

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 (I) 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. Gopal Kumar
Authorized Signatory



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
Phone: +91-124-4295383: www.rstechnologies.co.in

CONTENTS

	Page No.
Executive Summary	i
CHAPTER - 1	1
1.1. BRIEF NOTE ABOUT THE PROJECT AND ITS UTILITY	1
1.1.1 Project Location	1
1.1.2 Project Description	1
1.1.3 Land Requirement	2
1.1.4 Project Benefits	3
1.2. PROVISIONS OF ALL RELEVANT ACTS AND REGULATION	3
1.2.1. The Electricity Act, 2003	4
1.2.2. The Forest (Conservation) Act, 1980	4
1.2.3. The Environment (Protection) Act of 1986	4
1.2.4. Air (Prevention and Control of Pollution) Act of 1981	4
1.2.5. Water (Prevention and Control) Act, of 1974	5
1.2.6. Wildlife Protection Act, 1972	5
1.2.7. Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016	5
1.2.8. Solid Waste Management Rules, 2016	5
1.2.9. National Environment Tribunal Act, 1995	6
1.3. Villages and habitations within the area	6
1.3.1. Socio-economic Profile of Villages in the Study Area	6
1.3.2. Demographic Profile of Project Affected Villages, i.e., Kaloni, Baint and Mungawali	10
1.3.3. Social Survey of Project Affected Village	11
1.3.4. Main Agricultural Crops Grown in the Area	12
1.3.5. Livestock's	13
1.3.6. Dependency on Forest Resources	13
1.3.7. Historical, Religious and Archaeological Importance Places	13
1.4. Physical Environment	13
1.4.1. Physiography	13
1.4.2. Drainage	14
1.4.3. Geology	14
1.4.4. Land use/Landcover	20
1.4.5. Meteorology	20
1.4.6. Soil	21
1.5. Details of Linear Structure in Project Area	22
1.6. Description of Flora and Fauna of the Project Area	22
1.6.1. Floristic Diversity	22
1.6.2. Faunal Diversity	25
1.7. Description of Forest and Habitat Condition	29
1.7.1. Vegetation Profile of the Study Area	29
1.7.2. Faunal Species Sighted During Survey	30
1.7.3. Protected Areas	33
1.8. Wildlife Movement in the Area	33
1.9. Man-Animal Conflict and Depredation Caused By The Wild Animals	33
1.10. Indicative Plans of the Present Projects	34

1.11. The List of Experts Involved And Sampling Procedures Adopted	34
1.12. Brief Note About Literature Reviewed	35
1.13. Relevant Geographical Maps	36
CHAPTER 2	37
2.1. Details Of Investigated Environmental Impacts	37
2.1.1. Impacts on Air Quality	37
2.1.2. Impact on Noise Environment	38
2.1.3. Water Environment	41
2.1.4. Land Environment	42
2.1.5. Impacts on Forests and Forest Land	43
2.1.6. Flora and Fauna	43
2.1.7. Impacts on Socio-economic Environment	44
2.2. Measures For Minimizing/Offsetting Adverse Impacts	45
2.3. Irreversible And Irretrievable Commitments Of Environmental Components	46
2.4. Assessment Of Significance Of Impacts	46
2.5. Study technique adopted and observations of the experts in the field	50
CHAPTER 3	51
3.1. Objective of Wildlife Conservation Plan	51
3.2. Mitigation Measures	51
CHAPTER 4	53
4.1. Proposed Management Strategies Within The Project Site	53
4.1.1 Mitigation Measures	53
4.1.2 Management Measures	54
4.2. Locations of the Proposed Interventions	56
4.3. Environment Management Plan overlapping in Nature	56
4.4. Plan period	56
CHAPTER 5	58
5.1. Proposed Management Strategies Within The Buffer Area (10.0km Radius of Proposed Project Components)	58
5.2. Wildlife Management Plan	58
5.2.1. Purpose of Report	58
5.2.2. Threats to Biodiversity & Wildlife	58
5.2.3. Objectives of Management	60
5.2.4. Mitigation Measures	60
5.3. Conservation and Management Measures	60
5.3.1. Wildlife Habitat Preservation & Improvement	60
5.4. Conservation And Management of Schedule-I Species	62
5.4.1. Schedule-I Species Reported from the Area	63
5.4.2. Conversation Measures for Schedule-I Species	64
5.4.2.1. Habitat Description for Different Faunal Species	64
5.4.2.2. Threats	66
5.4.3. Habitat Conservation and Management Measures	67
5.4.4. Management Measures	69
5.4.4.1. Veterinary care	69

5.4.4.2. Training to Local Youth	70
5.4.4.3. Prevention of Forest Fire	70
5.4.4.4. Construction and Maintenance of Water Holes/ Ponds in Wildlife Habitat	70
5.4.4.5. Training and Capacity building	70
5.5. Safeguards during construction phase	70
5.6. Strengthening of Infrastructural Facilities of Forest Department	71
CHAPTER 6	72
6.1. Budgetary Provisions	72
6.2. Breakup of the Budget	72
CHAPTER 7	73
7.1. Relevant Maps	73
7.2. Annexures	87

LIST OF TABLES

Table 1: Land Requirement of Shahpur Pumped Storage Project.....	2
Table 2: List of Villages of the Study Area	6
Table 3: Demographic Profile of Study Area	7
Table 4: Profile of Working Population in the Study Area	8
Table 5: Basic Amenities & Available Infrastructure in the Study Area	9
Table 6: Area under different elevation categories	14
Table 7: Area under different slope categories.....	14
Table 8: Area under different land use/ landcover classes	20
Table 9: Soil Taxonomic groups in the Study Area	22
Table 10: List of Plant Species recorded during field survey.....	22
Table 11: Conservation Status (IUCN Ver. 2022-2) of Plant Species	24
Table 12: List of Mammalian Species Reported in the Study Area	25
Table 13: List of birds reported from the study area with their conservation status	26
Table 14: List of Herpetofauna Reported from the Study Area	28
Table 15: Butterflies recorded from Study Area	28
Table 16: Forest types found in the Study Area	29
Table 17: Environmental Management Plan for Proposed Project Area	34
Table 18: Sampling Locations for Floristic and Faunal Survey	35
Table 19: Equivalent Noise Levels due to Operation of Construction Equipment	38
Table 20: Decrease in Sound Levels with Distance from Source*	39
Table 21: Noise generated due to blasting.....	40
Table 22: Maximum Exposure Periods Specified by OSHA	40
Table 23: Impact Assessment Matrix	47
Table 24: Mitigation and management measures	51
Table 25: Faunal Species reported from the study area under Schedule-I of The Wildlife (Protection) Amendment Act, 2022	62
Table 26: Habitat description of Schedule I Faunal Species	63
Table 27: Break-up for Wildlife Management Plan	71

LIST OF FIGURES

Figure 1: Project Location Map	72
Figure 2: Project Layout on Toposheet	73
Figure 3: Topo Map of Project layout.....	74
Figure 4: Village Map of the Study Area.....	75
Figure 5: Digital Elevation Map of the Study Area	76
Figure 6: Relief Map of the Study Area	77
Figure 7: Slope map of the Study Area.....	78
Figure 8: Seismic Zone Map of India	79
Figure 9: Land Use/ Landcover map of the study area	80
Figure 10: Soil map of the Study Area	81
Figure 11: Map showing location of project components w.r.t. Shahabad Conservation Reserves .	82
Figure 12: Distance of project components from Kuno National Park on Google Earth Map.....	83
Figure 13: Map showing distance of project components from Kuno National Park.....	84
Figure 14: Location of Muck Disposal Site	85

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 livestock.
- 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 and 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 its 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, Shyampur, 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	Kushalpur	33	Sangeswar
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°/ 3° - 5° (Dip Direction/ Dip amount)

Other Bedding: N332°/ 78° - 80°

Other Bedding: N221°/ 78° - 80°

- **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°12'15.75"/ E77°12'14.03") - 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°12'10.08"/ E 77°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°11'39.67" / E 77°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°11'32.66"/ E 77°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; <i>associated with</i> : 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	S. No.	Botanical Name	Habit
	Acanthaceae		4	<i>Barleria prionitis</i>	Shrub
1	<i>Achyranthes aspera</i>	Herb	5	<i>Rungia repens</i>	Herb
2	<i>Achyranthes bidentata</i>	Herb		Acoraceae	
3	<i>Justicia adhatoda</i>	Shrub	6	<i>Acorus calamus</i>	Herb

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

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

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

S. No.	Botanical Name	Habit
	Solanaceae	
106	<i>Datura metel</i>	Herb
107	<i>Solanum virginianum</i>	Herb
	Symplocaceae	
108	<i>Symplocos racemosa</i>	Herb
	Ulmaceae	
109	<i>Holoptelea integrifolia</i>	Tree
	Verbenaceae	
110	<i>Gmelina arborea</i>	Tree
111	<i>Lantana camara</i>	Shrub
	Vitaceae	
112	<i>Leea macrophylla</i>	Herb
	Zygophyllaceae	
113	<i>Tribulus terrestris</i>	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	<i>Acorus calamus</i>	LC
	Anacardiaceae	
2	<i>Mangifera indica</i>	DD
	Annonaceae	
3	<i>Annona squamosa</i>	LC
	Anthericaceae	
4	<i>Chlorophytum tuberosum</i>	LC
	Apocynaceae	
5	<i>Carissa spinarum</i>	LC
6	<i>Holarrhena pubescens</i>	LC
7	<i>Nerium oleander</i>	LC
8	<i>Wrightia tinctoria</i>	LC
	Araceae	
9	<i>Colocasia esculenta</i>	LC

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

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

S. No.	Family/ Scientific Name	Conservation Status
40	<i>Grewia tenax</i>	LC
41	<i>Kydia calycina</i>	LC
	Meliaceae	
42	<i>Azadirachta indica</i>	LC
43	<i>Melia azedarach</i>	LC
	Moraceae	
44	<i>Ficus hispida</i>	LC
45	<i>Ficus racemosa</i>	LC
	Myrtaceae	
46	<i>Corymbia citriodora</i>	LC
47	<i>Syzygium cumini</i>	LC
	Phyllanthaceae	
48	<i>Bridelia retusa</i>	LC
49	<i>Phyllanthus emblica</i>	LC
50	<i>Phyllanthus reticulatus</i>	LC
	Plantaginaceae	
51	<i>Lindenbergia indica</i>	LC
	Poaceae	
52	<i>Brachiaria eruciformis</i>	LC
53	<i>Cynodon dactylon</i>	LC
54	<i>Echinochloa colona</i>	LC
55	<i>Saccharum spontaneum</i>	LC
	Rhamnaceae	
56	<i>Ziziphus jujuba</i>	LC
	Rubiaceae	
57	<i>Gardenia gummifera</i>	LC
	Rutaceae	
58	<i>Aegle marmelos</i>	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	<i>Vulpes bengalensis</i>	LC	I
2	Canidae	Golden Jackal	<i>Canis aureus</i>	LC	I
3	Canidae	Indian Wolf	<i>Canis lupus</i>	LC	I
4	Mustelidae	Honey Badger	<i>Mellivora capensis</i>	LC	I
5	Felidae	Common Leopard	<i>Panthera Pardus</i>	VU	I
6	Herpestidae	Indian Grey Mongoose	<i>Herpestes edwardsii</i>	LC	I
7	Ursidae	Sloth Bear	<i>Melursus ursinus</i>	VU	I
8	Hyaenidae	Striped Hyena	<i>Hyaena hyaena</i>	NT	I
9	Viverridae	Small Indian Civet	<i>Viverricula indica</i>	LC	I
	CETARTIODACTYLA				
10	Bovidae	Nilgai/Blue Bull	<i>Boselaphus tragocamelus</i>	LC	II
11	Cervidae	Sambar	<i>Rusa unicolor</i>	VU	I
12	Cervidae	Chital	<i>Axis axis</i>	LC	II
13	Suidae	Wild Boar	<i>Sus scrofa</i>	LC	II

S. No.	Order/ Family	Common Name	Scientific Name	Conservation Status	
				IUCN 2022-2	WPAA, 2022
	LAGOMORPHA				
14	Leporidae	Common Hare	<i>Lepus nigricollis</i>	LC	II
	PRIMATES				
15	Cercopithecidae	Rhesus macaque	<i>Macaca mulatta</i>	LC	II
16	Cercopithecidae	Northern Plain Gray Langur	<i>Semnopithecus entellus</i>	LC	II
	RODENTIA				
17	Hystriidae	Indian Crested Porcupine	<i>Hystrix indica</i>	LC	I
18	Sciuridae	Five-striped Palm Squirrel	<i>Funambulus pennantii</i>	LC	-
	CHIROPTERA				
19	Pteropodidae	Leschenault's Rousette	<i>Rousettus leschenaulti</i>	NT	-
	EULIPOTYPHLA				
20	Soricidae	House Shrew	<i>Suncus murinus</i>	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)	<i>Sarcogyps calvus</i>	R	CR	I
	Order: Anseriformes					
2	Anatidae	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	R	LC	II
	Order: Bucerotiformes					
3	Upupidae	Common Hoopoe	<i>Upupa epops</i>	R	LC	II
	Order: Charadriiformes					
4	Charadriidae	Red-wattled Lapwing	<i>Vanellus indicus</i>	R	LC	II
5	Recurvirostridae	Black-winged Stilt	<i>Himantopus himantopus</i>	R	LC	II
6	Scolopacidae	Wood Sandpiper	<i>Tringa glareola</i>	WV	LC	II
	Order: Apodiformes					
7	Apodidae	Little Swift	<i>Apus affinis</i>	R	LC	II
	Order: Columbiformes					
8	Columbidae	Laughing Dove	<i>Streptopelia senegalensis</i>	R	LC	II
9	Columbidae	Spotted Dove	<i>Spilopelia suratensis</i>	R	LC	II
10	Columbidae	Eurasian Collard-Dove	<i>Streptopelia decaocto</i>	R	LC	II
11	Columbidae	Rock Dove	<i>Columba livia</i>	R	LC	II
	Order: Coraciiformes					
12	Alcedinidae	Common Kingfisher	<i>Alcedo atthis</i>	R	LC	II
13	Alcedinidae	Pied Kingfisher	<i>Ceryle rudis</i>	R	LC	II
14	Alcedinidae	White-throated Kingfisher	<i>Halcyon gularis</i>	R	LC	II
15	Coraciidae	Indian Roller	<i>Coracias benghalensis</i>	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	<i>Merops orientalis</i>	R	LC	II
	Order: Cuculiformes					
17	Cuculidae	Western Koel	<i>Eudynamys scolopaceus</i>	R	LC	II
18	Cuculidae	Greater Coucal	<i>Centropus sinensis</i>	R	LC	II
	Order: Passeriformes					
19	Alaudidae	Rufous-tailed Lark	<i>Ammomanes phoenicura</i>	R	LC	II
20	Cisticolidae	Common tailorbird	<i>Orthotomus sutorius</i>	R	LC	II
21	Cisticolidae	Rufous-Fronted Prinia	<i>Prinia buchanani</i>	R	LC	I
22	Cisticolidae	Graceful Prinia	<i>Prinia gracilis</i>	R	LC	II
23	Cisticolidae	Grey-breasted Prinia	<i>Prinia hodgsonii</i>	R	LC	II
24	Cisticolidae	Ashy Prinia	<i>Prinia socialis</i>	R	LC	II
25	Corvidae	Large-billed Crow	<i>Corvus macrorhynchos</i>	R	LC	II
26	Corvidae	House Crow	<i>Corvus splendens</i>	R	LC	II
27	Corvidae	Rufous Treepie	<i>Dendrocitta vagabunda</i>	R	LC	II
28	Dicruridae	Black Drongo	<i>Dicrurus macrocercus</i>	R	LC	II
29	Estrildidae	Scaly-breasted Munia	<i>Lonchura punctulata</i>	R	LC	II
30	Hirundinidae	Wire-tailed Swallow	<i>Hirundo smithii</i>	R	LC	II
31	Laniidae	Long-tailed Shrike	<i>Lanius schach</i>	R	LC	II
32	Leiothrichidae	Jungle Babbler	<i>Turdoides striata</i>	R	LC	II
33	Motacillidae	White Wagtail	<i>Motacilla alba</i>	WV	LC	II
34	Motacillidae	Western Yellow Wagtail	<i>Motacilla flava</i>	WV	LC	II
35	Muscicapidae	Brown Rock Chat	<i>Oenanthe fusca</i>	R	LC	II
36	Muscicapidae	Oriental Magpie-Robin	<i>Copsychus saularis</i>	R	LC	II
37	Muscicapidae	Indian Robin	<i>Saxicoloides fulicatus</i>	R	LC	II
38	Passeridae	House Sparrow	<i>Passer domesticus</i>	R	LC	II
39	Ploceidae	Baya Weaver	<i>Ploceus philippinus</i>	R	LC	II
40	Pycnonotidae	Red-vented Bulbul	<i>Pycnonotus cafer</i>	R	LC	II
41	Sturnidae	Common Myna	<i>Acridotheres tristis</i>	R	LC	II
42	Sturnidae	Asian Pied Starling	<i>Gracupica contra</i>	R	LC	II
43	Sturnidae	Brahminy Starling	<i>Sturnia pagodarum</i>	R	LC	II
	Order: Pelecaniformes					
44	Ardeidae	Grey Heron	<i>Ardea cinerea</i>	R/WV	LC	II
45	Ardeidae	Indian Pond-Heron	<i>Ardeola grayii</i>	R	LC	II
46	Ardeidae	Cattle Egret	<i>Bubulcus ibis</i>	R	LC	II
47	Ardeidae	Little Egret	<i>Egretta garzetta</i>	R	LC	II
	Order: Piciformes					
48	Ramphastidae	Coppersmith Barbet	<i>Psilopogon haemacephalus</i>	R	LC	II
	Order: Psittaciformes					
49	Psittaculidae	Rose-ringed Parakeet	<i>Psittacula krameri</i>	R	LC	II
	Order: Suliformes					
50	Phalacrocoracidae	Little Cormorant	<i>Microcarbo niger</i>	R	LC	II
	Order: Gruiformes					
51	Rallidae	Common Moorhen	<i>Gallinula chloropus</i>	R	LC	II
52	Rallidae	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	R	LC	II
	Order: Galliformes					
53	Phasianidae	<i>Pavo cristatus</i>	Indian Peafowl	R	LC	I
	Order: Strigiformes					
54	Strigidae	Eurasian Eagle-owl	<i>Bubo bubo</i>	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	<i>Duttaphrynus stomaticus</i>	Marbled Toad	LC	-
2	Dicroglossidae	<i>Duttaphrynus melanostictus</i>	Common Indian Toad	LC	-
3	Dicroglossidae	<i>Hoplobatrachus tigerinus</i>	Indian Bull Frog	LC	II
4	Dicroglossidae	<i>Sphaerotheca breviceps</i>	Indian Burrowing Frog	LC	-
CLASS: REPTILIA					
	Order: Squamata				
5	Boidae	<i>Eryx johnii</i>	Indian sand Boa	NT	I
6	Colubridae	<i>Ptyas mucosa</i>	Rat snake	LC	I
7	Elapidae	<i>Bungarus caeruleus</i>	Krait	LC	II
8	Elapidae	<i>Naja naja</i>	Indian Cobra	LC	I
9	Pythonidae	<i>Python molurus</i>	Python	NT	I
10	Viperidae	<i>Vipera russelli</i>	Russell's Viper	LC	I
11	Agamidae	<i>Calotes versicolor</i>	Indian Garden Lizard	LC	-
12	Chamaeleonidae	<i>Chamaeleo zeylanicus</i>	Indian Chameleon	LC	I
13	Varanidae	<i>Varanus bengalensis</i>	Indian Monitor Lizard	NT	I
14	Gekkonidae	<i>Hemidactylus flaviviridis</i>	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	<i>Danaus chrysippus</i>	LC	-
2	Nymphalidae	Common leopard	<i>Phalanta Phalantha</i>	LC	-
3	Nymphalidae	Blue Pansy	<i>Junonia orithya</i>	LC	-
4	Nymphalidae	Lemon Pansy	<i>Junonia lemonias</i>	-	-
5	Nymphalidae	Danaid Eggfly	<i>Hypolimnys misippus</i>	LC	II
6	Pieridae	Common Emigrant	<i>Catopsilia pomona</i>	-	-
7	Pieridae	Cabbage White	<i>Pieris brassicae</i>	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 <i>Anogeissus pendula</i> 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 oojenense*, *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 Deer (*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

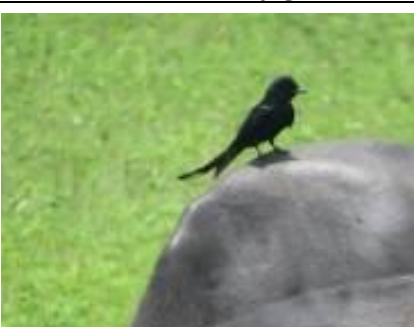
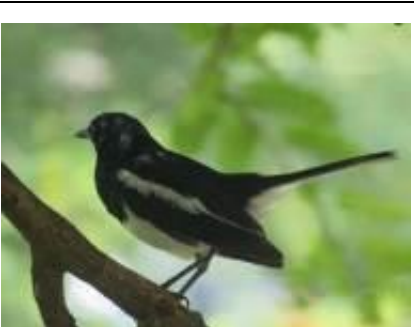
During the field survey, only 7 species of butterfly were recorded from the study area. These butterflies belong to the families Nymphalidae, and Pieridae. Plain Tiger (*Danaus chrysippus*), Blue Pansy (*Junonia orithya*), Lemon Pansy (*Junonia lemonias*), Common Emigrant (*Catopsilia Pomona*), Cabbage 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 1 st June and 1 st 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).
- Champion, H.G., Seth, S.K. (1968): A revised survey of the forest types of India. Manager of publications, Government of India, Delhi, 600 pp.
- Forest Working Plan (2020). Pangi Forest Division, Himachal Pradesh.
- Grimmett, R., Inskipp, C. and Inskipp, T. (1998). Birds of the Indian Subcontinent. London: Oxford University Press. 384p.
- Grimmett, R., Inskipp, C. and Inskipp, T. (2011). Birds of the Indian Subcontinent. London: Oxford University Press. 528p.
- Inskipp, T., N. Lindsay and W. Duckworth (1996). An Annotated Checklist of Birds of the Oriental Region. Oriental Bird Club. UK. IUCN ver. 2021-3.

- Kazmierczak, K. (2000). Field Guide to the Birds of The Indian Subcontinent. Bloomsbury Natural History
- Nayar M P & Shastry A R K. Red data Book of Indian Plants. Vol. I & II, 2000 (Repdr.ed.). Botanical Survey of India. 25. CITES. Pictorial Identification Manual of CITES Plants in India. www.bsienvi.org/citesplant. 26. IUCN, SSC.
- Nayar M.P. and Sastry A.R.K. (1987). Red Data Book of Indian Plants. Botanical Survey of India, Calcutta. Vol.I.
- Nayar M.P. and Sastry A.R.K. (1988). Red Data Book of Indian Plants. Botanical Survey of India, Calcutta. Vol.II.
- Nayar M.P. and Sastry A.R.K. (1990). Red Data Book of Indian Plants. Botanical Survey of India, Calcutta. Vol.III.
- Prater S.H., (1980). The book of Indian animals. Third ed. Bombay Natural History Society. Bombay, pp. 428.
- The IUCN Red List of Threatened species, version 2022-2. <http://www.iucnredlist.org/>.
- Rodgers, W.A., Panwar, H. S. and Mathur, V. B. (2000) Wildlife Protected Area Network in India: A Review (Executive Summary). Wildlife Institute of India, Dehradun.
- 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.worldweatheronline.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. NO_x, hydrocarbons and CO are major pollutants; SO₂ 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, PM₁₀ 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:

$$N_2 = N_1 - 20 \log_{10}(r_2/r_1) - A_f \quad \text{dBA}$$

Where, N_2 = Sound level at any location at a distance r_2 from the source

N_1 = Sound level at any location at a distance r_1 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) Impact on Terrestrial Flora

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), SO_x 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	<i>Vulpes bengalensis</i>	I
2		Golden Jackal	<i>Canis aureus</i>	I
3		Indian Wolf	<i>Canis lupus</i>	I
4	Felidae	Common Leopard	<i>Panthera Pardus</i>	I
5	Herpestidae	Indian Grey Mongoose	<i>Herpestes edwardsii</i>	I
6	Hyaenidae	Striped Hyena	<i>Hyaena hyaena</i>	I
7	Mustelidae	Honey Badger	<i>Mellivora capensis</i>	I
8	Viverridae	Small Indian Civet	<i>Viverricula indica</i>	I
9	Ursidae	Sloth Bear	<i>Melursus ursinus</i>	I
	Order - Cetartiodactyla			
10	Cervidae	Sambar	<i>Rusa unicolor</i>	I
	Order - Rodentia			
11	Hystricidae	Indian Crested Porcupine	<i>Hystrix indica</i>	I
BIRDS				
	Order: Accipitriformes			
12	Accipitridae	Asian King Vulture	<i>Sarcogyps calvus</i>	I
	Order: Passeriformes			
13	Cisticolidae	Rufous-Fronted Prinia	<i>Prinia buchanani</i>	I
	Order: Galliformes			
14	Phasianidae	Indian Peafowl	<i>Pavo cristatus</i>	I
	Order: Strigiformes			
15	Strigidae	Eurasian Eagle-owl	<i>Bubo bubo</i>	I
REPTILIA				
	Order: Squamata			
16	Boidae	Indian sand Boa	<i>Eryx johnii</i>	I
17	Chamaeleonidae	Indian Chameleon	<i>Chamaeleo zeylanicus</i>	I
18	Colubridae	Rat snake	<i>Ptyas mucosa</i>	I
19	Elapidae	Indian Cobra	<i>Naja naja</i>	I
20	Pythonidae	Python	<i>Python molurus</i>	I
21	Varanidae	Indian Monitor Lizard	<i>Varanus bengalensis</i>	I
22	Viperidae	Russell's Viper	<i>Vipera russelli</i>	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 (<i>Vulpes bengalensis</i>)	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 (<i>Canis aureus</i>)	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 (<i>Canis lupus</i>)	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 (<i>Mellivora capensis</i>)	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 (<i>Panthera Pardus</i>)	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 (<i>Herpestes edwardsii</i>)	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 (<i>Melursus ursinus</i>)	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 (<i>Hyaena hyaena</i>)	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 (<i>Viverricula indica</i>)	Forest, Savanna, Shrubland, Grassland, Wetlands (inland)
10	Sambar (<i>Rusa unicolor</i>)	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 (<i>Hystrix indica</i>)	Forest, Shrubland, Grassland
BIRDS		
12	Asian King Vulture (<i>Sarcogyps calvus</i>)	Near human habitations, feeding mostly from carcasses of dead animals
13	Rufous-Fronted Prinia (<i>Prinia buchananii</i>)	Forest, Shrubland, Grassland, Rocky areas (eg. inland cliffs, mountain peaks)
14	Indian Peafowl (<i>Pavo cristatus</i>)	Prefer human dominated and associated surrounding habitats like agricultural fields, fallow 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 (<i>Bubo bubo</i>)	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 (<i>Eryx johnii</i>)	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 (<i>Ptyas mucosa</i>)	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 (<i>Naja naja</i>)	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 (<i>Python molurus</i>)	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 (<i>Vipera russelli</i>)	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 (<i>Chamaeleo zeylanicus</i>)	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 (<i>Varanus bengalensis</i>)	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 Deer, 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

N. Gopi Krishna

CHAPTER 7

7.1. RELEVANT MAPS

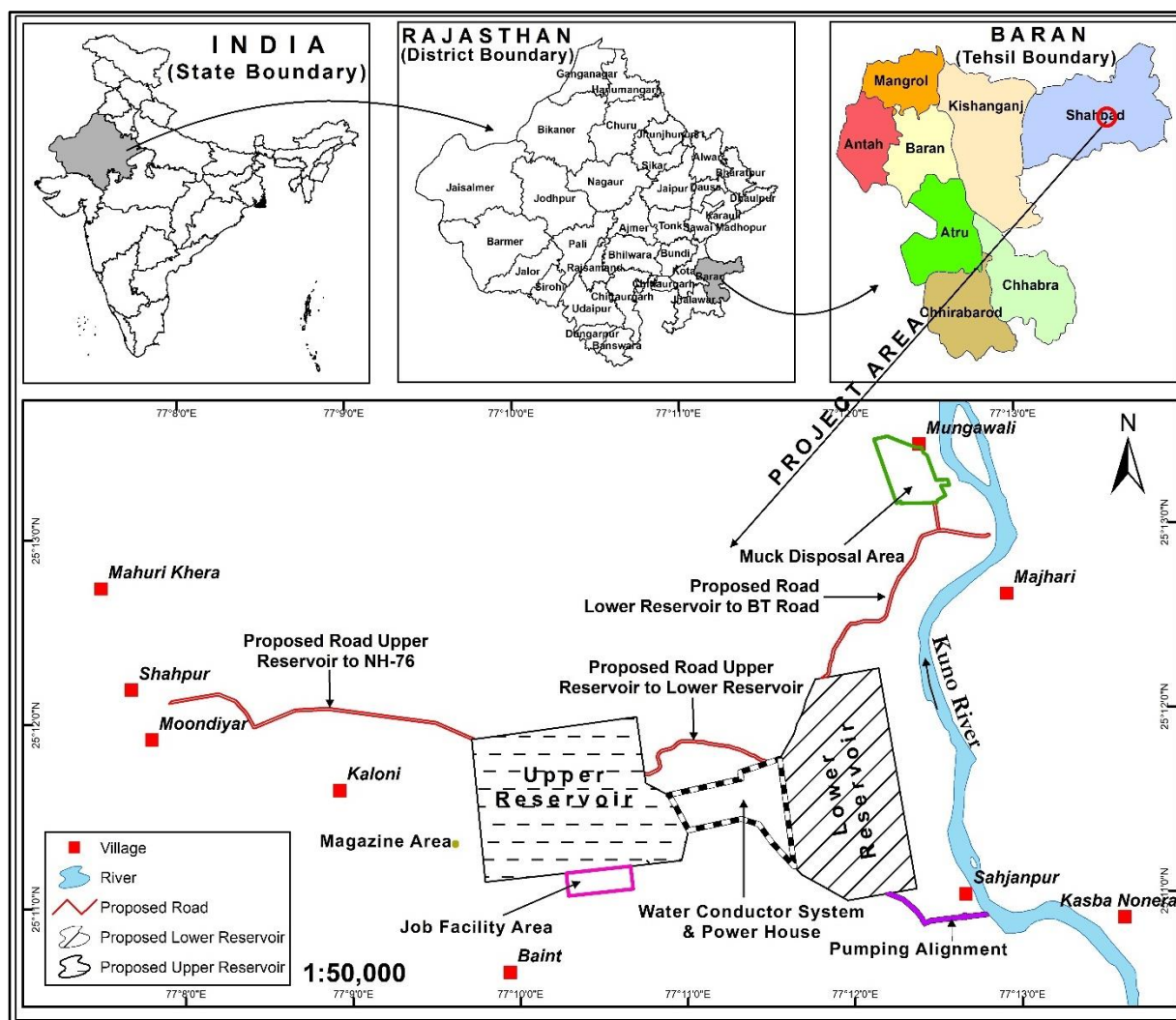


Figure 1: Project Location Map

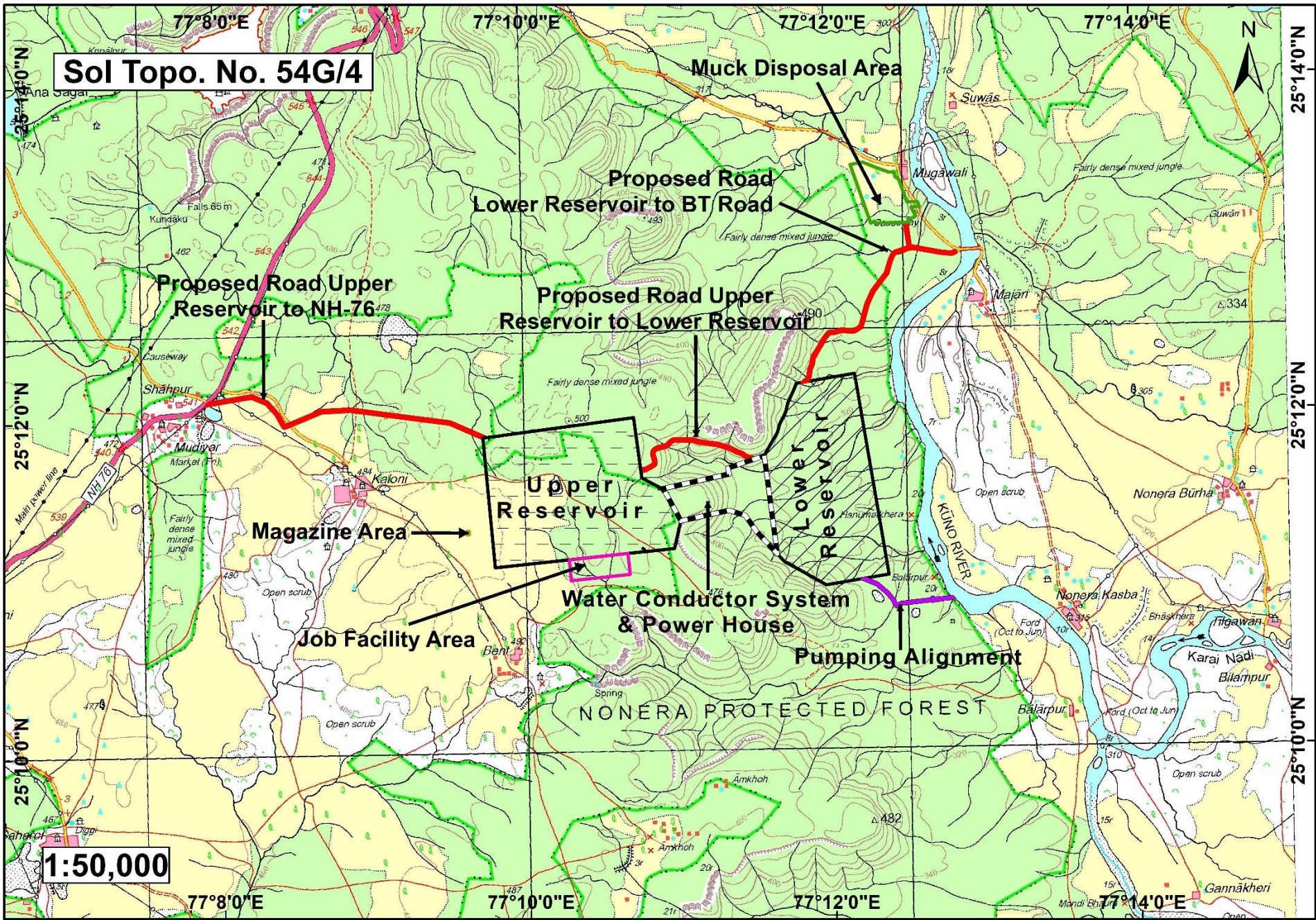


Figure 2: Project Layout on Toposheet

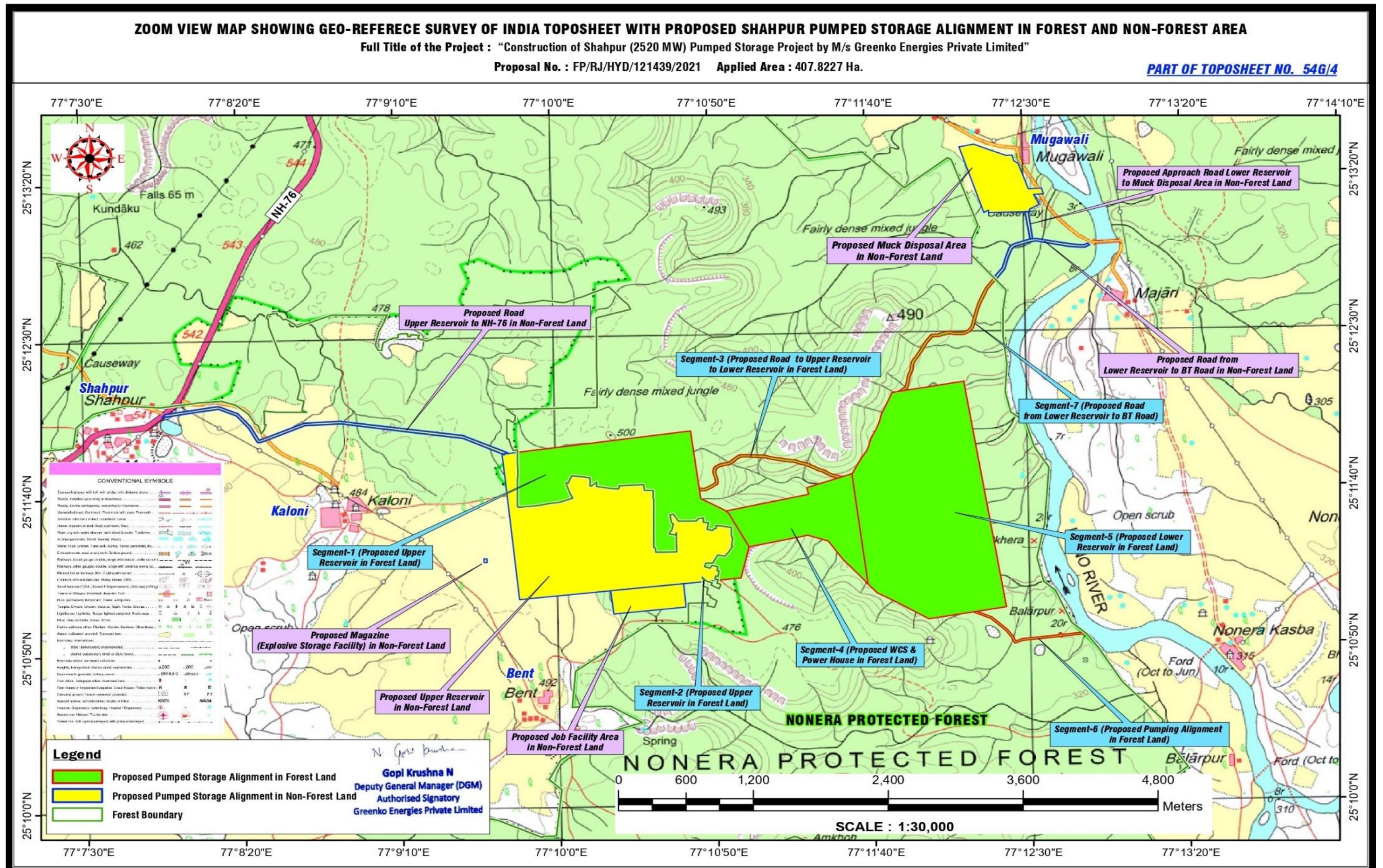


Figure 3: Topo Map of Project layout



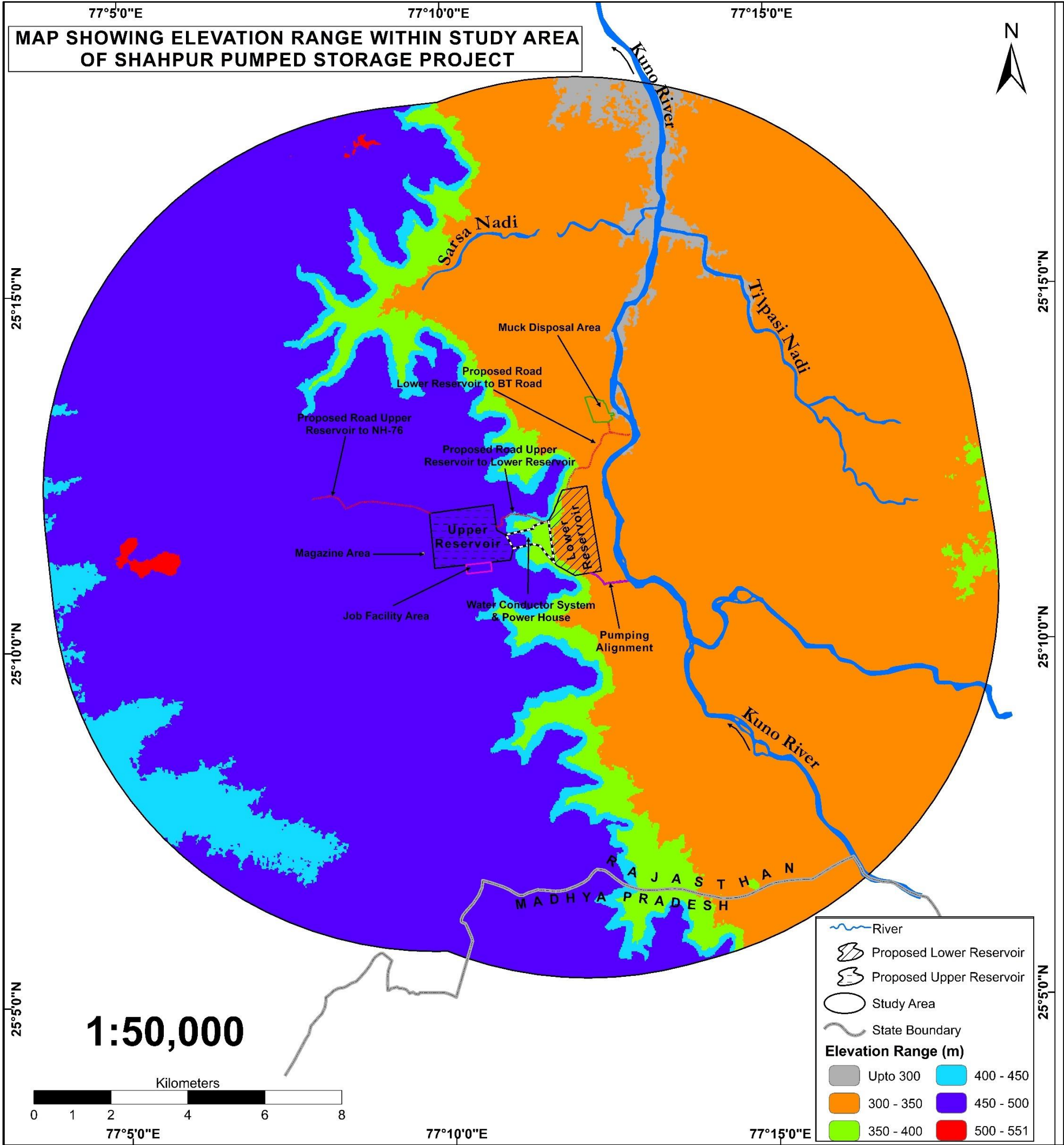


Figure 5: Digital Elevation Map of the Study Area

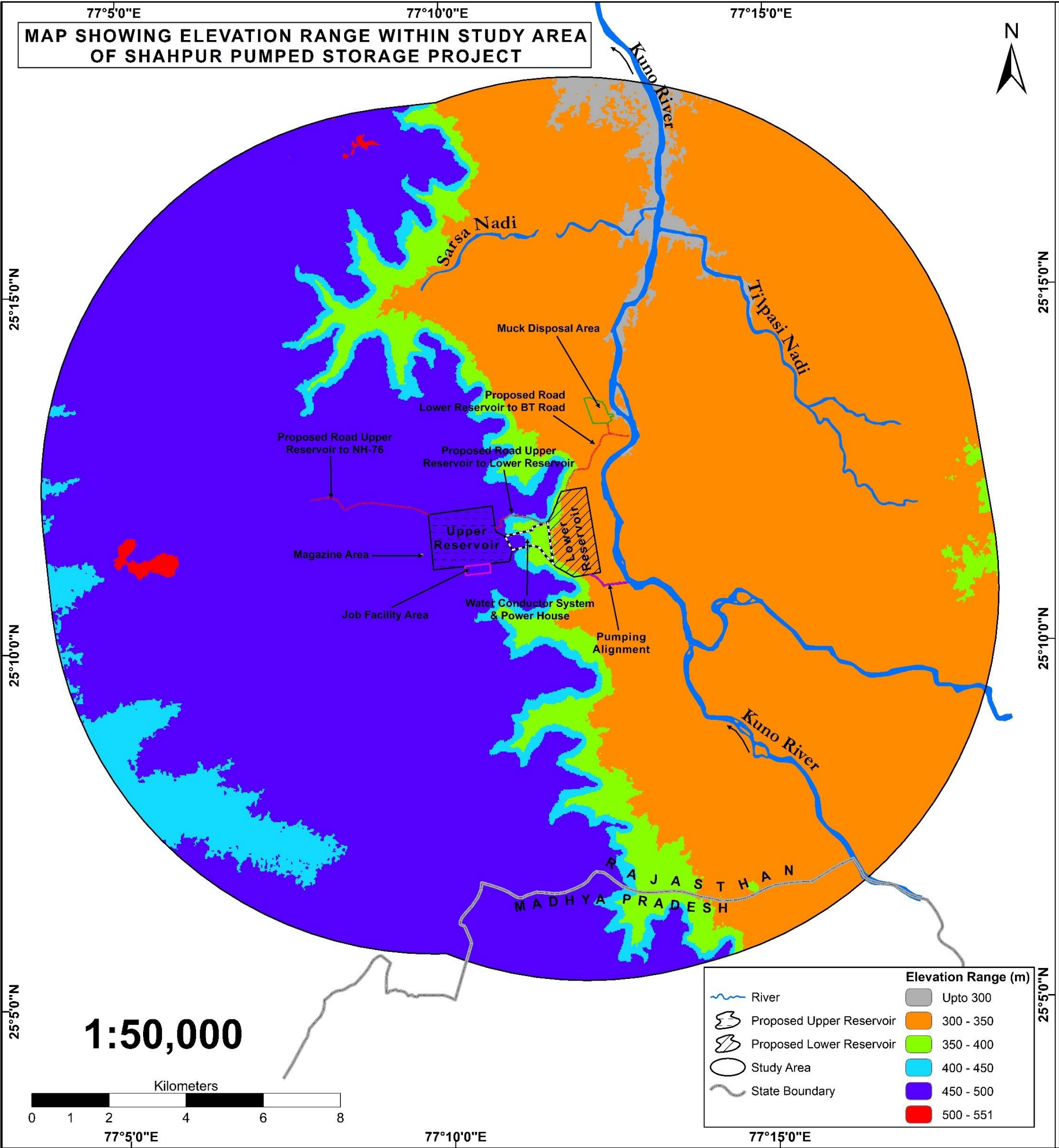


Figure 6: Relief Map of the Study Area

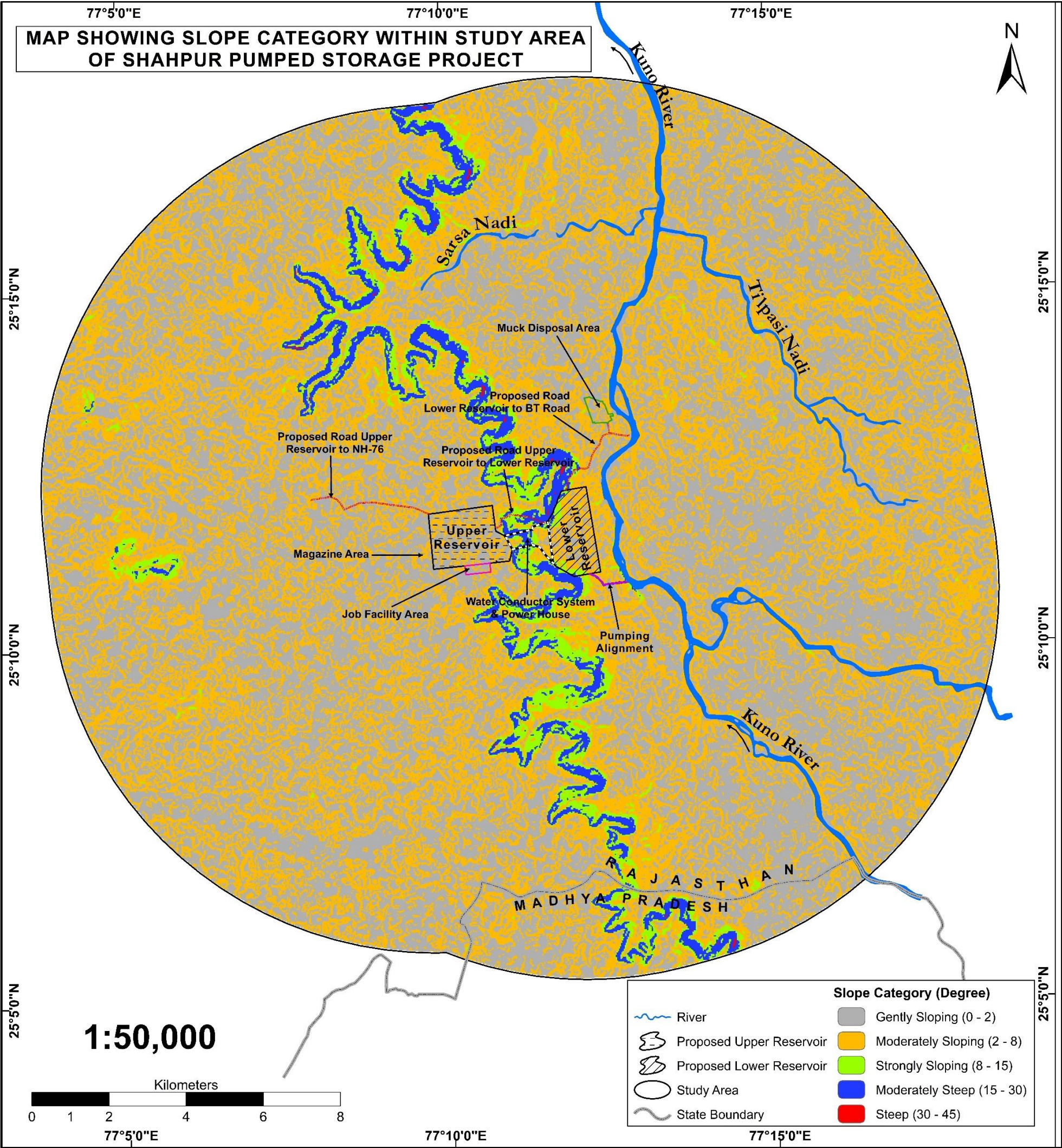


Figure 7: Slope map of the Study Area

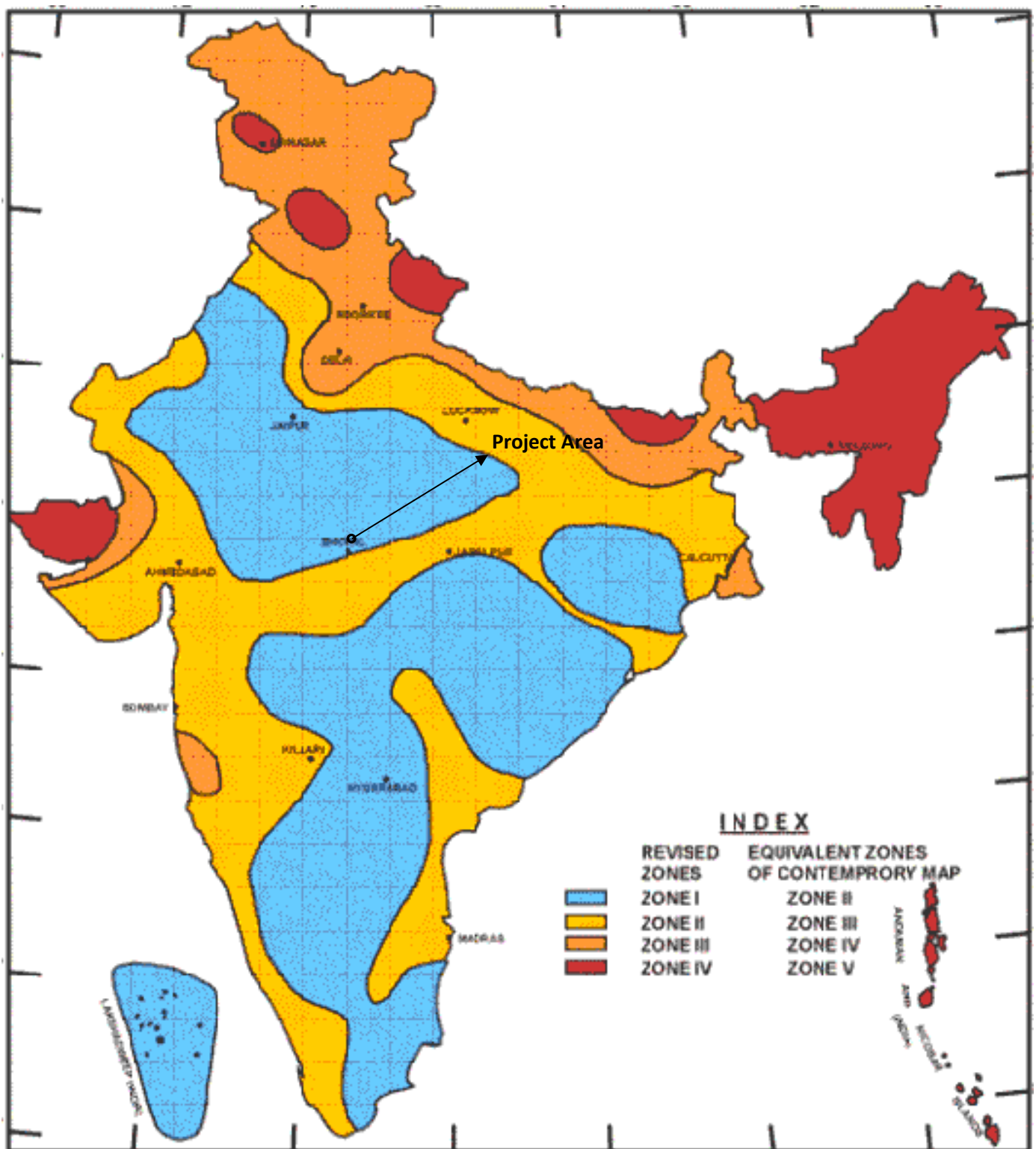


Figure 8: Seismic Zone Map of India

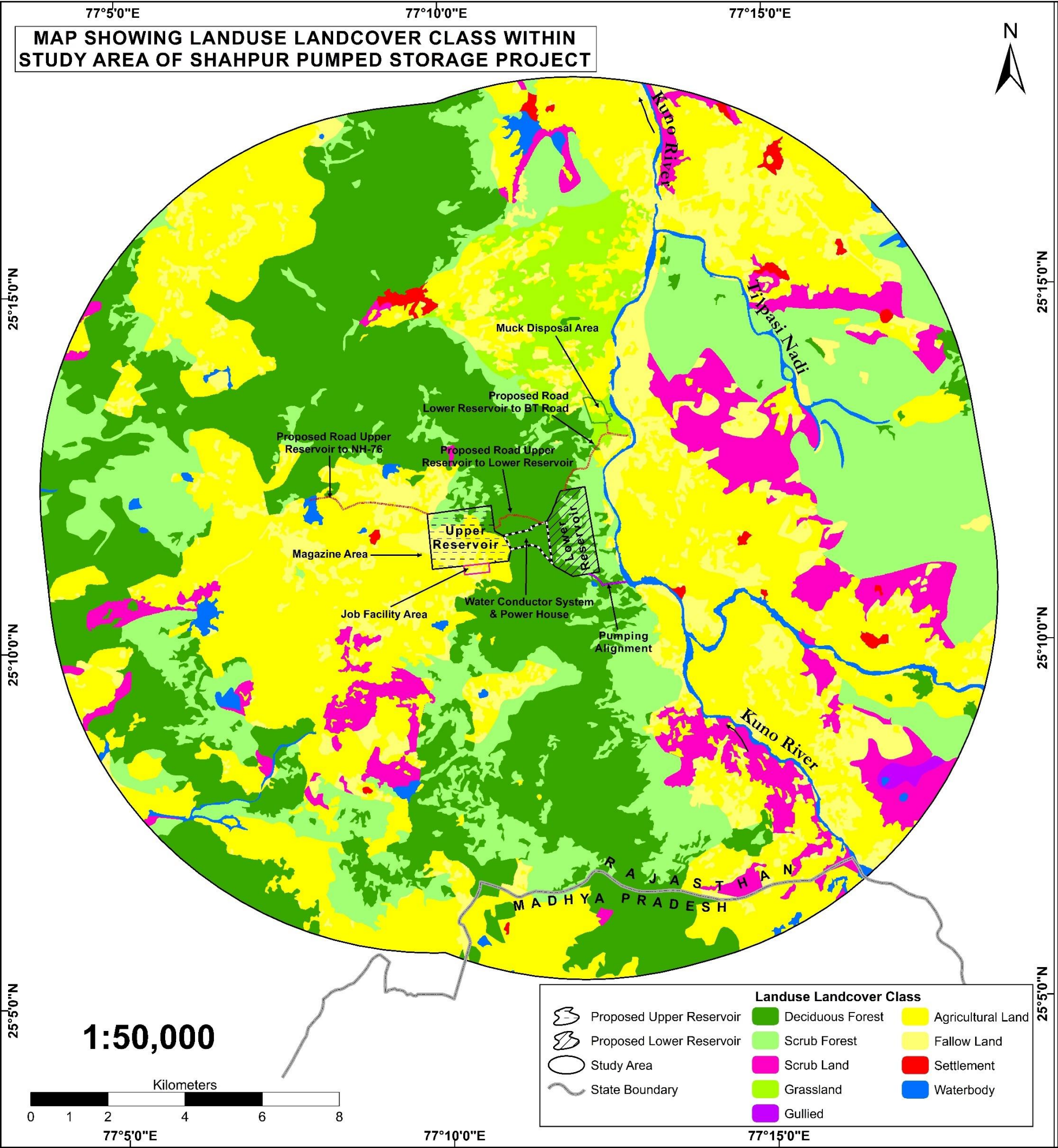


Figure 9: Land Use/ Landcover map of the study area

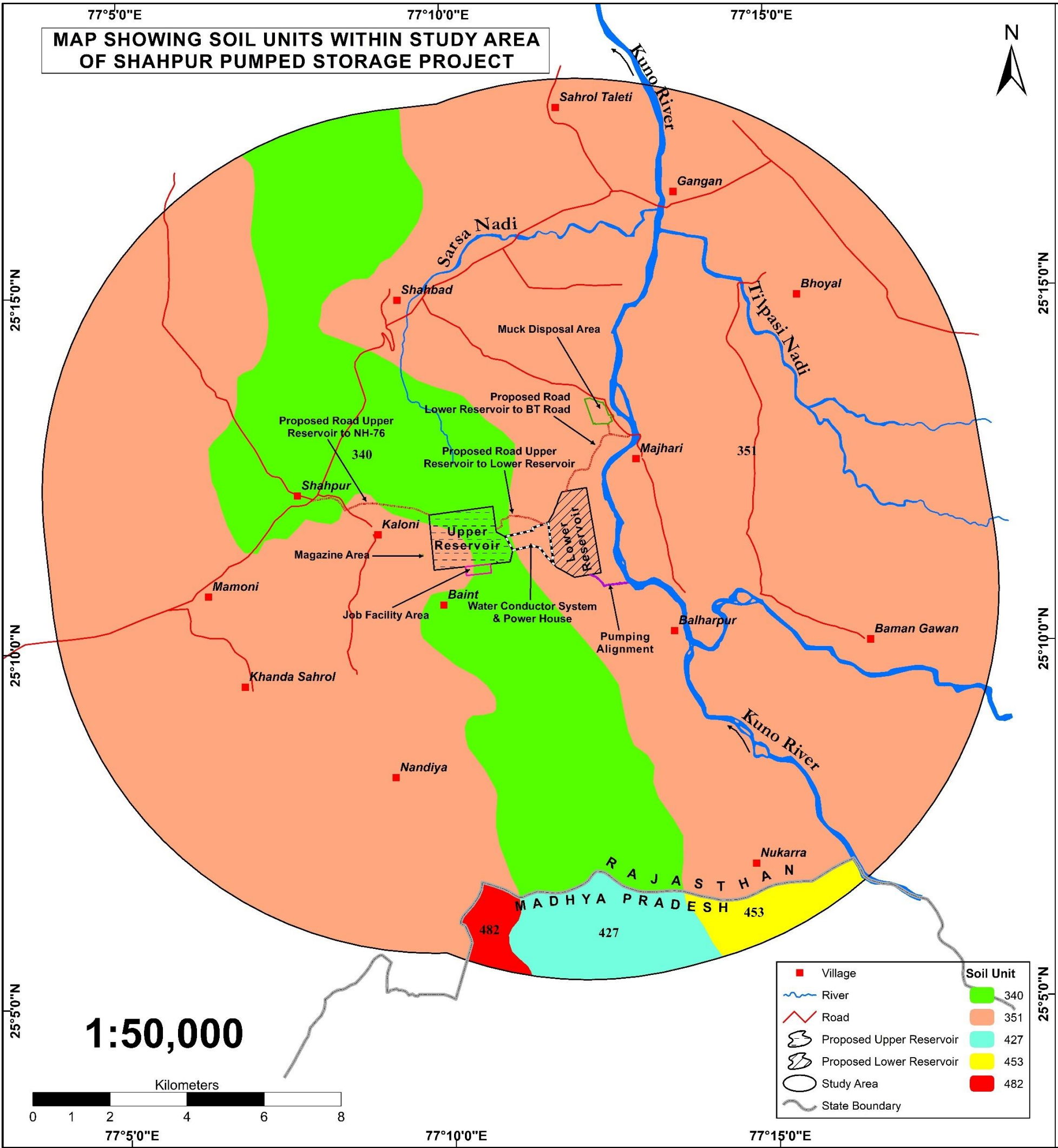


Figure 10: Soil map of the Study Area

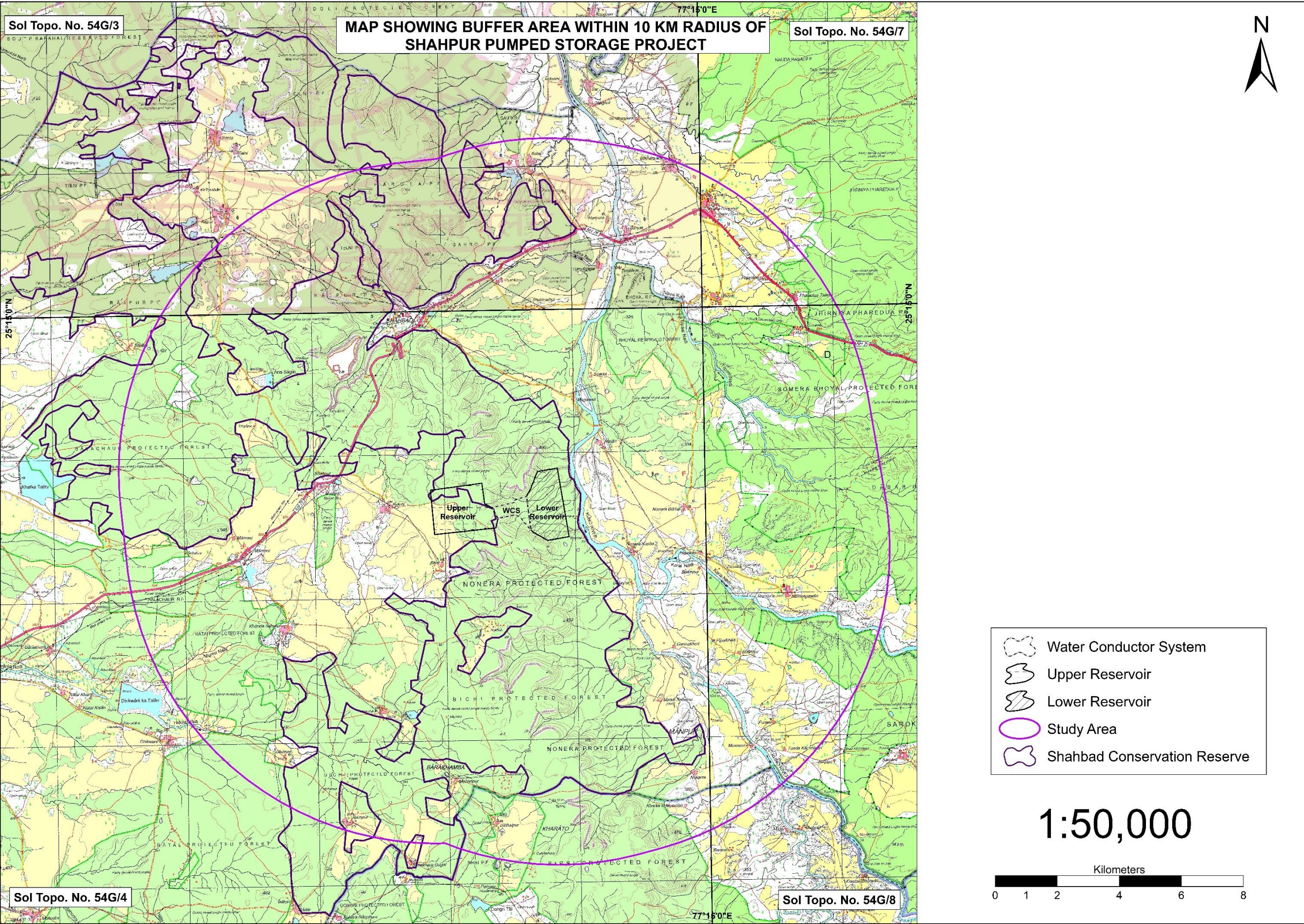


Figure 11: Map showing location of project components w.r.t. Shahabad Conservation Reserves

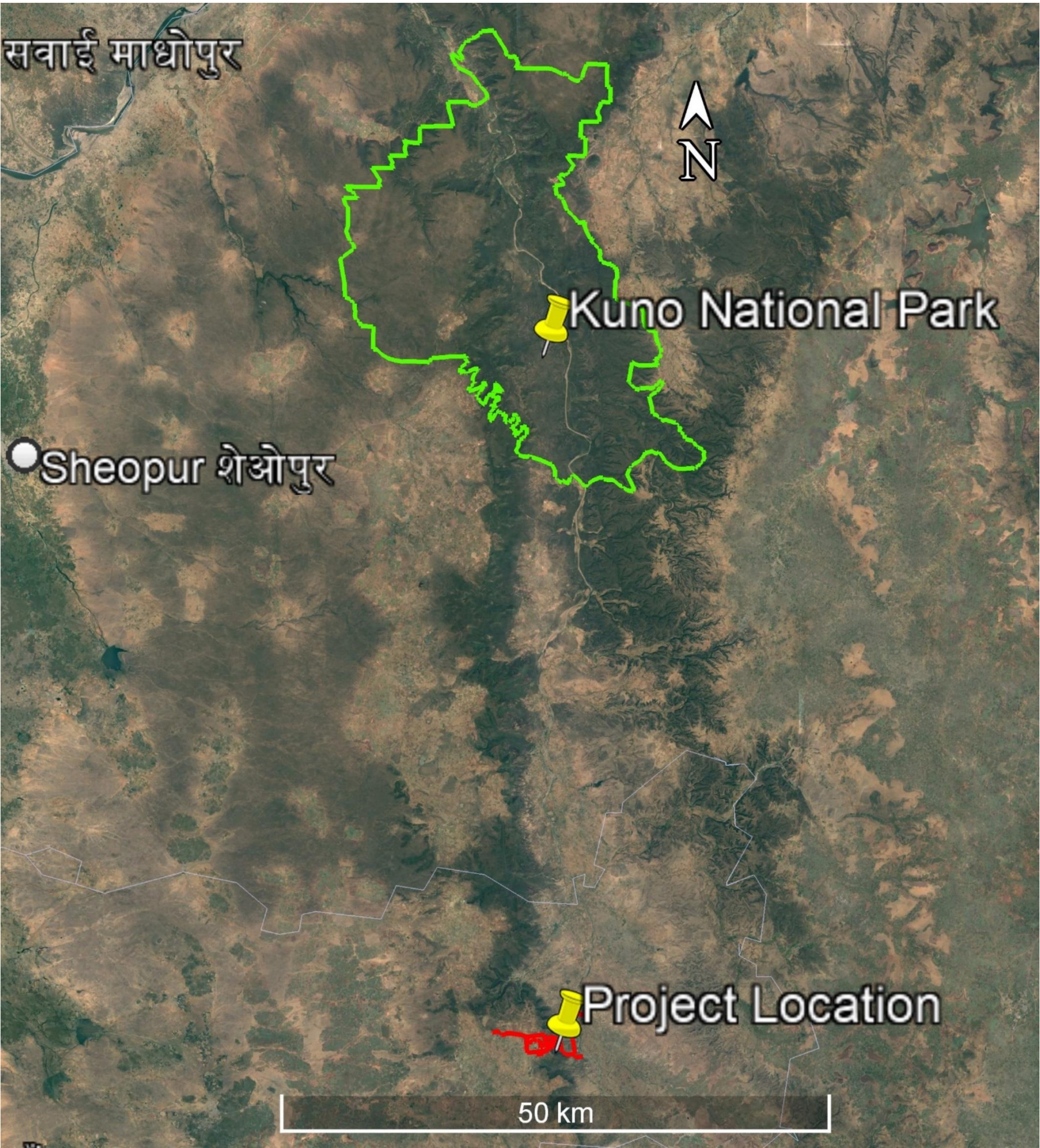


Figure 12: Distance of project components from Kuno National Park on Google Earth Map

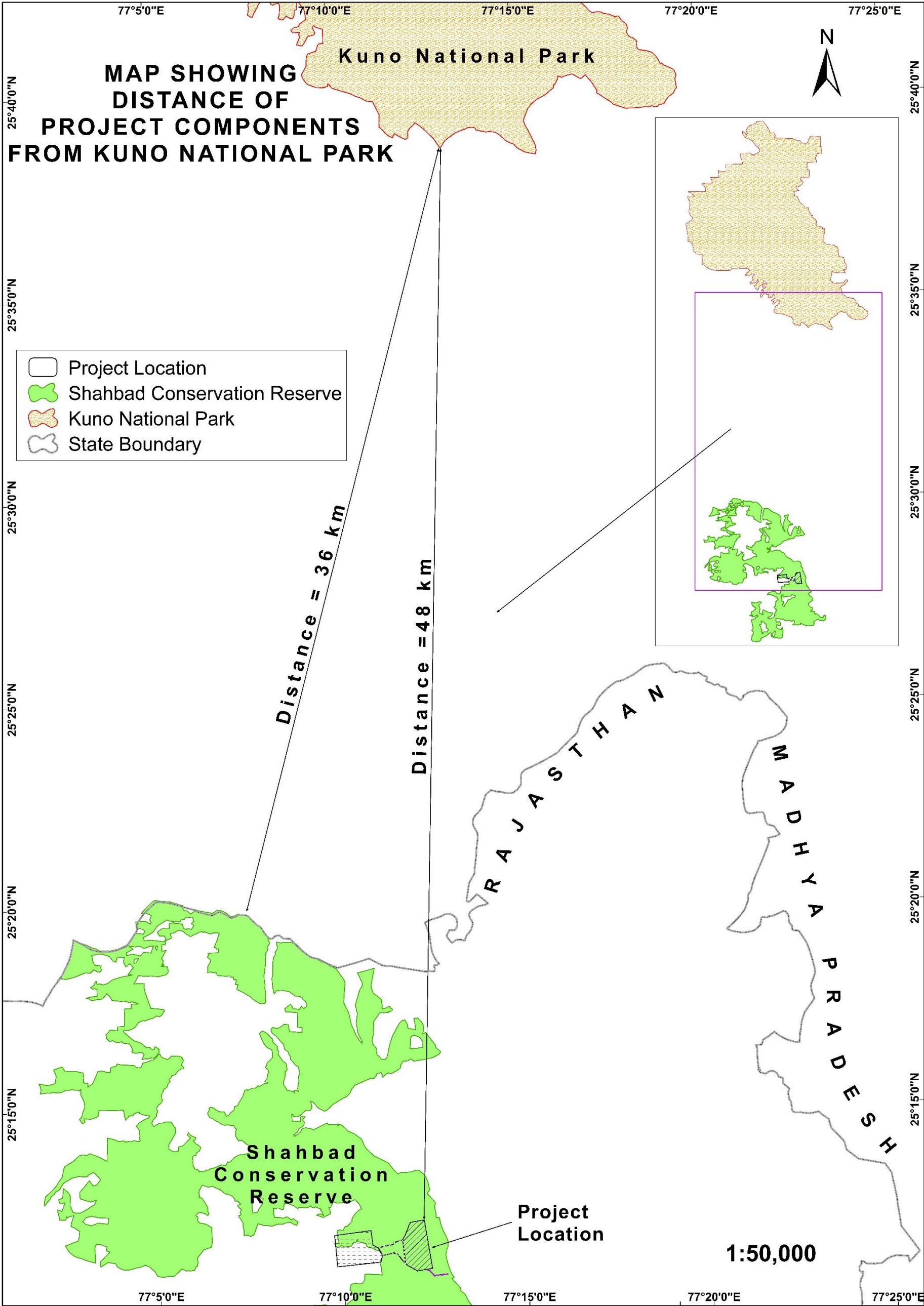


Figure 13: Map showing distance of project components from Kuno National Park



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	<i>Mangifera indica</i>
2	Anacardiaceae	<i>Buchanania cochinchinensis</i>
3	Annonaceae	<i>Annona squamosa</i>
4	Apocynaceae	<i>Holarrhena pubescens</i>
5	Apocynaceae	<i>Wrightia tinctoria</i>
6	Arecaceae	<i>Phoenix sylvestris</i>
7	Boraginaceae	<i>Cordia dichotoma</i>
8	Burseraceae	<i>Boswellia serrata</i>
9	Combretaceae	<i>Anogeissus latifolia</i>
10	Combretaceae	<i>Anogeissus pendula</i>
11	Combretaceae	<i>Terminalia arjuna</i>
12	Combretaceae	<i>Terminalia bellirica</i>
13	Combretaceae	<i>Terminalia tomentosa</i>
14	Cornaceae	<i>Alangium salviifolium</i>
15	Ebenaceae	<i>Diospyros melanoxylon</i>
16	Ebenaceae	<i>Diospyros montana</i>
17	Fabaceae	<i>Acacia catechu</i>
18	Fabaceae	<i>Acacia nilotica</i>
19	Fabaceae	<i>Acacia senegal</i>
20	Fabaceae	<i>Albizia lebbeck</i>
21	Fabaceae	<i>Albizia procera</i>
22	Fabaceae	<i>Bauhinia racemosa</i>
23	Fabaceae	<i>Bauhinia variegata</i>
24	Fabaceae	<i>Butea monosperma</i>
25	Fabaceae	<i>Cassia fistula</i>
26	Fabaceae	<i>Dalbergia sissoo</i>
27	Fabaceae	<i>Delonix regia</i>
28	Fabaceae	<i>Desmodium oojenense</i>
29	Fabaceae	<i>Erythrina suberosa</i>
30	Fabaceae	<i>Hardwickia binata</i>
31	Fabaceae	<i>Parkinsonia aculeata</i>

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

b. Shrub

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

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

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

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

c. Herbs

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

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

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