofauna is given below in **Table 14.**

Table 14: List of Herpetofauna Reported from the Study Area

S. No.	Family	Scientific name	Common name	Conservation Status	
				IUCN (2022-2)	WPAA, 2022
CLASS: AMPHIBIA					
	Order Anura				
1	Dicroglossidae	*Duttaphrynus stomaticus*	Marbled Toad	LC	-
2	Dicroglossidae	*Duttaphrynus melanostictus*	Common Indian Toad	LC	-
3	Dicroglossidae	*Hoplobatrachus tigerinus*	Indian Bull Frog	LC	II
4	Dicroglossidae	*Sphaerotheca breviceps*	Indian Burrowing Frog	LC	-
CLASS: REPTILIA					
	Order: Squamata				
5	Boidae	*Eryx johnii*	Indian sand Boa	NT	I
6	Colubridae	*Ptyas mucosa*	Rat snake	LC	I
7	Elapidae	*Bungarus caeruleus*	Krait	LC	II
8	Elapidae	*Naja naja*	Indian Cobra	LC	I
9	Pythonidae	*Python molurus*	Python	NT	I
10	Viperidae	*Vipera russelli*	Russell's Viper	LC	I
11	Agamidae	*Calotes versicolor*	Indian Garden Lizard	LC	-
12	Chamaeleonidae	*Chamaeleo zeylanicus*	Indian Chameleon	LC	I
13	Varanidae	*Varanus bengalensis*	Indian Monitor Lizard	NT	I
14	Gekkonidae	*Hemidactylus flaviviridis*	Yellow-bellied House Gecko	LC	-

(*The list has been compiled based on description given in the Forest Working Plan of Baran Forest Division and information collected during the public consultation and about the study area*).

d) Butterflies

During the field survey, only 7 species of butterfly were recorded from the study area (**Table 15**). These butterflies belong to the families Nymphalidae, and Pieridae. These are frequently observed along the river, scrub forest, and borewells/ handpumps near settlements.

Table 15: Butterflies recorded from Study Area

S. No.	Family	Common Name	Scientific name	Conservation Status	
				IUCN (2022-2)	WPAA, 2022
1	Nymphalidae	Plain Tiger	*Danaus chrysippus*	LC	-
2	Nymphalidae	Common leopard	*Phalanta Phalantha*	LC	-
3	Nymphalidae	Blue Pansy	*Junonia orithya*	LC	-
4	Nymphalidae	Lemon Pansy	*Junonia lemonias*	-	-
5	Nymphalidae	Danaid Eggfly	*Hypolimnas misippus*	LC	II
6	Pieridae	Common Emigrant	*Catopsilia pomona*	-	-
7	Pieridae	Cabbage White	*Pieris brassicae*	LC	-

e) Conservation Status of Fauna

Different faunal species like mammals and birds were assessed for their conservation status according to IUCN Red List categories (Ver. 2022-2) accessed in April 2022 and WPAA (2022) Schedules (refer Table 12, 13 14 &15).

As per the Wildlife (Protection) Amendment Act 2022, 11 species of mammals, 4 species of birds and 7 species of herpetofauna are listed under Schedule I category.

1.7. Description of Forest and Habitat Condition

The project area falls in the Baran Forest Division under Kota Circle, Forest Department, Government of Rajasthan. As seen from the land use map of the study area, a large part of the vegetation is comprised of forests especially in the surrounding of proposed project components. These forests in the study area can be classified following the 'A Revised Survey of the Forest Types of India' by Champion and Seth (1968) fall under Group 5: Dry Tropical Dry Deciduous (**Table 16**)**.**

Table 16: Forest types found in the Study Area

Group	Sub-Group	Forest Type
Group 5. Tropical Dry Deciduous Forests	5B-Northern Tropical Dry Deciduous Forests	5B/C2 Northern dry mixed deciduous forest
		5E1/DS1 *Anogeissus pendula* scrub forest

1.7.1. Vegetation Profile of the Study Area

The project study area falls under the Baran Forest Division, Government of Rajasthan. The area is characterized by undulating terrain dominant with forest and Scrubland. Forest in the study area comprises of Northern dry mixed deciduous forest on slopes of hillocks, along the drainages and scrub vegetation around the habitation and degraded/ fallow land.

In the study area Northern dry mixed deciduous forests occurs on the slopes of hillocks comprises of tree species like *Tectona grandis, Anogeissus pendula, Diospyros melanoxylon, Madhuca longifolia, Terminalia tomentosa, Terminalia bellirica, Lannea coromandelica, Boswellia serrata, Albizia lebbeck, Butea monosperma, Syzygium cumini, Desmodium oojeinense, Bombax ceiba,* etc.

Vegetation on Scrub Forest and scrub land in the study area *was* represented by species like *Acacia nilotica, Aegle marmelos, Cassia fistula, Bauhinia racemosa, Grewia tiliifolia, Phyllanthus emblica, Bridelia retusa* and *Ziziphus jujuba*.

Among the trees, *Azadirachta indica*, *Madhuca longifolia, Mangifera indica, Cassia fistula, Dalbergia sissoo, Aegle marmelos*, *Syzygium cumini*, *Morus alba*, *Desmodium oogeinense*, *Acacia nilotica, Albizia lebbeck, Phyllanthus emblica,* and *Ziziphus* species are the most common tree species found growing near the settlements. *Tectona grandis* (Teak) was observed as a plantation along the road and the bunds of agricultural fields.

The bushes are comprised of shrubs like *Asparagus racemosus, Butea superba, Justicia adhatoda, Lantana camara, Murraya koenigii, Phyllanthus reticulatus, Trema politoria* and *Woodfordia fruticosa* are commonly found on margins of forest. The species like *Abutilon indicum, Datura stramonium, Helicteres isora, Murraya koenigii, Senna obtusifolia, Woodfordia fruticosa, Xanthium strumarium,* and *Ziziphus xylopyrus* are found in scrub forest and scrub land. Commonly found herbaceous species are *Ajuga integrifolia, Andrographis paniculata, Argemone mexicana, Bidens pilosa, Boerhavia diffusa, Capparis zeylanica, Flemingia chappar, Galium aparine, Lindenbergia indica, Rumex hastatus, Rungia repens, Senna tora, Tribulus terrestris, Solanum americanum* and *Sonchus asper* and are found around Scrubland and open/ scrub forest.

Grasses in the study area are represented by species like *Apluda mutica, Aristida adscensionis, Brachiaria eruciformis, Cenchrus ciliaris, Dichanthium aristatum, Digitaria*

ciliaris, Heteropogon contortus, Saccharum spontaneum, Themeda quadrivalvis, and *Vetiveria zizanioides.*

1.7.2. Faunal Species Sighted During Survey

a) Mammals

In the study area, species like *Semnopithecus entellus* (Common Langur)*, Macaca mulatta* (Rhesus macaque), *Canis aureus* (Jackal), *Herpestes edwardsii* (Indian Grey Mongoose), and *Funambulus pennantii* (Five-striped Palm Squirrel) were sighted during the field survey. In addition to the presence of *Sus scrofa* (Wild Boar) and *Lepus nigricollis* (Common Hare) was also confirmed by villagers.

In addition, the presence of *Panthera pardus* (Leopard), Sloth Bear (*Melursus ursinus*), *Axis axis* (Spotted deer), *Vulpes bengalensis* (Fox), Honey Badger (*Mellivora capensis*), Indian Wolf (*Canis lupus*) and *Canis aureus* (Jackal), were also confirmed by villagers. The Forest Working Plan of Baran Forest Division has reported the presence of mammals like Leopard (*Panthera Pardus*), Sloth Bear (*Melursus ursinus*), Indian Wolf (*Canis lupus*), Spotted Dear (*Axis axis*), Sambar Deer (*Rusa unicolor*), Hyaena (*Hyaena hyaena*) and Chinkara (*Gazella gazella*), etc., in their jurisdiction. However, during the field surveys, none of these mammalian species were sighted in the study area. Locals also did not confirm the probable presence or sighting of Wolf, Sloth bear, Sambar Deer and Chinkara in the study area.

b) Avifauna

During the field surveys, 54 species of birds belonging to 16 Orders were recorded from the study area. Birds like House sparrow, White-Throated Kingfisher, Dove, Common Myna, House crow, Red-wattled Lapwing, Red-vented bulbul, Indian Peafowl, Rock Pigeon, Black Drongo, and Cattle Egret were most frequently sighted bird species in the study area. Most of the birds recorded are resident in nature. Bird species like Wood Sandpiper, White Wagtail and Western Yellow Wagtail are winter visitor in the area. Asian King Vulture (Red Headed Vulture) is also reported by state forest department in the area.

c) Herpetofauna

The sampling for herpetofauna was carried along the bunds of the proposed reservoir area, around the periphery of the reservoir, and ponds and area along the existing and proposed water conductor system. Sampling was repeated during evening time also. Visual Encounter Survey (VES) search was followed for recording herpetofauna (amphibians and reptiles). During the surveys, 2 reptiles viz; Northern House Gecko and Garden lizard were sighted in the study area.

d) Butterflies

During the field survey, only 7 species of butterfly were recorded from the study area. These butterflies belong to the families Nymphalidae, and Pieridae. Plain Tiger (*Danaus chrysippus*), Blue Pansy (*Junonia orithya*), Lemon Pansy (*Junonia lemonias*), Common Emigrant (*Catopsilia Pomona*), Cabbage White (*Pieris brassicae*) are frequently observed along the river, scrub forest, and borewells/ handpumps near settlements.

MAMMALS SIGHTED DURING FIELD SURVEY

	
Common langur	**Rhesus macaque**
	
Five-striped Palm Squirrel	**Blue Bull**
	
Jackal	**Mongoose**

Some of the bird species sighted during the surveys

		
Little Egret	**Laughing Dove**	**White-throated Kingfisher**
		
Large-billed Crow	**Sparrow**	**Long-tailed Shrike**

		
Little Cormorant	**Red-vented Bulbul**	**Indian Robin**
		
Asian Pied Starling	**Red-wattled Lapwing**	**White-breasted Waterhen**
		
Pond Heron	**Common Myna**	**Spotted Dove**
		
Brahminy Starling	**Common Wood-pigeon**	**Indian Roller**
		
Jungle Babbler	**Black Drongo**	**Oriental Magpie-Robin**

1.7.3. Protected Areas

Proposed project is located within newly declared Shahabad Conservation Reserve. Scoping Clearance for Shahpur Pumped Storage was accorded by MoEF&CC in April 2020, while the Shahabad Conservation Reserve was notified by Govt. of Rajasthan on 28th October 2021. Map showing location of components with respect to Shahabad Conservation Reserve is shown in **Figure 10**.

The other nearest Protected Areas to the project components are in Madhya Pradesh i.e. Madhav National Park and Kuno National Park having aerial distance more than 40 km from the project site. Map showing location of components Madhav National Park and Kuno National Park is shown in **Figure 11**.

As per the WPA, 1972 (subsequent amendments) Conservation reserve do not enjoy the same level of protection status as compared to National Parks and Sanctuaries. Further, as per the MoEF & CC guidelines dated 06.05.2022, projects falling in Conservation Reserve does not attract Wildlife Clearance. However, considering the presence of Conservation Reserve, a detailed Wildlife Conservation Plan has been prepared and incorporated in the EIA/EMP report.

1.8. Wildlife Movement in the Area

The proposed project is being constructed in the jurisdiction of Rajasthan Forest Department. The forest land in the area is comprised of dry Deciduous and Scrub Forest lies in Shahabad Conservation Reserve. Although the project area is in Shahabad conservation Reserves, however the project site is surrounded by habitation.

Sighting of mammals like *Semnopithecus entellus* (Common Langur)*, Macaca mulatta* (Rhesus macaque), *Sus scrofa* (Wild Boar) and *Lepus nigricollis* (Common Hare), *Herpestes edwardsii* (Indian Grey Mongoose), *Canis aureus* (Jackal), and *Funambulus pennantii* (Five-striped Palm Squirrel) were common in the area. In addition to these villagers also confirmed the presence of *Panthera pardus* (Leopard), *Axis axis* (Spotted deer), and *Vulpes bengalensis* (Fox), in the area.

1.9. Man-Animal Conflict and Depredation Caused By The Wild Animals

Proposed project is surrounded by forest, although there is agriculture field and human settlement also. Deforestation, growing human settlements, expansion of agricultural land and fragmentation of natural habitat and grazing ground of species like Wild Boar, Nilgai/Blue Bull, Sloth bear and habitat other wild animals are the causes behind rising of human wildlife conflict. In the study area human-wildlife conflict in terms of crop damage is perhaps more common and causes huge loss to the farmers.

Also, the expansion of agriculturally used land, encroachment of humans and their livestock into forest areas are main factors contributing to habitat loss and decrease of wild prey. As a result, animals like Leopard, Sloth Bear Jackal and Fox approach human settlements, where they are tempted to prey on domestic livestock like cattle, dogs, and goats, which constitutes an important part of their diet if they live on the periphery of human habitations. In retaliation for attacks on livestock, wild animals are trapped in brutal snares.

During the survey villages revealed that the human wildlife conflict is common, but villagers doesn't report the cases to avoid the dispute over the land boundary with forest department.

1.10. Indicative Plans of the Present Projects

Institutional arrangement for planning and implementing various mitigation and management measures along with environment monitoring are given at **Table 17.**

Table 17: Environmental Management Plan for Proposed Project Area

S. No.	Activities	Implementing Agency	Monitoring/ Supervising/ Approving Agency
1	Compensatory Afforestation Programme	Forest Department	Forest Department
2	Biodiversity Conservation and Wildlife Management Plan	State Forest Department	State Forest Department
3	Muck Management	Contractor	Greenko Energies Pvt. Ltd./ SPCB
4	Sanitation and Solid Waste Management	Contractor	Greenko Energies Pvt. Ltd./ SPCB
5	Public Health Delivery System	Contractor	Greenko Energies Pvt. Ltd./ District Administration (Health Department)
6	Energy Conservation Measures	Contractor	Greenko Energies Pvt. Ltd./ SPCB/ Forest Department
7	Control of Air, Noise and Water Pollution	Contractor	Greenko Energies Pvt. Ltd./ SPCB
8	Rehabilitation and Resettlement Plan	Greenko Energies Pvt. Ltd.	District Administration
9	Disaster Management	Greenko Energies Pvt. Ltd.	District Administration
10	Local Area Development Plan	Greenko Energies Pvt. Ltd.	District Administration
11	Environmental Monitoring	Greenko Energies Pvt. Ltd.	SPCB
12	Submission of half yearly compliance report on 1st June and 1st December of each calendar year	Greenko Energies Pvt. Ltd.	Regional Office MoEF&CC

1.11. The List of Experts Involved And Sampling Procedures Adopted

Ecology and Biodiversity experts of R S Envirolink Technologies Pvt. Ltd. (RSET), a QCI-NABET accredited consulting organisation visited the Project site for Ground-truthing. The study was carried out in direct influence zone of the proposed project i.e. the main project components like Powerhouse, proposed upper and lower reservoirs and approach roads, etc. and area with in 10.0km radius of the proposed project components. The field surveys for the collection of primary data commenced from March 2020 and were completed in December 2020 covering pre-monsoon/summer, monsoon, and winter seasons to collect data/ information on terrestrial ecology and physical environment parameters.

The main objectives of the floristic studies is to prepare an inventory of plants species distributed around the project area as well as with 10.0km radius of proposed project components. The study has been conducted covering the locations of proposed project components. Vegetation survey was done to cover different land use/ land cover categories like Forest area (open and Scrub Forest), Scrubland near agricultural fields, fallow/ abandoned land, and vegetation along the bank of water bodies, etc. Floristic surveys of the vegetation were conducted at 6 sampling locations. The selection of sampling sites for

vegetation analysis was based on the land use pattern in the study area. A list of sampling locations is given in **Table 18.**

Table 18: Sampling Locations for Floristic and Faunal Survey

Site Code	Sampling Location	Land use	Latitude	Longitude
V1/ Tr1	Near Shahabad	Open Forest	25°13'1.30"N	77° 8'15.74"E
V2/ Tr2	Near Pindasal Village	Scrub Land	25°13'25.27"N	77°11'19.79"E
V3/ Tr3	Proposed Lower Reservoir Area	Open Forest	25°11'25.74"N	77°11'44.85"E
V4/ Tr4	Proposed Upper Reservoir Area	Scrub Land	25°11'55.89"N	77° 9'54.44"E
V5/ Tr5	Khanda Sahrol Village	Scrub Land	25° 9'43.30"N	77° 9'16.23"E
V6/ Tr6	Majhari Village	Fallow Land	25°11'38.42"N	77°14'4.07" E

The faunal survey was carried out for the species of Mammals, Birds, Herpetofauna, and butterflies. For the preparation of the checklist of animals, the Forest Working Plan of the Baran Forest Division was consulted. In addition, data was compiled from published literature like Prater (1998) for mammals, Daniel (2002) for reptiles, and Ali & Ripley (1983) for birds.

Sampling Methodology & Constraints

A systematic field visit was carried out in the study area during day hours. The survey of wild animals was conducted by using 10x50 prismatic field binocular and handheld GPS 72 in different locations. The presence of wildlife was also confirmed by the local inhabitants depending on the animal sightings and the frequency of their visits in the catchment and study area. In addition to these, secondary sources mainly literature was also referred to for preparing checklists and other analysis in the study of animals and wildlife in the region. The sampling locations of transects for faunal surveys are given in **Table 18**.

1.12. Brief Note About Literature Reviewed

i. Impact on Flora and fauna

Impacts of construction and operation of proposed project in surrounding environment is discussed in Chapter 2.

ii. Relevant Research on WCP area.

- Ali, S. and Ripley, S.D. (1983). Handbook of the birds of India and Pakistan. Oxford (Delhi and New York).
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- Wildlife (Protection) Amendment Act (2022) - 2023. Ministry of Environment and Forests, Government of India. http://envfor.nic.in/legis/wildlife/wildlife1.html.
- The soil map of the study area was prepared using maps published by the National Bureau of Soil Survey & Land Use Planning (NBSS &LUP), Nagpur i.e. “Soils of Rajasthan for Optimising Land Use, NBSS Publ.51b, 1995” and “Soils of Madhya Pradesh for Optimising Land Use, NBSS Publ. 59b, 1996”.
- The data on meteorology on parameters like Temperature, Relative Humidity, Rainfall, Wind Speed, and Wind Direction were downloaded from https://www.worldweather online.com.
- For Land use/ landcover, thematic maps prepared by the National Remote Sensing Centre (NRSC), Indian Space Research Organisation (ISRO) of Dept. of Space with State Remote Sensing Applications Centre, Dept. of S&T, Govt. of Rajasthan and Remote Sensing Applications Centre, MP Council of S&T, Govt. of MP as partners for the period 2016-17 were downloaded from their web portal http://bhuvan.nrsc.gov.in/gis/thematic/index.php.
- For the generation of FCC, Landsat 8 satellite data of Path 146 Row 42 dated 28.04.2019.
- The description of the Geology of the area was sourced from Pre-Feasibility Studies of the proposed project prepared by the project proponent.
- For describing the socio-economic profile of the study area and available infrastructure in the area data were collected during field survey and supplemented by Village and Town Directory, District Census Handbook, Baran, Series -09, Part-XIIA and Village and Town wise Primary Census Abstracts (PCA) Directory, District Census Handbook, Baran, Series -09, Part-XIIB published by Census of India Demographic profile of the study area from Census of India 2011, Directorate of Census Operations, Rajasthan were consulted.

1.13. Relevant Geographical Maps

All geographical map indicating various information of the Study area is given in in Chapter-7 of the report.

CHAPTER 2

2.1. Details Of Investigated Environmental Impacts

All the likely impacts have been considered for various aspects of the environment, including physico-chemical, ecological and socio-economic aspects. Invariably there are two types of impacts that occur due to construction and operation of projects viz. permanent which generally lead to loss of plant species, change of land-use, etc. which can be compensated/managed and temporary which can be minimized and mitigated.

Based on the project details and the baseline environmental status, potential impacts as a result of the construction and operation of the proposed Shahpur Pumped Storage Project have been identified. Wherever possible, the impacts have been quantified and otherwise, qualitative assessment has been undertaken. Environmental protection measures can be best enforced through inclusion of relevant clauses in the contract not only for the main contractors but also for sub-contractors as most of activities are undertaken through various contractors.

2.1.1. Impacts on Air Quality

A. Construction Phase Impacts

The sources and activities that might affect air quality in the project area are vehicular traffic, dust arising from unpaved village roads and domestic fuel burning. The air environment around project site is free from any significant pollution source. Therefore, ambient air quality is quite good in and around the project area.

Increased vehicular movement for transportation of man and material and use of construction equipment will impact air quality at the construction site through emissions from the engines and equipment, fugitive emissions due to material handling, etc. Additionally, construction activities including operation of crushers, concrete batch plants, construction work and movement of vehicles along unpaved road will generate dust & gaseous emission and impact air quality. The burning of waste will also affect air quality and therefore, need to be controlled. In absence of proper fuel, construction workers at the project site may use wood for fuel burning.

a. Pollution due to fuel combustion in various equipment

The operation of various construction equipment requires combustion of fuel. Normally, diesel is used in such equipment. Diesel exhaust contains various types of organic and inorganic pollutants, whose concentration depends upon fuel quality and engine running conditions. NOx, hydrocarbons and CO are major pollutants; SO_2 is not significant due to low Sulphur diesel. Depending upon the fuel quality and quantity and rating of DG sets and other equipment, it is important to provide adequate stack height for emission to be dispersed in the atmosphere to have minimum increase in Ground Level Concentrations (GLCs).

b. Emissions from various crushers and other construction plants

The operation of the crusher and other construction plants during the construction phase generates dust and fugitive emissions, which can impact plant area and surrounding area as

well, depending on wind direction. Crushing process generates dust consisting of PM, PM_{10} and $PM_{2.5}$; substantial part of the emissions is in the form of coarse dust which settles in immediate surrounding. Finer particles ($PM_{2.5}$) gets carried to larger distances and have likely impacts on local residents depending upon wind direction. Preventive and Protective measures are required to be implemented by contractors at site to control such emissions and further reduce their impacts on workers and locals. CPCB's and State Pollution Control Board's guidelines need to be followed to minimize the impact.

c. Fugitive Emissions from material handling and transportation

During construction phase, there will be increased vehicular movement. Lot of construction material like sand, fine aggregate is stored at various sites, during the project construction phase. Normally, due to blowing of winds, especially when the environment is dry, some of the stored material can get entrained in the atmosphere. Although it is very difficult to completely eliminate such an impact, it is possible to reduce its intensity by implementing mitigation measures discussed in ensuing text.

B. Operation Phase Impacts

In pumped storage projects, air pollution occurs mainly during project construction phase. During operation phase, no major impacts are envisaged on air environment.

2.1.2. Impact on Noise Environment

Sources of noise will be increased vehicular traffic due to project construction on approach roads and at construction sites. Due to construction activity in the area, noise levels will increase during the period of construction, however, they will remain limited to the work area mainly where large-scale construction activity will progress. Other sources of noise and vibration will be the use of explosives for blasting purposes for construction activities.

I. Construction Phase Impacts

a) Noise due to Construction Equipment

The noise levels due to operation of the different construction equipment are given in **Table 19**.

Table 19: Equivalent Noise Levels due to Operation of Construction Equipment

Equipment	Noise level dB(A)	Equipment	Noise level dB(A)
Earth Moving		**Material Handling**	
Compactors	70-72	Concrete mixers	75-85
Front loaders	72-82	Movable cranes	82-84
Backhoes	70-92		
Tractors	76-90		
Scrappers, graders	82-90		
Truck	84-90		
Others			
Vibrators	69-81	Saws	74-81

Noise level of about 80 dB(A) at 1m from the source will reduce significantly with distance and can be calculated with the following formula at any location:

$$N2 = N1\text{-}20 \log_{10}(r2/r1) - A_f \quad \text{dBA}$$

Where, N2 = Sound level at any location at a distance r2 from the source
N1 = Sound level at any location at a distance r1 from the source

The decrease in sound level of 80 dB(A) (at 1m from the source) at a distance of 100 m from the source is 40 dB(A) even in the absence of external attenuation factor. Decrease in sound levels (measured at 1 m from the source) at various distances are given at **Table 20**. In the absence of details of attenuation factors, they have assumed zero, whereas in actual practice attenuation factors such as vegetation, barricades, etc. will reduce the sound level significantly. Noise levels get reduced by 6 dB(A) with every doubling of distance.

Table 20: Decrease in Sound Levels with Distance from Source*

Distance from Source (m)	Corresponding Sound levels dB(A)
100	40.0
200	34.0
500	26.0
1000	20.0
1500	16.5
2000	14.0
2500	12.0
3000	10.5

* Source sound is 80 dB(A) at a distance of 1m

Walls of houses attenuates at least 30 dB(A) of noise. In addition, there is attenuation due to air absorption, atmospheric in homogeneities, vegetal cover, etc. Thus, no increase in noise levels is anticipated beyond 100m from source during the project construction phase. However, it can be a cause of concern from workers working in proximity to machines generating noise.

b) Noise due to increased vehicular movement

During construction phase, there will be increase in vehicular movement for transportation of construction material in and around the project sites. During construction phase, the increase in vehicular movement is expected to be at least 5-6 trucks/hour during peak construction period. The impact on noise level due to increased vehicular movement cannot be quantified as it will depend upon various factors such as vehicle condition, vehicle speed, road condition, idling time, traffic condition, etc. Project site will be connected from NH76 by a new proposed road directly to upper reservoir site and through BT road to lower reservoir site. NH76 and BT road have adequate traffic capacity to handle increased traffic. The proposed new roads are away from habitation; nearest village, Shahpur is more than 2 Km away. Therefore, noise impact due to increase of traffic in area is not significant.

c) Noise Generated due to Blasting

Noise generated by blasting is instantaneous in nature. Noise generated due to blasting is site specific and depends on type, quantity of explosives, dimension of drill hole, degree of compaction of explosives in the hole and rock. Noise levels generated due to blasting at various sites recorded in other projects are given in **Table 21**.

Table 21: Noise generated due to blasting

No. of holes	Total charge (kg)	Maximum charge/delay (kg)	Distance (m)	Noise level dB(A)
15	1500	100	250	76-85
17	1700	100	250	76-86
18	1800	100	250	74-85
19	1900	100	400	70-75
20	2000	100	100	76-80

It can be observed from **Table 21** that noise level due to blasting operations are expected to be of the order of 75-85 dB(A) at a distance of about 250m; which will be reduced to 35-45 dB(A) in another 100m. External attenuation factor will reduce it further. As the blasting is likely to last for 4 to 5 seconds depending on the charge, noise levels over this time would be instantaneous and short in duration. Considering attenuation due to various sources, even the instantaneous increase in noise level is not expected to be significant especially during daytime. Hence, noise level due to blasting is not expected to cause any significant adverse impact.

e) Impacts due to Ground Vibrations

The explosive energy generated during blasting sets up a seismic wave within the surface, which may affect the structures and cause discomfort to human population. When an explosive charge is fired in a hole, stress waves traverse in various directions, causing the rock particles to oscillate. Blasting also generates ground vibrations and instantaneous noise. Various measures have been recommended to minimize the adverse impacts due to blasting:

- Proper design of blast hole to be developed.
- Use of noiseless trunk delays to minimize the noise due to air blast.
- Use of non-electric system of blasting for true bottom-hole initiation.
- Use of muffling mats to arrest the dust and fly rock.

Noise in and around the construction site have the potential to affect the wildlife and residents in the nearby areas. Typically, wildlife in the area will likely move away from the noise and eventually return to the area when the blasting is over. However, there is no major wildlife observed in and around the construction site and hence this may not be a significant issue.

f) Impacts on Labour

The effect of high noise levels on the operating personnel has to be considered as this may be particularly harmful. It is known that continuous exposures to high noise levels above 90 dB(A) affects the hearing ability of the workers/operators and hence, should be avoided. To prevent these effects, it has been recommended by Occupational Safety and Health Administration (OSHA) that the exposure period of affected persons be limited as in **Table 22**.

Table 22: Maximum Exposure Periods Specified by OSHA

Maximum equivalent continuous noise level dB(A)	Unprotected exposure period per day for 8 hrs/day and 5 days/week
90	8
95	4
100	2
110	½
120	¼

II. Operation Phase Impacts

No major impacts are envisaged on noise environment during project operation phase.

2.1.3. Water Environment

Various sources of water pollution in the project area during the construction phase include disposal of effluents with high turbidity from crushers commissioned at various sites, sewage disposal from labour camp, blasting and other land clearing activities, washing of oil, grease and other chemicals from diesel generator sets, vehicles and other machinery etc.

I. Impacts of water pollution

Water pollution is harmful and is considered to be a serious health hazard. It has far-reaching consequences and effects on human beings and animals also. The effect can be felt not only in the surface water bodies but also the ground water source in the area. The affect may be of temporary or permanent nature. The major impacts of water pollution are given as under:

- The civil and hydro-mechanical work at site will lead to stockpiling and excavation activity on site, thereby exposing the base soil to erosion. The run-off from this site and also from muck disposal sites may contain a high quantity of Suspended Solids which shall add to the inorganic load of water bodies and drainages in the area. However, the impact of runoff may not be very significant except during rainy season.
- During construction phase, wastewater, sewage etc., shall be generated from the labour camp and workshops. If disposed untreated, this would substantially deteriorate the surface and ground water quality in the area.
- The oil and grease released from the project related activities may also change the physico-chemical characteristics of water.

II. Construction Phase Impacts

The major sources of water pollution during project construction phase are as follows:

- Sewage from Construction work camps/colonies
- Effluent from Construction Plants and Workshops
- Disposal of muck

Sewage from Construction worker Camps

The domestic water requirement for the construction worker and the technical staff migrating into the project area is of the order of 360 cum/day @ 100 lpcd. Adding other requirement from fluctuating population, it can go up to 380 cum/day. With 80% of this quantum to be generated as wastewater, the quantity of 305 cum/day is considered significant and require planned disposal otherwise it will lead to water pollution, resulting in increase in coliforms and other pathogens, which can lead to incidence of water borne diseases. Therefore, project authorities would be taking appropriate measures to check such disposal into the natural water bodies. In order to avoid any deterioration in water quality due to disposal of untreated wastewater from labour camps, appropriate sewage treatment facilities will be commissioned in the labour camps and only treated wastewater will be discharged following “General Discharge Standards”.

Effluent from Construction Plants and Workshops

As discussed earlier, construction plants viz. aggregate processing and concrete mixing and workshops will be established. Water is used in these construction plants and wastewater generated with high suspended solids. Similarly from workshops, major pollutant will be oil and grease. Discharge of untreated wastewater will adversely affect the surface and ground water quality. To minimize the impact, such effluent needs to be treated in-site before discharge to any water body or for land application.

Disposal of Muck

The major impact on the water quality arises when the muck is disposed along the water bodies and natural drainage system. The unsorted waste going into the channels/ water bodies will greatly contribute to the turbidity of water continuously for long time periods. The high turbidity is known to reduce the photosynthetic efficiency of primary producers in the water bodies and as a result, the biological productivity will be greatly reduced. Therefore, the prolonged turbid conditions would have negative impact on the water quality. Therefore, muck disposal has to be done in line with the Muck Disposal Plan, as proposed under Environment Management Plan to avoid any negative impact.

III. Operation Phase Impacts

During the operation phase, due to absence of any large-scale construction activity, the cause and source of water pollution will be much different. Since, only a small number of O&M staff will reside in the area in a well-designed colony with sewage treatment plant and other infrastructural facilities, the problems of water pollution due to disposal of sewage are not anticipated. The treated sewage will be reused for gardening and green belt around the colony.

2.1.4. Land Environment

I. Construction Phase Impacts

For the development of Shahpur Pumped Storage Project (PSP), Both Forest and Non- Forest land would be acquired for construction of project components, reservoir area, muck dumping, construction camps and colony, etc. Based on the project layout, land requirement has been worked out as 624.17 ha, out of which 407.82 ha is forest land, 216.35 ha is Non-Forest.

A) Impact due to change in land-use

Major impact of land acquisition is permanent change of land use, which is unavoidable. Land acquisition has impacts on local population by way of loss of their agriculture land and hence livelihood. Land acquisition also lead to loss of flora and fauna by way of loss of forest land and clearing of vegetation on acquired land. These impacts can be mitigated to a large extent by providing adequate compensation to private landowners and by compensatory afforestation in lieu of loss of forest land.

B) Impacts Due to Muck Generation

It is proposed to dispose off the unused muck, i.e 0.87 Mcum Muck disposal in dead storage part of Upper and Lower Reservoirs and 5.61 Mcum at a one pre-identified muck disposal site. The site will be fully rehabilitated and restored on completion of muck dumping. Muck,

if not securely transported and dumped at pre-designated site, can have serious environmental impacts, such as:

- Can be washed away into the natural water bodies which can cause negative impacts on surface and ground water quality.
- In many of the sites, muck is stacked without adequate stabilisation measures. In such a scenario, the muck moves along with runoff and creates soil erosion like situations.
- Normally muck disposal is done at low lying areas, which get filled up due to stacking of muck. This can sometimes affect the natural drainage pattern of the area leading to accumulation of water or partial flooding of some area which can provide ideal breeding habitat for mosquitoes.

Muck disposal needs to be carefully planned else it becomes a major impact from construction of project.

C) Impacts Due to Waste Generation

The construction of the proposed Pumped Storage Project will involve different categories of manpower like labour, technical, other officials and service providers. These people will be living in temporary and permanent colonies/ settlements. The main sources of waste generation can be categorized as:

- Municipal waste (includes commercial and residential wastes generated in either solid or semi-solid form excluding industrial hazardous wastes and bio-medical wastes)
- Construction and demolition debris (C&D waste)
- Bio-medical waste
- Hazardous waste (generated from construction machinery and equipment)
- e-Waste (computer parts, Printer cartridges, electronic parts, etc.,).

Solid waste generated from temporary and permanent colonies in construction as well as operation phase requires special management to dispose off, as warranted under the Solid Wastes Management Rules (SWM) 2016. The project authorities will ensure sewage generated from labour colonies and site office is treated and disposed as per the SPCB guidelines. It's proposed to provide adequate septic tanks with soak pits for treatment and disposal of sewage.

2.1.5. Impacts on Forests and Forest Land

About 407.82 ha of forest land will be diverted for the construction of the project components. This shall lead to loss of some of the plant species used for various economic purposes. This impact is partially mitigated by implementation of Compensatory Afforestation Plan as well as Biodiversity Management Plan.

2.1.6. Flora and Fauna

I. Construction Phase

A) <u>Impact on Terrestrial Flora</u>

Proposed project is located with the recently notified Shahabad Conservation Reserve. The change in land use pattern of the area will result as loss of 407.82 ha forest area of Shahabad Conservation Reserve. However, by implementing, the compensatory afforestation plan

along with green belt development plan and biodiversity conservation and wildlife management plan the impact on forest cover will be minimized.

The direct impact of construction activity is generally limited in the vicinity of the construction sites only. As mentioned earlier, a large population of people are likely to congregate in the area during peak project construction phase. The workers and other population groups residing in the area may use fuel wood, if no alternate fuel is provided. Hence, to minimize such impacts, it is proposed to provide alternate fuel for cooking e.g. LPG/kerosene to the construction workers. The other alternative is to provide community kitchens on a cooperative basis by the contractor.

B) Impact on Terrestrial Fauna

Forest cover in the vicinity of proposed project working sites and their immediate vicinity is comprised of deciduous forest with agriculture as next pre-dominant land use type. 19 species of mammals and 53 species of avifauna have been compiled from the study area. The acquisition of forest land within the Shahabad Conservation Reserve will cause disturbance to wildlife habitat.

In addition, during construction period, large number of machinery and construction workers shall be mobilized, which may create disturbance to wildlife population in the vicinity of project area. The operation of various equipment will generate significant noise; noise and vibration will also increase during blasting which will have adverse impact on fauna of the area. The noise may scare the fauna and force them to migrate to other areas. Likewise siting of construction plants, workshops, stores, labour camps etc. could also lead to adverse impact on fauna of the area. During the construction phase, accessibility to area will lead to influx of workers and the people associated with the allied activities from outside will also increase. Increase in human interference will have an impact on terrestrial ecosystem.

Therefore, adequate measures will be required during the construction phase not to cause any adverse impact on terrestrial and avifaunal population. Impact of blasting and other construction activities needs to be mitigated by adopting controlled blasting and strict surveillance regime and the same is proposed to be used in the project. This will reduce the noise level and vibrations due to blasting to a great extent.

II. Operation Phase Impacts

On completion of the construction of the project, the land used for construction activities will be restored. Construction workers who have resided in that area will move to another project site. By ensuring all the mitigation and management measures, as planned for this project, are implemented to minimize the impact of construction phase, large part of the area will go back to its original form. Operation phase impacts on flora and fauna will be positive due to green belt development, restoration of construction areas, restoration of muck disposal area. Increase of greenery in the area and creation of reservoir, will have positive impact on avifauna.

2.1.7. Impacts on Socio-economic Environment

A project of this magnitude is likely to entail both positive as well as negative impacts on the socio-cultural fabric of area.

a) Positive Impacts on Socio-Economic Environment

The following positive impacts are anticipated on the socio-economic environment of the local people of villages of project area during the project construction and operation phases:

i) A number of marginal activities and jobs would be available to the locals during construction phase.
ii) Developer bringing large scale investment to the area will also invest in local area development and benefit will be reaped by locals. Education, medical, transportation, road network and other infrastructure will improve.
iii) The availability of alternative resources provided by developer in the rural areas will reduce the dependence of the locals on natural resources such as forest.

b) Negative Impacts on Socio-Economic Environment

Such projects, in addition, to positive impact on socio-economic environment may also bring certain negative impact due to influx of outside population. Workforce for construction activities will reside in that area for around three years and also there will be influx of drivers and other workers on temporary basis.

Villagers in the area also depend on forest resources for their day by day needs, other than fodder and fuel, villagers also collected NTFP like *Tendu* leaves from the forest area. Scrub forest in the area also used as grazing land for livestock's. Loss of forest and grazing land have impact on social environment of the area. These impacts can be mitigated by implementing biodiversity conservation and wildlife management plan along with green belt development plan. Loss of natural habitat will also lead to human wildlife conflict by means of damage of agriculture crops.

This influx of people in otherwise isolated area may lead to various social and cultural conflicts during the construction stage. Developer need to take help of local leaders, Panchayat and NGOs to ensure minimum impact on this count.

c) Increased incidence of Diseases

Large scale activity in the area due to the proposed project may become a cause of spread different types of diseases in the project area due to following reasons:

- Project requires long-term input of labour from outside the area.
- Project requires that significant numbers of project employees be separated from their families for long periods of time.
- Project involves the creation of large, temporary construction camp(s).
- Increases mobility of people in and out of the area (job seekers, formal and informal service providers).
- Requires participation/ resettlement of the local population.

2.2. Measures For Minimizing/Offsetting Adverse Impacts

Pollution generation mainly during construction phase will be in the form of air, water and noise pollution, which will be mitigated by adopting various mitigation measures during construction activities as discussed in later section under the head, "Mitigation Measures".

Impacts of projects such as muck generation, worker's health and safety, waste generation from labour colonies, impact on workers' health, impact of tree cutting for fuel, impact on

physical environment due to material handling and operation of construction machinery, etc. will be minimized by implementing various management plans. Environmental Management Plans viz. Compensatory Afforestation Plan, Green Belt Development Plan, Landscaping & Restoration Plan, Muck Management Plan, Dam Break Modeling & Disaster Management Plan, Public Health Delivery Plan, Sanitation and Solid Waste Management Plan, Energy Conservation Measures and Biodiversity Management & Wildlife Conservation Plan have been prepared to address these specific impacts with a view to minimize adverse impacts.

2.3. Irreversible And Irretrievable Commitments Of Environmental Components

The proposed Scheme will involve construction of both upper reservoir and lower reservoir in Baran district of Rajasthan and involves construction of rockfill embankment with avg height of 24.5 m for the length of 5309 m for creation of Shahpur PSP upper reservoir of 1.21 TMC gross capacity and construction of rockfill embankment with avg height of 26.5m for the length of 2937 m for creation of Shahpur PSP lower reservoir with 1.06 TMC gross capacity. Total 6 numbers of independent Head Race Pipe / Pressure Shaft with one pressure Tunnel bifurcating into two-unit pressure tunnel convey water between Lower and Upper reservoirs. Surface Power/Pump House will be located at about 830 m from the intake structure and shall be equipped six vertical shaft reversible Francis type units composed each of a generator/motor and a turbine/pump having generating/pumping capacity of 300 & 150 MW/330 & 165MW.

Irreversible environment components or resources are those, whose use limit the future use options and Irretrievable components are those whose use eliminate the future use options. Typically, in the context of infrastructure project, Irreversible and Irretrievable commitments of environmental components are due to use of non-renewable resources in project construction and operation.

During the construction stage of the project, raw material will be consumed as resources, which are in abundant supply. No impact is identified on any of the flora or fauna species which will make them extinct by the project. Land required for the project will undergo permanent change of land use. Forest land will be compensated by compensatory afforestation and private land will be compensated as per the law. No displacement of population is involved. During the project operation, water will be the main raw material for power generation. About, 1.26 TMC of water is required for project operation, which will be sourced from Kuno river as one-time storage/filling, out of which 1.01 TMC shall be utilized for power generation by recirculation. Only evaporation losses will be added on annual basis. Therefore, project does not have any significant irreversible and irretrievable impacts on environmental components.

2.4. Assessment Of Significance Of Impacts

Impacts, as discussed above, along with the mitigation measures have been summarized in the form of matrix and subjected to categorization in the form of magnitude, significance and duration of impact. Categorization is largely judgement based as assessed by experts who were involved in carrying out the study. Impact assessment matrix is given at **Table 23**.

Table 23: Impact Assessment Matrix

S. No.	Environmental attribute	Potential impacts	Nature of impact	Phase	Magnitude of impacts			Significance		Long Term/Short Term	
					Low	Medium	High	Significant	Insignificant	Permanent	Temporary
A.	**Physical Resources**										
1.	Land use and Topography	Change in the surface features and present aesthetics due to the construction of the project Muck disposal	Direct/Local/ irreversible	Before construction phase			X	X		X	
B.	**Environmental Resources**										
1.	Air Quality	Project will have impact on air quality during the construction period due to increase in the dust emission, fuel combustion in various equipment, crushers and other construction plants & Emissions from material handling and transportation	Direct/Local/ reversible	During construction activity		X		X			X
2.	Noise	Noise due to general construction activities and equipment, increased vehicular traffic, blasting etc.	Direct/Local/ reversible	During construction activity		X		X			X
3.	Surface and Ground Water quality	Waste from construction labor camps, effluent from construction plants and workshops Runoff from the construction site and its disposal	Direct/Local/ reversible	During construction activity		X		X			X

S. No.	Environmental attribute	Potential impacts	Nature of impact	Phase	Magnitude of impacts			Significance		Long Term/Short Term	
					Low	Medium	High	Significant	Insignificant	Permanent	Temporary
		Domestic wastewater from construction sites	Direct/Local/ reversible	During construction and operation	X				X		X
4.	Soils	Soil erosion due to excavation, muck generation, construction activities and clearing of vegetation and access roads. Muck disposal	Direct/Local/ reversible	During and after the construction activity			X	X		X	
C.	**Ecological Resources**										
1.	Terrestrial Flora	Loss of vegetation	Direct/ Local/ irreversible	Before and during the construction phase			X	X		X	
2.	Terrestrial Fauna	Disturbance to the local fauna during construction	Direct/ Local/ reversible	Before, and during construction phase		X		X			X
3.	Aquatic Ecology	Disturbance to the aquatic fauna after construction	Direct/ Local/ reversible	During construction	X				X		X
D.	**Human Environment**										
1.	Health and Safety	Increased incidence of Diseases Fires, explosion and other accidents at construction sites	Direct/ Local/ Continuous	During and after the construction phase.	X			X			
2.	Agriculture	Impact envisaged as there is private land involved	Direct/ Local/ reversible	Before the construction		X		X		X	
3.	Socio-economics	Positive and negative impacts on socio-economic environment Job opportunities	Direct/ Regional/ Continuous	During operational phase		X		X			

S. No.	Environmental attribute	Potential impacts	Nature of impact	Phase	Magnitude of impacts			Significance		Long Term/Short Term	
					Low	Medium	High	Significant	Insignificant	Permanent	Temporary
		during construction phase.									
4.	Private land acquisition	Impact envisaged as there is private land involved without displacement	Direct/ Local/ reversible	Before the construction		X		X			X
5.	Historical and archaeological sites	No archaeological, historical or cultural important sites are affected by the construction.	Direct/ Local/ reversible		X				X		X
6.	Traffic and Transportation	Traffic congestion on BT road due to movement of construction vehicles	Direct/ Local/ reversible	During construction phase		X		X			X
7.	Solid Waste Generation	Probability of Surface and ground water pollution	Indirect/ Local/ reversible	During construction and operation phase	X				X		X

2.5. Study technique adopted and observations of the experts in the field

The methodology and techniques for collection of data were discussed in Section 1.1 of Chapter 1. QCI-NABET accredited experts of various sectors from RS Envirolink Technologies Pvt. Ltd. (RSET), a consulting organisation visited the Project site and surrounding area. After interpretation of primary and secondary baseline information/ data and keeping in view the nature of project the impact of the project on biological, physical and social environment has been accessed.

There is no direct sighting of Schedule-I species from the project area. However as per the information collected from field survey and data available with forest department, Schedule-I species under Wildlife Protection Act 1972 reported from the area are:

1. Leopard (*Panthera pardus*),
2. Sloth Bear (*Melursus ursinus*)
3. Honey Badger (*Mellivora capensis*)
4. Indian Wolf (*Canis lupus pallipes*)
5. Asian King Vulture (*Sarcogyps calvus*)
6. Common Pea fowl (*Pavo cristatus*)
7. Indian Monitor Lizard (*Varanus bengalensis*), and
8. Indian Rock Python (*Python molurus molurus*)

In addition to these Shahabad Conservation Reserve provide habitat to many other mammals, birds, herpetofauna, butterflies and other faunal species. Same has been discussed in Section 1.7 of Chapter 1.

CHAPTER 3

3.1. OBJECTIVE OF WILDLIFE CONSERVATION PLAN

Keeping in view of the anticipated impacts as per the foregoing chapters, the management objectives can be described as:

i. Maintenance of ecological balance through preservation and restoration, wherever it has been disturbed due to project developmental activities,
ii. Conservation and preservation of natural habitats in project surrounding
iii. Mitigation and control of project induced biotic and/or abiotic pressures/ influences that may affect the natural habitats,
iv. Habitat enhancement in project area by taking up afforestation and soil conservation measures,
v. Creating all round awareness regarding conservation and ensuring people's participation in the conservation efforts and minimizing human wildlife conflict.

3.2. MITIGATION MEASURES

Institutional arrangement for planning and implementing various mitigation and management measures along with carrying out environment monitoring are given at **Table 24**. Table given below also give view of the implementing and monitoring agency for proposed mitigation and management measures.

Table 24: Mitigation and management measures

S. No.	Activities	Implementing Agency	Monitoring/ Supervising/ Approving Agency
1	Compensatory Afforestation Programme	Forest Department	Forest Department
2	Biodiversity Conservation and Wildlife Management Plan	Forest Department	Forest Department
3	Muck Management	Greenko Energies Pvt. Ltd	Greenko Energies Pvt. Ltd./ SPCB
4	Sanitation and Solid Waste Management	Greenko Energies Pvt. Ltd	Greenko Energies Pvt. Ltd./ SPCB
5	Public Health Delivery System	Greenko Energies Pvt. Ltd	Greenko Energies Pvt. Ltd./ District Administration (Health Department)
6	Energy Conservation Measures	Greenko Energies Pvt. Ltd	Greenko Energies Pvt. Ltd./ SPCB/ Forest Department
7	Control of Air, Noise and Water Pollution	Greenko Energies Pvt. Ltd	Greenko Energies Pvt. Ltd./ SPCB
8	Rehabilitation and Resettlement Plan	Greenko Energies Pvt. Ltd.	District Administration
9	Disaster Management	Greenko Energies Pvt. Ltd.	District Administration
10	Local Area Development Plan	Greenko Energies Pvt. Ltd.	District Administration
11	Environmental Monitoring	Greenko Energies Pvt. Ltd.	SPCB*

*SPCB: State Pollution Control Board

In addition to above given mitigation and management measures following management strategies proposed under Wildlife Conservation Plan shall be implemented by forest department in the impact area of proposed project.

i. Habitat Improvement of Schedule-I species through conservation and preservation of natural habitats in project surrounding
ii. Infra-structure development
iii. Anti-Poaching measures
iv. Training Programme for Techniques of faunal species Rescue
v. Prevention of Forest Fire
vi. Creating all round awareness regarding conservation and ensuring people's participation in the conservation efforts and minimizing human wildlife conflict.

CHAPTER 4

4.1. Proposed Management Strategies Within The Project Site

4.1.1 Mitigation Measures

Mitigation of construction-related impacts would be the responsibility of the project proponent (through its contractors). Air and water are two major environmental factors that are directly affected by any kind of construction activity. Transportation of material, storage and handling of material and construction operations lead to air and noise pollution. During construction period generation and release of effluents from construction site, workshops, sewage disposal from labour camp, blasting and other land clearing activities, washing of oil, grease and other chemical from diesel generator sets, vehicles and other machinery etc. cause water pollution and affect the quality of surface as well ground water.

The major air pollutants, which could be generally, released during various construction activities and vehicular movements are Particulate Matter (PM), SOx and NO_X. In addition to these construction activities also generate noise due to the use of heavy machinery, heavy vehicles, blasting, etc. which has serious impacts on humans as well as the wildlife of the area.

I. Control of Air Pollution

For the control of air pollution during construction phase of the project, it is suggested that it should be made mandatory for the contractor/s engaged in the construction works to ensure the following conditions:

- The crushers should be provided with air pollution control devices as per the rules laid down by pollution control board, so as to minimize the release of PM into the atmosphere.
- The chimneys of the Diesel Generator Sets should be kept at appreciable height (as per the CPCB guidelines). The DG sets should be properly maintained and with valid certificates of Type Approval and valid certificates of Conformity of Production.
- Regular water sprays at the crushing sites, dumping sites as well as on roads should be ensured. Necessary clause shall be incorporated in the contractor's agreement.
- Masks should be provided to the workers and staff.
- Proper ventilation facilities shall be provided inside the tunnel and at all the residential complexes of the staff and labour.
- Ambient Air quality shall be monitored seasonally during the construction phase at different locations with the help of NABL accredited lab.
- Controlled blasting during construction activities will be ensured.

II. Control of Noise Pollution

Since continuous exposure to noise is detrimental to health, it is essential to control the noise pollution. Various measures for control of noise pollution in the project area are suggested below:

- Diesel Generator sets should have acoustic enclosures to reduce the noise as per the CPCB guidelines.
- Ear protection aids such as ear plugs, earmuffs, must be provided to the workers who

have to continuously work in the high noise area.

- Proper and regular maintenance/lubrication of machines should be done.
- Noise producing still machines (such as crushers, aggregate processing plants, etc.) should be provided with sound barriers, if close to habitation.
- Quieter machines and vehicles with high quality silencers should be used.
- Afforestation around the residential colonies and office complexes should be done as proposed under the Green Belt Development Plan.
- Ambient noise should be monitored periodically at different locations as outlined in Environment Monitoring Program.

III. Control of water pollution

To avoid deterioration of water quality of the receiving water body following measures are suggested:

- During Construction phase provision of Portal STP/septic tank/ soak pit etc., of adequate capacity for labour camp so that it can function properly for the entire duration of construction phase
- Construction of settling tank to settle the suspended impurities from various sources i.e. HMP/ crushers, labour camps, etc. before discharging into the main stream
- During Operation, Commission of suitable treatment facilities to treat the sewage generated from the colony
- Provision of sedimentation cum grease traps at the outer mouth of drains located along workshops, fuel filling stations, diesel generator rooms etc. so as to prevent entry of contaminants to the water bodies.
- Oil interceptors shall be provided for refueling areas, vehicle parking, washing areas etc. All spills and collected petroleum products will be disposed off in accordance with SPCB guidelines.

4.1.2 Management Measures

I. Muck Management Plan

The construction activities would generate muck from excavation for various project structures. The total quantity of muck generated from soil and rock excavation is about **13.31 Mcum.** Of the total muck generated, about **12.16 Mcum** is expected to be utilized for as aggregate for construction. Total quantity of muck proposed to be disposed in designated muck disposal area, after considering 40% swelling factor would be **6.48 Mcum**. For the disposal of 5.61 M Cum of muck an area of 30 Ha has been identified and 0.87 MCum of muck disposal in dear storage part of Lower & Upper reservoirs. Map showing location of Muck dumping site is given at **Figure 12.** The Rehabilitation plan of muck dumping site includes following engineering and biological measures.

A. Engineering Measures

i) Retaining Wall
ii) Compaction
iii) Fencing

B. Biological Measures

i. Soil treatment
ii. Plantation

II. Landscaping and Restoration of Construction Sites

During construction phase of the project, number of temporary construction sites and working areas will come up. For the restoration of proposed project affected areas to its original landscape as much as possible and retain its aesthetic values. Various engineering and biological measures will be implemented for the restoration of proposed project affected areas.

III. Sanitation and Solid Waste Management

Solid waste generated from temporary and permanent colonies in construction as well as operation phase requires special management for disposal. The project authorities will ensure sewage generated from labour colonies and site office is treated and disposed as per the SPCB guidelines. It is proposed to provide adequate septic tanks with soak pits for treatment and disposal of sewage. Various aspects of solid waste management include:

- Reuse/Recycling
- Storage/Segregation
- Collection and Transportation
- Disposal

The waste generated from the project area will be collected, segregated and disposed off in line with the provisions laid down in Solid Waste Management Rules, 2016.

IV. Public Health Delivery System

Project construction and operation will bring about several changes in the socio-economic environment of the area including increased threats to health of the community.

i. New Diseases due to Migratory Population
ii. Chances of increase in water borne diseases as malaria, and dengue are high
iii. Chances of increase in respiratory troubles due to increase in suspended particles during the construction phase.
iv. Chances of occurrence of gastroenteritis, cholera and typhoid in the labour camps.

Medical services at secondary level play a vital and complimentary role to the tertiary and primary health care systems and together form a comprehensive district-based health care system. Following activities are proposed:

- Ambulance: 2 no. with all the basic Medicare facilities and small DG set, etc. to cater for villages in the project area.
- Budget for running the ambulances including driver, fuel and maintenance for 3 years.
- First aid posts including sheds, furniture and basic equipment.
- Budget for running the first aid post including cost of medico, para-medico/Nurses and attendant, consumables, etc. for 3 years.
- Budget for strengthening existing medical facilities.
- Budget for Health Awareness/ Vaccination Camps for 3 years.
- Mitigation measures to avoid spread of contagious diseases among workforce.

V. Energy Conservation Measures

The existing facilities will become insufficient for supply of kitchen fuel for the migrant population during the construction of the project. Therefore, the project authorities would

make adequate arrangements such as Community kitchen, Supply of Kitchen fuel, efficient cooking facilities and solar lantern either directly by developer or through contractor to reduce the pressure on natural resources in the project area and minimize impacts on this count.

VI. Labour Management Plan for their Health and Safety

Construction work has many associated risks and health impacts for the workers who are directly exposed to such health and safety risks. Therefore, there is a need to prepare complete health and safety documents for workers either by project proponent/contractor and proponent shall ensure its implementation. A detailed plan will be prepared covering the above activities before start of construction work.

VII. Green Belt Development Plan

Green belt development will comprise of plantations at various places like periphery of reservoir, roads, powerhouse area and at different project offices and colonies etc. The green belt helps to provide habitat for faunal species and capture the fugitive emission and to attenuate the noise generated apart from improving the aesthetics environment in the area.

VIII. Disaster Management Plan

In order to visualize the worst case scenario Dam Break Modeling exercise was undertaken and an inundation map was prepared. Based upon the outputs generated from this modeling, a Disaster Management Plan has been formulated. This plan presents warning and notification procedures to be followed in case of failure or potential failure of the embankments. The purpose is to provide timely warning to the population likely to be affected and alert key people who have to take respective actions in case of an emergency.

4.2. Locations of the Proposed Interventions

The proposed mitigation and management measure has been implemented within the project area near Kaloni, Baint and Mungawali villages (Near Shahpur), Shahabad Tehsil, Baran District, Rajasthan. The key locations for implementation of proposed plan are:

- Periphery of the proposed upper and lower reservoir area
- Project colony area
- Job facility Area
- Along the proposed project road
- Temporary construction sites
- Muck dumping sites

4.3. Environment Management Plan overlapping in Nature

The section 3.2 of Chapter 3 (**refer Table 24**) provides details of mitigation measures and management plan along with details of executing and monitoring agencies proposed under Environmental Management Plan.

4.4. Plan period

Construction of Shahpur PSP is planned to be completed in a period of three (3) years, therefore, the proposed mitigation measures and management plans shall be executed within the construction period.

CHAPTER 5

5.1. Proposed Management Strategies Within The Buffer Area (10.0km Radius of Proposed Project Components)

The proposed Biodiversity Conservation and Management Plan shall be implemented within the buffer zone of the proposed project.

5.2. Wildlife Management Plan

5.2.1. Purpose of Report

In reference to additional conditions of Terms of Reference (ToR) issued by Ministry of Environment, Forest, and Climate Change (MoEF&CC), Government of India vide letter no. J-12011/02/2020-IA-I, dated: 13.04.2020, directed to submit Conservation plan for the Scheduled I species reported from the study area. In pursuant to the condition of ToR, the Conservation Measures of Schedule-I species is prepared. It is pertinent to mention that Golden Jackal and Indian Grey Mongoose were the only two Schedule-I species which were reported in the primary survey during EIA/EMP studies. However, 22 faunal species including Leopard (*Panthera pardus*), Sloth Bear (*Melursus ursinus*), Honey Badger (*Mellivora capensis*), Indian Wolf (*Canis lupus pallipes*), Asian King Vulture (*Sarcogyps calvus*), Indian Peafowl (*Pavo cristatus*), Indian Monitor Lizard (*Varanus bengalensis*), Indian Rock Python (*Python molurus*), etc. are the Schedule-I species reported from the study area.

5.2.2. Threats to Biodiversity & Wildlife

The fragmentation of forested landscape in the area is likely to happen due to acquisition of forest land thereby change in land use, degradation of adjoining forested landscape due to various project construction activities. Therefore, land use change and construction activities will affect biodiversity in the study area. Such activities might lead to increased disturbance to wildlife in the area, man-animal conflict, introduction of exotic weedy plant species into the adjacent forested area. Major threats to biodiversity and wildlife in the project area are as follows.

a) Diversion of Forest land for Project

The proposed project is being constructed in the jurisdiction of Rajasthan Forest Department. For the development of Shahpur PSP, the total land requirement has been worked out as 624.17 ha, out of which 407.8227 ha is forest land lies in Shahabad Conservation Reserve. The forest land in the area is comprised of dry Deciduous and Scrub Forest. The diversion of forest land for project i.e., land use change will immediately put wildlife present in those forest patches under stress leading to landscape fragmentation. Increased access to nearby forests by construction of new roads will result in disturbance to wildlife by degradation as well as loss of habitats thereby affecting wildlife populations in the area.

A large population around 3500 persons from other areas, including technical staff, workers, and other groups of people is likely to congregate in the area during the peak project construction phase. It can be assumed that the technical staff will be of higher economic

status and will live in a more urbanized habitat, and will not use wood as fuel if adequate alternate sources of fuel are provided. However, workers and other population groups residing in the area may use fuel wood, if no alternate fuel is provided. The workers may also cut trees to meet their requirements for the construction of houses, furniture. Normally in such situations, a lot of indiscriminate use or wastage of wood is also observed, especially in remote or inaccessible areas.

During the construction period, a large number of machinery and construction workers shall be mobilized, which may create disturbance to the wildlife population in the vicinity of the project area. The operation of various equipment will generate significant noise, especially during blasting which will affect the fauna of the area. The noise may scare the fauna and force them to migrate to other areas. Likewise, siting of construction plants, workshops, stores, labour camps, etc. could also lead to adverse impacts on the fauna of the area. During the construction phase, accessibility to the area will lead to an influx of workers and the people associated with the allied activities from outside will also increase. An increase in human interference could have an impact on the terrestrial ecosystem.

Thus, it is necessary to formulate a conservation and management plan to mitigate the adverse impacts on terrestrial flora during the project construction phase.

b) Operation Phase Impacts

On completion of the construction of the project, the land used for construction activities will be restored. Construction workers who have resided in that area will move to another project site**.** By ensuring all the mitigation and management measures, as planned for this project, are implemented to minimize the impact of the construction phase, a large part of the area will return more or less to its original form. Operation phase impacts on flora and fauna will be positive due to green belt development, restoration of construction areas, restoration of the muck disposal area and implantation of biodiversity management and Wildlife Conservation Plan. An increase of greenery in the area and the creation of the reservoir will have a positive impact on wildlife habitat and avifaunal diversity.

c) Human Wildlife Conflict:

Deforestation, growing human settlements, expansion of agricultural land and fragmentation of natural habitat and grazing ground of species like Wild Boar are the causes behind rising of human wildlife conflict. In the study area human-wildlife conflict in terms of crop damage is perhaps more common and causes huge loss to the farmers.

d) Hunting and poaching:

Damage of crops by species like Monkey, Langur, Wild Boar, etc. and loss of livestock's results as hunting and killing of these wild animals by means of poisoning or with the help of hunters.

e) Illegal cutting of trees:

The stakeholders from the study area depends upon forest for their day to day need of fodder, fuelwood, and other non-Timber Forest products (NTFP) as well as timber wood needs. This results in tremendous pressure on the forests.

f) Grazing pressure:

The scrub forest in the area is under heavy grazing pressure by the livestock and is susceptible to damage by livestock.

5.2.3. Objectives of Management

Keeping in view of the anticipated impacts as per the foregoing chapters, the management objectives can be described as:

i. Maintenance of ecological balance through preservation and restoration, wherever it has been disturbed due to project developmental activities,
ii. Conservation and preservation of natural habitats
iii. Mitigation and control of project induced biotic and/or abiotic pressures/ influences that may affect the natural habitats,
iv. Habitat enhancement in project area by taking up afforestation and soil conservation measures,
v. Creating all round awareness regarding conservation and ensuring people's participation in the conservation efforts and minimizing human wildlife conflict.

5.2.4. Mitigation Measures

The following management strategies including shall be implemented by forest department in the impact area of proposed project.

i. Habitat Improvement of Schedule-I species through conservation and preservation of natural habitats in project surrounding
ii. Infra-structure development
iii. Anti-Poaching measures
iv. Training Programme for Techniques of faunal species Rescue
v. Prevention of Forest Fire
vi. Creating all round awareness regarding conservation and ensuring people's participation in the conservation efforts and minimizing human wildlife conflict.

5.3. Conservation and Management Measures

Wildlife conservation is the preservation and protection of animals, plants, and their habitats. The most effective way of biodiversity management and wildlife conservation in the area are habitat management through habitat enhancement, preservation and improvement, conducting conservation programmes and creation of environmental awareness involving local people, and strict enforcement of wildlife protection laws.

5.3.1. Wildlife Habitat Preservation & Improvement

i. Afforestation and Enrichment plantation

Afforestation and enrichment plantation will be carried out in the area. The area under forest and tree cover will be expanded through systematic planning and implementation of afforestation and rehabilitation programs in available community lands. Afforestation programme in the degraded Forest Compartments is also proposed to be carried out in the surrounding of the project area. The sites and species to be planted will be finalized by the state Forest Department as the program will be implemented by them.

The plantation site will be trench fenced and brushwood fence, for the protected from cattle grazing. With the improvement in the habitat of wildlife, the incidences of human-wildlife conflict will accordingly reduce. The enrichment plantation will be carried along the periphery of the proposed reservoirs in the adjoining forest area. As such, no additional forest land will be diverted for this purpose.

ii. Farm Forestry

The project area harbors several economically important plants like *Diospyros melanoxylon, Tectona grandis, Buchanania cochinchinensis, Phyllanthus emblica, Terminalia bellirica, etc*. These valuable resources will be directly useful to the people of the area which can form the basis of economic upliftment.

To reduce dependency on the natural forests for biomass and other Non-Timber Forest Products (NTFPs) or Minor Forest Products (MFPs) alternate resources need to be built up. NTFPs/MFPs plantations will be carried out on community land, degraded land, fallow lands which help in sustainable land management and a tool for reclamation.

Decentralized nurseries will be created with the help of the forest department. Species to be raised are primarily to cater to fuel, fodder, and small timber needs. Besides, seedlings of economically important plant species like Amla (*Phyllanthus emblica*), Behda (*Terminalia bellirica*)*,* Bamboo, etc., will be distributed every year to villagers at a nominal rate. The distribution will be facilitated through the Forest Range office in the area. The Forest department may take up a prior survey with the help of local administrative bodies/ panchayats to assess the required plants.

iii. Development of Grassland

Grassland/ and Scrubland in the area provide habitat to faunal species like, Wild Boar, Spotted Dear, Sambhar and other small faunal species that play important role in food chain. The grazing pressure of livestock from the surrounding villages on the grassland and scrubland leads to habitat destruction and cause human wildlife conflict. Also, the over grazing cause soil erosion and affect the seed germination.

In order to prevent habitat destruction, soil erosion and to avoid such conflict and habitat destruction it is necessary to conserve the natural maintain grassland. To ensure uniform growth of grasses, seed pellets of grasses will be sown at regular intervals. Pellets are made by mixing powdered clay and farmyard manure into which grass seeds are mixed. The mixture is then made into balls and sun dried in summer to be sown before monsoon. This will also help in arresting erosion to a great extent. Also, fencing at the vulnerable sites that attract conflict between wild and domestic animals will be preferred.

iv. Awareness Programme

The success of any conservation plan of this magnitude is entirely hinged on the active support and wholehearted co-operation of all stakeholders with the members of the public playing a major role. For this purpose, meetings and workshops will be organized from village to village on regular basis. Functions like Van Mahotsav, Wildlife Week, World Forestry Day, and World Environment Day will be organized in a befitting manner to which village heads, members of public representatives' system at Gram Panchayat level, local leaders, and members of NGO

will be involved. The topics should include deterioration of biodiversity, habitat loss, human-wildlife conflicts, fire damage control, and how best the vegetation can be revamped, etc. Members of the public will be encouraged to speak. The student community should also be sensitized to various conservation issues.

Considering that the wildlife populations will be impacted by project construction activities and due to the influx of migrant labour force, mitigation measures should also be taken for the larger area. The following measures are proposed:

- Control on hunting and poaching.
- Awareness campaigns are aimed at creating awareness towards respecting habitat protection in general and the protection of wildlife species.

General awareness of the Wildlife Protection Act and its rules would be spread among the locals through communication and extension services. The wildlife populations in this area are likely to be affected by project construction activities and due to the influx of migrant labour force, awareness among them and contractors would be inculcated.

Under this programme, various activities viz. training, publishing of pamphlets, brochures, hoardings, etc. shall be carried out during the construction phase of the project. The following activities are planned under this programme:

Observance of Wildlife Week: The wildlife week will be celebrated every year in March to assess all the tasks set aside for wildlife management. Under this programme, seminars, art competitions, and awareness campaigns will be held.

Nature Club: Nature clubs will be introduced at the Higher Secondary and High school level in the project area. They will be imparted education using audio-visual aids to sensitize them about the importance of wildlife conservation.

Involvement of Village Panchayats and NGOs: The Panchayats of affected villages and active NGOs in the project area would be involved to disseminate the knowledge about the benefits of the proposed project and ensuring greater participation in the conservation efforts and safeguard the environment of the area.

5.4. Conservation And Management of Schedule-I Species

The development activities often present a threat to biodiversity in the area like habitat destruction, degradation, fragmentation through overexploitation, poaching, hunting, pollution, etc. Therefore, developmental projects are required to maintain ecological integrity to ensure biodiversity conservation and sustainable development together. The impacts need be mitigated or minimized substantially through well drafted conservation management plan. The Wildlife (Protection) Amendment Act, 2022 mandates protection of plants and animal species by way of listing them under different schedules to provide them varying degrees of protection. Schedule I are provided absolute protection and offences under these are prescribed the highest penalties. Key strategies required for any management plan are *in situ* strategy, *ex situ* strategy, reduction of anthropogenic pressure and rehabilitation of endangered species.

5.4.1. Schedule-I Species Reported from the Area

As per data collected during field survey and information collected from Working Plan of concerned Forest Division, 22 faunal species including 9 species of mammals, 4 species of birds and 7 species of herpetofauna reported from the study area **(Table 25)** which are listed as Schedule-I under The Wildlife (Protection) Amendment Act, 2022.

Table 25: Faunal Species reported from the study area under Schedule-I of The Wildlife (Protection) Amendment Act, 2022

S. No.	Order/ Family	Common Name	Scientific Name	Conservation Status (WPAA, 2022)
MAMMALS				
	Order- Carnivora			
1	Canidae	Bengal Fox	*Vulpes bengalensis*	I
2		Golden Jackal	*Canis aureus*	I
3		Indian Wolf	*Canis lupus*	I
4	Felidae	Common Leopard	*Panthera Pardus*	I
5	Herpestidae	Indian Grey Mongoose	*Herpestes edwardsii*	I
6	Hyaenidae	Striped Hyena	*Hyaena hyaena*	I
7	Mustelidae	Honey Badger	*Mellivora capensis*	I
8	Viverridae	Small Indian Civet	*Viverricula indica*	I
9	Ursidae	Sloth Bear	*Melursus ursinus*	I
	Order - Cetartiodactyla			
10	Cervidae	Sambar	*Rusa unicolor*	I
	Order - Rodentia			
11	Hystricidae	Indian Crested Porcupine	*Hystrix indica*	I
BIRDS				
	Order: Accipitriformes			
12	Accipitridae	Asian King Vulture	*Sarcogyps calvus*	I
	Order: Passeriformes			
13	Cisticolidae	Rofous-Fronted Prinia	*Prinia buchanani*	I
	Order: Galliformes			
14	Phasianidae	Indian Peafowl	*Pavo cristatus*	I
	Order: Strigiformes			
15	Strigidae	Eurasian Eagle-owl	*Bubo bubo*	I
REPTILIA				
	Order: Squamata			
16	Boidae	Indian sand Boa	*Eryx johnii*	I
17	Chamaeleonidae	Indian Chameleon	*Chamaeleo zeylanicus*	I
18	Colubridae	Rat snake	*Ptyas mucosa*	I
19	Elapidae	Indian Cobra	*Naja naja*	I
20	Pythonidae	Python	*Python molurus*	I
21	Varanidae	Indian Monitor Lizard	*Varanus bengalensis*	I
22	Viperidae	Russell's Viper	*Vipera russelli*	I

WPAA 2022 – The Wild Life (Protection) Amendment Act, 2022

5.4.2. Conversation Measures for Schedule-I Species

5.4.2.1. Habitat Description for Different Faunal Species

To prepare the conservation and management strategies of different schedule I faunal species, their habitat and feeding habits should be understood. Therefore, a brief description of habitat of 22 schedule I species has been provided in the following table **(Table 26)** by consulting IUCN version 2022-2 (https://www.iucnredlist.org/).

Table 26: Habitat description of Schedule I Faunal Species

S. No.	Name of Species	Habitat
MAMMALS		
1	Bengal Fox *(Vulpes bengalensis)*	Prefers semi-arid, flat to undulating terrain, scrub and grassland habitats where it is easy to hunt and dig dens. In the Indian peninsula, the species is restricted to plains and open scrub forest.
2	Golden Jackal *(Canis aureus)*	Due to its tolerance of dry conditions and its omnivorous diet, the Golden Jackal can live in a wide variety of habitats, exceeding 2,000 m in elevation, ranging from semi-arid environments to forested, mangrove, agricultural, rural and semi-urban habitats in India
3	Indian Wolf *(Canis lupus)*	All northern habitats where there is suitable food, densities being highest where prey biomass is highest. Food is extremely variable, but the majority comprises large ungulates.
4	Honey Badger *(Mellivora capensis)*	Vareity of habitats: Forest, Savanna, Shrubland, Desert. They are opportunistic, generalist carnivores, and feed on a range of prey items varying in size from small insect larvae to the young of ungulates
5	Common Leopard *(Panthera Pardus)*	On the Indian subcontinent, topographical barriers to the dispersal of this subspecies are the Indus River in the west, and the Himalayas in the north. In the east, the lower course of the Brahmaputra and the Ganges Delta form natural barriers to the distribution of the Indochinese leopard. Indian leopards are distributed all over India, in Nepal, Bhutan, Bangladesh and parts of Pakistan. They inhabit tropical rain forests, dry deciduous forests, temperate forests and northern coniferous forests.
6	Indian Grey Mongoose *(Herpestes edwardsii)*	It has been recorded in disturbed (even urban) areas, in dry secondary forests, and thorn forests. In central India, reported near refuse bins and dumps, scavenging on carrion, and on roads. This species feeds on a wide variety of animal food including insects and snakes.
7	Sloth Bear *(Melursus ursinus)*	Distribution includes a large portion of India, Bangladesh, and Sri Lanka, as well as the southern lowlands of Nepal. At least 90% of the present Sloth Bear range occurs in India. Sloth Bears occupy a wide range of habitats on the Indian mainland including wet and dry tropical forests, savannahs, scrublands, and grasslands.

S. No.	Name of Species	Habitat
8	Striped Hyena *(Hyaena hyaena)*	In most of its range the Striped Hyaena occurs in open habitat or light thorn bush country in arid to semi-arid environments.
9	Small Indian Civet *(Viverricula indica)*	Forest, Savanna, Shrubland, Grassland, Wetlands (inland)
10	Sambar *(Rusa unicolor)*	Within India, Sambar occurs in the thorn and arid forests of Gujarat and Rajasthan, in the moist and dry deciduous forests throughout peninsular India, in the pine and oak forests at the Himalayan foothills, and in the evergreen and semi-evergreen forests of northeastern India and the Western Ghats.
11	Indian Crested Porcupine *(Hystrix indica)*	Forest, Shrubland, Grassland
BIRDS		
12	Asian King Vulture *(Sarcogyps calvus)*	Near human habitations, feeding mostly from carcasses of dead animals
13	Rofous-Fronted Prinia *(Prinia buchananii)*	Forest, Shrubland, Grassland, Rocky areas (eg. inland cliffs, mountain peaks)
14	Indian Peafowl *(Pavo cristatus)*	Prefer human dominated and associated surrounding habitats like agricultural fields, fellow and scrub land. Peafowls are omnivorous; they consume insects, worms, lizards, frogs and other arthropods, reptiles and amphibians. They also feed on plant parts, flower petals, seed heads, grains, grasses and bamboo shoots.
15	Eurasian Eagle-owl *(Bubo bubo)*	Forest, Shrubland, Grassland, Caves and Subterranean Habitats (non-aquatic). It feeds mostly on mammals from small rodents to hares and birds to the size of herons and buzzards, but it also consumes reptiles, frogs, fish and larger insects.
REPTILES		
16	Indian sand Boa *(Eryx johnii)*	It is a generally nocturnal and fossorial species found in flat desert with loose clay soil and sparse grasses. Sometime found in sandy deserts and similar open areas with loose soil. In India it is also found in dry deciduous forest and scrub (Srinivasulu), and moist lowland forest in the northern Western Ghats
17	Rat snake *(Ptyas mucosa)*	Found in a great diversity of habitats, including forest, forest clearings and edges, open tropical dry forests, savannas, scrublands, plantations, villages and cultivated areas. It may be found in adjacent semi-desert or forest habitats
18	Indian Cobra *(Naja naja)*	Highly adaptable species and is found in a wide variety of habitats ranging from moist evergreen forests, tropical dry deciduous forests, grassland habitat and dry scrub jungle to rice paddies. It is also found in artificial habitats and other agricultural lands.
19	Python *(Python molurus)*	Inhabits a wide range of habitats including wetlands, open forest, scrublands, harsh desert, rainforests, woodlands, grassy marshes, river valleys, rocky slopes, and savanna.

S. No.	Name of Species	Habitat
		They live in hollows of trees, mangrove thickets, mammal burrows and dense water reeds, in caves and unattended ruins of old buildings with clumps of vegetation around and is reluctant to move away from its established territory. It is adept at both swimming and climbing trees.
20	Russell's Viper *(Vipera russelli)*	Not restricted to any particular habitat, and while it is mostly found in open, grassy or bushy areas it may also occur in secondary forests (scrub jungles), forested plantations and farmland. It avoids dense forests and is most common in plains, coastal lowlands and hills. This species is often found in highly urbanized areas and settlements in the countryside, where it feeds on rodents' commensal with humans.
21	Indian Chameleon *(Chamaeleo zeylanicus)*	Found in scrublands, dry deciduous and secondary forests. It ranges into desert areas, but is restricted to oases in these habitats
22	Indian Monitor Lizard *(Varanus bengalensis)*	Found in a variety of habitats, from desert areas to floodplains, scrubland to forests, at moderate elevations. It can also inhabit agricultural areas.

5.4.2.2. Threats

i . Habitat Threats:

Loss and fragmentation of natural habitat are the major threat to most species. Habitat has been lost, degraded, and fragmented by overharvest of forest products (timber, fuelwood, fodder, fruits, honey), establishment of monoculture plantations (e.g. Teak, Eucalyptus), over-grazing, extraction of minerals, quarrying, and expansion of agricultural areas, human settlements, and roads. Loss of tall trees, where bird species like peafowl and vultures usually roost and build their nests for shelter and reproduction, is major threats for their habitats.

ii. Human - Leopard Conflicts:

Expansion of agriculturally used land, encroachment of humans and their livestock into protected areas are main factors contributing to habitat loss and decrease of wild prey owing to excessive hunting & local extinction. As a result, the wild animals approach human settlements, where the carnivore species are tempted to prey on domestic livestock like cattle's, dogs, and goats, which constitutes an important part of their diet, if they live on the periphery of human habitations. Human-leopard conflict situations ensue and have increased in recent years.

iii. Poaching:

A significant immediate threat to wild leopard populations is the illegal trade in poached skins and body parts. Illegal trade of body parts (skin, bones, and claws) continues to threaten the survival of most species in the wild.

iv. Other threats:

The species are sometimes threatened by eating chemically treated agricultural crop seeds, steel-jawed traps, poisoning by diclofenac, which is used as veterinary non-steroidal anti-

inflammatory drug (NSAID), leaving traces in cattle carcasses which when fed on leads to kidney failure in birds, killings of reptile species due to fear, use of pesticides and agrochemicals and unexpected floods are also increasing the intensity of potential threat. The snakes are likely to be under localized pressure due to demand for venom collection and for the leather industry.

5.4.3. Habitat Conservation and Management Measures

Wildlife conservation is the preservation and protection of animals, plants, and their habitats. The most effective way of biodiversity management and wildlife conservation in the area are habitat management through habitat enhancement, preservation and improvement, conducting conservation programmes and creation of environmental awareness involving local people, and strict enforcement of wildlife protection laws.

I. Afforestation And Enrichment Plantation

Afforestation and enrichment plantation will be carried out in the area. Area under forest and tree cover will be expanded through systematic planning and implementation of afforestation and rehabilitation programme on available community lands. Afforestation programme in the degraded Forest Compartments is also proposed to be carried out in the surrounding to the project area. The sites and species to be planted will be finalized by the state Forest Department as the program will be implemented by them.

Plantation site will be trench fenced and brushwood fence, for the protected from cattle grazing. With the improvement in habitat of wildlife the incidences of human wildlife conflict will accordingly reduce. The enrichment plantation will be carried along the periphery of upper reservoir in the adjoining forest area. As such, no additional forest land will be diverted for this purpose.

ii. Biological Fences:

Conflicts generally arises when leopard or Sloth Bear enters in human settlements, which indirectly reflect the condition of adjacent forested areas, i.e. its ability to support Leopard and Sloth Bear habitat. Protective Fencing to Protect Livestock: Biological fences will be used to protect the livestock from the attack wild animals like Leopard, Sloth Bear, Jackal, etc.

iii. Farm Forestry

The project area harbours number of economically important plants like *Tectona grandis, Terminalia* spp., *Phyllanthus emblica*, *Mangifera indica*, *Madhuca longifolia*, *Diospyros melanoxylon*, etc. These valuable resources will be directly useful to the people of the area which can form the basis of economic upliftment.

With a view to reduce dependence on the natural forests for biomass and other non-timber forest products (NTFPs) or minor forest produce (MFP) alternate resources need to be building up. NTFPs/MFP plantations will be carried out on the community land, degraded land, fallow lands which help in sustainable land management and a tool for reclamation.

To ensure the supply of plant materials fund will also be allocated for strengthening and maintenance of existing nurseries that will be created by state forest department in their

jurisdiction. Species to be raised are primarily to cater to fuel, fodder, and small timber needs. Seedlings will be distributed every year to villagers on a nominal rate. The distribution will be facilitated through Forest Range office in the area. Forest department may take up prior survey with the help of local administrative bodies/panchayats to assess the requirement plants.

iv. Development and Management of Grassland

Grassland/ and Scrubland in the area provide habitat to faunal species like, Wild Pig, Spotted Dear, Barking deer, Sambar and other small faunal species that play important role in food chain. The grazing pressure of livestock from the surrounding villages on the grassland and scrubland leads to habitat destruction and cause human wildlife conflict. Also, the over grazing cause soil erosion and affect the seed germination.

In order to prevent habitat destruction, soil erosion and to avoid such conflict and habitat destruction it is necessary to conserve the natural maintain grassland. To ensure uniform growth of grasses, seed pellets of grasses will be sown at regular intervals. Pellets are made by mixing powdered clay and farmyard manure into which grass seeds are mixed. The mixture is then made into balls and sun dried in summer to be sown before monsoon. This will also help in arresting erosion to a great extent. Also, fencing at the vulnerable sites that attract conflict between wild and domestic animals will be preferred.

v. Removal of Invasive Species

Increase in abundance of invasive species effect floral diversity which may harm the ecosystem integrity in the area where project activities are going on. Some of the important invasive plant species inhabiting the area are *Lantana camara*, *Bidens* sp., *Parthenium hysterophorus* and *Ipomoea carnea*. Invasion of such invasive species is necessary to maintain the floral diversity in the area. Among the various methods of removal like mechanical, chemical and biological, mechanical is most suitable method. It includes physical uprooting and digging., etc.

vi. Awareness Programme

The success of any conservation plan of this magnitude is entirely hinged on the active support and wholehearted co-operation of all stakeholders with the members of public playing a major role. For this purpose, meetings and workshops will be organized from village to village on regular basis. Functions like Van Mahotsav, Wildlife Week, World Forestry Day, and World Environment Day will be organized in a befitting manner to which village heads, members of public representatives' system at Gram Panchayat level, local leaders and members of NGO will be involved. The topics should include deterioration of biodiversity, habitat loss, control of crop damages by wild animals like Wild Boar, Sambhar, Nilgai, Monkey and other human wildlife conflicts, fire damage control and how best the vegetation can be revamped etc. Members of public will be encouraged to speak. Student community should also be sensitized on various conservation issues.

Considering that the wildlife populations will be impacted by project construction activities and due to influx of migrant labour force, mitigation measures should also be taken for the larger area. The following measures are proposed:

- Control on poaching.

- Awareness campaigns aimed at creating awareness towards respecting the habitat protection in general and the protection of wildlife species in particular.

Under this programme, various activities viz. training, publishing of pamphlets, brochures, hoardings, etc. shall be carried out during the construction phase of the project. The following activities are planned under this programme:

Observance of Wildlife Week: The wildlife week will be celebrated every year in the month of March to assess all the tasks set aside for wildlife management. Under this programme, seminars, art competitions and awareness campaigns will be held.

Nature Club: Nature clubs will be introduced at Higher secondary and High school level in the project area. They will be imparted education by means of audio-visual aids so as to sensitize them about importance of wildlife conservation.

Involvement of Village Panchayats and NGOs: The Panchayats of affected villages and active NGOs in the project area would be involved to disseminate the knowledge about the benefits of the proposed project and ensuring greater participation in the conservation efforts and safeguard the environment of the area.

5.4.4. Management Measures

In view of the above, various Management and Conservation measures like Habitat improvement, development of Biological Fences using suitable plant species, enforcement of Strict Protection Measures, Public Awareness Programme involving villagers and forest officials for protection and conservation of various species, Anti-Poaching measures, Construction and filling of water holes and check dams/Ponds, tube wells etc., Support/Provision of veterinary care, cages, rescue centers, etc., Infra-structure development (Surveillance Equipment's like Cameras, Wireless Sets, GPS etc)., Training Programme for Rescue Techniques of faunal species, Prevention of Forest Fire activities like Training and Infrastructure facilities etc., have been proposed.

5.4.4.1. Veterinary care

Following provision has been made for ensure the veterinary care of wildlife in the protected area.

i. Creation of veterinary facilities and rescue centres for healthcare of wild animals and for disease control. For this purpose, it is essential to maintain medical facilities in the veterinary centres.
ii. Provision of 01 mobile-rescue-cum-rehabilitation-van.
iii. For Maintenance of mobile-rescue-cum-rehabilitation-van and medical budgetary provision has been made under this plan.

5.4.4.2. Training to Local Youth

In addition to activities like management and conservation of habitat and provision of veterinary care for faunal species in the area, training programme for interested local

youths and officials of forest department about the rescue techniques of faunal species with the help of recognized organizations, wildlife professionals and NGO's.

5.4.4.3. Prevention of Forest Fire

Incidences of fire in Semi-evergreen forests are rare except in areas. In the forest area having dry grass lands or bushy vegetation, fire incidences are common. Main reason for fire is Rab burning in the agriculture land and for inducing fresh flush of grass. It has a damaging effect on the soil and affects growth of naturally regenerated seedlings. Burning of leaf litter also makes the soil prone to erosion in the incoming rains. Incident of forest fire will be minimized through forming a fire line around the forest area. The following measures are therefore proposed to be taken to prevent forest fire:

i. **Fire Fighting Equipments:** These Fire watchers will also be equipped with certain Fire Fighting Equipments such as Fire resistance dress, Water bottle, Axe, Shoes etc. to attend to emergencies. Therefore, financial provision has been made for fire-fighting equipments.
ii. **Clearing of Fire Line:** Fireline will be cleared over a vulnerable area.
iii. **Training & Awareness:** Financial provision to organise firefighting training for forest officials and villagers residing around project area has been made under this Plan.

5.4.4.4. Construction and Maintenance of Water Holes/ Ponds in Wildlife Habitat.

For easy accessibility of drinking water for wildlife within the forest area provision of water holes/ artificial ponds has been made. Fund has been allocated for construction of new waterholes/ ponds and maintenance of existing waterholes/ ponds in the forest area. In addition to the cost of construction and maintenance, financial provision of has been made for water supply and filling of dry ponds during dry season.

5.4.4.5. Training and Capacity building

In addition to activities like management and conservation of habitat provision of training programme for interested local youths and officials of forest department about veterinary care and the rescue techniques of faunal species with the help of recognized organizations, wildlife professionals and NGO's has been made under this plan Training.

5.5. Safeguards during construction phase

During the construction phase, various adverse impacts on the forest and wildlife are anticipated in the surrounding areas of the proposed project in terms of increased noise levels, release of air and water pollutants, etc. To avoid and minimize the negative impacts of these activities, project authorities are advised to prepare strict guidelines as suggested below:

(i) Minimum levels of noise during construction activities will be maintained and ambient noise should be monitored periodically at different locations as outlined in Environment Monitoring Program.
(ii) Strict restrictions shall be imposed on the workers at project sites to ensure that they do not harvest any species/produce from the forests and cause any danger or harm to the animals and birds in the wild.

(iii) The provision made for community kitchen and ensure the supply of the kitchen fuel from the nearest depots to avoid forest degradation and destruction of forest and wildlife habitats.

(iv) The interference of human population would be kept to a minimum in the adjacent forested areas and it would be ensured that the contractors do not set up labour colonies in the vicinity of forests and wilderness areas.

5.6. Strengthening of Infrastructural Facilities of Forest Department

Under this plan, the Project Authority would assist the State Forest Department in strengthening the infrastructure facilities, which are poorly developed in the area. Various activities that are necessary for the forest protection plan are described in the following paragraphs.

i. For improvement of vigilance and measures to check illegal tree falling, extraction of Minor Forest products, and poaching, check posts and watchtowers will be needed. To strengthen the working capacity, the workforce of the State Forest/ Wildlife Department must be provided with necessary equipment such as a camera, wireless, binoculars GPS, searchlights, health kits, etc. that would increase their capability and efficiency of monitoring.

ii. The construction of inspection paths and watchtowers for more effective and meaningful patrolling by the department.

iii. Creation of veterinary facilities and rescue camps for the healthcare of wild animals and disease control. For this purpose, it is essential to maintain a stock of medicines in addition to setting up a *mobile-rescue-cum-publicity-van*.

CHAPTER 6

6.1. Budgetary Provisions

As per instructions for processing of Wildlife Conservation Plan for Projects issued by Office of Addl. Principal Conservator of Forest and Chief Wildlife Warden, Rajasthan, provisions for the proposed Wildlife Conservation and Management Plan have been made and given in table below.

S. No.	Particulars	Provisions	Cost Rs. In Lakh
1	**407.8227 ha** of Forest land to be diverted for Proposed Shahpur PSP	Rs 0.50 per ha for 407.8227 ha	20391135.00
2	**22 No. of Schedule- I species** reported from the project area.	Rs. 5.00 lakh for each Schedule-I species	11000000.00
Total Cost			**31391135.00**

The total budget allocated focusing on Biodiversity and Wildlife Conservation and Management Plan including conservation and management measures for Schedule-I species is **Rs 31391135.00**. The Break-up of the budget is given in **Table 25**.

State Forest Department shall be the executing agency for implementation of the proposed mitigation measure under Wildlife Management Plan in the surrounding of proposed project site, therefore, a total amount of **Rs 31391135.00** will be deposited with the Rajasthan State Forest Department for taking up proposed activities within the area.

6.2. Breakup of the Budget

As per guidelines issued by Office of Addl. Principal Conservator of Forest and Chief Wildlife Warden, Rajasthan, Jaipur issued by letter no. WCP/CWLW/2019/651-663 dated 24/05/2019, budget allocated under various categories is given below in **Table 27**.

Table 27: Break-up for Wildlife Management Plan

S. No.	Item	% of Total Outlay of Plan (in Rs.)
1	Habitat improvement & mitigative measures and measures to reduce/ minimize the human- animal conflicts (50% of the total cost)	15695567.50
2	Awareness and Extension (10% of the total cost)	3139113.50
3	Support to Forest Department for monitoring, rescue & rehabilitation of Wildlife (10% of the total cost)	3139113.50
4	Contribution towards conservation of Wildlife in PA's (10% of the total cost)	3139113.50
5	Administrative Cost for processing inspections etc. (10% of the total cost)	3139113.50
6	Miscellaneous including Eco- development (10% of the total cost)	3139113.50
	Total	**31391135.00**

Gopi Krushna N
General Manager
Authorised Signatory
Greenko Energies Private Limited

CHAPTER 7

7.1. RELEVANT MAPS

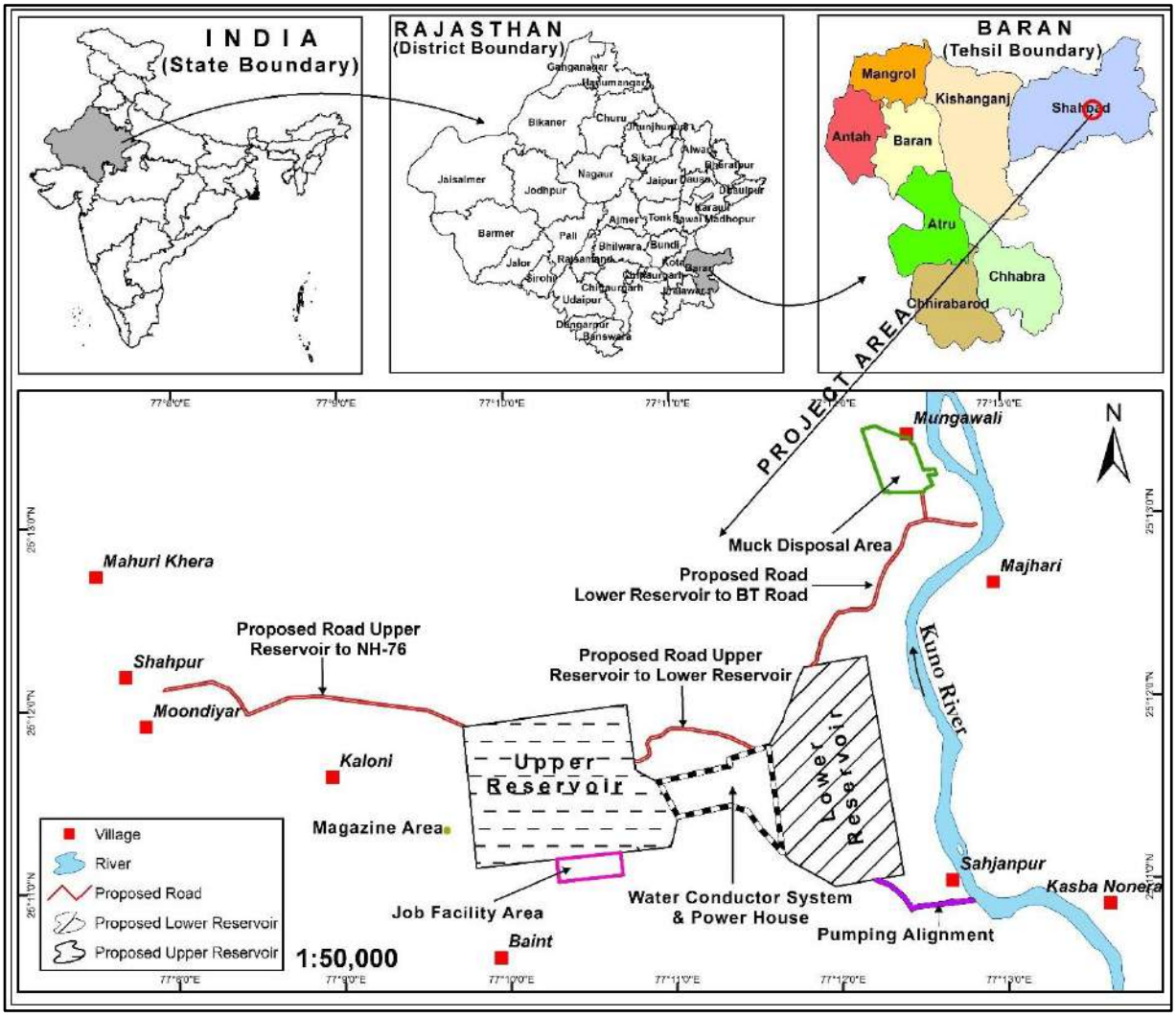


Figure 1: Project Location Map

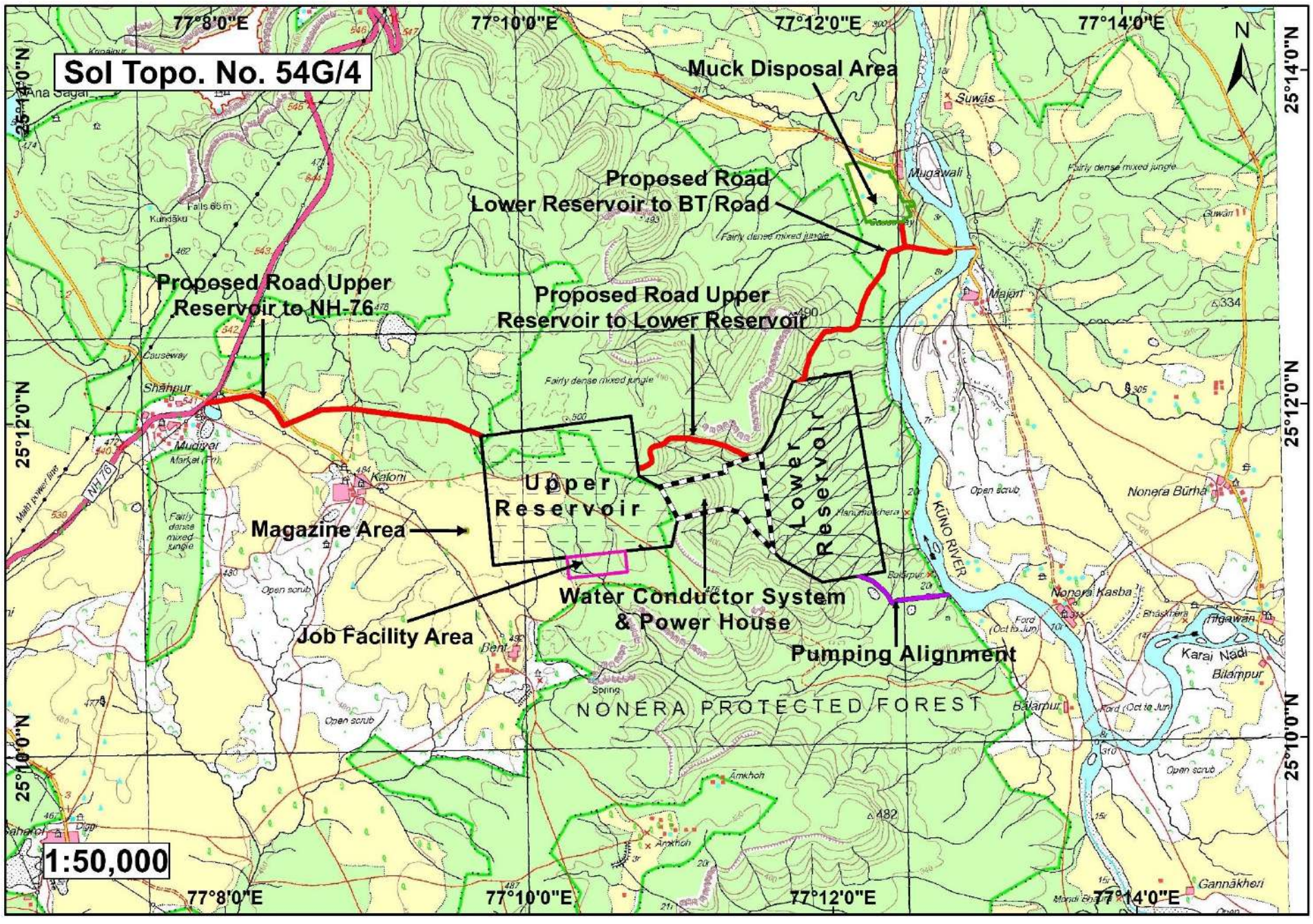


Figure 2: Project Layout on Toposheet

ZOOM VIEW MAP SHOWING GEO-REFERECE SURVEY OF INDIA TOPOSHEET WITH PROPOSED SHAHPUR PUMPED STORAGE ALIGNMENT IN FOREST AND NON-FOREST AREA

Full Title of the Project : "Construction of Shahpur (2520 MW) Pumped Storage Project by M/s Greenko Energies Private Limited"

Proposal No. : FP/RJ/HYD/121439/2021 **Applied Area :** 407.8227 Ha.

PART OF TOPOSHEET NO. 54G/4

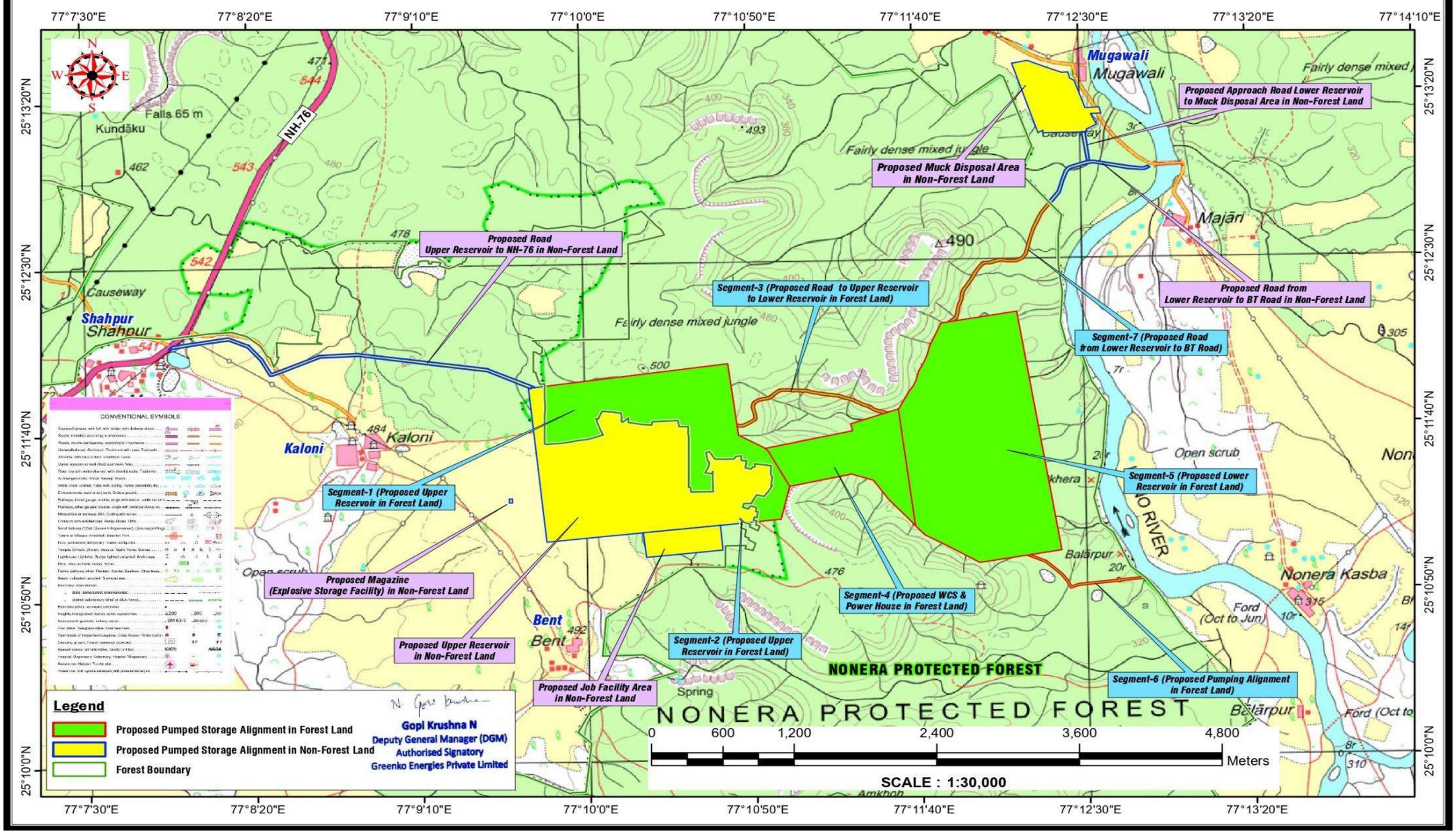


Figure 3: Topo Map of Project layout

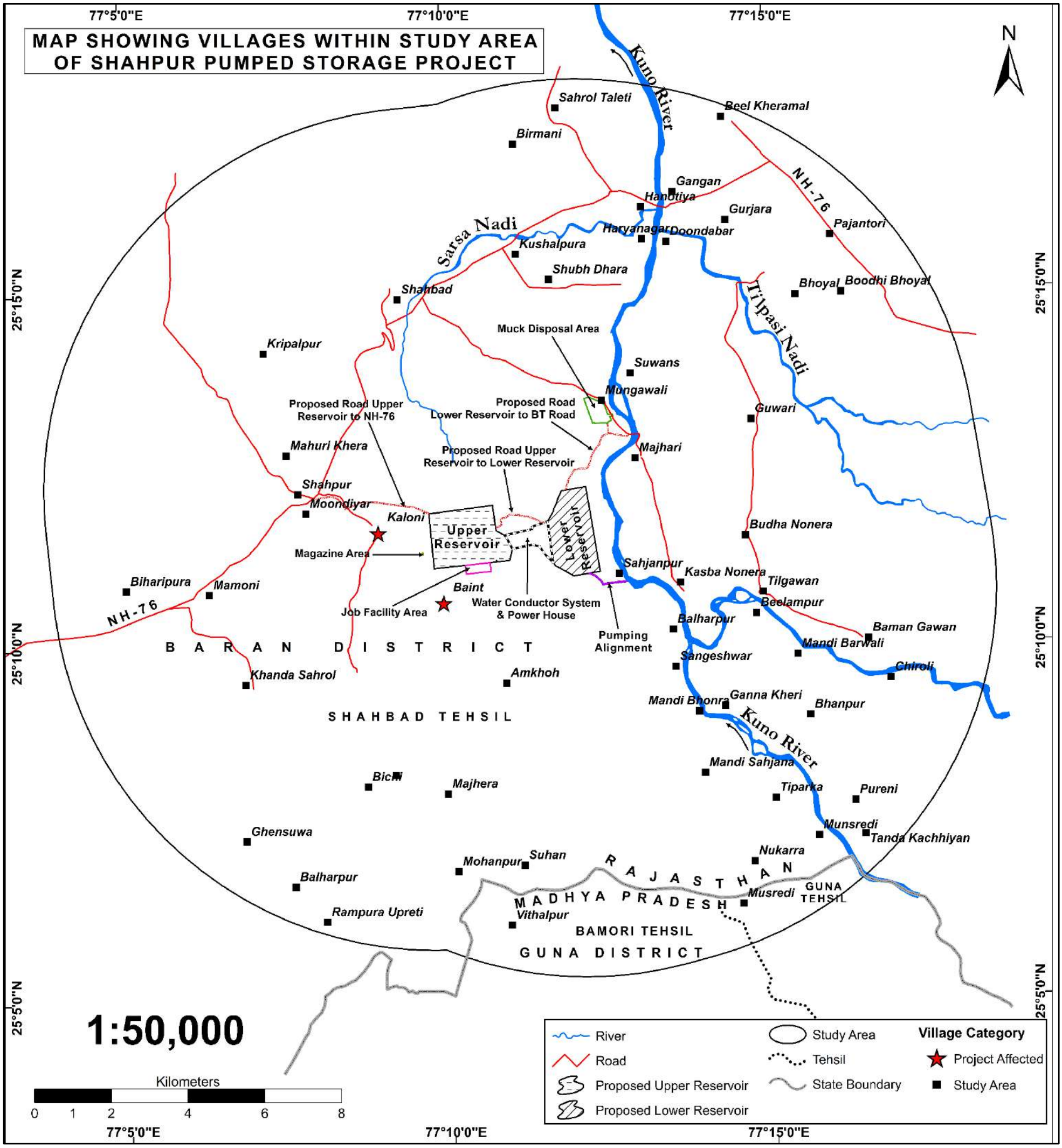


Figure 4: Village Map of the Study Area

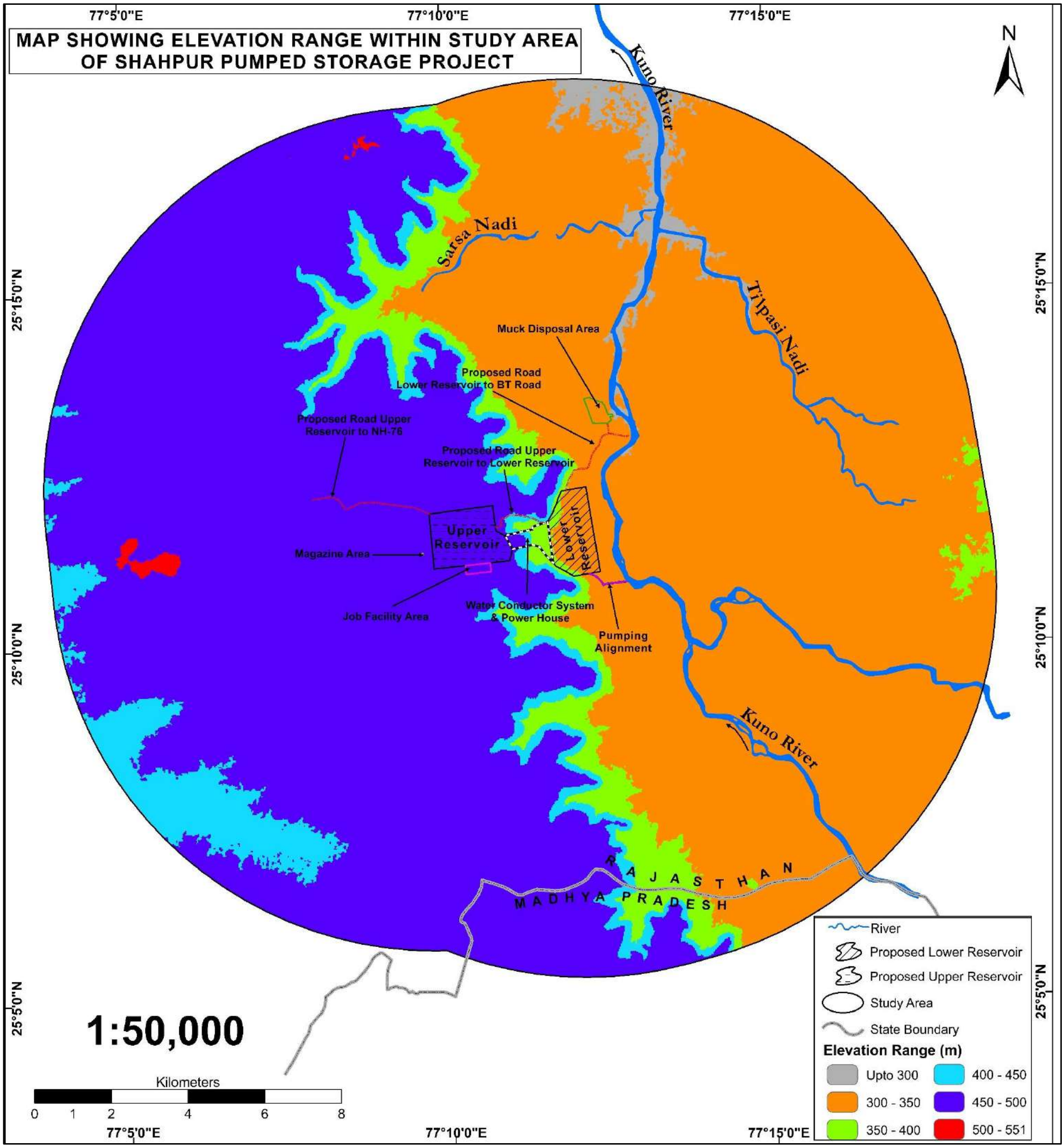


Figure 5: Digital Elevation Map of the Study Area

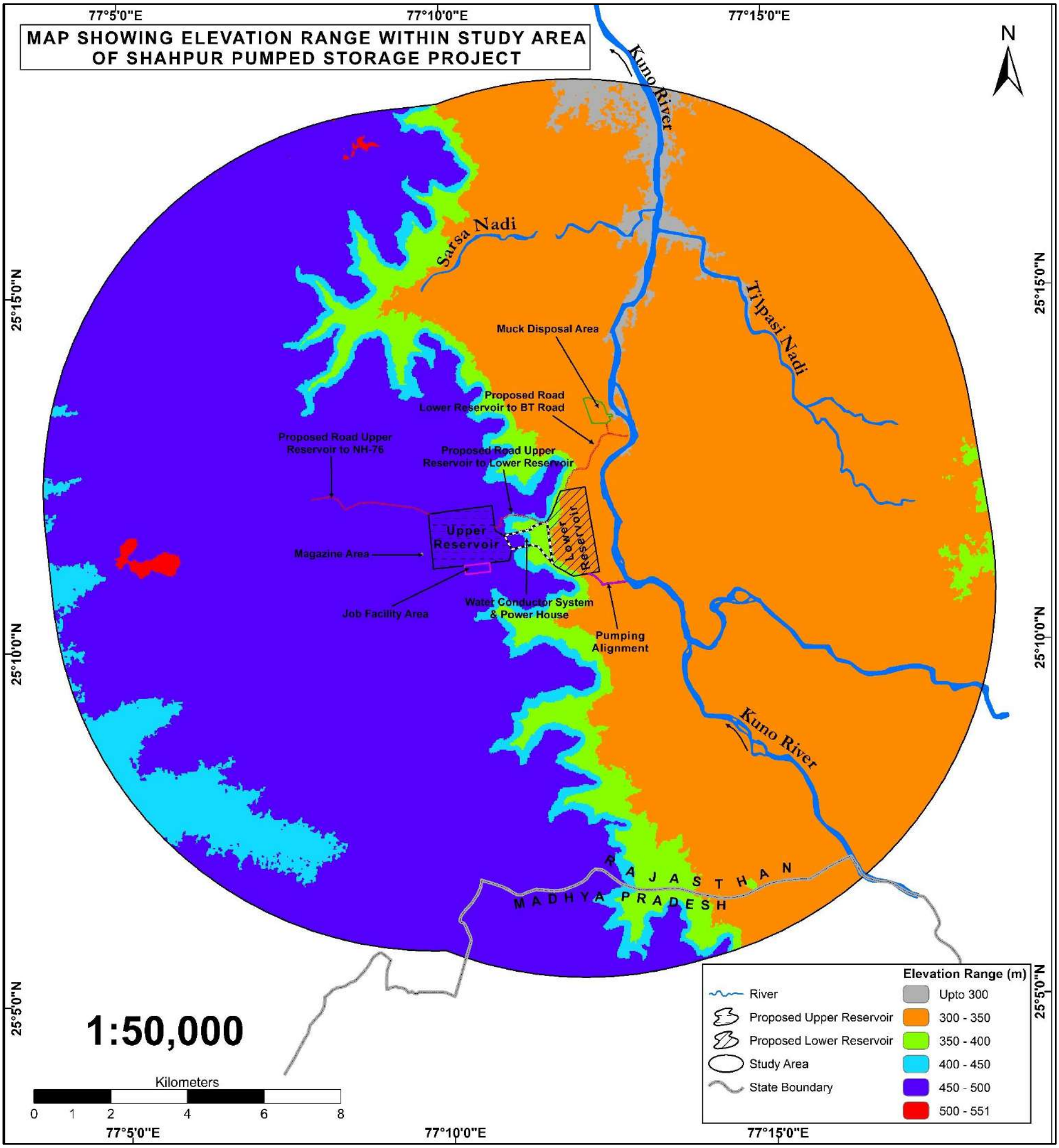


Figure 6: Relief Map of the Study Area

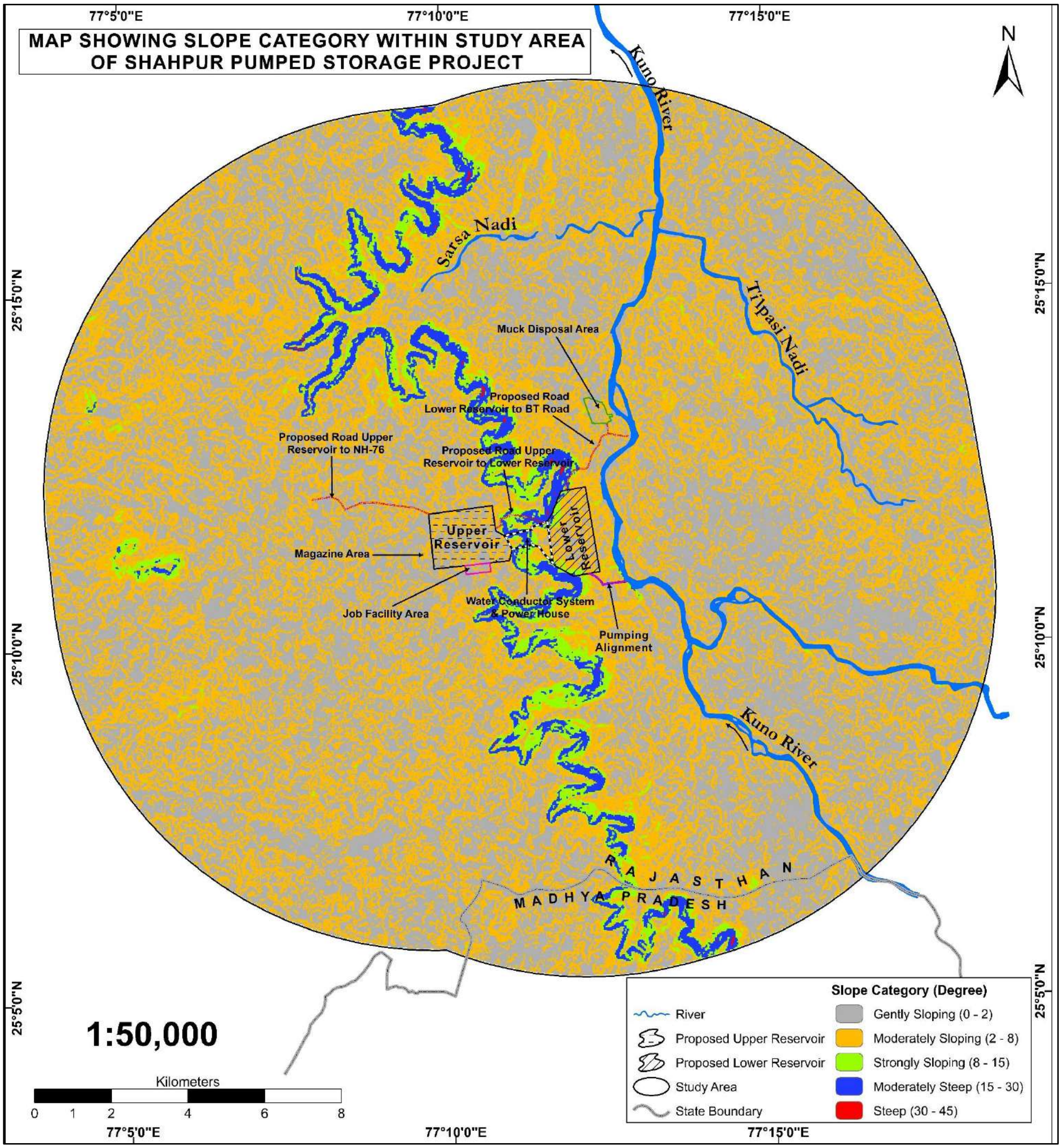


Figure 7: Slope map of the Study Area

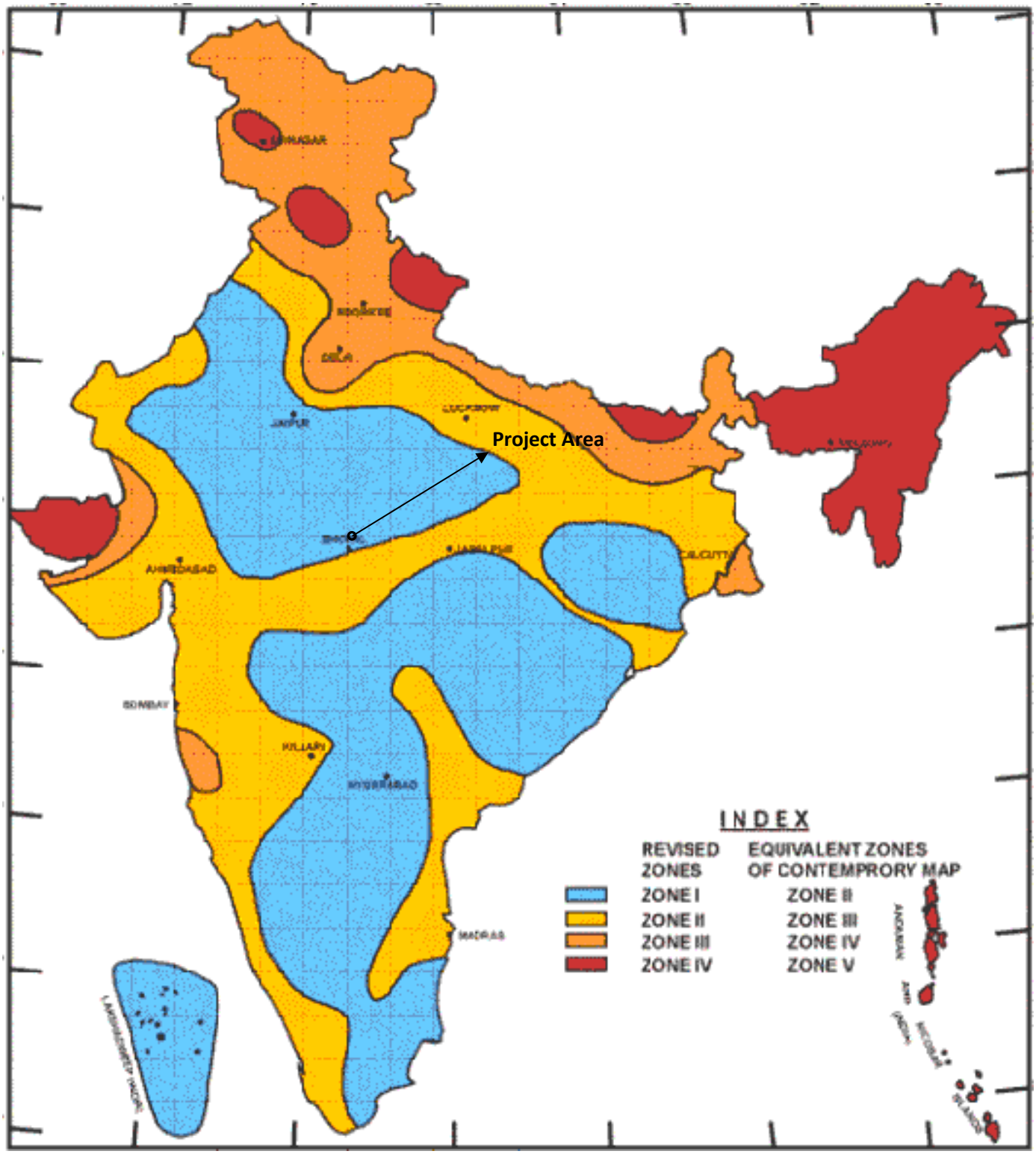


Figure 8: Seismic Zone Map of India

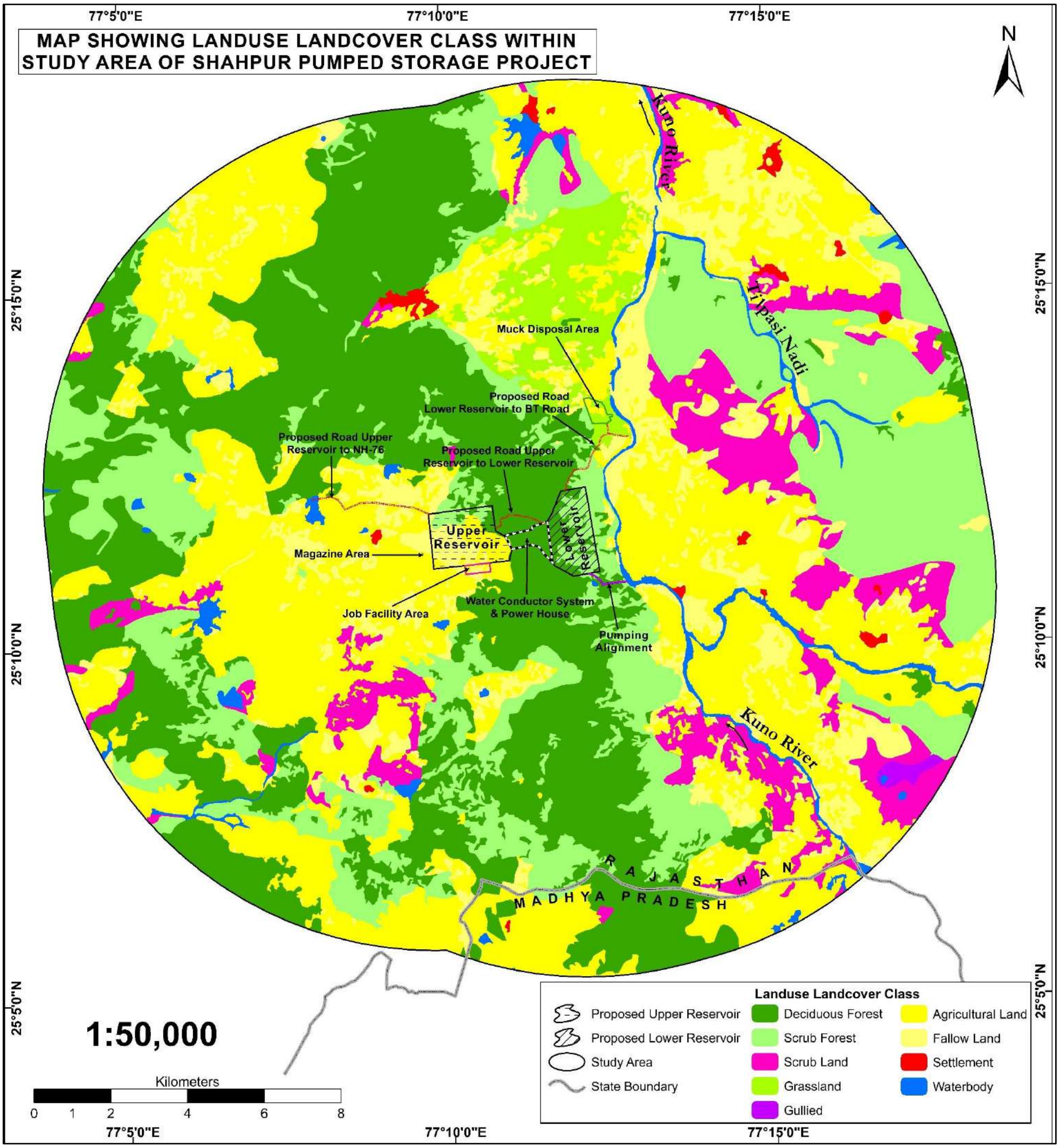


Figure 9: Land Use/ Landcover map of the study area

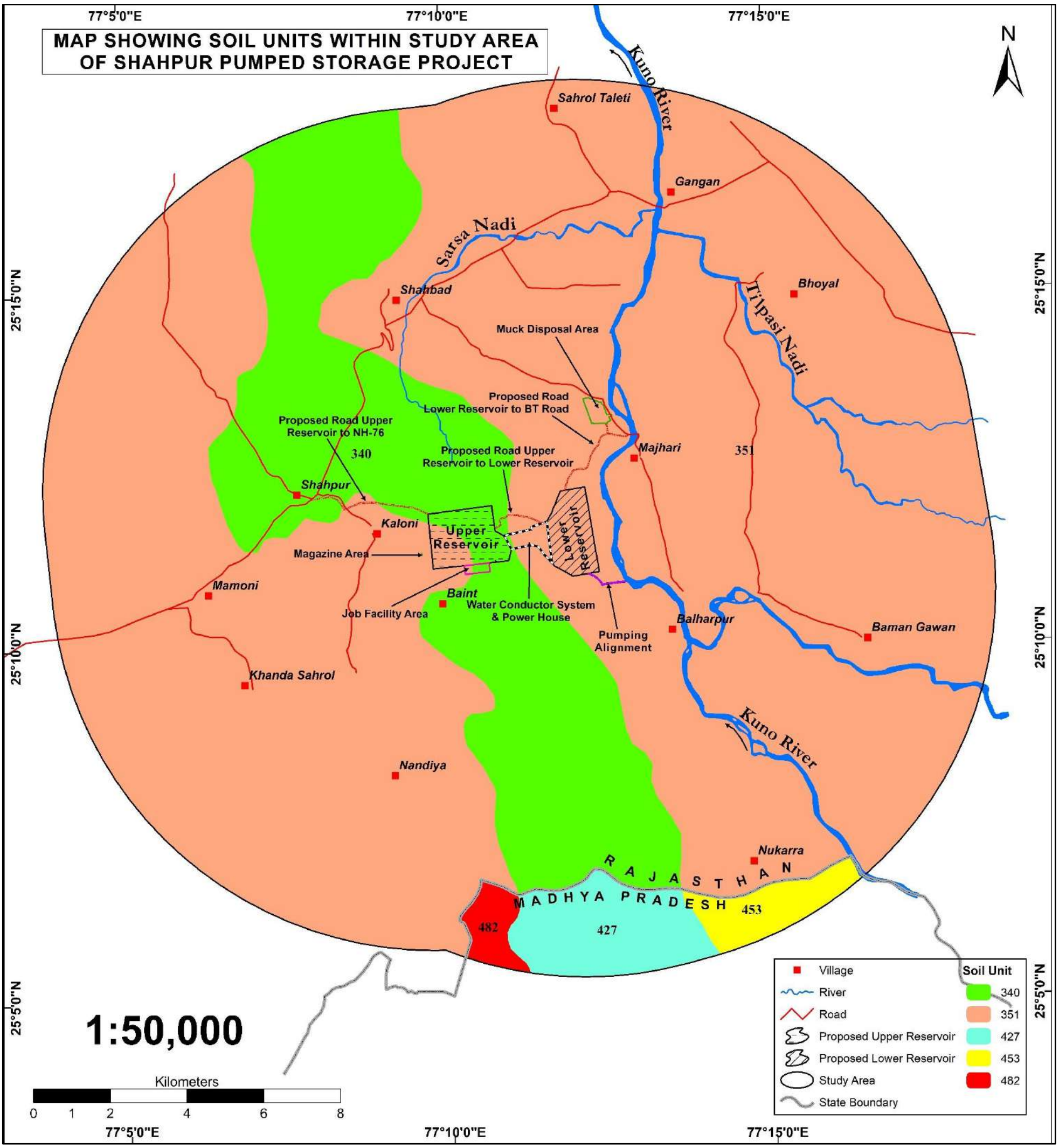


Figure 10: Soil map of the Study Area

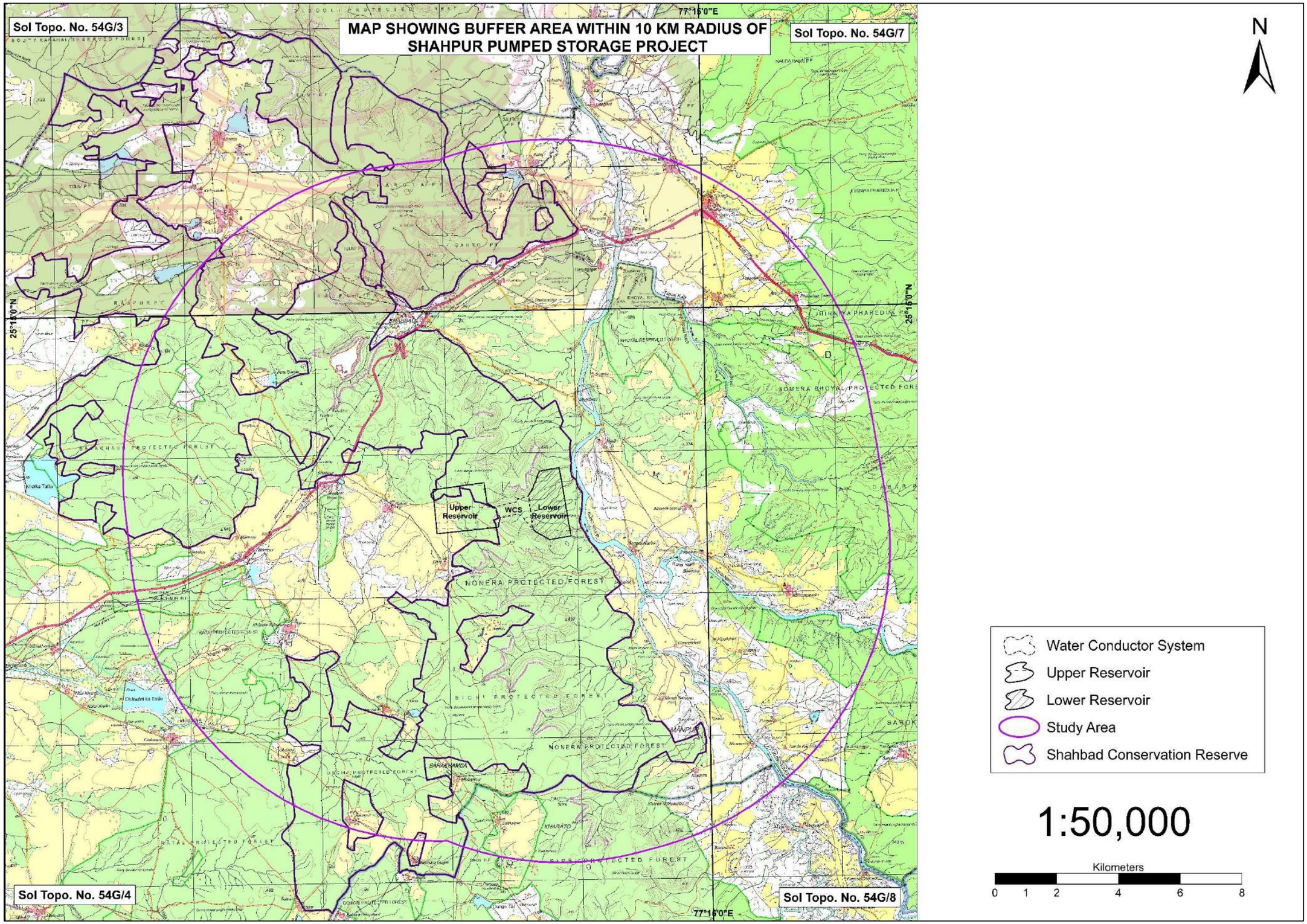


Figure 11: Map showing location of project components w.r.t. Shahabad Conservation Reserves

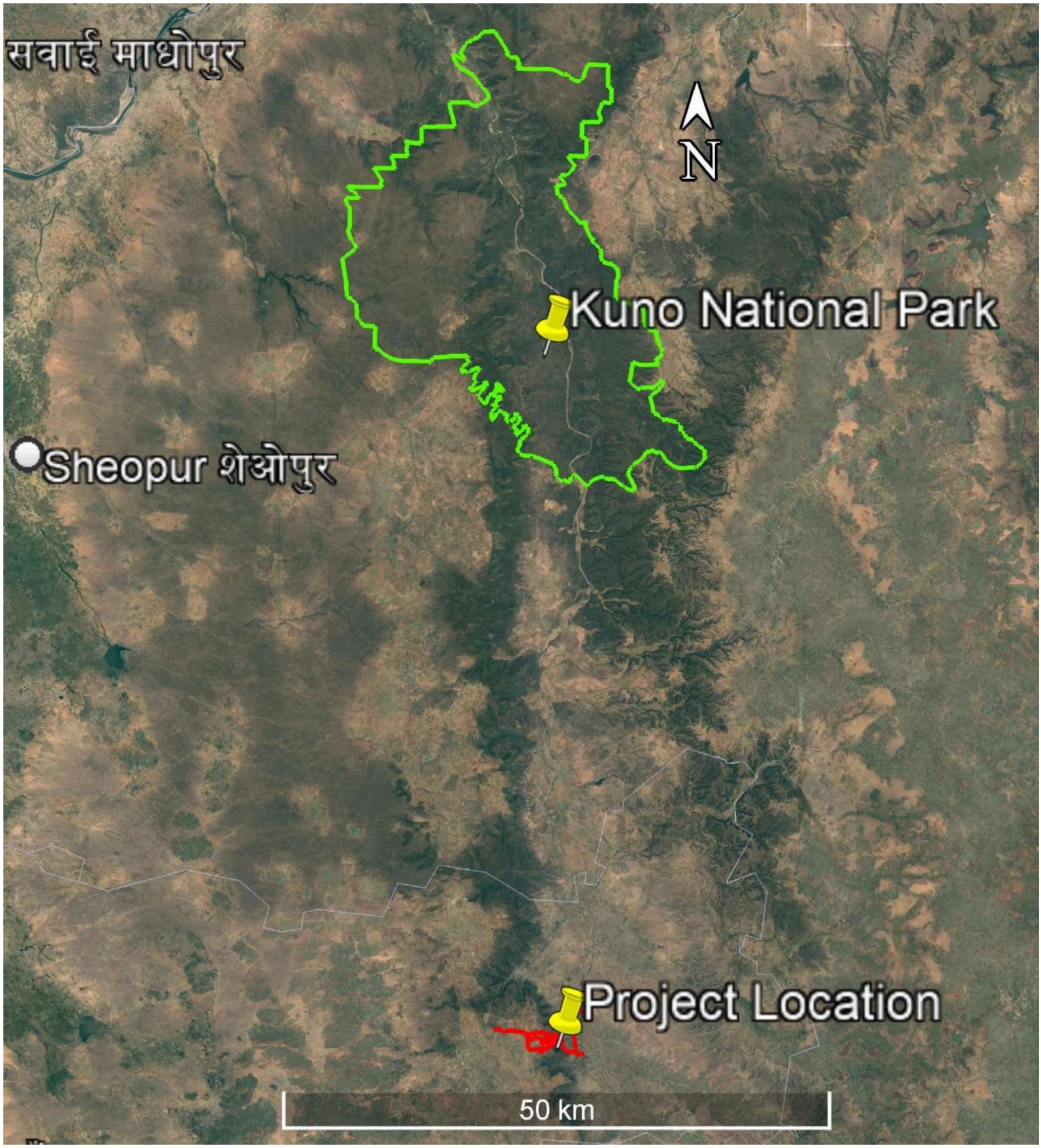


Figure 12: Distance of project components from Kuno National Park on Google Earth Map

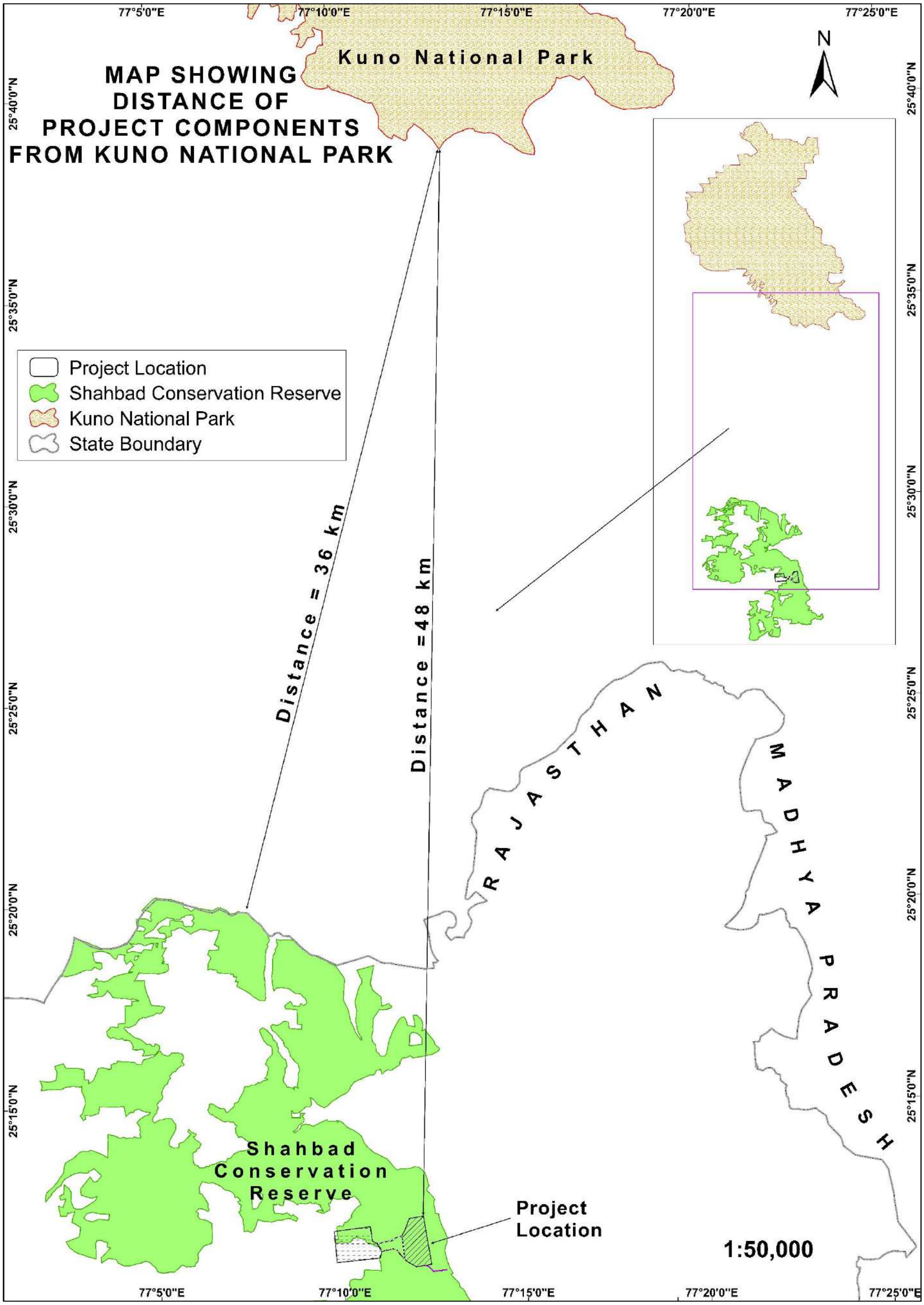


Figure 13: Map showing distance of project components from Kuno National Park

Figure 14: Location of Muck Disposal Site

7.2. ANNEXURES

Annexure I: List Of Plant Species Reported From The Study Area

a. Trees

S. No.	Family	Scientific Name
1	Anacardiaceae	*Mangifera indica*
2	Anacardiaceae	*Buchanania cochinchinensis*
3	Annonaceae	*Annona squamosa*
4	Apocynaceae	*Holarrhena pubescens*
5	Apocynaceae	*Wrightia tinctoria*
6	Arecaceae	*Phoenix sylvestris*
7	Boraginaceae	*Cordia dichotoma*
8	Burseraceae	*Boswellia serrata*
9	Combretaceae	*Anogeissus latifolia*
10	Combretaceae	*Anogeissus pendula*
11	Combretaceae	*Terminalia arjuna*
12	Combretaceae	*Terminalia bellirica*
13	Combretaceae	*Terminalia tomentosa*
14	Cornaceae	*Alangium salviifolium*
15	Ebenaceae	*Diospyros melanoxylon*
16	Ebenaceae	*Diospyros montana*
17	Fabaceae	*Acacia catechu*
18	Fabaceae	*Acacia nilotica*
19	Fabaceae	*Acacia senegal*
20	Fabaceae	*Albizia lebbeck*
21	Fabaceae	*Albizia procera*
22	Fabaceae	*Bauhinia racemosa*
23	Fabaceae	*Bauhinia variegata*
24	Fabaceae	*Butea monosperma*
25	Fabaceae	*Cassia fistula*
26	Fabaceae	*Dalbergia sissoo*
27	Fabaceae	*Delonix regia*
28	Fabaceae	*Desmodium oojeinense*
29	Fabaceae	*Erythrina suberosa*
30	Fabaceae	*Hardwickia binata*
31	Fabaceae	*Parkinsonia aculeata*

S. No.	Family	Scientific Name
32	Fabaceae	*Pithecellobium dulce*
33	Fabaceae	*Pongamia pinnata*
34	Fabaceae	*Prosopis cineraria*
35	Fabaceae	*Prosopis juliflora*
36	Fabaceae	*Tamarindus indica*
37	Lamiaceae	*Tectona grandis*
38	Lythraceae	*Lagerstroemia parviflora*
39	Malvaceae	*Bombax ceiba*
40	Malvaceae	*Grewia tilifolia*
41	Malvaceae	*Kydia calycina*
42	Meliaceae	*Azadirachta indica*
43	Meliaceae	*Melia azedarach*
44	Moraceae	*Ficus benghalensis*
45	Moraceae	*Ficus hispida*
46	Moraceae	*Ficus racemosa*
47	Moraceae	*Ficus religiosa*
48	Moraceae	*Morus alba*
49	Myrtaceae	*Corymbia citriodora*
50	Myrtaceae	*Syzygium cumini*
51	Phyllanthaceae	*Bridelia retusa*
52	Phyllanthaceae	*Phyllanthus emblica*
53	Rhamnaceae	*Ziziphus jujuba*
54	Rubiaceae	*Haldina cordifolia*
55	Rubiaceae	*Mitragyna parvifolia*
56	Rubiaceae	*Neolamarckia cadamba*
57	Rutaceae	*Aegle marmelos*
58	Rutaceae	*Feronia limonia*
59	Sapindaceae	*Sapindus laurifolius*
60	Sapotaceae	*Madhuca longifolia*
61	Simaroubaceae	*Ailanthus excelsa*
62	Ulmaceae	*Holoptelea integrifolia*

b. Shrub

S.No	Family	Scientific Name
1	Acanthaceae	*Justicia adhatoda*
2	Apocynaceae	*Calotropis gigantea*
3	Apocynaceae	*Carissa carandas*
4	Apocynaceae	*Carissa spinarum*
5	Apocynaceae	*Cryptolepis buchananii*

S.No	Family	Scientific Name
6	Apocynaceae	*Gymnema sylvestre*
7	Apocynaceae	*Ichnocarpus frutescens*
8	Apocynaceae	*Nerium oleander*
9	Arecaceae	*Phoenix acaulis*
10	Asparagaceae	*Agave americana*

S.No	Family	Scientific Name
11	Asparagaceae	*Asparagus racemosus*
12	Asteraceae	*Xanthium strumarium*
13	Boraginaceae	*Heliotropium indicum*
14	Cactaceae	*Opuntia elatior*
15	Cannabaceae	*Trema politoria*
16	Capparaceae	*Capparis sepiaria*
17	Celastraceae	*Celastrus paniculatus*
18	Colchicaceae	*Gloriosa superba*
19	Convolvulaceae	*Ipomoea carnea*
20	Euphorbiaceae	*Euphorbia nerifolia*
21	Euphorbiaceae	*Jatropha curcas*
22	Euphorbiaceae	*Ricinus communis*
23	Fabaceae	*Acacia pennata*
24	Fabaceae	*Butea superba*
25	Fabaceae	*Caesalpinia decapetala*
26	Fabaceae	*Flemingia macrophylla*
27	Fabaceae	*Indigofera tinctoria*
28	Fabaceae	*Senna obtusifolia*
29	Fabaceae	*Senna occidentalis*
30	Lamiaceae	*Colebrookea oppositifolia*
31	Lamiaceae	*Vitex negundo*
32	Lythraceae	*Woodfordia fruticosa*
33	Malvaceae	*Abutilon indicum*

S.No	Family	Scientific Name
34	Malvaceae	*Grewia rothii*
35	Malvaceae	*Grewia tenax*
36	Malvaceae	*Helicteres isora*
37	Malvaceae	*Sida cordifolia*
38	Malvaceae	*Thespesia lampas*
39	Menispermaceae	*Tinospora sinensis*
40	Myrtaceae	*Syzygium salicifolium*
41	Oleaceae	*Nyctanthes arbor-tristis*
42	Phyllanthaceae	*Phyllanthus reticulatus*
43	Poaceae	*Dendrocalamus strictus*
44	Primulaceae	*Embelia robusta*
45	Rhamnaceae	*Ziziphus xylopyrus*
46	Rubiaceae	*Gardenia gummifera*
47	Rubiaceae	*Leptodermis lanceolata*
48	Rutaceae	*Murraya koenigii*
49	Salicaceae	*Flacourtia indica*
50	Sapindaceae	*Sapindus emarginatus*
51	Solanaceae	*Datura stramonium*
52	Solanaceae	*Withania somnifera*
53	Tamaricaceae	*Tamarix dioica*
54	Verbenaceae	*Lantana camara*
55	Vitaceae	*Leea asiatica*

c. Herbs

S.No	Family	Scientific Name
1	Acanthaceae	*Achyranthes aspera*
2	Acanthaceae	*Achyranthes bidentata*
3	Acanthaceae	*Andrographis paniculata*
4	Acanthaceae	*Eranthemum pulchellum*
5	Acanthaceae	*Rungia repens*
6	Acoraceae	*Acorus calamus*
7	Amaranthaceae	*Aerva lanata*
8	Anthericaceae	*Chlorophytum tuberosum*
9	Apocynaceae	*Catharanthus roseus*
10	Apocynaceae	*Cryptolepis dubia*
11	Apocynaceae	*Rauvolfia serpentina*
12	Araceae	*Colocasia esculenta*
13	Asparagaceae	*Drimia indica*
14	Asteraceae	*Acanthospermum hispidum*
15	Asteraceae	*Artemisia annua*
16	Asteraceae	*Aster peduncularis*
17	Asteraceae	*Bidens biternata*
18	Asteraceae	*Bidens pilosa*

S.No	Family	Scientific Name
19	Asteraceae	*Erigeron canadensis*
20	Asteraceae	*Parthenium hysterophorus*
21	Asteraceae	*Sonchus asper*
22	Asteraceae	*Tridax procumbens*
23	Cactaceae	*Opuntia stricta*
24	Cannabaceae	*Cannabis sativa*
25	Capparaceae	*Capparis zeylanica*
26	Convolvulaceae	*Convolvulus prostratus*
27	Convolvulaceae	*Cuscuta reflexa*
28	Cucurbitaceae	*Mukia maderaspatana*
29	Cyperaceae	*Cyperus rotundus*
30	Euphorbiaceae	*Baliospermum solanifolium*
31	Euphorbiaceae	*Chrozophora oblongifolia*
32	Euphorbiaceae	*Euphorbia hirta*
33	Fabaceae	*Abrus precatorius*
34	Fabaceae	*Acacia polyacantha*
35	Fabaceae	*Alysicarpus monilifer*

S.No	Family	Scientific Name
36	Fabaceae	*Alysicarpus rugosus*
37	Fabaceae	*Bauhinia vahlii*
38	Fabaceae	*Crotalaria medicaginea*
39	Fabaceae	*Desmodium gangeticum*
40	Fabaceae	*Flemingia chappar*
41	Fabaceae	*Indigofera cassioides*
42	Fabaceae	*Mimosa pudica*
43	Fabaceae	*Senna alexandrina*
44	Fabaceae	*Senna tora*
45	Fabaceae	*Tephrosia purpurea*
46	Hypericaceae	*Hypericum gaitii*
47	Hypoxidaceae	*Curculigo orchioides*
48	Lamiaceae	*Ajuga integrifolia*
49	Lamiaceae	*Ocimum basilicum*
50	Lamiaceae	*Ocimum sanctum*
51	Malvaceae	*Abelmoschus moschatus*
52	Malvaceae	*Corchorus aestuans*
53	Nyctaginaceae	*Boerhavia diffusa*
54	Papaveraceae	*Argemone mexicana*
55	Phyllanthaceae	*Glochidion lanceolarium*
56	Plantaginaceae	*Lindenbergia indica*
57	Poaceae	*Apluda mutica*
58	Poaceae	*Aristida adscensionis*
59	Poaceae	*Brachiaria eruciformis*
60	Poaceae	*Cenchrus ciliaris*
61	Poaceae	*Cymbopogon martini*
62	Poaceae	*Cynodon dactylon*
63	Poaceae	*Dichanthium aristatum*
64	Poaceae	*Digitaria ciliaris*
65	Poaceae	*Echinochloa colona*
66	Poaceae	*Eragrostis amabilis*
67	Poaceae	*Erianthus munja*
68	Poaceae	*Heteropogon contortus*
69	Poaceae	*Imperata cylindrica*
70	Poaceae	*Ischaemum pilosum*
71	Poaceae	*Pennisetum glaucum*
72	Poaceae	*Saccharum spontaneum*
73	Poaceae	*Setaria pumila*
74	Poaceae	*Themeda quadrivalvis*
75	Poaceae	*Vetiveria zizanioides*
76	Polygonaceae	*Rumex hastatus*
77	Primulaceae	*Anagallis arvensis*
78	Rhamnaceae	*Ziziphus nummularia*
79	Rubiaceae	*Galium aparine*
80	Smilacaceae	*Smilax macrophylla*
81	Smilacaceae	*Smilax zeylanica*
82	Solanaceae	*Datura metel*
83	Solanaceae	*Solanum americanum*
84	Vitaceae	*Leea macrophylla*
85	Xanthorrhoeaceae	*Aloe vera*
86	Zygophyllaceae	*Tribulus terrestris*

Annexure-2

No. J-12011/02/2020-IA-I
Government of India
Ministry of Environment, Forest & Climate Change
(IA.I Division)

Indira Paryavaran Bhawan
3rd Floor, Vayu Wing
Jor Bagh Road
New Delhi-110 003

Dated: 13th April, 2020

To

M/s Greenko Energies Private Limited
Plot No. 1071, Road No. 44
Jubilee Hills, Hyderabad-500033
Telangana

Sub: Shahpur Pumped Storage Project (**2520 MW**) in District Baran, Rajasthan by M/s Greenko Energies Private Limited- reg. Terms of Reference (ToR).

Sir,

This has reference to online proposal No. IA/RJ/RIV/142374/2020 and letter no SHAHPUR/SPSP/MoEF&CC /ToR/ 20200210 Dated 10.02.2020 submitted to the Ministry for ToR to the project cited in the subject.

2. The above referred proposal was considered by the Expert Appraisal Committee (EAC) for River Valley & Hydroelectric projects in its 31st meeting held on 05.03.2020. The comments and observations of EAC on the project may be seen in the Minutes of the meeting which are available on the web-site of this Ministry.

3. Above proposal is for to develop Pumped Storage Project (PSP) in Shahpur (Village), Shahabad (Tehsil) of Baran (District) in the State of Rajasthan. Total capacity of the proposed PSP is 2520 MW (17640 MWH, based on 7-hour operation per day). Project involves creation of new upper reservoir and lower reservoirs consisting of rock fill embankment with central clay core. The geographical coordinates of the proposed upper reservoir are at Latitude 25°11'25.21"North and Longitude is 77°10'55.78" East and that of lower reservoir are at 25°11'40.00" North and 77°11'50.00" East.

4. The upper reservoir is proposed to be located on flat / gradually sloping land which is suitable for creating the desired gross storage capacity of 1.70 TMC. Out of 1.70 TMC, the live storage capacity is 1.63 TMC and the dead storage capacity is 0.075 TMC by keeping FRL & MDDL at EL 512.00m & EL 489.00m, respectively. For creating this storage, it is proposed to construct rockfill embankment for the average height of around 28 m (with maximum height of 30m) for the length of 6985m. Similarly, the lower reservoir is proposed to be located in the

flat / gradually sloping portion which is suitable for creating the desired gross storage capacity of 1.71 TMC in which the live storage capacity is 1.64 TMC and dead storage capacity is 0.07 TMC by keeping FRL and MDDL at EL 354.00m & EL 323.00m, respectively. For creating this storage, it is proposed to construct rockfill embankment for the average height of 34m (with maximum height of 42m) for the length of 3842 m.

5. Water conductor system consist of 52.20m high Power Intake Structure; 8 nos. each of 909 m long and 7.5m dia. surface circular steel lined Penstock / Pressure Shaft (i.e. consisting of 711 m long surface penstock, 121 m long vertical pressure shaft and 77 m long Horizontal pressure shaft) to feed 8 units of 315 MW; A surface Powerhouse having an installation of eight nos. reversible Francis turbine each of 315 MW capacity (6 units of fixed speed and 2 units of variable speed turbines) operating under a rated head of 157.00m in generating mode and 168.00m in pumping mode. 8 nos. 8.5 m diameter,190m long Tailrace Tunnel. 125 m wide and FSD of 5.5m is the Tail race channel of 953 m long joining with the proposed lower reservoir. As such, the proposed project will generate 2520 MW by utilizing design discharge of 1817.98 Cumec with rated head of 157.00 m. Upper and lower reservoir (both are to be constructed newly) and one-time water will be pumped from existing nearby Shahabad Kuno river to the proposed Shahpur Standalone PSP lower reservoir which is about 150 m away from the toe of the embankment of lower reservoir

6. Total land required for construction of various components, including infrastructure facilities and muck disposal area is estimated to be around 777.44 ha, involving 543.52 ha of forest land and 233.92 ha of non-forest land. An estimated cost of the project is Rs. 11736.73 Crores. As per the Form 1 there is no Protected Area notified under the Wild Life (P) Act, 1972; Critically Polluted areas as identified by the CPCB constituted under the Water (P) Act 1974; Eco Sensitive Areas as notified within 10 km of the project boundary.

7. The above proposal was appraised by the EAC in the 31st meeting held on 05.03.2020. EAC in the 31st meeting held on 05.03.2020 deliberated on the information submitted (Form 1, PFR, kml file, etc.) and as presented in the meeting and observed that in the instant project upper is located away from all existing natural water systems and have no/negligible catchment area therefore CAT Plan, RIM treatment, L-section of river and Environmental flow study for the upper and lower reservoir will not be required under EMP.

8. Based on recommendations of the EAC, the Ministry of Environment, Forest & Climate Change hereby **accords a fresh Terms of Reference (TOR)** as per the Standard ToR (Hydro projects) for the proposed activity as per the provisions of the Environmental Impact Assessment Notification, 2006 and as amended time to time along with the following additional ToR for preparation of EIA/EMP report:

<u>Standard ToR</u>

The EIA/EMP report should contain the information in accordance with provisions & stipulations as given in the **Standard ToR for hydro projects (***Please visit the following link to download the Standard ToR:*

http://environmentclearance.nic.in/writereaddata/standardtorreference.pdf.

Additional ToR

i. Land acquired for the project shall be suitably compensated in accordance with the law of the land with the prevailing guidelines. Private land shall be acquired as per provisions of Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.

ii. The project involves diversion of about **543.52 ha** of forestland. Forest clearance shall be obtained as per the prevailing norms of Forest (Conservation) Act, 1980.

iii. Application to obtain prior approval of Central Government under the Forest (Conservation) Act, 1980 for diversion of forest land required should be submitted as soon as the actual extent of forest land required for the project is known, and in any case, within six months of issuance of this letter.

iv. Funds allocation for Corporate Environment Responsibility (CER) shall be made as per O.M. No. 22-65/2017-IA.III dated 01.05.2018 for various activities therein.

v. The details of funds allocation and activities for CER shall be incorporated in EIA/EMP report.

vi. The EIA report should clearly mention activity wise EMP and CER cost details and should earmarked clear break-up of the capital and recurring cost along with the timeline for incurring the capital cost.

vii. Consolidated EIA/EMP report is to be submitted as per the generic structure (Appendix III & IIIA) given in the EIA Notification, 2006.

viii. Conservation plan for the Scheduled I species, if any, in the project study area shall be prepared and submitted to the Competent Authority for approval.

ix. Pre-DPR Chapters viz., Hydrology and Layout Map and Power Potential Studies duly approved by CWC/CEA shall be submitted.

x. Dam break analysis, Disaster Management Plan and Fisheries Management Plan be prepared and submitted in the EIA/EMP report.

xi. Environmental matrix during construction and operational phase needs to be submitted.

xii. Both capital and recurring expenditure under EMP shall be submitted.

xiii. Impact of developmental activity/project on the wildlife habitat, if any, within 10 km of the project boundary shall be studied.

xiv. The consultant engaged for preparation of EIA/EMP report has to be registered with Quality Council of India (QCI/ NABET) under the scheme of Accreditation & Registration of MoEF& CC. This is a pre-requisite.

xv. Consultant shall include a "Certificate" in EIA/EMP report regarding portion of EIA/EMP prepared by them and data provided by other organization(s)/ laboratories including status of approval of such laboratories. Declaration by the Consultant that information submitted in the EIA/EMP is factually correct and shall be submitted along with EIA/EMP reports.

xvi. An undertaking as part of the EIA report from Project proponent, owning the contents (information and data) of the EIA report with the declaration about the contents of the EIA report pertaining to a project have not been copied from other EIA reports.

xvii. The draft EIA/EMP report prepared as per the Generic Structure (Appendix III of EIA Notification, 2006) incorporating information as per the Standard ToR, should be submitted to the State Pollution Control Board concerned for conducting Public Consultation, district wise, as per the provisions stipulated in EIA Notification, 2006. Public Hearing, which is a part of Public Consultation, shall be held district wise at the site or in its close proximity as prescribed in Appendix (IV) of EIA Notification, 2006. The draft EIA/EMP report is to be submitted to SPCB sufficient before the expiry of the ToR validity so that necessary amendments in EIA/EMP can be undertaken based on public hearing and the same is to be submitted to MoEF&CC before expiry of validity.

xviii. All the tasks including conducting public hearing shall be done as per the provisions of EIA Notification, 2006 and as amended from time to time. Public hearing issues raised and compliance of the same shall be incorporated in the EIA/EMP report in the relevant chapter. Final EIA/EMP report should be submitted to the Ministry for Environmental Clearance only after incorporating these issues, before the expiry of validity of ToR.

xix. As per Ministry's Notification 17.02.2020, the ToR will remain valid for a period of 5 years from the date of issue of this letter for submission of EIA/EMP report along with public consultation. The ToR will stand lapsed after completion of 5 years in case final EIA/EMP is not submitted.

xx. Baseline data and public consultation shall not be older than 3 years, at the time of submission of the proposal, for grant of Environmental Clearance.

xxi. In case of any change in the scope of the project such as capacity enhancement, change in submergence, etc., fresh scoping clearance has to be obtained.

xxii. The PP should submit a copy of TEC of the DPR along with EIA/EMP report.

xxiii. Details of the name and number of posts to be engaged by the project proponent for implementation and monitoring of environmental parameters be specified in the EIA report.

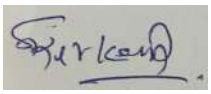
xxiv. The EIA/ EMP report must contain an Index showing details of compliance of all ToR conditions. The Index will comprise of page No. etc., vide which compliance of a specific ToR is available. It may be noted that without this index, EIA/ EMP report will not be accepted.

xxv. The PP should complete all the tasks as per the provisions of EIA Notification, 2006 and as amended time to time) and submit the application for final clearance within the stipulated time.

xxvi. Appropriate Biodiversity Conservation and Management plan for the Native, Rare & Endangered floral and faunal species getting affected due to the project shall be prepared.

This has approval of the Competent Authority.

Yours faithfully,

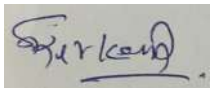


(Dr. S. Kerketta)
Director

Telefax: 011-24695314

Copy to:

1. The Secretary, Ministry of Water Resources, RD & GR, Sharm Shakti Bhawan, Rafi Marg, New Delhi-3.
1. The Secretary, Ministry of Power, Sharm Shakti Bhawan, Rafi Marg, New Delhi-110001.
2. The Pr. Secretary to Government Energy Department, Govt. of Rajasthan, Room No. 8340, SSO Building, Government Secretariat, Jaipur, Rajasthan
3. The Principal Chief Conservator of Forests, (HOFF), Rajasthan, Aranya Bhawan, Jhalana Institutional Area, Jaipur-302004, Rajasthan.
4. The Member Secretary, Rajasthan State Pollution Control Board, 4, Jhalana Institutioal Area, Jhalana Doongri, Jaipur, Rajastan-302004
5. The Chief Engineer, Project Appraisal Directorate, Central Water Commission, Sewa Bhawan R.K. Puram, New Delhi-110066.
6. The Deputy Director General of Forests (C), Regional Office (CZ), Ministry of Environment, Forest & Climate Change, Kendriya Bhawan, 5thFloor, Sector "H", Aliganj, Lucknow — 226020
7. Sr. PPS to JS(GM)
8. NIC Cell of MoEF&CC with a request to upload on MoEF&CC Website.
9. Guard File.



(**Director**)