Draft Environmental and Social Impact Assessment

Project Number: 49241-001
March 2016

IND: Mytrah Wind and Solar Power Development Project
- Nipaniya Wind Power Project

INTRODUCTION

Mytrah Energy (India) Limited ('Company' or 'MEIL') is developing a wind farm of 50 MW capacity at Nipaniya in Mandsaur District of Madhya Pradesh. ERM (also referred as 'consulting firm') has been commissioned by MEIL to conduct an Environmental and Social Impact Assessment Study (ESIA) for the Project. This wind farm is a part of the larger Nipaniya Wind Farm of 180 MW capacity and comprising of 96 Wind Turbine Generators (WTGs), being developed by M/s INOX WIND. While MEIL is investing in 25 of these WTGs, the remaining WTGSs are being procured by other companies such as Green Infra (approx. 22 WTGs), ReNew Power (approx. 20 WTGs), Mark Data Power (approx. 22 WTGs), PTC India (approx. 10 WTGs)etc.

Project Description

The Key components of proposed wind farm includes 25 Wind Turbine Generators (WTGs), a pooling sub-station (PSS), internal and external transmission lines, access roads and additional project infrastructure as material storage yard, scrap yard and, central monitoring station (CMS) building. The Project is presently in the preconstruction and construction stage. The WTG is of INOX WT 2000 DF 100 model with rated capacity of 2.0 MW.

The project site is located in Shamgarh tehsil, and is located at a distance of 80 km north-east of Mandsaur town, which is the administrative centre of the district. The project area is spread across eleven (11) village areas: Barkheda Uda, Takrawad, Chhayan, Jamuniya, Khankhari, Aakli Shivdas, Manpura, Sagoriya, Semli hada, Bardiya Amara and Nariya Buzurg. The area surrounding the Wind farm site is rural with the primary land use being rain fed agriculture, primarily cultivating rabi crops such as wheat and maize. The land requirement for the project is 2.5 acres/ WTG (approx. 1 ha/WTG) amounting to 62.5 acres (25.29 ha) and 3.26 acres (1.3 ha) of land under pooling substation.

The Project is proposed to have a 33 kV/220 kV PSS in Takrawad village. It was reported by MEIL that the length of internal transmission lines will be approximately 30 Km. The power will be transmitted through 4 feeder 33 kV transmission lines up to 33/220 kV pooling substation at Takrawad. From there on a 14.8 km long 220 kV DC power line feeds the power from the wind farm to the state grid of Madhya Pradesh on Loop-In-Loop-Out (LILO) arrangement of Bhadod-Bhanpura line, which is owned by Madhya Pradesh Power Transmission Co. Ltd. (MPPTCL).

The interconnection point lies near Nariya Khurd village. There will be about 55 towers for the transmission line and the line will pass through the villages of Melkheda, Jamuniya, Sagoriya and Bhanpur Banod.

The transmission line route does not pass through any permanent water body, forest land and any other ecological sensitive areas. The project species observed within the study area also qualifies for their presence in transmission line route. The electrocution risk of vultures and migratory species with the transmission line conductors is unlikely as there is sufficient space available between two conductors. The collision by migratory bird species with these conductors is also unlikely as the transmission route is far from waterbodies. The collision risk to endangered species Egyptian vulture is unlikely due to its low abundance in the area.

The proposed project is being developed by MEIL and Inox will be the O & M contractor (20 years) for the project. Inox Wind is a subsidiary of the Inox Group. There will be about 11 contractors engaged for various construction related activities ranging from civil works, construction of WTG foundations, roads, transmission lines, security services etc. About 345 labours will be engaged depending upon the stage of construction and about 20 employees from MEIL and its sub-contractors will be there during the construction phase. 30% of labour will be engaged from the local area and for migrants labours there will be labour accommodation facility provided through contractors in the nearby area. During the operations, there will be 20 technical staff for O & M.

Water requirement will be met through tankers procuring water from local sources mostly open wells from villages of Asawati, Pitchna and Orwal villages under Shamgarh Tehsil. Drinking water will be supplied through purchase of bottled water during both the construction and operations phases. Most of the raw materials for construction and other supplies will be procured from Mandsaur town. Batching plant will be set up near the Village Krishna ka Dera. Power requirement will be met through 12 DG sets of varying capacities (10 to 125 KVA) during the construction phase.

There will be provisions for fugitive emissions and dust control through ensuring 10-15 km/hr vehicular speed, proper maintenance of vehicles; diesel generator (DG) sets with adequate stack heights, provisions of enclosure around batching plant etc. For reducing noise generation, DG sets with acoustic enclosure will be used etc. The waste generated will be mainly construction debris, domestic waste, packaging materials, used oil, oil contaminated rags for which provisions have been specified for management and disposal. Wastewater management will be done through septic tanks and soak pits for both phases. There will be appropriate firefighting system and equipment provided for fire safety and prevention.

As per the organization structure, the day to day HSE related activities on site will be overlooked by respective department Engineers who in turn will

report to the Project Manager (Site head). The Site head will report to Corporate Project head and Corporate HSE head (planned) for various aspects during the construction phase as well as operational phase.

Land requirement and allotment process

The land identification and procurement for the WTGs and other project components is presently under process. The 25 WTGs identified for MEIL are located in 11 villages in the Shamgarh Tehsil of Mandsaur. The land for the WTGs is to comprise of private agricultural land. as discussed earlier, approx. 1 Ha or 2.5 acres of land per WTG and unit sub station will be procured based on the prevailing market rates in the area.

According to the information made available by the INOX project team, the land procurement for the associated project components is in process. It is to be understood that most of these project components will be common for the larger wind farm being developed, and will thus be shared by MEIL with other companies. While the land requirement is likely to comprise of primarily private land, certain project components may require government land, categorised as cultivable waste land, however none have been identified so far.

The land requirement for these project components will be comprised of temporary land requirement (only for the duration of the construction phase, or a part of it) and permanent land requirement. The temporary land requirement will comprise of land required for labour camp, batching plants and hot mix plant. While the permanent land requirement/ right of way requirement will comprise of requirement for access roads, transmission lines and the pooling substation. According to the discussion with the INOX team it is understood that the temporary land requirement is being identified based on requirement and the land required is leased for short durations of time. Due to this, the total land requirement for these associated components was unavailable at the time of the assessment. However, the land requirement per Batching plant and hot mix plant is expected to be approx 0.1 ha, while the labour camps are usually set up over 1 ha. The land requirement for the sub station is 1.3 Ha. The right of way for the internal and external tranmssion lines will be 30m, across the length of the lines.

The land for the WTGs and associated project components is being procured by INOX as part of the larger land requirement for the wind farm, and will follow the same procedure. It is understood that MEIL will not be involved in the land identification and procurement process. While the private land for the project will be procured (permanent and temporary) on the basis of willing-buyer willing seller transactions, the government land will be procured under the Madhya Pradesh Wind Power Project Policy 2012 (amended February 2013). In order to ensure this, an audit of the land procurement process shall be undertaken by MEIL, prior to the disbursement

of funds from ADB, to ensure that the land procurement has been undertaken in keeping with the requirements of the wind policy and ADB requirements.

The project area does not fall under Schedule V areas as defined by the Indian Constitution. No tribal land has been identified for the project so far. The land requirement for the project is comprised mostly of private land and according to the information made available by the project team and the consultations with the local community, it is understood that the land procurement for the project has not resulted in any land owner owning economically unviable land parcels or has faced economic vulnerability. No cultural heritage sites were identified in the project area or in a radius of 5 km (Area of Influence).

According to the information made available by the project team, and one of the Patwaris involved in the survey of the land, Inox has paid a rate higher than the prevailing market rate for the private land procured. According to the patwari, the minimum amount paid for private agricultural is 14 lakh/ha for irrigated land and 7 lakh/ ha for unirrigated land. Based on the discussions with the local community, the land owners received Rs 8 lakh/ha for unirrigated land for the land procured for the project.

Baseline

The Project area comprises largely of undulating land with small rolling hills with average elevation of 467 m above the Mean Sea Level (MSL) with a variation of 450 m to 501m above MSL.

The study area considered for ESIA includes an area within 5 km radius from wind farm area of WTGs. The study area of 5 km has been selected based on the location of Project site and its footprint, nature and spatial distribution of potential social and environmental impacts (based on similar type of projects). No national park, Reserve forest, wildlife sanctuaries, biosphere reserves, notified historical or cultural sites etc. are located within the study area. Physically, there is no demarcation or fencing for the Project Site boundary and hence it is contiguous with the rest of the area.

ERM undertook a site visit (17th July to 20th July, 2015) to understand the site setting, environmental and social sensitivities and to identify the relevant local stakeholders.

Landuse

The land is primarily used for agricultural practices in the Mandsaur district as well as in the project AoI, contributing 78.64% of geographical extent, followed by wasteland of 13.02%.

Towards the south west and south of the Project AoI lies forest land comprising of deciduous and scrub forest. Three of the WTGs NPY-P- 51 (240m, W), NPY-P- 52 (180 m, w) and PY-P3-143 (100 m, S) are located near the

forests. These forests contribute to 3.64% of the total geographical extent of the AOI.

The other land uses in the area are built up area comprising of rural settlements, urban contributing 2.83 % followed by water bodies contributing 1.87% of the total geographical extent.

Topography

There is an increase in elevation from north to south of the project AoI in the range of 433-501 m above MSL. The contour levels of WTGs footprint area vary in the range of 440 – 485 m above MSL. Furthermore the increase in north-south elevation is not uniform as the landscape is fairly undulating with hillocks in between.

Hydrology and drainage pattern

The AoI has two rivers in the east and the west side: Rupaniya and Ansan respectively which have their source in the reservoir of the Gandhi Sagar dam located around 50 km north-west of the Project Area. The Project's footprint area is criss-crossed by drainage from these two rivers. Other than these bigger streams, several smaller streams are located in the Project area. There is also a large reservoir near Akli Shivdas village and smaller check dams type water bodies near Takrawad, Manpura and Nariya Buzurg village.

Climate and Meteorology

The climate of the district is characterised by hot summer and general dryness throughout the year except during the southwest monsoon season, i.e., June to September. May is generally the hottest month with the mean daily maximum temperature at 39.8 ^{o}C and the mean daily minimum at 25.4 ^{o}C; January is the coldest month with the mean daily maximum temperature at 35 ^{o}C and mean daily minimum at 9.30 C. As per the district's website the average annual rainfall in the Mandsaur is 786.6 mm.

Natural Hazards

The Project area falls in Seismic Zone II which is defined as a low damage risk zone which corresponds to MSK VI or less severe earthquakes (as defined by the BMTPC). The Project area falls in High Damage Risk Zone – B (Vb=47 m/s). The Project site and AoI do not fall under flood prone areas.

Ambient Noise

Noise Level was recorded at 11 locations in the study area during the monitoring period. The equivalent ambient noise level for day time (Leq day)

and night time (Leq night) at the monitoring locations were observed to be below the prescribed CPCB corresponding limits[1] for residential area.

Water Resources and Quality

The study area mostly relies on groundwater for their water requirements, both domestic and agricultural. Several wells were also observed amongst agricultural fields in the study area which are the primary source of irrigation. Water quality assessment was undertaken for 1 ground and 2 surface water samples within the AOI. Ground water quality was found to have TDS, magnesium and coliforms above the desirable limits of drinking water standards. Surface water samples collected from the Jamuniya village pond can be best classified as 'Class D' (Propagation of Wild life and Fisheries) and that of Barkheda Uda village pond can be classified as 'Class E' (Irrigation, Industrial Cooling, Controlled Waste disposal)

Ecological baseline

The major vegetation habitats identified in the wind farm area and 5 km buffer area are open scrub, grasslands and agricultural lands. Open scrub forms the major vegetation types in the study area. The area is mainly dominated by tree species of *Butea monosperma, Prosopis juliflora, Acacia nilotica* followed by isolated patches of *Azadirachta indica, Prosopis cineraria, Madhuca longifolia* species. Shrubs and Herb species are dominated by *Calotropis gigantea, Lantana camara, Carissa spinarum, Datura metal, Jatropha curcas, Nerium indicum, Woodfordia fruticose, Ziziphus nummularia, Cassia tora, Argemone maxicana, Xanthium strumarium, Tribulus terrestris and Solanum nigerum* in most dominant in the open scrub areas. Grasses such as *Apluda mutica, Cynodon dactylon, Eragrostis tenella, Heteropogon contortus, Themeda caudate and Themeda triandra* can be seen in Open scrub area.

Crops of ground nut, were commonly seen during the study period. Black gram, Rice, Jowar and Maize are also grown in the area. Weeds such as *Calotropis* species, *Lantana* are also observed in the agricultural fields. Farms of oranges can also be seen in the Study Area.

Homestead plantation of *Mangifera indica, Aegle marmelos, Albizzia procera, Ficus religiosa, Ficus benghalense, Madhuca indica, Moringa oleifera, Eucalyptus lanceolatus, Phoenix sylvestris* and *Azadirachta indica* are seen planted near the habitation. *Delonix regia*, *Syzygium cuminii, Tamarindus indica, Acacia nilotica, Cassia siamea, Ficus racemosa*, *Madhuca longifolia*, *Pongammia pinnata*, *Bauhinia purpurea, Pithecolobium dulce* can also be observed planted in these areas. Climbers such as *Vitis latifolia, Vallaris solanaceae* and *Smilax macrophylla* can be commonly seen.

[1] Central Pollution Control Borad (CPCB) stipulated noise limit for residential areas is 55 dB(A) during day time and 45 dB(A) during night time..

Ipomea aquatic and *Eichhornia crassipes* are seen as most dominant species observed in the water bodies.

A total of four (04) species belonging to 2 families of Amphibians were observed from the study area. None of the species are of conservation significance. A total of sixteen (16) species of reptiles belonging to 9 families were observed from the study area. One (01) species Indian Python (*Python molorus*) is listed as Near Threatened as per IUCN category.

While the study confirmed the presence of threatened species and migratory species and species listed as Schedule I of Indian Wildlife Protection Act, 1972 within the project area the following facts needed to be considered.

- The site is at a far distance of 16 km from the Gandhi Sagar Wildlife Sanctuary and Reservoir (IBA Code-IN-MP-06, IBA Criteria (A4i-≥1% biogeographic population), A4iii (≥20,000 water birds).
- There are reports of Lesser Adjutant *Leptoptilos javanicus* (IUCN v2015.4 Vulnerable) and flamingos *(Phoenicopterus roseus)* (IUCN v2015.4 Least Concern) from this sanctuary. This reservoir is also famous for large numbers of the migratory Bar-headed Goose *Anser indicus* (IUCN v2015.4 Least Concern).
- During the first phase of the long term monitoring (February 2016) 20 migratory species were recorded from the study area and in the second phase of Long term monitoring (March 2016), 13 migratory species have been recorded. However, review of the migratory routes clearly suggests that none of the major migratory routes pass through the project area.
- Some of the migratory species from Gandhi Sagar Wildlife Sanctuary and Reservoir may use the study area as their foraging area due to the presence of habitats in small and large waterbodies. However given the major congregations of the water birds in the reservoir, any impacts on species visiting the wind farm, as a spill over, are unlikely to be significant and will certainly not impact species abundance within congregations in the region. The wind farm area is not a critical habitat for migratory birds.
- Even though there were threatened species observed at the site (one EN and 3 VU species) all these species are resident, widely distributed and abundant in the region and any mortality is likely to be very low because of low abundance in the study area and hence will not cause any decline of populations of these species.
- The low level of mortality can be further reduced with appropriate mitigation measures available. These include placing bird markers on insulators and insulating conductors where they cross-over electric poles.

A total of 12 species of mammals of 12 genera belonging to 10 families were observed/ reported from the study area. One (01) species Indian Pangolin (*Manis crassicaudata*) is categorized as Near Threatened (IUCN v2015.4.) categorization and listed as Sch. I species, as per Wildlife Protection Act, 1972.

Socio-economic baseline

The project lies in the Mandsaur district in the north-west Madhya Pradesh, which is known for its rich archaeological heritage. Mandsaur is divided into 4 Development Blocks, head-quartered at Mandsaur, Malhagarh, Sitamau and Garoth. In addition, there are 8 tehsils in the district, namely, Mandsaur, Malhagarh, Garoth, Shamgarh, Dalauda, Bhanpura, Suwasra and Sitamau.

The WTGs are being erected within or close to the periphery of 13 villages, viz., Aaklishivdas, Bardiya Amra, Barkheda Uda, Bhagori, Khankhari, Makdichaoda, Manpura, Nariya Buzurg, Semli, Takrawad, Chhayan, Jamuniya, Sagoriya and Bardiya Amra. In addition, there are 25 other villages which lie in the the 5 km span of the project and together with the above 13 villages form the Area of Influence for human receptors of the Project.

As per the 2011 Census, the AoI, covering 38 villages in the 5 km radius, has a total of 9,351 households supporting a population of 42,547 individuals. Bardiya Amra, Sagoriya and Takrawad are the most thickly populate villages amongst all. The average household size in the AoI is 6 individuals per HH. The AoI has a negative sex ratio of 966 females per 100 males, which is better than the district and the state figure of 963 females per 1000 males and 931 females per 1000 males, respectively.

The entire population in the AoI falls in the rural category and the proportion of SC population is quite varied across the AoI villages, tehsil and the district. There is considerable presence of tribal population in Madhya Pradesh, but the AoI has a marginal contribution of 2.6% ST population. The major sub castes of SC population inhabiting the area are Thakur, Meena, Patel Porwal, Chamar, Balai, Seth, Suthar, Harijans, Nai, Bairagi, Lohar, Telis, etc. According to the information made available during the consultations and the visual observations during the site visit, it is understood that there is no demarcation on the basis of caste or religion in the settlement patterns in the AoI.

According to the Census data of 2011, majority of the land (about 70%) forms the net sown area, while 11% land forms the barren and uncultivable land. The agriculture is dependent on rain but sufficient sources are available for irrigation in the AoI.

The AoI is categorized by nearly 58% working population (main and marginal workers) in Core zone and 55% working population in buffer zone. Majority of the working population of the AoI (67%) comes under “Main Workers”, i.e., being employed for more than 6 months in a year. The core zone houses nearly 70% of Main workers while the proportion goes a little lower to 66% in buffer zone.

Agriculture is the mainstay of the economy and people cultivate crops like Maize, Pulses (Urad, Moong,) and Soybean amongst Kharif crops and Wheat, Gram, Mustard, Coriander, Fenugreek, Onion, Tomatoes, Chillies, Fenugreek

and Linseed being the Rabi crops. In addition, the people also cultivate vegetables like eggplant, cauliflower, cabbage, turnip, carrot, cucumber, garlic, etc.

In addition to agriculture, livestock holdings play an important role in the livelihoods of the community, in terms of providing extra income in addition to meeting the nutritional intake of the household.

The AoI is characterised by poor sanitation facilities which increases the risk of diseases amongst people. The status of water availability also varies across the villages and the scenario becomes troublesome during summer months of April to June.

The villages of Bardiya Amra, Makdichaoda and Semli are reported to have piped water connections, while hand-pumps act as a constant source of water during most part of the year in all the villages of AoI. Tube-wells are also a significant source of water serving a majority of villages. The water is available in most of the villages at about 100 ft. during monsoons and early winters, however; the quality of water degrades with increase in the depth. The community consultations in Chhayan, Sagoriya, Barkheda Uda and Bhagori village have pointed towards water problems leading to people covering distance of 2-3 km to fetch water. In some villages, the people have to order water tanks for household consumption and pay an amount between INR. 300-500 per tank, depending on the distance.

Information Disclosure and consultation and participation

Keeping in mind the nature of the project and its setting, the stakeholders identified were categorized under community, institutional stakeholders, government bodies and other groups.

INOX Renewables is the EPC and O&M contractor for the site and all activities are being carried out by them. There have been no village information meetings prior to setting up of the project and the land owners were contacted through the local people.

The consultations with the stakeholders also revealed that no CSR activities were being conducted during the time of the site visit and they were expected to start after the project becomes operational.

Key issues identified through the stakeholder consultations are:

- Delay in the payment of wages to Security Guards
- Temporary Employment of people in the Project
- Delay in the erection of WTGs and stringing activities, leading to crop losses
- The land transaction is the district is happening at a rate lower than the District Circle Rate

Grievance Redressal and engagement with the community

In order to manage the above mention issues, MEIL needs an internal mechanism to allow prior to approaching the formal legal mode of solutions. Presently, MEIL does not have a formal grievance redressal mechanism in place for external stakeholders. Since the project is part of a larger project being developed by Inox, the Inox operations and maintenance team will be required to be a part of the Grievance redressal mechanism put in place. Presently Inox has an employee grievance redressal mechanism in place, which will be applicable to the project. However, Inox does not have a community grievance redressal mechanism in place.

According to the consultations with the local community, it was understood that presently the local community communicated any concern/grievance verbally to the project land team. However, this is an informal process and no records of such communication are maintained. For the remaining project lifecycle, a formal grievance redressal mechanism has been put in place for the project.

The grievance redressal cell (GRC) will be established which will be driven internally by the INOX and MEIL Project teams and shall representation from the following teams to ensure fair and timely solution to the grievances:

- Inox Section Heads and HoD
- Inox Site Manager/Project Manager
- Inox EHS Officer
- Inox HR Department
- Senior representation on behalf of MEIL
- Any other concerned person with decision making authority in relevance to the grievance or aggrieved party

The GRC shall be led by a Grievance Officer, who can either be the site EHS officer or Community Relations Officer. The aggrieved party shall register their grievances with the GRC. The GRC shall be empowered to take a decision which is to be considered final and binding on the Project. However, the decision of the GRC is not binding on the aggrieved person and he or she may take the grievance to the administrative setup in case any grievance channel is available at that level or take a legal course, in case not satisfied with the outcome of GRC decision.

Impact Assessment

The project activities that would result in impacts are as follows:

- Site preparation as clearance of vegetation;
- Construction of temporary structures such as construction site office, store yard, labour accommodation, batching plant;
- Construction/ upgradation of access roads;

- Vehicular movement for transportation of WTG components and construction materials;
- Movement of construction equipment like cranes, excavators, dumpers, trucks;
- Civil works for foundations excavation, construction related activity at each WTG location;
- Erection of WTGs and associated transformer yard and permanent site office;
- Operations and scheduled maintenance of the WTGs, transmission lines etc.; and
- Removal of WTGs and elated infrastructure during decommissioning.

Change in Landuse

Currently, majority of the project area is primarily used for agricultural purposes and hence receptor sensitivity is assessed as medium. The WTGs are to be located on waste land (open scrub) and agricultural fallows. The impact magnitude is assessed as medium based on the spread of the project (about 62.5 acres (25.29 ha) of land for WTGs, 75 km of access roads, 3.26 acres (1.3 ha) for pooling substation). As a result, the impact significance is assessed to be moderate.
The residual impact is expected vary from negligible to **minor** post implementation of mitigation measures.

Impacts on land and soil environment

Soil erosion

During the construction phase, top soil will be susceptible to erosion to some extent due to site clearance activities. The scale of site clearance activities would be small at WTG footprints at different parcel of lands, whereas in areas of new internal road construction, excavated loose soil would be susceptible to erosion. Few WTGs as NPY-P-52, NPY-P-56, NPY-P-57, NPY-P-59 and PY-P3-113 are located within 500 m of water bodies so impacts of soil erosion on waterbodies will contribute to increase in dissolved and suspended solids. Significance of impact of soil erosion is considered **minor**.

Soil compaction

The project will undertake the soil compaction activity to ensure soil stability during the establishment of storage areas for WTG components, access road, installation of batching plant, establishment of substation, CMS building etc. During construction activities, there would be compaction of soil in the project area during movement of vehicles/ construction machinery and work force movement. In addition, laying of electrical wires in the agricultural field during erection of internal and external transmission lines will also lead to the compaction of soil to certain extent. Routes will be designated for heavy vehicle movement. As soil is being used for agricultural activities in the

project AoI the sensitivity is assessed as medium. The impact magnitude is assessed as small. Based on the above the impact after incorporating the embedded control the impact significance is considered to be minor. The significance of impact will be **negligible** post implementation of mitigation measures.

Impact on land due to improper waste disposal

General construction waste and municipal domestic wastes will be generated. A small proportion of the waste generated during construction phase will be hazardous and may include used oil, hydraulic fluids, waste fuel, grease and waste oil containing rags. If improperly managed, these wastes could create impacts on land. Workers will be strictly instructed about random disposal of any waste generated from the construction activity and construction contractor shall ensure that no unauthorized dumping of used oil and other hazardous wastes is undertaken. The impact significance is assessed as minor and residual impact will be **negligible** post implementation of mitigation measures.

During operation phase, the waste generated from project will include domestic solid waste at SCADA building, Central Monitoring Station (CMS) and substation and hazardous waste like waste oil and lubricants and oil containing jutes and rags will be generated during maintenance activities. The quantity of hazardous waste generated will be much lesser quantity than during the construction stage. With proper waste management the impact significance is assessed as **negligible**.

Soil contamination due to leaks and spills

Soil contamination during the construction phase may result from leaks and spills of oil, lubricants, or fuel from heavy equipment, improper handling of chemical/fuel storage and wastewater. Such spills could have a long-term impact on soil quality, but are expected to be localised in nature. Spill control measures such as the storage and handling of chemicals and fuel in concrete areas with secondary containment will be implemented to minimize impacts in the event of a spill. The impact significance is considered to be minor. The significance of impact will be reduced to negligible on implementation of mitigation measures.
During operation phase, the probability of the impact is only during WTG maintenance and therefore occasional. In case of accidental spillage, the impacts will be confined to the WTG land parcels and storage area. The impact significance is assessed as **negligible**.

The overall significance of impacts on soil and land environment due to decommissioning activities is assessed as **minor**.

Impact on Water Resources

The impacts of proposed project on water environment are assessed with respect to

- Decreased water availability form the water resources of the area due to consumption of water for carrying out project activities; and
- Decreased water quality due to wastewater release and spills/leaks from project activities.

The sensitivity of water resource in the area is considered as medium due to the extensive usage of ground water resource for irrigation and other purposes by the locals. The direct negative impact on water resources due to usage by construction activities will be short term and limited mainly to construction phase of the project. Also the requirement will be in a phased manner so based on the above the impact is assessed to be minor. The significance of impact will be **negligible** on implementation of mitigation measures.

Around 2-3 m3/day water is required during operation phase to meet domestic requirements of O&M staff and for use in the SCADA building and sub-station complex. The overall significance of impacts on water availability due to operational activities is assessed as negligible.

As mentioned in the context, there are few surface water bodies in vicinity of few WTG foot print area which could be directly impacted from project activities. There may also be chances of ground water contamination during the rains. Based on the above the impact is assessed to be minor. Residual significance of impacts during construction phase will be negligible post implementation of mitigation measures.

During operation phase, there will be no wastewater generation from the power generation process. Only sewage would be generated from substation and SCADA building and this will also be of negligible quantity. The estimated sewage generation from project site will be less than 2 m^3/day. The overall significance of impacts on water quality due to operational activities is assessed as **negligible**.

Air Quality

The receptor sensitivity has been assessed as medium based on the location of receptors located near some WTGs. The impact on air quality will be local and short-term, restricted to the construction period. The overall impacts are assessed to be minor. The residual impact due to the Project on air quality will be **negligible** post implementation of Mitigation measures.

Ambient noise levels

There are 12 receptors across 8 WTGs. Three of the WTGs NPY-P- 51 (240m, W), NPY-P- 52 (180 m, W) and PY-P3-143 (100 m, S) are located near the forest existing in the AoI. High ambient noise levels during construction phases might be a cause of discomfort for the inhabitants as well as fauna in the forest area. The resource sensitivity is assessed as medium for all the locations and high for WTG location NPY-P-56 which has a school located 300 m, N. Peak construction works generating noise are expected to last for not more than 1 month at any particular location and construction activities will be limited to daytime only. Based on the scattered activity areas impact of construction activities will be limited within 500 m of the WTGs locations and within 100 m from the road network, which will be developed/upgraded and used for man and material movement within and outside the project area. The impact on noise quality during construction phase of the project is assessed to be minor to moderate. The significance of the residual impact will be negligible to minor based on the location post implementation of mitigation measures.

Based on the noise modelling results and magnitude criteria, the impact magnitude will be negligible during daytime for all the receptors except for Receptor G where it will be of small magnitude, and small to medium during night time (considering that the school will be closed during night time). Therefore, the impact of noise on identified receptors due to operation of WTGs (in predominantly moderate wind condition) during day time has been estimated as negligible to minor, whereas during night time it has been estimated as minor to moderate, since the maximum noise throughout the day and no barrier has been considered between the source and receptors.
By implementing mitigation measures, the residual impact due to the Project on noise will vary from **negligible to minor**.

The results of shadow flicker modelling show that theoretical shadow flickers in real case scenario occur at 7 shadow receptors. The maximum shadow flicker occurs at shadow receptor 'E', located close to the WTG *NPY-P-57*, with a maximum of 410:31 hr/year followed by receptor 'G' with 217:54 hr/year. The other affected receptors are 'B', 'D', 'K', 'H', and 'A' in decreasing order of hours/year of shadow flicker. Further, shadow flicker impact of more than 30 hours per year was observed due to only6 WTGs out of the total 25, which are: *NPY-P-58, NPY-P-57, NPY-P-56, NPY-P-53 NPY-P-51* and *PY-P3-115*.
There needs to be close monitoring through engagement with residents during the operational phase where there are predicted impacts from shadow flicker. The likelihood of direct line of sight to the location of proposed turbine locations can be assessed visually and the potential for using screening like higher fencing and planting trees can be explored at problem locations. The use of curtains can also be explored. Should the impact of shadow flicker be identified, and the mitigation measures proposed above prove ineffective, further analysis can be carried out to identify the exact timings and conditions under which shadow flicker occurs, and a technical solution sought.

Ecological Impacts

The associated ecological impacts of the construction phase are due to following construction activities;

i. clearance of vegetation for storage yards;
ii. laying of WTG foundation and WTG installation
iii. laying of transmission lines and transmission towers
iv. laying of approach roads

The impacts of vegetation clearance will be both direct and indirect and limited to construction phase of the project. Overall impact significance of the vegetation clearance is assessed as minor.

The WTG foundation laying and WTG component installation will require camping/ of work force on site, movement of vehicles for transportation of man and material, construction noise due to excavation etc. Noise generated by construction activities and vehicle movement may further disturb the wild life movement in the nearby areas. The habitat is considered of low sensitivity as it harbours species listed as of Least Concern (LC) on IUCN Red List of Threatened Species. However as there are several Schedule I species within the wind farm area, species sensitivity is considered medium.Overall impact significance is assessed as ***minor***.

Approach roads are integral to any wind farm projects as they are established usually away from habitation and the main commutation routes. Biodiversity along these therefore tends to be higher. Approach roads will also lead to mortality of faunal species crossing the road (especially smaller mammals) and occasionally birds flying across. The impacts of laying approach roads will be both direct and indirect and limited to construction phase of the project. Impacts are at a small scale and do not affect the overall viability/functionality of the overall habitat for the species listed. The impact will furthermore not cause a significant change in the population of species as species numbers are abundant. The impact magnitude is thereby considered small. The habitat is considered of low sensitivity as it harbours species listed as of Least Concern (LC) on IUCN Red List of Threatened Species. Overall impact significance of the construction of approach roads is assessed as **minor**.

During operation phase mortality of avifauna due to collision risk and electrocution is a risk. The magnitude of the impacts of the WTGs and transmission lines through both collision and electrocution are likely to be long term though their impacts are small as they are likely to affect only a small part of the arial habitat (especially for migratory birds and vultures or other raptors) thereby not affecting overall habitat viability/functionality. This has to however be confirmed in the migratory season, in case the wind farm lies in the path of a major flyway for migratory birds visiting the Gandhi Sagar reservoir, a major habitat for migratory species. As ascertained till now impacts on species is likely to be small as there will be no change in the

population of any threatened species as a consequence. The sensitivity of habitats is medium due to the presence of the several Schedule I species and the sensitivity of species high, due to the presence of the Egyptian Vulture and possibly other migratory species of conservation significance. The significance of impacts prior to any mitigation methods is likely to be **minor** for habitats and **moderate** for species.

It is proposed for Additional Monitoring for Requirement of baseline data generation for bird species visiting the study area during migratory season, The said monitoring would give probable flight path of migratory birds and endangered species during their daily movement; The study will also involve survey of bird species specific to water bodies (if there are any) along with terrestrial migratory species which may also be under threat of collision risk; and

Community Health and Safety

The receptors for impacts on community health and safety include the local community within the AoI who may be present in the vicinity of the project activities. The construction phase activities such as the erection of the WTGs, construction of the transmission line and substations and movement of material and personnel may result in impacts on the health and safety of the community. The impact significance is assessed as moderate and residual impact reduced to **minor** on implementation of mitigation measures.

Impact on Economic opportunities

The receptors for impacts on livelihood profile and economic opportunities include the land losers and local community within the study area. According to the information available, the land requirement for the project is mostly comprised of private land.

The construction phase activities of the project including construction of access road, civil works, foundation activities, site clearance and security will involve semi-skilled and unskilled workers, out of which nearly 30% labourers are expected to be from the local community. The project is also likely to create a number of indirect economic opportunities in terms of hiring of tractors and cars, setting up of tea shops etc.

During the operations phase, the employment opportunities will be reduced and restricted to the maintenance of access roads, hiring of cars and drivers, and a few security personnel and housekeeping staff at the site office.
The significance of impact across both phases will be positive.

Occupational Health and safety

The receptors of the impacts on occupational health and safety include the workers, both regular and contractual working on the project. The

construction phase activities such as construction of WTGs, access roads, transmission lines and other project components and maintenance activities in the operations phase are likely to result in a risk on the health and safety of the workers on the project. The significance of the impacts will be reduced to Minor on implementation of mitigation measures.

Labour Rights and Welfare

The projects will employ skilled, semi-skilled and un-skilled workers, across the project lifecycle, which will include contractual and regular employees and local and migrant workers. The significance of impact is assessed as minor.

Impact on Indigenous Communities/ Vulnerable Groups

The study area is characterised by a SC population of 22.1% and ST population of 2.5%. The major sub castes of SC population inhabiting the area are Thakur, Meena, Patel Porwal, Chamar, Balai, Seth, Suthar, Harijans, Nai, Bairagi, Lohar, Telis, etc. while the main tribal population is of the Bhil tribe. The vulnerable groups identified are women, SC and ST households, women headed households and Below the Poverty Line People. The land for the project is mostly comprised of private land, however the details of the same is presently not available. However, the significance of impact will be reduced to negligible on implementation of mitigation measures.

Analysis of Alternatives

Wind energy projects are non -polluting energy generation projects which are site specific and dependent on the availability of wind resource. The proposed wind power project site has the following location advantages:

- No ecological sensitive receptor such as national Parks, Wildlife Sanctuary, within 5 km radius; Though forest land exist in the AOI but none of the WTGs and any associated facility are/shall be located within these lands.
- No cultural property of archaeological importance and tribal population is getting impacted;
- No major habitations falling within 500 m of WTG locations.
- Access roads being developed as part of the project can be used by locals.

It will contribute towards the state of Madhya Pradesh attaining self-sufficiency in power supply.

Environmental and Social Management Plan

The ESMP defines mitigation measures to minimize adverse impacts during different phases of project lifecycle, monitoring plan and responsibilities for its implementation.

MEIL management

MEIL has put an organisational structure in place with roles and responsibility for each of the verticals identified at the corporate as well as on site. MEIL will have a corporate EHS Head, who will be responsible for ensuring the implementation of the ESMP.

In addition to the Corporate EHS head, MEIL will have in place regional and project level Engineers looking after EHS. The roles and responsibilities include the implementation of the ESMP, either by MEIL directly or through in-house, EPC sub-contractors and O & M contractor.

Inspection, monitoring and audit

Inspection and monitoring of the environmental and social impacts of the Project activities will increase the effectiveness of ESMP. Through the process of inspection and auditing, MEIL will ensure that the conditions stipulated in various permits are complied. The inspection and audits will be done by the project identified EHS staff and any other external agencies identified. The inspection and audit findings are to be implemented by the site In-charge (O & M) in coordination with respective departments.

Reporting and documentation

MEIL will develop and implement a programme of regular reporting through the stages of the project lifecycle involving O & M contractor personnel. The personnel delegated EHS roles shall be required to fully comply with the monitoring programme in terms of timely submissions of reports as per acceptable level of detail.

Conclusions and Recommendations

The proposed project is a green energy project comprising of 25WTG to generate 50 MW power through wind energy. Impacts due to wind energy projects are short term, generally limited to construction phase and operation phase have negligible adverse environmental and social impacts.

The project and its key components such as access road, WTGs, Office building and transmission lines, are likely to have limited adverse environmental impacts on baseline parameters such as land use, water quality etc. The social impacts from the project are assessed to be generally beneficial in terms of overall local area development.

The key features of the project in terms of impact include the following:

- Majority of the project area is primarily used for agricultural purposes. The WTGs are to be located on waste land (open scrub) and agricultural fallows.

- There are about 12 receptors located within 500 m of WTG locations. There are also few water bodies and forest area in the Project AOI though none of the WTG locations fall within the forest land. .
- The construction of proposed project may bring local changes in the landuse pattern of the site;
- The Project will require ~2-4 m^3/day of water during construction and about 2-3 m^3/day of fresh water during operation phase planned to be sourced from tanker water;
- The negligible quantity of sewage will be generated at site office, which will be disposed through septic tanks;
- The project will have negligible to moderate residual impacts varying across receptors and day and night time post implementation of mitigation measures as suggested;
- The project will have minor to moderate impacts due to shadow flicker across receptors. It is suggested either to shift the WTG location (NPY-P-56) near the school and WTG NPY—P-58 (near houses) to avoid or reduce flickering impact or the options suggested needs to be considered.
- The hazardous waste will be disposed of as per authorisation from MPPCB. The storage, handling, transportation and disposal will be strictly as per the requirement of authorisation by MPPCB and Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008. The waste will be stored into closed containers under covered area with concrete flooring and sent for disposal to TSDF through authorized vendors;
- The proposed project will not result in any physical displacement of people.

To conclude, the implementation of ESMP will help MEIL in complying with national/ state regulatory framework as well as to meet IFC/ ADB reference framework requirements.

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1 INTRODUCTION

Mytrah Energy (India) Limited, hereinafter referred to as 'Company' or 'MEIL', is interested in developing a wind farm of 50 MW and comprising of 25 Wind Turbine Generators (WTGs) in Mandsaur district of Madhya Pradesh, hereinafter referred to as 'proposed Project' or 'Project'. This wind farm is a part of the larger Nipaniya Wind Farm of 180 MW capacity and comprising of 96 WTGs, being developed by M/S INOX WIND, hereinafter referred to as 'INOX'. While MEIL is investing in 25 of these WTGs, the remaining WTGSs are being procured by other companies such as Green Infra (approx. 22 WTGs), ReNew Power (approx. 20 WTGs), Mark Data Power (approx. 22 WTGs), PTC India (approx. 10 WTGs)etc.

Other facilities included in the 180 MW Nipaniya Wind Farm development are pooling sub-station (PSS), internal and external transmission lines and other associated facilities. As the proposed project is a part of this bigger development, it is understood it is also going to utilise these facilities.

ERM has been commissioned by MEIL to conduct an Environmental and Social Impact Assessment Study (ESIA) of the proposed project and associated facilities. This report presents the results of the ESIA study.

1.1 PURPOSE OF THE REPORT

The consulting firm understands that MEIL intends to invest in the wind farm project with financial assistance from the Asian Development Bank (ADB). In this context, the project requires evaluating the environmental and social risks associated with the proposed project and to implement mitigation measures to avoid adverse impacts during the project lifecycle. In addition to ADB Guidelines the project has to comply with the applicable International Finance Corporation (IFC)/World Bank (WB) guidelines relating to the environment, social issues and occupational health and safety matters, in addition to complying with local laws and regulations.

The report discusses the environmental and social baseline within which the proposed wind farm project will be commissioned and assesses the potential adverse and beneficial impacts that the project could have, along with suitable mitigation measures and an Environmental and Social Management Plan (ESMP) for the project.

The applicable reference framework in accordance with which the consulting firm has performed and reported this study includes the following:

- Applicable Indian national, state and local regulatory requirements;
- ADB safeguards Policy Statement, 2009;
- ADB policy on Social Protection Strategy, 2001;

- ADB policy on Public Communications Policy, 2011;
- IFC Performance Standards (2012);
- IFC/World Bank General EHS Guidelines (2007);
- IFC/World Bank EHS Guidelines for Wind Energy projects (2007); and
- IFC/World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007)
- Relevant ILO conventions covering core labour standards and basic terms and conditions of employment (limited to operational phase of the proposed project).

**Note: Wind energy projects in India at present do not require an Environmental Clearance under the EIA Notification, 2006. The ESIA is thus being undertaken as an internal management tool for MEIL. Thus, ERM is not preparing the ESIA for any regulatory requirements, hence, if any deliverable if used for the same purpose, ERM needs to be communicated by the Client.*

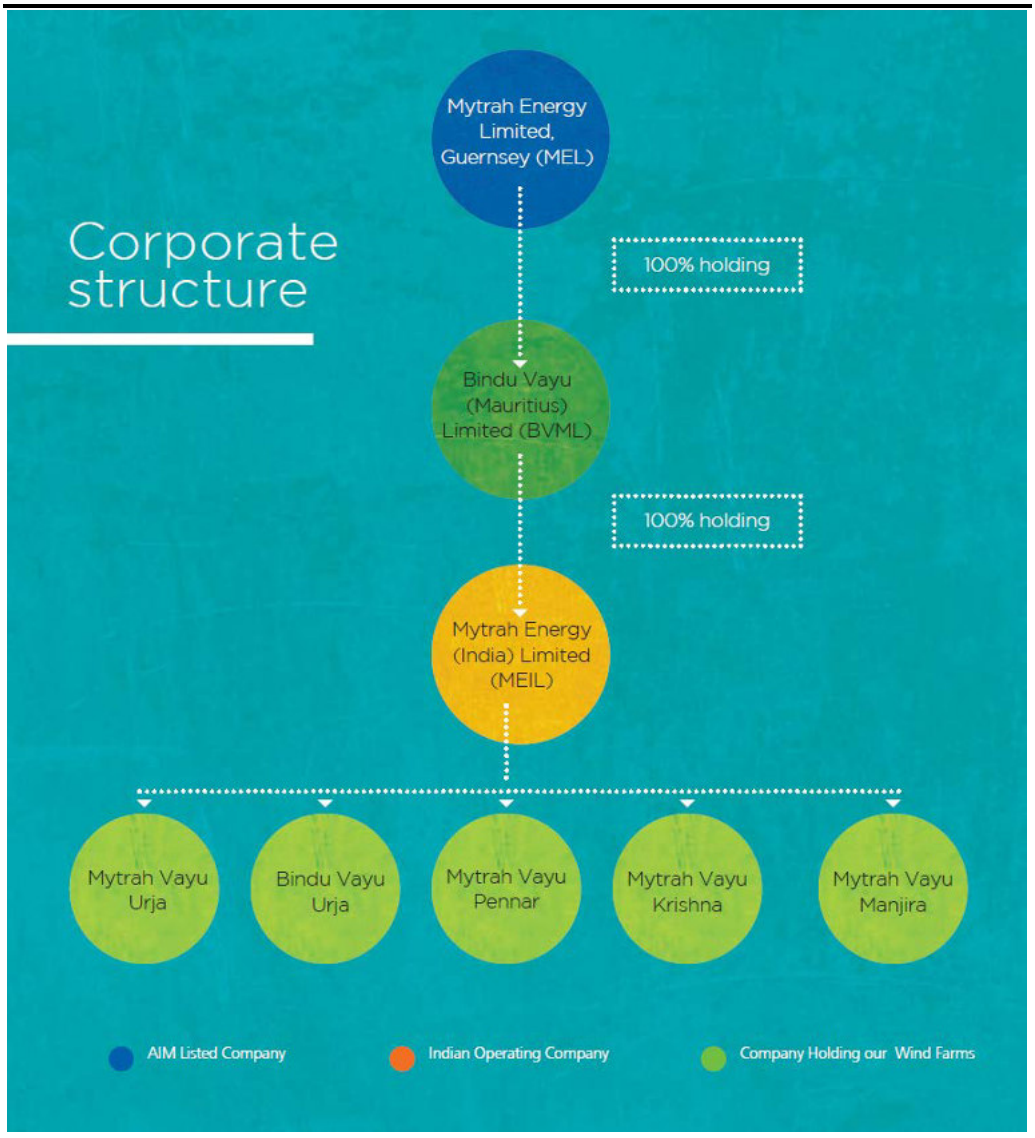
1.2 MYTRAH ENERGY (INDIA) LIMITED (MEIL)

Mytrah Energy (India) Limited (MEIL) is a wholly owned subsidiary of Mytrah Energy Limited (MEL) in India and aims to own and operate 5000 MW of renewable power in India. MEL is a pioneer and one of the largest Independent Power Producers (IPP) in renewable energy, in India, with 543 MW power generation across 10 projects and 6 States. MEL has 172 wind masts installed across multiple states in India, providing a rich source of information from which to select its future projects. MEL currently has an active development pipeline of about 3500 MW.

From a standing start in late 2010, MEIL has built a portfolio of over 500 MW of operating wind plants in India, with a further 100 MW in 2014. These assets are spread across ten wind farms in six states - Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu. The company's portfolio was built using a combination of 'turn-key' developers and in-house project development, with wind turbines purchased from three leading vendors.

MEIL sells power mainly to state grids through 13 to 25 year Power Purchase Agreements. In addition, the 100.5 MW project in Tamil Nadu will sell power directly to customers on long-term agreements. Additionally, MEIL has the largest wind data bank in India, being the only independent power producer that has 172 wind masts across the country.

Figure 1.1 MEIL Corporate structure



Source: *'smart utility'* Mytrah Energy Limited Annual Report 2014

As per data provided, MEIL has 578.7 MW operating facilities across 11 wind farms in India as presented in ***Table 1.1***.

Table 1.1 MEIL operating wind farms in India (as of December 2014)

S. No.	Project Location		Capacity (MW)	Operational since
1	Gujarat	Mahidad	25.2	October 2011
		Jamanvada	52.5	March 2013
2	Rajasthan	Mokal	42	September 2011
		Kaladonger	75.6	September 2012
		Bhesada	35.7	
3	Maharashtra	Chakla	39	February 2012
		Sinner	12.6	September 2012
4	Andhra Pradesh and Telengana	Vajrakarur	63	December 2012
		Burgula	37.4	March 2014
5	Tamil Nadu	Vagarai	100.5	December 2014
6	Karnataka	Savalsang	95.2	December 2014
	Total		578.7	

Source: 'smart utility' Mytrah Energy Limited Annual Report 2014

As per the MEIL Annual Report 2014, further 300 MW of wind power projects are under construction in Andhra Pradesh, Maharashtra, Rajasthan and Telengana.

The proposed project is being developed by MEIL and Inox will be the O & M contractor (20 years) for the project. Inox Wind is a subsidiary of the Inox Group. Inox Wind, part of the Inox Renewables Limited is an ISO 9001: 2008 certified company. Inox Wind is involved in the business of setting up and operating wind power projects and the manufacturing of Wind Turbine Generators.

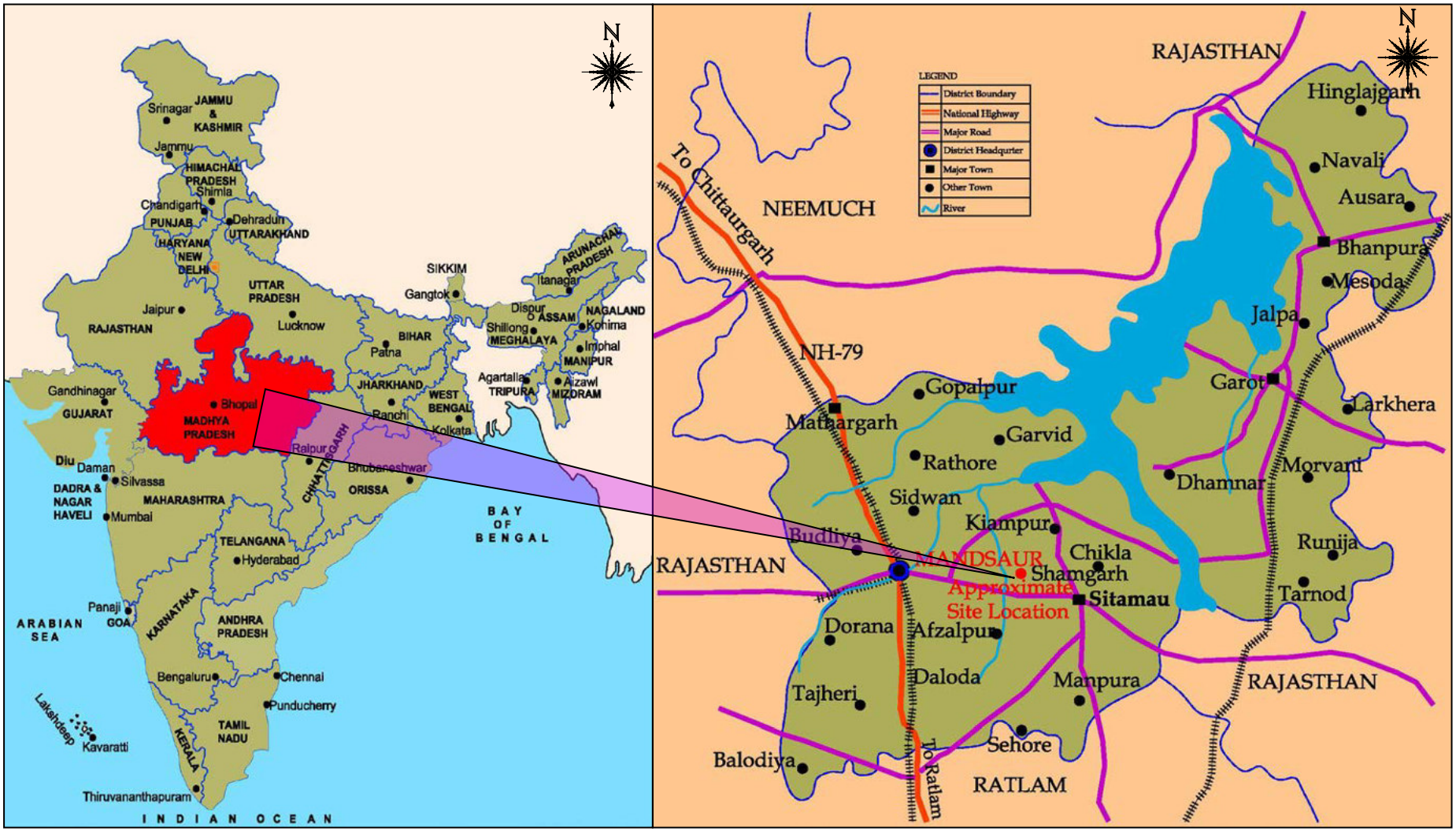
1.3 OVERVIEW OF THE PROJECT

The project comprises of 25 WTGs of 2.0 MW each combining to provide 50 MW power in total and is located in Mandsaur district of Madhya Pradesh (MP). ***Table 1.2*** provides a snapshot of the proposed project and location of the project is shown in .

Table 1.2 Project Nipaniya- a snapshot

Detail	Description	
Location	Mandsaur district, Madhya Pradesh	
	Tehsil	Village
	Shamgarh	Jamuniya, Sagoria, , Akali shivdas, Barkheda Uda, Nariya Buzurg, Khankhari, Semli Hada, Manpura, Badariya Amra, Chhayan, Takrawad
Terrain	Undulating	
Type of WTGs	25 WTGs of 2.0 MW each with 100 m rotor diameter and 80 m hub height. Model: INOX WT 2000 DF 100	
Total Land Requirement for WTG's	Approx 62.5 Acres (25.29 ha) (2.5 Acres/WTG or 1 ha/WTG)	
Substation	Pooling station will be located in Takrawad Village in 3.26 acres (1.3 ha). Grid station is located in Bhanod-Bhanpura.	
External Transmission line	MEIL has obtained permission under section 68 of Electricity Act, 2003. The External transmission line will be 14. 8 km long having 55 towers and will join state grid of MP on LILO of Bhadod-Bhanpura line at interconnection point of Nariya Khurd Village.	
Project Commissioning	March 2016	
Project Status at time of ESIA study	Planning, Pre-Construction and construction Stage	

Figure 1.2 Location of the Nipanya Project



Source : Copyright © Compare Infobase Pvt. Ltd. 2004

1.4 ESIA SCOPE

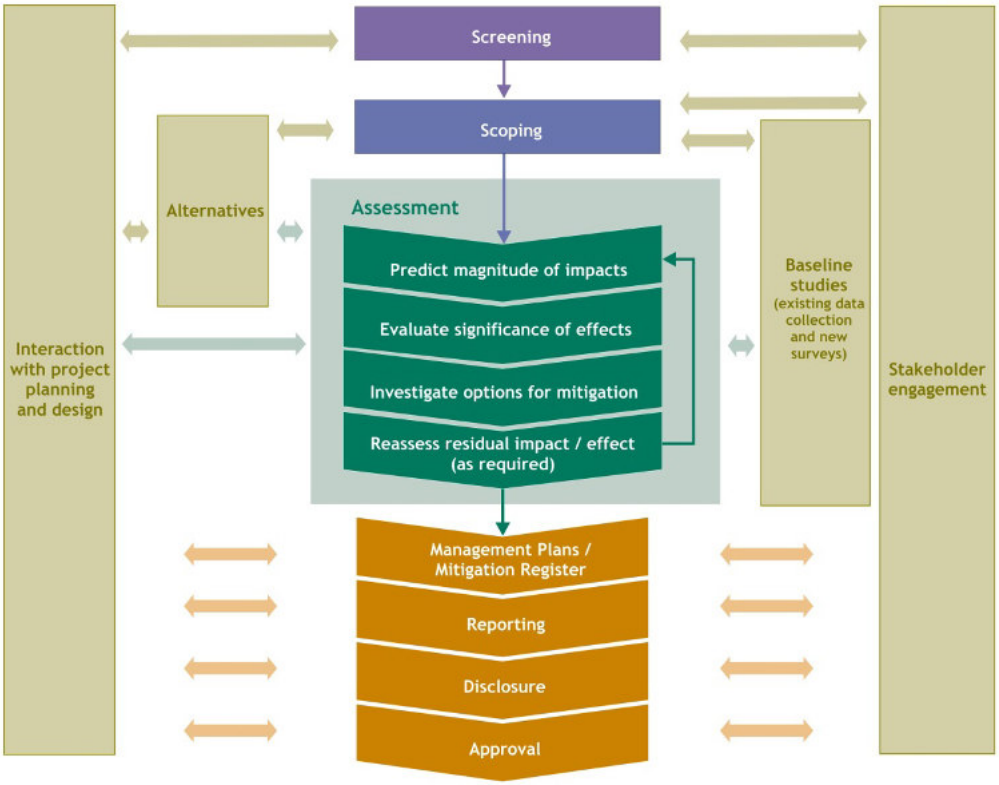
The Scope of Work for the ESIA broadly entailed:

- Identification and review of the applicable local, state, national and international environmental legislation and regulatory framework.
- Collection of baseline information through limited primary field surveys and monitoring with respect to ambient noise quality, land use pattern and socio economic profile within the study area of 5 km radius from the boundary of the project. Though as part of initial scope the consulting firm intended to collect baseline for surface water too, however no perennial surface water bodies were observed in the study area of 5 km and seasonal ponds were observed to be almost dry, thus no surface water samples were collected as part of baseline study.
- Collection of secondary data on geology, geomorphology etc.
- Prediction and identification of environmental impacts of the project followed by evaluation of significance of the predicted impacts.
- Suggesting appropriate mitigation/enhancement measures for identified environmental and social impacts.
- Comparison and analysis of the alternatives considered for the project with respect to power generation technology.
- Formulation of Environmental and Social Management Plan (ESMP) in accordance with IFC's Performance Standard 1 addressing the various aspects considered in IFC's Performance Standards 2 through 8 with management tools and techniques including monitoring and reporting requirements for effective implementation.

1.5 ESIA METHODOLOGY

The ESIA methodology follows the overall ESIA approach illustrated in ***Figure 1.3***. The ESIA has been undertaken following a systematic process that predicts and evaluates the impacts the project could have on aspects of the physical, biological, social/ socio-economic and cultural environment, and identifies measures that the project will take to avoid, minimise/reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The stages of the ESIA process are described below.

Figure 1.3 The ESIA Process



1.5.1 *Screening*

The screening for the proposed project is provided in ***Section 5*** of this ESIA report.

1.5.2 *Scoping*

The main objective of the Scoping is to ascertain the environmental issues associated with the project on which ESIA study will be focused by reviewing the project information and ascertaining likely environmental issues associated with the project activities through matrices. Scoping process determines terms of reference for ESIA study to be conducted for the project activities. This process helps in ensuring that all the relevant issues are identified and addressed in an appropriate manner in the ESIA study.

For this ESIA study, scoping has been undertaken to identify the potential Area of Influence for the project (and thus the appropriate Study Area), to identify potential interactions between the project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to prioritize these impacts in terms of their likely significance. This stage is intended to ensure that the impact assessment focuses on issues that are most important decision-making and stakeholder interest.

It is to be noted here that during the period of ESIA study, project is in the Planning and Pre-Construction phase, therefore, the scoping exercise includes

all the phases of the project, i.e., planning and pre-construction, construction, operation and maintenance and decommissioning into consideration.

The details of scoping exercise are reported in ***Section 1*** of this ESIA report.

1.5.3 Project Description

In order to set out the scope of the project features and activities, with particular reference to the aspects which can impact on the environment, a project description is prepared. This is based on information as provided by the project Proponent. The project description has been provided in ***Section 2*** of this ESIA report.

1.5.4 Baseline Conditions

Environmental baseline data has been collected through primary monitoring and surveys of the study area of 5 km distance from project area. Secondary information through literature surveys was also collected for the study area.

The detailed baseline characterisation for the project is provided in ***Chapter 6*** of this ESIA report.

1.5.5 Stakeholder Analysis and Consultations

An effective ESIA Process requires engagement with relevant stakeholders throughout the key stages. This assists in understanding stakeholder views on the project and in identifying issues that should be taken into account in the prediction and evaluation of impacts.

ERM identified/profiled the various stakeholders of the project, such as the affected families, the village-level intermediaries, the line departments (revenue, land, agriculture, forest), state/district administration and civil society organisations as well as developed an understanding of their stakes, interests and influences on the project.

Details of the Stakeholder Engagement activities undertaken for this project to date are presented in ***Chapter 7*** of this ESIA report.

1.5.6 Impact Identification/Prediction

Impact identification and assessment starts with scoping and continues through the remainder of the ESIA Process. It is an iterative process and completes only when the effects of all identified impacts arising out of the project, including Residual impacts, have been assigned a mitigation strategy. The IA comprises of four sequential steps: Impact prediction, Impact evaluation, Mitigation and enhancement, and finally, Residual impact evaluation.

The detailed IA is presented in ***Chapter 8*** of this ESIA report.

1.5.7 Analysis of Alternatives

A comparative analysis of alternative for the project is provided in terms of site location analysis and feasibility, Power generation technology available including no project scenario etc. in ***Section 9*** of this ESIA report**.**

1.5.8 Environmental and Social Management Plan (ESMP)

The results of ESIA study form the basis of the project ESMP. The ESMP will incorporate measures and procedures for the short and long-term environmental and social management of the project during its various stages. The Environmental and Social Management Plan (ESMP) is developed for the project and is presented in ***Chapter 10*** of this ESIA report.

1.6 LIMITATIONS

The limitations to the impact assessment pertain to the availability of information regarding the project, the accessibility of villages and stakeholders and the secondary information for the project.

It is understood that MEIL is in the process of finalizing the deal with Inox, the developers for the larger project. As a result of this, the locations of the WTGs are not finalized and may change upon the finalization of the deal. The consultations undertaken during the site visit were based on the present understanding of the project, the WTG locations and the project footprint area. However, it is understood that any change in the WTG locations, while may result in a change in villages and landowners, it is unlikely to result in a substantial alteration of the project understanding or its impacts. This is because all the locations for the wind farm are located on private land, with similar land use and dependence.

Furthermore, due to the confidential nature of the information required, certain information pertaining to the project, such as land requirement and records, employment details, stakeholder engagement details and management systems were not available for review at the time of the visit. While this had understanding of the project footprint and the potential land related impacts from project activities.

The consultations undertaken as part of the impact assessment were restricted to the stakeholders who were available during the site visit. It is understood that the negotiations for the land procurement for the WTG sites identified is in process for 18 locations. Due to this, consultations with land owners could not be undertaken at the time of the site visit, as the consultations may have adversely impacted the negotiation process. It is recommended that upon the completion of the land procurement process, a review be undertaken of the land procurement process by MEIL or a third party agency. The purpose of this review shall be to assess whether the land procurement process met the

requirements of the applicable reference framework. Also, due to the large number of villages within the study area, and the limited time in which the assessment had to be completed, the consulting firm undertook consultations in a sample of the villages, with a focus on the villages in the core zone and coverage of maximum number of stakeholder groups.

1.7 LAYOUT OF THE REPORT

The structure of this ESIA report is as given in ***Table 1.3***

Table 1.3 Structure of the report

Section	Title	Description
Section 1	Introduction	*(this section)* Introduction to the project and ESIA methodology
Section 2	Project Description	Technical description of the project & related infrastructure and activities
Section 3	Applicable Legal and Regulatory Framework	Discussion of the applicable environmental and social regulatory framework and its relevance for the project.
Section 4	Impact Assessment and Methodology	Description of the impact assessment process undertaken to identify potential environmental and social impacts.
Section 5	Scoping	Description of the Scoping outcomes undertaken as part of the ESIA process.
Section 6	Environmental and Social Baseline	An outline of the Environmental and Social Baseline status in the area of the project.
Section 7	Information Disclosure Consultation and Participation	Overview of the stakeholder engagement activities undertaken during the ESIA.
Section 8	Impact Assessment	This section includes details of identified environmental impacts and associated risks due to project activities, assessment of significance of impacts and presents mitigation measures for minimizing and /or offsetting adverse impacts identified.
Section 9	Analysis of Alternatives	Description of the reason for selection of adopted alternative.
Section 10	Grievance Redress and engagement with Community	Descriptions of the grievance redress framework and mechanisms for resolving complaints.
Section 11	Environmental and Social Management Plan	Outline of the Environmental and Social Management Plan (ESMP) taking into account identified impacts and planned mitigation measures and monitoring requirements.
Section 12	Impact Summary and Conclusion	Summary of impacts identified for the project

2 PROJECT DESCRIPTION

2.1 INTRODUCTION

This section provides an overview of proposed wind farm project. It provides a description of the project in terms of location, associated infrastructure, equipment required and activities to be performed during the construction, operation and decommissioning stages of the project.

The project forms a part of a proposed 180 MW wind farm area being developed and promoted by M/s INOX WIND in the same area. The project once complete is proposed to have 96 WTGs built in two phases of construction. The details about this development as reported to the consulting firm during the site visit are summarised in ***Table 2.1*** below:

Table 2.1 Reported status of the 180 MW wind farm being developed by INOX WIND

Total Capacity of the proposed development	180 MW
No. of WTGs	96
Execution Methodology	Construction work is to be done in two phases. Phase I active now: scheduled to be completed in March 2016
No. of WTGs to be erected in Phase I	40
Current Status	Erection of 31 WTGs completed, 23 commissioned
No. of MEIL WTGs	25 out of total 96 proposed
Status of MEIL WTGs	3 out of 25 erected; not commissioned

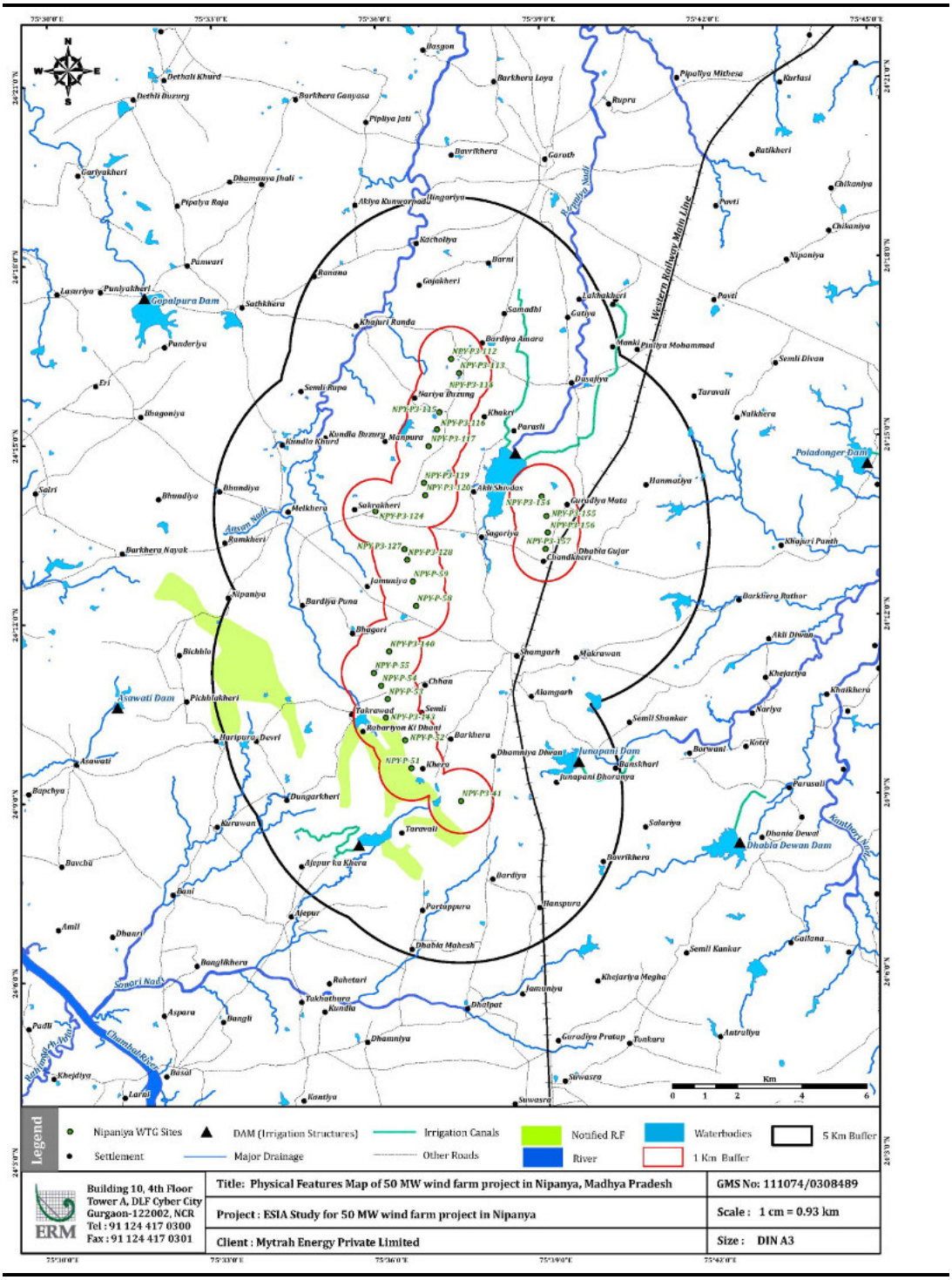
2.2 SITE SETTING

The project site is located in Nipaniya Region in Shamgarh Taluk, Mandsaur district of Madhya Pradesh. The district borders Neemuch and Ratlam districts of MP on its north and south respectively. On the east and west it is bound by Banswara and Jhalawar districts of the state of Rajasthan respectively. The district is well connected by road and rail networks.

The proposed project site is located in Shamgarh tehsil, and is located at a distance of 80 km north-east of Mandsaur town, which is the administrative centre of the district. The project area is spread across eleven (11) villages: Barkheda Uda, Takrawad, Chhayan, Jamuniya, Khankhari, Aakli Shivdas, Manpura, Sagoriya, Semli hada, Bardiya Amara and Nariya Buzurg. The area surrounding the Wind farm site comprises of rural setup with the primary land use being rain fed agriculture, primarily cultivating rabi crops such as wheat and maize.

The project location map along with WTG locations, 1 and 5 km radius is shown in ***Figure 2.1***.

Figure 2.1 Location of the Project



2.3 *FACILITIES*

The proposed WTGs amount to a capacity of 50 MW which would be fed to the State Power Grid of Madhya Pradesh Power Transmission Co. Ltd. (MPPTCT). The key components of the proposed wind farm include the following:

- Wind turbines;
- Pooling substation;
- Transmission lines - Internal and External
- Access roads;
- Additional project infrastructure

While the WTGs will be owned by MEIL, the associated project components such as pooling substation, transmission lines and access roads will be used in common by MEIL along with the other owners, which are yet to be finalized.

2.3.1 *Wind Mills*

The project is proposed to have 25 nos. Wind Turbine Generators (WTGs) of the INOX WT 2000 DF 100 make, with a rated capacity of 2.0 MW each. The specifications of WTGs are provided in ***Table 2.2***

Table 2.2 ***Specification for the proposed WTGs***

S. No.	Parameters	INOX WIND - MODEL WT 2000 DF 100
	No. of WTGs	25
OPERATING DATA		
1	Rated power	2000 kW
2	Cut-in wind speed	3 m/s
3	Rated wind speed	11.0 m/s
4	Cut-out wind speed	20 m/s
5	Survival Wind Speed	52.5 m/s
6	Hub height	80 m and 92 m
7	Type	Class TC IIIB
8	Rotor Speed	15.7 RPM
9	Operational mode	Variable speed
10	Design Standards	Germanischer Lloyd
ROTOR		
11	Pitch system	Pitch Control- Electrical; Variable Speed Inverters; Power back up with Ultra Capacitor
12	Diameter	100 m
13	Swept area	7894 m^2
14	Blade material type	Epoxy Glass Fibre
GENERATOR		
15	Type	Double fed Induction Generator
16	Rated power	2000 kW
17	Rated voltage	690 V AC, 3 Phase
18	Frequency	50 Hz
19	Cooling system	Water Cooled
20	Insulation	Class H
BRAKING SYSTEM		
21	Aerodynamic brake	Full span independent blade Pitching

S. No.	Parameters	INOX WIND - MODEL WT 2000 DF 100
22	Mechanical brake	Disc Brakes
	DRIVE TRAIN	
23	Drive Train	Patented integral drive train with rotor shaft and drive train as single unit
24	Rated Drive Torque	1280 k-Nm
25	Maximum Static Torque	2235 k-Nm
26	Type of Gearing	Two Planetary and One Parallel shaft gear
27	Transmission Ratio	1≈ 114.7
28	Gear Lubrication	Forced Lubrication
29	Connection gear / generator	Flexible Coupling
YAW SYSTEM		
30	Type	Driven by 4 gear Motors
31	Bearings	Roller Bearings
TOWER		
32	Type	Conical Tubular Steel Tower
33	Tower Height	78 m
34	Corrosion protection	Protective Paint

Source: DPR for Nipaniya Project as prepared by INOX

2.3.2 Pooling sub-stations

The 33 kV/220 kV Pooling Sub-Station (PSS) is being constructed by INOX at Takrawad village in 3.26 acres (1.3 ha).

2.3.3 Transmission lines – Internal and External

Internal Lines

33k V lines from each WTG will feed power into the 22kV/220 kV PSS at Takrawad village. As 10 WTG locations are only confirmed and rest under discussions, the exact total length of internal lines is yet not finalized. It was reported by MEIL that it will be approximately 30 Km.

External Transmission Lines

The power is transmitted through 4 feeder 33 kV transmission lines up to 33/220 kV pooling substation at Takrawad. From there on a 14.8 km long 220 kV DC power line feeds the power from the wind farm to the state grid of MP on LILO of Bhadod-Bhanpura line which is owned by Madhya Pradesh Power Transmission Co. Ltd. (MPPTCL). The interconnection point lies near Nariya Khurd village. The ***Figure 2.2***provides the route for the 220 kV transmission line. There will about 55 towers for the transmission line and the line will pass through the villages of Melkheda, Jamuniya, Sagoriya and Bhanpur Banod. The transmission route line does not pass through any forest land, human settlement and water body. There is no tree removal in the transmission line route, however, some trees and shrubs might require pruning for necessary conductor clearance.

Figure 2.2 220 KV Transmission Line Route

Source: MEIL

2.3.4 *Access roads*

The project area lies near the town of Shamgarh town in the sub-division of the same name. Shamgarh lies at a distance of around 80 km from Mandsaur town and the two are connected by the State Highway 14. The project Area can be reached from Shamgarh via the Suwasara road. Suwasara road is a paved single carriage way and connects Shamgarh with Melkheda and Bardiya Amra villages. Around the project Area it spreads out in a V- shaped formation. All the 25 WTGs are spread around both arms of this V-shaped formation. At present temporary access roads exist from this road only to 3 WTGs which have been erected[1]. These WTGs are:

- NPY-P-53
- NPY-P-54
- NPY-P-55

Access roads will be planned on confirmation of WTG locations and approximately 1.5 Km/MW of access road will be required as reported by MEIL which totals to about 75 Km .

Table 2.3 ***The Project area, nearby villages and surrounding access roads (in blue and yellow)***

2.3.5 *Additional Project Infrastructure*

Associated ancillary facilities and utilities provided for the project include:

- Unit Transformers with each WTG;
- Metering point for measuring production from each WTG;
- Vacuum Circuit Breaker (VCB) yards;
- Material storage yards and stores;
- Scrap yard;
- Central Monitoring Station building and facilities.

Some of these facilities constructed for the purpose of the broader 180 MW plant are going to be utilised for the proposed project as well.

[1] It was reported by MEIL that Meil may change the WOG loications.

2.3.6 Wind Turbine profiling

All 25 WTG locations were assessed for sensitivities within 1 km radius. A detailed WTG profiling is provided in ***Table 2.4***. The pictorial presentation of land use around WTGs is provided in ***Annexure A***.

Table 2.4 Wind Turbine Profiling

S. No.	WTG ID	WTG Co-ordinates (in UTM)		WTG Site Elevation (m)	WTG Footprint Area		Nearest house/ structure					Nearest Village		Nearest Waterbody		Nearest Cultural/ Religious Site		Approach/ Access Road Condition			Distance from the nearest Paved Road	Land use around WTG Location (Explain)1 based on visual observation			
		Easting (m)	Northing (m)		Topography (undulating land/flat land/on plateau or hill ridge)	Landuse (Based on Land Records*)	Identification (Name/ ID in Map)	Distance (km) and Direction	(temple/ mosque/ graveyard etc.)	Use of Structure (residential/ agriculture / storage)	Any window in direction of WTG, if yes, type of window	Name	Distance (km) and Direction from WTG	Identification ID	Distance (km) and Direction from WTG	Name/ Identification ID in Map	Distance (km) and Direction from WTG	Is there motorable access to site?	Condition of Road and Type	Name of the nearest approach road and Distance from the nearest Approach Point		North	East	West	South
1.	NPY-P-51	561778.24	2671930.1	482	Undulating	Agricultural land – Rabi crop	Houses of village Barkeda Uda	380 m East	Pucca/Semi-Pucca	Residential	TBC	Barkeda Uda	300 m East	None	None	Cremation ground	300 m south	None	None	Village road from Semli to Brkheda Uda along the protected forest	Road passes through the village	Agricultural	Agricultural	Agricultural	Agricultural
2.	NPY-P-52	561590	2672733	484	Plain	Agricultural land – Rabi crop	None	None	None	None	None	Barkeda Uda	950 m south-eastt	Surface water body	200 m north-west (Takrawad village pond)	None	None	None	None	Village road from Semli to Brkheda Uda along the protected forest	150 m east	Agricultural	Agricultural	Agricultural	Agricultural
3.	NPY-P-53	561047	2674067	477	Plain	Agricultural land – Fallow	One hut; A grey house	360 m south-west; 370 m north-west	Kutcha: Pucca	Residential	1 window of both the structures	Takrawad	1.15 km in the south-west	None	None	None	None	Yes	None	None	190 m to he north	Agricultural	Agricultural	Agricultural	Agricultural
4.	NPY-P-54	560663	2674487	472	Plain	Agricultural land – Fallow	None	None	None	None	None	Takrawad	1.2 km in the south-west	None	None	None	None	No, agriculture has begun so the WTG can only be approached on foot	None	None	270 m to the south	Agricultural	Agricultural	Agricultural	Agricultural
5.	NPY-P-55	561112	2675108	474	Plain	Agricultural land – Fallow	None	None	None	None	None	Takrawad	1.4 km in the south-west	None	None	None	None	Yes	Temporary cosntruction road	Chhayan-Takrawad village road	~1km to the south Chhayan-Takrawad village	Agricultural	Agricultural	Agricultural	Agricultural
6.	NPY-P3-41	563300.00	2670901.00	481 m	Flat	Agricultural land – fallow	None	None	None	None	None	Dhamaniya Diwan	Approx. 1.5 km north	Yes, one waterbody	Approx. 650 m west	None	None	Yes	Kuccha road	Village road within Dhamaniya Dawan leading to farmland	Approx. 940 m east	Agricultural	Agricultural	Agricultural	Agricultural
7.	NPY-P-58	561969.00	2676944.00	458 m	Flat	Agricultural land – fallow	Concrete structure; Cluster of	Approx., 265 m east; Approx. 200	Pucca type	Residential;Residential,	Cannot be determined; 2 windowsfacin	Jamuniya	Approx. 2 km east	Yes, two wate	Approx. 155 m east,	Yes	Approx. 400 m south	Yes	Kuccha road	Village road within Jamuniya	Approx. 390 m south	Agricultural	Agricultural	Agricultura	Agricultural

S. No.	WTG ID	WTG Co-ordinates (in UTM)		WTG Site Elevation (m)	WTG Footprint Area		Nearest house/ structure					Nearest Village		Nearest Waterbody		Nearest Cultural/ Religious Site		Approach/ Access Road Condition			Distance from the nearest Paved Road	Land use around WTG Location (Explain)1 based on visual observation			
		Easting (m)	Northing (m)		Topography (undulating land/flat land/on plateau or hill ridge)	Landuse (Based on Land Records*)	Identification (Name/ ID in Map)	Distance (km) and Direction	(temple/ mosque/ graveyard etc.)	Use of Structure (residential/ agriculture / storage)	Any window in direction of WTG, if yes, type of window	Name	Distance (km) and Direction from WTG	Identification ID	Distance (km) and Direction from WTG	Name/ Identification ID in Map	Distance (km) and Direction from WTG	Is there motorable access to site?	Condition of Road and Type	Name of the nearest approach road and Distance from the nearest Approach Point		North	East	West	South
							structures; Cluster of structures; 3 warehouses and a school; Pucca structure	m north; Approx. 310 m south-south-west; Approx 340 m south-south-east; Approx. 380 m south		Residential. Cannot be determined; Residential	g north			rbodies	approx. 440 m south		Approx. 480 m south			leading to farmland				l	
8.	NPY-P-59	561873	2677703	464	Undulating	Agricultural land – Rabi crop	None	None	None	None	None	Jamuniya	1.4 km south-west	None Bardiya	None	None	None	None	None	None	Suwasra road 1.1 km south	Agricultural	Agricultural	Agricultural	Agricultural
9.	NPY-P3-112	563124.95	2684569.6	450	Undulating	Agricultural land - Fallow	None	None	None	None	None	Bardiya Amra	800 m north-east	Amra village pond	1.5 km north-east	None	None	None	None	None	Suwasra road 500 m east	TBC	TBC	TBC	TBC
10.	NPY-P3-113	563365.46	2684127	453	Undulating	Agricultural land - Fallow	Limestone quarry alongside the locaiton	~130 m south	TBC	Commercial	None	Bardiya Amra	1 km north	Lake alongside the quarry	~ 50 m south	None	None	None	None	None	Suwasra road 130 m east	Quarry	Quarry	Quarry	Quarry
11.	NPY-P3-114	563016.86	2683540	455	Undulating	Agricultural land - Fallow	None	None	None	None	None	Bardiya Amra	1.4 km north	None	None	None	None	None	None	None	280 m Suwasara Road to the east	Agricultural 11 kW power line passing	Agricultural	Agricultural	Agricultural 11 kW power line passing
12.	NPY-P3-115	562738	2682923	458	Plain	Built Up-Mining	Structure	120 m north-west	Pucca	Could not be ascertained	9 windows	Nariya Bujurg	700 m north-west	None	None	None	None	None	None	None	250 m Suwasara Road to the east	Waste/scrub	Quarry	Quarry	Quarry
13.	NPY-P3-116	562661	2682395	457	Undulating	Wasteland –Scrub land – Open	None	None	None	None	None	Nariya Bujurg	1 km north west	1 lake	1 km west	None	None	None	None	None	Suwasra road 240 m east	Agricultural	Agricultural	Agricultural	Agricultural

S. No.	WTG ID	WTG Co-ordinates (in UTM)		WTG Site Elevation (m)	WTG Footprint Area		Nearest house/ structure					Nearest Village		Nearest Waterbody		Nearest Cultural/ Religious Site		Approach/ Access Road Condition			Distance from the nearest Paved Road	Land use around WTG Location (Explain)1 based on visual observation			
		Easting (m)	Northing (m)		Topography (undulating land/flat land/on plateau or hill ridge)	Landuse (Based on Land Records*)	Identification (Name/ ID in Map)	Distance (km) and Direction	(temple/ mosque/ graveyard etc.)	Use of Structure (residential/ agriculture / storage)	Any window in direction of WTG, if yes, type of window	Name	Distance (km) and Direction from WTG	Identification ID	Distance (km) and Direction from WTG	Name/ Identification ID in Map	Distance (km) and Direction from WTG	Is there motorable access to site?	Condition of Road and Type	Name of the nearest approach road and Distance from the nearest Approach Point		North	East	West	South
						scrub																			
14.	NPY-P3-117	562399.00	2681877.00	464 m	Flat	Agricultural land – Rabi crop	One hut ; A roofed house; A roofed house; A roofed house	Approx. 200 m west; Approx. 300 m north east, Approx. 260 m east	Semi Kuccha structures	Residential and storage	No windows observed; Yes, two small windows facing southwards, no windows observed	Nariya Buzurg	Approx. 2 km east	Yes, four waterbodies	Approx. 600 m W; Approx. 850 m north to north west; approx. 470 m north-north east; approx; 530 m north-nort-east	None	None	Yes	Kuccha Road	Village road within Nariyabuzurg leading to farmland	Approx. 380 m south	Agricultural	Agricultural	Agricultural	Agricultural
15.	NPY-P3-119	562257	2680718	457	Plain	Agricultural land – Rabi crop	None	None	None	None	None	Akli Shivdas	1.5 km east	Akli Shivdas pond	2 km east	None	None	None	None	None	Suwasra road 240 m west	Agricultural	Agricultural	Agricultural	Agricultural
16.	NPY-P3-120	562280.00	2680363.00	456 m	Flat	Agricultural land – Rabi crop	None	None	None	None	None	Aaklishivdas	Approx. 1.5 km east	None	None	None	None	Yes	Kuccha Road	Village road within Aaklishivdas leading to farmland	Approx. 130 m S	Agricultural	Agricultural	Agricultural	Agricultural
17.	NPY-P3-124	560738.46	2679883.3	457	Undulating	Agricultural land – Rabi crop	None	None	None	None	None	Sadhey Khedi	500 m west	None	None	None	None	None	None	None	Suwasra road 90 m north-west	Agricultural	Agricultural 11 kW power line	Agricultural 11 kW power line	Agricultural
18.	NPY-P3-155	566024.00	2679687.00	425 m	Flat	Agricultural land – Rabi crop	None	None	None	None	None	Guradia Mata	Approx. 580 m east	None	None	None	None	Yes	Kuccha road	Village road within Guradia mata leading to farmland	Approx. 400 m west	Agricultural	Agricultural	Agricultural	Agricultural
19.	NPY-P3-154	565883.00	2680293.00	426 m	Flat	Agricultural land – Rabi crop	None	None	None	None	None	Guradia Mata	Approx. 795 m east	One waterbody	Approx. 1 km north-west	None	None	Yes	None	None	Approx. 830 m south-east	Agricultural	Agricultural	Agricultural	Agricultural

S. No.	WTG ID	WTG Co-ordinates (in UTM)		WTG Site Elevation (m)	WTG Footprint Area		Nearest house/ structure					Nearest Village		Nearest Waterbody		Nearest Cultural/ Religious Site		Approach/ Access Road Condition			Distance from the nearest Paved Road	Land use around WTG Location (Explain)1 based on visual observation			
		Easting (m)	Northing (m)		Topography (undulating land/flat land/on plateau or hill ridge)	Landuse (Based on Land Records*)	Identification (Name/ ID in Map)	Distance (km) and Direction	(temple/ mosque/ graveyard etc.)	Use of Structure (residential/ agriculture / storage)	Any window in direction of WTG, if yes, type of window	Name	Distance (km) and Direction from WTG	Identification ID	Distance (km) and Direction from WTG	Name/ Identification ID in Map	Distance (km) and Direction from WTG	Is there motorable access to site?	Condition of Road and Type	Name of the nearest approach road and Distance from the nearest Approach Point		North	East	West	South
20.	NPY-P3-157	565989.00	2678669.00	458 m	Flat	Agricultural land – Rabi crop	Cluster of structures	Approx. 310-490 m south	Primarily of Pucca stype	Primarily residential	Cannot be determined	Chandkhedi	Approx. 310-490 m south	None	None	None	None	Yes	None	None	Approx. 300 m east	Agricultural	Agricultural	Agricultural	Agricultural
21.	NPY-P3-156	566062.00	2679179.00	458 m	Flat	Agricultural land – Rabi crop	None	None	None	None	None	Guradia Mata	Approx. 890 m south east	None	None	None	None	Yes	None	None	Approx. 490 m east	Agricultural	Agricultural	Agricultural	Agricultural
22.	NPY-P3-127	561631.23	2678649.2	461	Flat	Agricultural land – Rabi crop	None	None	None	None	None	Jamuniya	1.5 km south-west	None	None	None	None	None	None	None	Suwasra road 2 km south and 1.8 m north	Agricultural	Agricultural 11 kV line passing	Agricultural 11 kV line passing	Agricultural
23.	NPY-P3-128	561705.00	2678371.00	465 m	Flat	Agricultural land – Rabi crop	None	None	None	None	None	Sagoria	Approx. 2.9 km east	None	None	None	None	Yes	Kuccha Road	Village road within Sagoriya leading to farmland	Approx. 1 km north	Agricultural	Agricultural	Agricultural	Agricultural
24.	NPY-P3-140	561121.65	2675544.6	471	Slightly undulating terrain	Agricultural land – Rabi crop	None	None	None	None	None	Bhagori & Chhayan	1.2 km north-west and 1.4 km south-east resp.	None	None	None	None	None	None	None	Suwasra Road 1.25 km north-east	Agricultural	Agricultural	Agricultural	Agricultural
25.	NPY-P3-143	561033	2673517	501	Plain	Agricultural land – Rabi crop	Structure	30 m south	Kutcha	Agriculture/Storage	The shed's face opens towards the WTG	Takrawat	1 km north-west	Lake (people dependant on it)	600m west	None	None	None	None	None	Suwasra Road 3.71 km east	Agricultural	Agricultural	Agricultural	Agricultural

2.4 PROJECT PHASES AND ACTIVITIES

The project life-cycle of a wind farm development can be divided into four phases as follows:

- Planning and preconstruction phase;
- Construction phase;
- Operation (including maintenance and repair) phase; and
- Decommissioning.

These phases are outlined in the sections below. The project is currently in the planning and pre construction phase and the resources are being mobilized to begin the construction activity.

2.4.1 *Planning and Preconstruction Phase*

The planning and pre-construction phase involves the conceptualization of the project and has following five components:

- Site selection and wind resource assessment;
- Land procurement process;
- Site surveys as topographic, geo-technical investigations, micro-siting studies, power evacuation arrangements, zero-point marking etc.;
- Approvals/clearances/ permits; and
- Design and finalization of contractors (discussions have started)
- Mobilisation of contractors

Most of the activities have been carried out by the project developer Inox.

2.4.2 *Construction Phase*

The Construction activities for the wind farm development includes:

- Construction of external connecting road and internal access roads;
- Site preparation activities such as clearance, excavation, filling, levelling etc.;
- Construction of site office, equipment and supplies storage areas, fuel storage areas and waste pits;
- Construction of turbine foundations at each WTG location;
- Transportation of equipment including towers, blades, turbines, supply materials and fuels;
- Completing internal electrical connections at each WTG location;
- Erection of internal overhead electrical lines;
- Establishment of pooling sub-station; and
- Commissioning of the WTGs

In addition to the above facilities, a labour camp is to be located at Melkheda village to house migrant labours involved in construction activities. The store yard for the project is located at village Dewari and is being maintained by the developer Inox.

2.4.3 Operation and Maintenance Phase

The wind farm projects have limited activities for the operations and maintenance phase and involve:

- Obtaining regulatory permit and approvals like the Consent to Operate (CTO) from Madhya Pradesh State Pollution Control Board (MPPCB);
- Regular remote monitoring of the WTG operations;
- Normal greasing and cleaning activities;
- Annual shut down for maintenance which will mostly include cleaning and greasing, change of parts etc.; and
- Internal road repairs as and when required.

The design life of the project is expected to be 25 years from the date of commissioning. Regular maintenance would be required to ensure that the turbines are kept in optimal working order. Most day to day facility operations would be done remotely through the use of computer networks using SCADA but some limited maintenance and repair activities would be undertaken on site.

2.4.4 Decommissioning Phase

The wind farm site, after having remained in operation for the lifecycle estimated at 25 years, will not lose its value as a wind power generation system. However, it is not yet decided if the project would approach for upgradation/expansion, once this project life is completed.

2.5 CONTRACTORS

The proposed project is being developed by MEIL and Inox will the O & M contractor responsible for the operation and maintenance of the proposed project for 20 years as per agreement with MEIL. In addition to these MEIL will hire various contractors for performing the following activities:

- Land procurement;
- Construction of Pooling sub-station;
- Construction of the internal 33 kV transmission line;
- Civil work of laying foundations of all the WTGs;
- Construction and management of the labour camp; and
- Construction of all the access roads and earthen roads

Other activities being undertaken through other agencies/sub-contractors are presented in ***Table 2.5.***

Table 2.5 Sub-Contractors and their scope of work for Project Nipania

S.No.	Contractor Name	Scope of Work	Maximum number of labour to be employed on any day through the contractor
1.	M/s Anand	WTG Foundation Work	80
2.	Malwa Construction Company	Road Contractor	10
3.	DR Engineers	33KV USS work	20
4.	Nilkanth Engineers	Loading/unloading work	10
5.	KSA Power Infra Pvt. Ltd.	33 KVA GSS Civil + Electrical	25
6.	Kailash Dev Infra Build India Pvt. Ltd	220 KVA Line + GSS Civil + Electrical	60
7.	M/s Sumitra Construction	WTG Erection & Cable Termination	15
8.	AP Secure Service Pvt. Ltd	Security Services	50
9.	M/s Tech Support Infrastructure Pvt	33 KVA Line	40
10.	M/s Anant Electricals & Engineers	33 KVA Line Work	20
11.	M/s Golshai India Power Pvt. Ltd	Electrical Unit Sub Station Work	15

Source: MEIL

2.6 RESOURCE REQUIREMENTS

2.6.1 Manpower

Construction Phase

The labour requirement varies during the construction phase from the initial phase to the commissioning phase. As reported by MEIL, approximately 345 labourers will be employed depending on stage of construction. 30% of the labours will be employed at the local level from the surrounding villages. Apart from these there will be about 20 employees from MEIL and its sub-contractors.

Operation Phase

20 technical staff of MEIL will be working at the wind farm during the O&M phase; These persons will be mostly from local area.

Labour Accommodation Facility

MEIL will be having a labour accommodation facility in Melkhada village which will be utilized for this project. The facility has accommodation capacity of 40-60 labours and provided with sanitation facilities and rest labours are staying in nearby villages on self-accommodation.

2.6.2 *Water Requirement*

Construction Phase

The water requirements are being met through tankers procuring water from local sources mostly open wells from villages of Asawati, Pitchna and Orwal villages under Shamgarh Tehsil.

Table 2.6 Water Requirement during construction phase

S.N.	Area	Approximate Quantity	Source
1	Construction activities	100 m^3 per WTG foundation	Tankers
2	Water for domestic requirement	2-4 m^3/day (considering regular and Peak labour requirement)	Tankers
3	Potable water	< 1 m^3/day	Bottled water purchase

Operation Phase

Approximately 2-3 m^3/day of water will be required for domestic usage during the O &M phase planned to be sourced from local tankers and drinking water through bottled water purchase.

2.6.3 *Raw Material and Equipment*

Construction Phase

The construction material required includes cement, aggregates, steel, paints, solvents etc (Refer ***Table 2.7***). Besides these, other supplies required for the project are fuels and oils, drilling requirements, spare parts for construction machinery and food and supplies for construction workforce. Most of the supplies will be procured from Mandsaur town. The large equipment to be used during construction phase can be referred from***Table 2.8***.

Table 2.7 Raw Material Requirement for construction

List of Construction materials	Quantity (tonnes/month)		Source of Material	Mode of transportation and storage site
	Peak	Average		
Cement	3750 Tonnes	3750 Tonnes	Approved Vendors	Vehicles
Steel	40Mt/WTG		Approved Vendors	Vehicles
Fuel	500L/day	250L/Day	Locally Sourced	Vehicles

Source: MEIL

Table 2.8 Equipment type and anticipated quantity

Construction equipment	Equipment number
350T crane Package	1 Nos

Construction equipment	Equipment number
tower Internal trailers	4 Nos
Nacelle Movement trailer	1 Nos
Hub Internal Movement trailer	1 Nos
Blade movement Trailer 1 set(3 Nos Trailer).	1 Nos

Source: MEIL

Operations Phase

Supplies, both for operational requirements and for the site staff, will be transported from Mandsaur town. This will include all fuels and oils, spare parts required for maintenance and food and supplies for the site staff.

2.6.4 Fuel requirement and Storage

Construction Phase
The onsite fuel requirement during construction phase will be about approximately 1500 -2000 litres /day of diesel, which shall be procured from outlets located within 3-5 kms from the project site. The fuel will be stored in diesel drums of 200 litres capacity at the storage yard.

Operations Phase
There will be above ground storage facility for storage of lubricating oil. The oils will be unloaded in designated areas and stored in drums.

2.6.5 Batching plant

A batching plant been installed near the Village Krishna ka dera for providing ready mix concrete for WTG foundation and other civil work. The approximate distance from any settlements is about 10-12 km.

2.6.6 Power Requirement

Construction Phase

As reported, power requirement of the project will be met through 12 DG sets of varying capacities as 125 KVA-1 nos, 25 KVA-1 nos and 5 KVA-10 nos.

Operations Phase
The power requirement at site office and WTG monitoring building during operation phase will be supplied by MPPTCL.

2.7 POLLUTION CONTROL MEASURES

2.7.1 Air Emissions

Construction Phase

Likely emissions into the ambient air from the project during the construction phase will include:

- Fugitive emissions from WTG site preparations works, such as excavation, clearing, filling etc. and use of construction machinery;
- Fugitive dust emissions from unpaved roads owing to transportation of manpower and equipment;
- Vehicular emission from increased traffic activity during the construction stages;
- Emissions form DG sets; and
- Dust emissions from batching plant

The control measures for these emissions are as follows:

- Fugitive dust emission from site preparation and the use of construction machinery will be mitigated through sprinkling of water and maintaining the vehicular speed to 10 – 15 km/hr;
- It will be ensured that the excavated soil is not kept uncovered;
- Vehicular emission will be controlled through proper maintenance of vehicles and vehicles with proper PUC will be operated at project site;
- DG sets to be used will have adequate stack height as per CPCB norms;
- Fugitive dust emission arising out of various activities in the batching plants will be mitigated through better material handling and provision of enclosure around the facility

Operations and Maintenance Phase

During the operations phase there will be no air emissions form the WTG. However, there will be gaseous and fugitive dust emissions owing to plying of maintenance vehicles. It will be ensured that well maintained vehicles with proper PUC are used for maintenance purposes. DG sets deployed as back-up power, will emit a limited amount of gaseous pollutants into the ambient air.

2.7.2 Noise Emissions

Construction Phase

During the construction phase noise will be generated primarily during the day time. Noise will be generated from moving vehicles as well as construction equipment, including the DG sets utilized for power.

As a control measure it will be ensured that noise emission from the vehicles and equipment's shall not exceed 91 dB(A) (*for Passenger or commercial vehicles with gross vehicle weight above 12000 kg as specified in Central Motor Vehicles Rules, 1989*). DG sets will be provided with acoustic enclosures and workers near noise generating machines will be provided with ear plugs as safeguard against high noise hazards.

Operations Phase

While in operation, wind turbines produce noise from mechanical and aerodynamic sources:

- Aerodynamic noise emanates from the movement of air around the turbine blades and tower. The types of aerodynamic noise may include low frequency, impulsive low frequency, tonal, and continuous broadband. In addition, the amount of noise may rise with increasing rotation speed of the turbine blades, therefore turbine designs which allow lower rotational speeds in higher winds will limit the amount of noise generated;
- Mechanical noise may be generated by machinery in the nacelle of the wind turbines.

The project will have 25 WTGs of 2.0 MW each and their model will INOX WT 2000 DF 100. The specifications for the WTGs for the proposed project are listed in ***Table 2.9***

Table 2.9 Specifications for noise from WTGs for the proposed project

INOX WT 2000 DF 100 Specifications	
Hub Height	80m
Rotor diameter	100 m
Noise	.8 DB (A) at a distance of 135 M at 10m/s wind speed/at power more than 95% of rated power
Technology	Model based controls, low noise trailing edge, vortex generators, weak grid support

Source: Nipaniya DPR prepared by INOX

2.7.3 Waste Management

Construction Phase

The solid waste generated by the project will consist of labour camp waste, garbage waste, metal scrap, and excess construction materials. The main types of waste that will be generated and sources are shown in ***Table 2.10***

Table 2.10 Waste generated, their sources and method of disposal

S. No.	Waste Type	Source	Estimated quantities	Method of Disposal
1	Domestic solid waste	Labour activities	~100-110 kg/day	Waste will be segregated onsite and will be disposed of at site as approved by local authority.
2	Construction Debris (excavated earth)	Construction of WTG, Access road, substation, Storage yard etc.	0.2-0.3 tonne/day (average) 0.5 – 1.0 tonne/day peak mainly during WTG foundation work.	Excavated materials to be used for backfilling and levelling and other debris shall be used for road construction.
3	Packaging waste containing wood, cardboard and other recyclables	Packing material for WTGs and Accessories	~10 kg per WTG	Return back to the suppliers or re used on site

S. No.	Waste Type	Source	Estimated quantities	Method of Disposal
4	Sludge from Wastewater Septic Tanks	Site Office	~10-15 kg/month	Collected and disposed of through contractors
5	Used oil/ waste oil	DG set, construction machinery	10-15 litres/month	Collected and disposed of through approved recyclers in accordance to *Hazardous Waste Rules, 2008.*
6	Oil contaminated rags	Cleaning activities	-15-20 kg/month	Collected and disposed of through approved vendors in accordance to *Hazardous Waste Rules, 2008.*

Operations Phase

- During operation phase, the waste generated from project will include domestic solid waste at SCADA and substation and hazardous waste like waste oil, lubricants and oil contaminated rags will be generated during maintenance activities;
- The hazardous wastes will be stored onsite at separate designated covered area provided with impervious flooring. The storage containers/ bins/ drum will be clearly marked and identified for their hazards;
- The hazardous wastes will be disposed of in accordance to Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, as amended, through MPPCB/ CPCB approved vendors;
- Non-recyclable material will be collected, segregated onsite and handed over to local Municipal Corporation for disposal;
- Sewage will be disposed of through septic tanks and soak pits.

2.7.4 Wastewater Management

Construction Phase

- The liquid effluents generated during the construction phase will include domestic sewage from project site office;
- As part of the site preparation stage, a drainage and sewerage system will be constructed for the site office. The sewerage system will consist of soak pits for the collection of waste water from the camp kitchen and washing areas. Sewage from the toilets will go into lined septic tanks. Sewage disposal trucks will be used to periodically remove the sludge/sewage from the site.

Operations Phase

The operation phase will have negligible wastewater generation. Septic tank and soak pits will be provided at SCADA building and CMS monitoring station for disposal of sewage.

2.7.5 Fire Safety and Security

Construction

Appropriate firefighting system and equipment shall be provided throughout the construction period. The fire extinguishers will be placed at all strategic locations such as camp site, site office, storage yard, heavy construction machinery etc. Besides this, emergency contact numbers shall also be displayed onsite.

Operations

Structural fire protection

Wind Turbines comprise predominantly of non-flammable materials. Most components of the WTGs are predominantly metal. The only inflammable components are rotor blades and the panelling of the machine house, which are made from glass-fibre reinforced plastic, electric cables and electrical components, Gear box, transformer and hydraulic oils, hoses and other plastic components. It is practically impossible for a fire to spread from the transformer station to the wind turbine or vice versa.

Fire prevention

The service personnel will take all appropriate measures to prevent fires. Lightening protection system will be based on lightening protection zone concept and in accordance to IEC 61400- 24, 62305-1, 3, 4 and DIN EN 50164-1,2. A lightning strike as a cause of fire is practically excluded.

Fire extinguishers

One portable powder fire extinguisher will be maintained at each WTG. These extinguishers are meant for immediate fighting of fire in early stages.

2.8 PROJECT SCHEDULE

The project schedule is as provided in

Figure 2.3 Nipanya Project Schedule

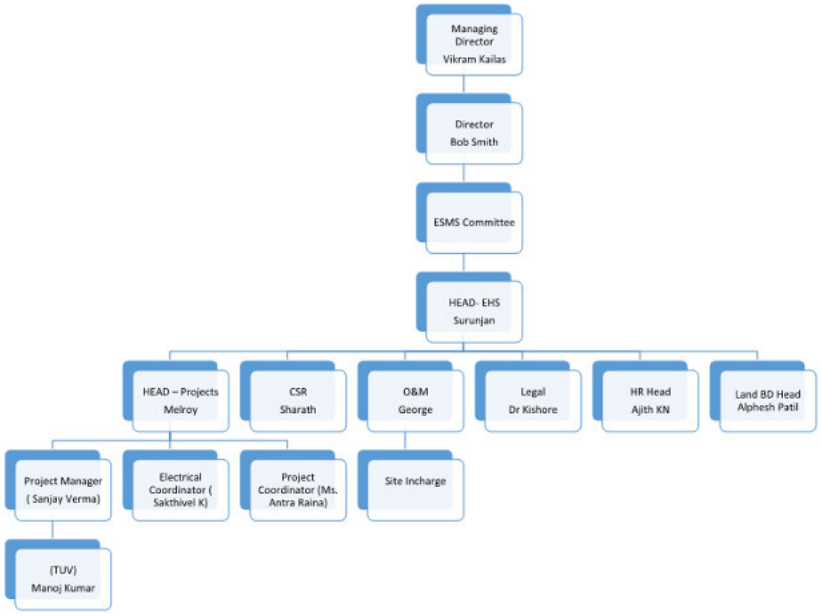
NIPANIYA 25*2= 50 MW																				
Sr No	**Activity**	**15-Nov**					**15-Dec**					**15-Jan**					**16-Feb**				
		Wk -1	**Wk -2**	**Wk -3**	**Wk -4**	**Wk -5**	**Wk -1**	**Wk -2**	**Wk - 3**	**Wk -4**	**Wk -5**	**Wk -1**	**Wk - 2**	**Wk -3**	**Wk -4**	**Wk -5**	**Wk -1**	**Wk - 2**	**Wk -3**	**Wk -4**	**Wk -5**
1	Pathway for No of Locations	1	2	2	2	2	2	2	2	2	-	1	2	2	2	1	-	-	-	-	-
2	Excavation/PCC	-	2	2	2	2	2	2	2	2	-	1	2	2	2	1	1				
3	Reinforcement	-	1	2	2	2	2	2	2	2	-	1	2	2	2	1	-	2			
4	Foundation Casting	-	1	2	2	2	2	2	2	2	-	1	2	2	2	1	-	2			
5	WTG Erection	-	-	1	1	2	2	2	2	2	-	2	2	2	2	1	1	1	2		
5	WTG Commissioning	-	-	-	1	1	2	2	2	2	2	-	2	2	2	2	1	1	1	1	1

Source: MEIL

2.9 PROJECT ORGANISATIONAL STRUCTURE ON SITE

An overall corporate structure along with a regional structure is presented in Figure ***10.1***. The Organizational structure of MEIL for project site Nipanya is presented in ***Figure 2.4.Organizational structure of Project Nipanya***

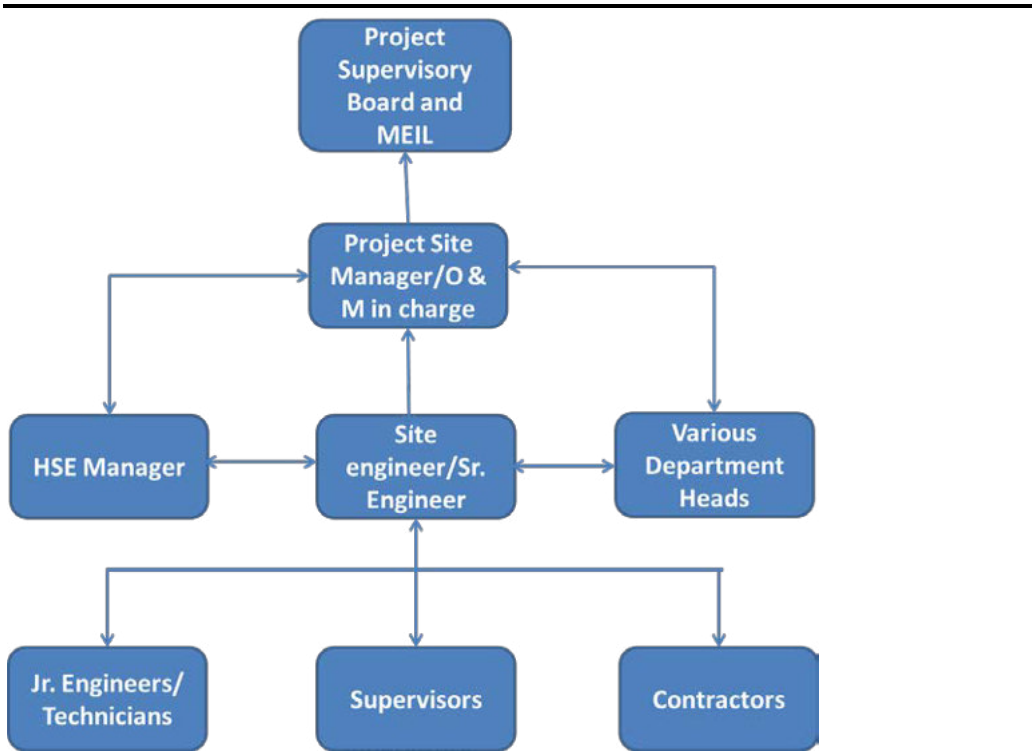
Figure 2.4. Organizational structure of Project Nipanya



Source :MEIL

As INOX will be the O & M contractor for the project, the organizational chart of INOX during the O & M phase is presented in ***Figure 2.5.***

Figure 2.5 Organization chart of INOX during operational phase



Source: INOX Site HSE Manual- Guideline No. Site/ HSE/002

3 LAND REQUIREMENT AND ALLOTMENT PROCESS

This section provides an understanding of the land requirement process and the procedure followed for procurement of the same. This understanding is developed keeping in mind the applicable reference framework, especially the requirements of the ADB SPS SR2 and IFC PS 5

3.1 METHODOLOGY

This review was carried out on the basis of the consultations undertaken with the project team on site and the local community. However, it should be noted that the land owners could not be consulted during the site visit as the land procurement for the project was still under way (refer to ***Section 1.6***). It is recommended that an audit of the land procurement process (including the RoW of the transmission lines) be undertaken once the complete land procurement for the project (including associated facilities) is completed and the complete transmission line is laid out. Furthermore, the land lease and purchase documents were not available for review at the time of the assessment.

3.2 EXISTING STATUS OF THE PROJECT

The project in question is part of a larger project being developed by INOX. Of the total 96 WTGs being developed by INOX, MEIL is investing in 25 WTGs. The tentative locations for these 25 WTGs were made available at the time of the assessment, however it is understood that these may change due to issues such as land availability, better locations etc. The project is presently in its construction phase, with construction of 6 of the 25 WTGs having been completed. The land procurement for the project is being undertaken by Inox, with the assistance of local support from key intermediaries. It is understood that the land procurement is a continuous process which is being undertaken as the WTGs are being developed. For the 25 WTGs identified for MEIL, the land procurement for 19 WTGs, the internal transmission line, unit sub stations and internal access roads is underway. The total land requirement for the WTGs is estimated at 62.5 acres (25.29 ha), at 2.5acre/WTG or 1 ha/WTG. The process of land identification and procurement is discussed in the following sub sections.

It should be noted that while any change in the 25 locations may result in changes in the village and land owners, it is unlikely to result in a change in the land procurement process or the impacts from the same. This is so because, the remaining 71 WTGs are also to be located on private land, and are expected to have similar land use and dependence on land.

3.3 LAND REQUIREMENT FOR THE PROJECT AND THE EXISTING PROCUREMENT STATUS

The land requirement for the project is comprised of the land for the WTGs, transmission line, labour camp, pooling substation, access roads, batching plant, hot mix plant, and site office.

Table 3.1 Total Land Requirement for the Project

Project Facility	Total Land size	Village Name	Land Category
WTGs	25 ha	Barkheda Uda, Takaravad, Chhayan, Jamuniya, Khankhari, Akali Shivdas, Manpura, Sagoriya, Semli Hada, Badariya Amara, Nariya Buzurg.	Private Land
Pooling Substation	1.3 ha	Takrawad	Private Land
Internal Transmission Line (33 KV)	30 m * 30 km	NA	NA
External Transmission Line (122 KV)	30 m* 14.8 km	Melkheda,Jamuniya,Sagoriya,Bhanpur Bhanod	NA
Labour camp (Construction Phase)	1 ha approx	Melkheda	Private Land
Internal Access Roads	6 m * 75 km	NA	NA
Site Office	0.5 ha approx	NA	NA
Batching Plant	0.1 ha approx	NA	NA
Laydown Area	NA	NA	NA

NA –Not available

Wind Turbine Generators

The land identification and procurement for the WTGs and other project components is presently being undertaken. The 25 WTGs identified for MEIL are located in 11 villages in the Shamgarh Tehsil of Mandsaur (refer to ***Table 2.4*** for the details of the WTG locations identified). The land for the WTGs is expected to be comprised of mostly private agricultural land, however, the details of the same in terms of total land procured, process and compensation rate were unavailable for review at the time of the site visit.

Table 3.2 Details of Land Obtained for the WTGs

WTG No.	Village	Tehsil	Type of Land
NPY-P-51	Barkheda Uda	Shamgarh	Private Land
NPY-P-52	Barkheda Uda	Shamgarh	Private Land
NPY-P-53	Takaravad	Shamgarh	Private Land
NPY-P-54	Takaravad	Shamgarh	Private Land
NPY-P-55	Chhayan	Shamgarh	Private Land
NPY-P-56	Jamuniya	Shamgarh	Private Land
NPY-P-57	Jamuniya	Shamgarh	Private Land
NPY-P-58	Jamuniya	Shamgarh	Private Land
NPY-P-59	Jamuniya	Shamgarh	Private Land
PY-P3-117	Khankhari	Shamgarh	Private Land
PY-P3-118	Akali Shivdas	Shamgarh	Private Land
PY-P3-119	Akali Shivdas	Shamgarh	Private Land
PY-P3-120	Akali Shivdas	Shamgarh	Private Land

WTG No.	Village	Tehsil	Type of Land
PY-P3-124	Manpura	Shamgarh	Private Land
PY-P3-125	Jamuniya	Shamgarh	Private Land
PY-P3-126	Sagoriya	Shamgarh	Private Land
PY-P3-127	Jamuniya	Shamgarh	Private Land
PY-P3-128	Jamuniya	Shamgarh	Private Land
PY-P3-140	Chhayan	Shamgarh	Private Land
PY-P3-143	Semli hada	Shamgarh	Private Land
PY-P3-112	Badariya Amara	Shamgarh	Private Land
PY-P3-113	Badariya Amara	Shamgarh	Private Land
PY-P3-114	Nariya Buzurg	Shamgarh	Private Land
PY-P3-115	Nariya Buzurg	Shamgarh	Private Land
PY-P3-116	Nariya Buzurg	Shamgarh	Private Land

Due to the fact that the land identification and procurement process for the project is in progress, the details of the land requirement were unavailable for review at the time of the assessment.

Associated Project Components

According to the information made available by the INOX project team, the land procurement for the associated project components is in process. While the land requirement is likely to comprise of primarily private land, certain project components may require government land, categorised as cultivable waste land, however no government land parcels have been identified presently.

It is to be understood that most of these project components will be common for the larger wind farm being developed, and will thus be shared by MEIL with other companies. The land requirement for these project components will be comprised of temporary land requirement (only for the duration of the construction phase, or a part of it) and permanent land requirement. The temporary land requirement will comprise of land required for labour camp, batching plants and hot mix plant. While the permanent land requirement/ right of way requirement will comprise of requirement for access roads, transmission lines and the pooling substation. According to the discussion with the INOX team it is understood that the temporary land requirement is being identified based on requirement and the land required is leased for short durations of time. Due to this, the total land requirement for these associated components was unavailable at the time of the assessment. However, the land requirement per Batching plant and hot mix plant is expected to be approx 0.1 ha, while the labour camps are usually set up over 1 ha.

Internal and External Transmission Lines

The internal transmission line has a length of 30 km and a RoW of 30 m. On the other hand, the external transmission line has a length of 14.8 km and a RoW of 30 m.

The typical land requirement for each of these towers under various categories is mentioned in table below.

Table 3.3 Snapshot of the Types of Poles & Towers in Internal Transmission Line

MCOH	DPDC	SPSC
2m by 2m	0.203m by 0.203m (excavation up to 0.300m)	0.152m by 0.152m
		

Source: ERM

The SPSC and DPDC poles may be erected with a gap of nearly 70m-80m (based on availability of land), but the MCOH towers are erected in a distance of 250m on an average.

According to the present information available, the land required for the RoWs of the internal and external transmission lines passes mostly through private land. According to the consultations with the INOX project team it is understood that the transmission line RoW is comprised completely of agriculture land, with no forest land, Schedule V land, community land or cultural heritage sites being impacted. Due to the fact, that only 30 m is required across the length of the transmission line, and RoW is being procured, the land procurement process will not result in any land owner owning economically unviable land parcels or has faced economic vulnerability. No encroachments were observed or reported during the site visit.

3.3.1 Project Related Land Procurement and Specific Issues

Based on the information made available, the key observations pertaining to the land procurement are mentioned below.

Schedule V Area

The project area does not fall under Schedule V areas[1] as defined by the Indian Constitution.

Tribal (Schedule Tribe) Land

According to the information available, while the land identified for the project is comprised of mostly private land, no tribal land has been presently identified for the project.

Landlessness

According to the information made available by the project team and the consultations with the local community, it is understood that the land procurement for the project has not resulted in any land owner owning economically unviable land parcels or has faced economic vulnerability.

Encroachment

Based on the discussions with the project team and the local community, the land parcels identified thus far for the project are primarily comprised of private agricultural land. The land belongs to the individual farmers, having necessary title deeds. No encroachments were observed or reported during the site visit.

Common Property Resources

The land presently identified for the project components is comprised primarily of agricultural land and does not impact any common property resources.

Cultural Heritage

No cultural heritage sites were identified in the project area or in a radius of 5 km (Study Area).

NoC from Panchayat

The state does not require wind power projects to take a NoC (No Objection Certificate) from the Gram Panchayat of the impacted villages prior to initiation of construction activities.

[1] The Schedule V areas comprise of the areas identified in the Paragraph 6 of the Fifth Schedule of the Indian Constitution. These areas comprise of those tribal inhabited areas which are located in other parts of the country than North-East India, including areas in Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Madhya Pradesh, Jharkhand, Maharashtra, Orissa and Rajasthan.

Madhya Pradesh Wind Power Policy

The project is being established under the Madhya Pradesh State Wind Power Project Policy 2012. According to this policy, the government will make government land available for wind power projects in keeping with the terms laid down in the circular No. F-16-14/2013/Seven/Gov.2A, dated 30-05-2013 issued by the Revenue Department of Madhya Pradesh. In case of procurement of private land, the policy makes wind power projects eligible for 50% exemption on stamp duty for purchase of private land.

3.4 LAND PROCUREMENT PROCESS

3.4.1 Identification/Procurement of Land

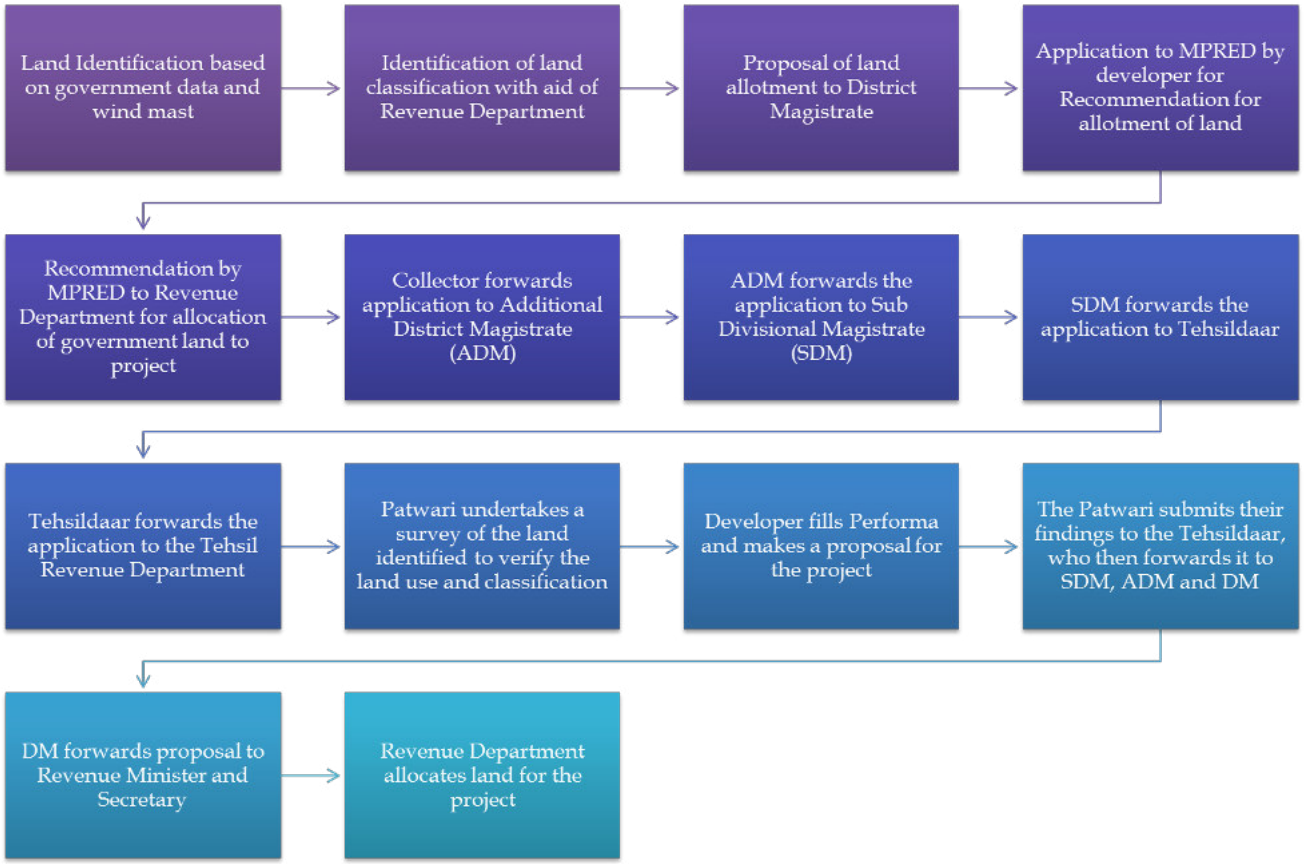
The land for the WTGs and associated project components is being procured by INOX as part of the larger land requirement for the wind farm. It is understood that MEIL will not be involved in the land identification and procurement process.

The land for the project and its components comprise of private land, with no government land identified presently. While the private land for the project will be procured on the basis of willing-buyer willing seller transactions, any government land that may be procured, will be done under the Madhya Pradesh Wind Power Project Policy 2012 (amended February 2013).

The land for the transmission lines is being procured by INOX as part of the larger land requirement for the wind farm. It is understood that MEIL is not involved in identifying land for RoW. The private land for the project is being procured based on negotiated settlements, with a one-time compensation being provided to the land owners for the pole construction and stringing of transmission lines. However, it is understood that the negotiations are based on verbal communications and no written agreements have been signed with the land owners.

The land procurement has been undertaken by the land team of INOX. While no land aggregators were engaged for the project, the local intermediaries were used for the purpose of identification of land plots, the land owners and the negotiations with the same.

Figure 3.1 Process for Land Identification and Allotment in Case of Government Land



The land procurement has been undertaken by the land team of INOX, comprised of two individuals. While no land aggregators were engaged for the project, the local intermediaries were used for the purpose of identification of land plots, the land owners and the negotiations with the same. It is reported that all the negotiations were based on the District Circle Rates applicable. However, the details of the payments for the private land required for the project were unavailable for review at the time of the ESIA Study.

3.4.2 Market Rate

According to the information made available by the project team, and one of the Patwaris involved in the survey of the land, INOX has paid a rate higher than the prevailing market rate for the private land procured. According to the patwari, the minimum amount paid for private agricultural is 14 lakh/ha for irrigated land and 7 lakh/ ha for unirrigated land (refer to ***Annexure B*** for Mandsaur Market Rate, 1-04-2015 to 31-03-2016). Based on the discussions with the local community, the land owners received Rs 8 lakh/ha for unirrigated land (low productivity) for the land procured for the project.

4 APPLICABLE LEGAL AND REGULATORY FRAMEWORK

4.1 INTRODUCTION

This section highlights the environmental and social regulations applicable to the Project. At the outset, it should be emphasized that this administrative framework focuses on:

- Applicable environmental and social regulations and policies in India and the State of Madhya Pradesh (MP);
- Institutional Framework for the implementation of the regulations;
- International Standards and Conventions; and
- Applicable Environmental Standards.

4.2 INSTITUTION FRAMEWORK- ENFORCEMENT AGENCIES

A brief description of the relevant enforcement agencies with respect to the institutional framework is described in the following ***Table 4.1***

Table 4.1 Enforcement Agencies relevant to the Project

Agency	Functions	Relevance & Applicability to the project
Madhya Pradesh State Pollution Control Board (MPPCB)	The MPPCB is a statutory authority entrusted to implement environmental laws and rules within the jurisdiction of the State of Madhya Pradesh, India. The Board ensures proper implementation of the statutes, judicial and legislative pronouncements related to environmental protection within the State.	The project will need to obtain Consent to Establish and Consent to Operate under the Water (Prevention and Control of Water Pollution) Act, and Air (Prevention and Control of Pollution) Act, 1981. The project would generate used oil from generator sets and thus requires to obtain authorization under Hazardous Waste Management, Handling and Transboundary Movement) Rules, 2008.
National Institute of Wind Energy (formerly Centre for Wind Energy Technology (C-WET))	▪ Research & Development ▪ Wind Resource Assessment Unit: ▪ Standards and Certification Unit: ▪ R&D Testing unit	Not a regulatory requirement however if a report is required from NIWE, then MEIL will go for it or get the report from WRA firms for validation eg. 3 Tier, AWS True power, etc.
Indian Renewable Energy	The main objectives of IREDA is to promote, develop and extend financial support to specific projects and schemes for generating	Not mandatory, however required if loan is taken from IREDA

Agency	Functions	Relevance & Applicability to the project
Development Agency Limited (IREDA)	electricity and / or energy through new and renewable sources and conserving energy through energy efficiency.	
Madhya Pradesh New and Renewable Energy Department (MPNRED)	The main objectives of the MPNRED are ▪ To generate electricity through renewable sources like wind and solar on decentralized manner; ▪ To conserve energy in rural areas; ▪ To import and adopt viable technology and machinery in the areas of Non-conventional energy sources and ensures post installation service; and ▪ To impart training and to promote research and development in the field of Non-conventional energy sources	Project should be developed based on the MPNRED guidelines for renewable energy
Madhya Pradesh Urja Vikas Nigam Limited (MPUVNL)	The main responsibilities of MPUVNL are Intra state transmission of electricity through Intra-State Transmission System; ▪ Creation of new EHV lines and Grid Sub Stations of 765 kV/400 kV/220 kV/132 kV rating including their maintenance and augmentations; ▪ Planning and co-ordination relating to intra-state transmission with all concerned agencies such as CTU, State Govt., generating companies, licensees, Regional Power Committees etc.; ▪ Ensuring development of an efficient, coordinated and economical system of intra-state transmission of electricity from generating stations to Load Centres; ▪ Non-discriminatory Open Access to its transmission system on payment of transmission charges; & ▪ Complying with the directions of RLDC (Regional Load Dispatch Center) and SLDC, operating SLDC (State Load Dispatch Center) until any other authority is established by the State Government,	The project should be developed based on the MPUVNL guidelines for renewable energy.
State Labour Department	All issues pertaining to implementation of labour laws in any establishment, shop or factory.	Labours to be involved during the construction phase and few in the operation should be provided with wages and other facilities with state as well as local labour laws and acts.
District Administration (Collector's Office)	Private land purchase process by the land aggregator will be regularized by the state government under Madhya Pradesh Land Revenue Act, 1959 (including rules for land conversion) through District collector and revenue department	Land purchase process for the various components of the Project needs to be followed as per State Land revenue code and land registration act of Madhya Pradesh.

Agency	Functions	Relevance & Applicability to the project
National Green Tribunal	The tribunal will have jurisdiction over all civil cases relating to implementation of the following regulations: ▪ The Water Act, 1974; ▪ The Water Cess Act, 1977; ▪ The Forest Conservation Act, 1980; ▪ The Air Act, 1981; ▪ The Environment Protection Act, 1986; ▪ The Public Liability Insurance Act, 1991; and ▪ The Biological Diversity Act, 2002 The Act provides for compensation on account of following ▪ Relief and compensation to the victims of pollution and other environmental damage arising under enactment of the above acts; ▪ Restitution of property damaged; and ▪ Restitution of the environment.	U/s 17, any person responsible for any untoward incidents (defined in Schedule II of the Act) is liable to pay relief or compensation as determined by the tribunal, failing which a penalty (u/s 26 and 27) is imposable which may lead to imprisonment up to 3 years or fine upto Rs. 10 Crores or both and an additional fine of Rs 25,000 per day for any delay, which may further be increased to one lac per day.

4.3 *APPLICABLE REGULATORY/ POLICY FRAMEWORK*

Table 4.2 summarizes the key regulations that are relevant to the project across its lifecycle. This table should be used to update/develop a comprehensive legal register for the project which can be regularly monitored for compliance as well as updated to reflect changes/non-applicability of regulations, policies and standards.

Table 4.2 Applicability of Key Legislations in India and Reference Framework in the different phases of life cycle of Project

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks
Land Purchase						
Madhya Pradesh Land Revenue Act, 1959	√	√	X	X	District collector and revenue department	Kindly refer to section 3.5 for details regarding land procurement.
The Electricity Act 2003	√	√	√	√	Central Electricity Authority	Generating company deemed to obtain a license under this Act and also to comply with all safety requirement as per rule 29 to 46 under Section 6.
Indian Telegraph Act, 1885	√	√	√	√	Telegraph Authority	Under this act, for any structures observed in along the transmission line, the telegraph authority is to compensate for the actual loss / damage to the owner for the property.
Forest Clearance and Wildlife						
Forest Conservation Act 1980	√	√	√	√	MOEF and State Department of Forest, Govt. of MP	The Forest (Conservation) Act (FCA), 1980 as amended in 1988 and revised Rules made there under in 2003 (in suppression of FC Rules of 1981) provide for prevention of diversion of any forestland for non-forest purposes. In all such cases, prior Forest Clearance is required from Central and State Government depending upon type and extent of forestland required for non-forest purposes. Under the Act, an Advisory Committee advises GoI for grant of approval and other matters connected with the conservation of forests. The Project does not require a NOC the Project does not involve any designated forest land.
Wildlife Protection Act, 1972, 2002 and Rules, 2003 and as amended	√	√	√	√	Wildlife Warden, State Forest Department;	If any protected/ endangered flora or fauna (as listed in Schedules of WP Act, 1972) are found in the project area, conservation measures require be proposing and implementing for their protection.
Environment Protection						
Environment Protection Act, 1986 and as amended	√	√	√	√	MPPCB MoEF CPCB	Permissible limits for ambient air quality, water quality, noise limits has been laid down by CPCB under EP Act, 1986 which requires to be complied with.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks
The Noise (Regulation & Control) Rules, 2000 and as amended up to 2010	√	√	√	√	MPPCB	Per the Act, ambient noise levels are to be maintained as stipulated in the rules for different categories of areas such as residential, commercial, and industrial and silence zones.
Ambient Noise Standards	X	√	√	x	MPPCB, MoEF	
The Water (Prevention and Control of Pollution) Act, 1974, as amended	X	√	√	X	MPPCB	Project requires to obtain Consent to Establish before start of construction activities and Consent to Operate before commissioning of the project from MPPCB;
The Air (Prevention and Control of Pollution) Act 1981, as amended	X	√	√	X	MPPCB	Project requires to obtain Consent to Establish before start of construction activities and Consent to Operate before commissioning of the project from MPPCB;
Storage of Hazardous Chemicals						
Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 and as amended	X	√	√	X	MPPCB	Rules will be applicable during construction and operation phases if chemicals stored at site satisfy the criteria laid down in the Rules.
Handling of Hazardous Wastes						
Hazardous Wastes (Management Handling and Trans boundary Movement) Rules, 2008 as amended up to 2010	X	X	√	√	MPPCB	Generation of waste oil and transformer oil at site attracts the provisions of Hazardous Waste Rules, 2008. The hazardous wastes have to dispose through approved recyclers only.
Labour and Working Conditions						
The Factories Act, 1948 and MP Factories Rules	X	X	√	X	Deputy Chief Inspector of Factories	MEIL and their contractors will need to comply to all requirement of factories rules and participate in periodic inspection during the Operations Phase
Building and Other Construction Workers Act, 1996; Inter-state Migrant Workers Act, 1979; Contract Labour Act, 1970	X	√	X	√	State Labour Department, MP	MEIL and their contractors will need to comply to the requirements of these regulations
The Child Labour (Prohibition and Regulation) Act, 1986; Bonded Labour (Abolition) Act	X	√	√	√	Department of Inspector of Factories, MP	MEIL and their contractors will need to comply to the requirements of these regulations

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks
1976; Minimum Wages Act, 1948; Equal Remuneration Act 1976; Workmen's Compensation Act, 1923; Maternity Benefit Act, 1961.						
Companies Act, 2013	X	X	√	X	MEIL	According to Schedule 135 sub-section 1, the companies meeting the threshold criteria specified should spend in every financial year, at least 2% of the average net profits of the company made during the three immediately preceding financial years, in pursuance of CSR Policy. The project will need to comply with the requirements as stated in the law.
IFC/World Bank Guidelines						
IFC Performance Standards, 2012	√	√	√	√	Equator Principles Financing Institutions	It will be applicable to the project, and this ESIA report is being prepared against this reference framework.
IFC/World Bank General EHS Guidelines, 2007	X	√	√	√	Equator Principles Financing Institutions	During the construction, operation and eventual decommissioning of the site, the following guidelines will need to be followed.
IFC Environment, Health and Safety Guidelines for Power Transmission and Distribution, 2007	X	√	√	√	Equator Principles Financing Institutions	
IFC Environment, Health and Safety Guidelines for Wind Energy, 2007	X	√	√	√	Equator Principles Financing Institutions	

4.4 PERMITTING AND COMPLIANCE STATUS FOR THE PROJECT

Based on interactions held with the MEIL team and document review key permitting and compliance status for proposed project is provided in ***Table 4.3*** below.

Table 4.3 Permitting and Compliance Status

Permit	Status	Remarks
Environmental Clearance	Not Required	As per the Indian regulations, Wind power projects are not covered under the EIA notification, 2006 and subsequent amendments and are exempted from environmental clearance by the Ministry of Environment and Forest (MoEF) or state bodies.
Nodal Agency Consent from New and Renewable Energy,	Required and Available	Allotment and Registration for set up of about 180 MW Wind Power Project given to M/s Maruti Shakti Energy India Pvt Ltd.
Forest Clearance from MoEF	Not Required	No forest land involved.
Power evacuation approval	Required and Available	Power evacuation approval has been obtained from MPPTCL for 179.9 MW by M/s Maruti Shakti Energy India Pvt Ltd.
Consent to Establish and Consent to Operate	Required	The project needs to obtain Consent to Establish which has to followed by Consent to Operate under Water (Prevention and Control of Pollution) Act, 1974 and Air ((Prevention and Control of Pollution) Act, 1981 from MP State Pollution Control Board (MPPCB) (1) . In light of the MPPCB categorization[2] of Industries as red, orange and Green for grant of Consent, Wind Power Project falls under the list of Green category of Industries at Sr. No. 95, the entry" Solar power generation through photovoltaic cell, wind power and mini hydel power (<25 MW) and biomass based power plant (<15 MW)" MEIL is considering the applicability of the same for its project.
Contractor permits	MEIL will need to monitor and incorporate claque in agreement with all contractors as relevant.	The contractor will need to abide by the following laws and MEIL will have to ensure its being done being the principle employer: • Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996; • Inter-state Migrant Workmen (Regulation of Employment and Condition of Service) Act, 1979; • Contract Labour Act, 1970 • The Child Labour (Prohibition and Regulation) Act, 1986;

(1) CTE and CTO are the permissions issued by Indian regulatory authorities of Environment to manage the wastewater and air emissions from industries.

[2] http://www.mppcb.nic.in/TP/R-17-NEW.pdf for categorization by MPPCB

Permit	Status	Remarks
		• The Bonded Labour System (Abolition) Act 1976; • Minimum Wages Act, 1948; • Equal Remuneration Act 1976; • Workmen's Compensation Act, 1923; • Maternity Benefit Act, 1961.
Land procurement	Details Awaited	
No Objection Certificate from the Gram Panchayat	Not Applicable	According to the regulations for procurement of private land for wind power projects, a NoC from the Gram Panchayats is not mandatory.

4.5 APPLICABLE ENVIRONMENTAL STANDARDS

The Central Pollution Control Board (CPCB) has stipulated different environmental standards w.r.t. ambient air quality, noise quality, water and waste water for the country as a whole under EP Act, 1986. Also as per the applicable reference framework WB/IFC guideline values are applicable to the project. Details on the standards are provided as ***Annexure C*** of this Report.

4.6 INTERNATIONAL SAFEGUARD REQUIREMENTS

4.6.1 ADB Safeguard Policy Statement, 2009

In July 2009, ADB's Board of Directors approved the new Safeguard Policy Statement (SPS) governing the environmental and social safeguards of ADB's operations. The SPS builds upon ADB's previous safeguard policies on the Environment, Involuntary Resettlement, and Indigenous Peoples, and brings them into one consolidated policy framework with enhanced consistency and coherence, and more comprehensively addresses environmental and social impacts and risks. The SPS also provides a platform for participation by affected people and other stakeholders in the project design and implementation.

The SPS applies to all ADB-financed and/or ADB-administered projects and their components, regardless of the source of financing, including investment projects funded by a loan; and/or a grant; and/or other means, such as equity and/or guarantees. ADB works with borrowers and clients to put into practice the requirements of SPS.

The SPS supersedes ADB's Involuntary Resettlement Policy (1995), Policy on Indigenous Peoples (1998), and Environment Policy (2002). In accordance with the SPS, these previous policies apply to all projects and tranches of multi-tranche financing facility projects that were reviewed by ADB's management before 20 January 2010.

The objectives of ADB's safeguards are to:

- avoid adverse impacts of projects on the environment and affected people, where possible;
- minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- assist borrowers and clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

ADB's SPS sets out the policy objectives, scope and triggers, and principles for three key safeguard areas:

- Environmental safeguards;
- Involuntary Resettlement safeguards; and
- Indigenous Peoples safeguards.

To help borrowers and clients and their projects achieve the desired outcomes, ADB adopts a set of specific safeguard requirements that borrowers and clients are required to meet in addressing environmental and social impacts and risks. These safeguard requirements are as follows:

- Safeguard Requirements 1: Environment (Appendix 1 of SPS);
- Safeguard Requirements 2: Involuntary Resettlement (Appendix 2 of SPS);
- Safeguard Requirements 3: Indigenous Peoples (Appendix 3 of SPS); and
- Safeguard Requirements 4: Special Requirements for Different Finance Modalities (Appendix 4 of SPS).

In addition, ADB does not finance activities on the prohibited investment activities list (Appendix 5 of SPS).Furthermore, ADB does not finance projects that do not comply with its safeguard policy statement, nor does it finance projects that do not comply with the host country's social and environmental laws and regulations, including those laws implementing host country obligations under international law.

Consultation and Disclosure requirements of ADB

ADB's *Safeguard Policy and Public Communications Policy (2011)* sets out disclosure requirements for various ADB activities, including safeguard requirement. Safeguard Requirements 2: Involuntary Resettlement (Appendix 2 of SPS); and Safeguard Requirements 3: Indigenous Peoples (Appendix 3 of SPS) sets out the need for meaningful consultation and information disclosure during project preparation and operation to the affected peoples and other stakeholders. Key requirements include:

- **Information Disclosure:** The borrower/client will submit the following documents to ADB for disclosure on ADB's website as per the applicability with respect to the Project:
  - Draft EIA including draft EMP;
  - Final EIA/IEE;
  - Updated EIA/IEE and corrective active plan;

- Environmental Monitoring Reports.
- Resettlement Plan (RP)/Resettlement Framework (RF)
- Indigenous Peoples Plan (IPP)/Indigenous Peoples Planning Framework (IPPF)
- Monitoring reports

- **Information disclosure to affected people or stakeholders:** The borrower/client will provide relevant environmental information in a timely manner, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. For illiterate people, other suitable communication methods will be used.
- **Consultation and Participation:** The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.
- **Timing and Frequency for consultation and participation:** Meaningful consultation begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle.

4.6.2 IFC Requirements

IFC applies the Performance Standards (1) to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards may also be applied by other financial institutions choosing to support them in the proposed project. These performance standards and guidelines provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts.

Together, the Client is required to meet the stipulations of all the eight Performance Standards throughout the life of an investment in the case such an investment is being sought either form IFC or any other institution which follows IFC standards.

(1) http://www.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards

Table 4.4 IFC Performance Standards

IFC- PS no.	Description	Objectives
1	Assessment and Management of Environmental and Social Risks and Impacts	• To identify and evaluate environmental and social risks and impacts of the project; • To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment; • To promote improved environmental and social performance of clients through the effective use of management systems; • To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately; and • To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.
2	Labour and Working Conditions	• To promote the fair treatment, non-discrimination, and equal opportunity of workers; • To establish, maintain, and improve the worker-management relationship; • To promote compliance with national employment and labor laws; • To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain; • To promote safe and healthy working conditions, and the health of workers; and • To avoid the use of forced labor.
3	Resource Efficiency and Pollution Prevention	• To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; • To promote more sustainable use of resources, including energy and water; and • To reduce project-related GHG emissions
4	Community Health, Safety and Security	• To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances; and • To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.
5	Land Acquisition and Involuntary Resettlement	• To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs; • To avoid forced eviction; • To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts

IFC- PS no.	Description	Objectives
		from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost4 and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected; • To improve, or restore, the livelihoods and standards of living of displaced persons; and • To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure5 at resettlement sites
6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	• To protect and conserve biodiversity; • To maintain the benefits from ecosystem services; and • To promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.
7	Indigenous Peoples	• To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples; • To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts; • To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner; • To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle; • To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present; and • To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.
8	Cultural Heritage	• To protect cultural heritage from the adverse impacts of project activities and support its preservation; and • To promote the equitable sharing of benefits from the use of cultural heritage.

Source: *Source: IFC Performance Standards on Environmental and Social Sustainability,*

In addition, during the construction, operation and eventual decommissioning of the site, the IFC EHS Guidelines for Wind Energy [(1)] and the *General Environmental, Health, and Safety (EHS) General Guidelines*[2] *(April 30, 2007*) will also be applicable for this project.

Where there is a discrepancy between the prevailing environmental standards on emission, discharge etc. and the corresponding standards published by the IFC/World Bank General EHS Guidelines, MEIL will incorporate the more stringent standard for the proposed Wind farm.

(1)
http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_WindEnergy/$FILE/Final+-+Wind+Energy.pdf

(1) [2]
http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS/$FILE/Final+-+General+EHS+Guidelines.pdf

5 SCREENING AND SCOPING

At the initial stage of the ESIA process, preliminary information was provided to aid in the determination of what legal and other requirements apply to the Project. This step was conducted utilising a high level description of the Project and its associated facilities. The screening process involved the following:

- Reviewing of applicable regulatory framework for the proposed Wind Power Project;
- Reviewing of available Project related activities and their impacts on various components of environment;
- Collection and compilation of available secondary baseline data from different sources; and
- Categorisation of Project as per ADB and IFC guidelines.

5.1 SCREENING METHODOLOGY

For the screening exercise, the consulting firm undertook discussions with the Project team and a review of the documents available. The following sub sections provide an understanding of the methodology followed.

5.1.1 *Kick-off Meeting*

The consulting firm team had a brief kick-off meeting with the MEIL team prior to site reconnaissance visit. A discussion was also held with regard to the expectations from this assessment in terms of scope of work, deliverables, timeline and the methodology to be followed for the same.

5.1.2 *Document Review*

Desk based review of the relevant documents of the project site and its surroundings were carried out to have a clear understanding of the Project and its impacts. Following documents were made available for review as part of ESIA:

- Co-ordinates of all the 25 WTG sites and transmission line;
- DPR and various documents for the proposed project;

A review of the secondary information available on the project area, the administrative block, the district and the state was undertaken so as to allow for the primary data to be substantiated and complimented.

5.2 PROJECT CATEGORISATION

5.2.1 ADB Safeguard Categories[1]

The projects are screened on the following criteria:

1. *Environment* -proposed project was screened according to type, location, scale, and sensitivity and the magnitude of their potential environmental impacts, including direct, indirect, induced, and cumulative impacts.

2. *Involuntary Resettlement* - The involuntary resettlement impacts of an ADB-supported project are considered significant if 200 or more persons will be physically displaced from home or lose 10% or more of their productive or income-generating assets.

   For those involving involuntary resettlement, a resettlement plan is prepared that is commensurate with the extent and degree of the impacts: the scope of physical and economic displacement and the vulnerability of the affected persons.

3. *Indigenous People* - The impacts of an ADB-supported project on indigenous peoples is determined by assessing the magnitude of impact in terms of
   - customary rights of use and access to land and natural resources;
   - socioeconomic status;
   - cultural and communal integrity;
   - health, education, livelihood, and social security status; and
   - the recognition of indigenous knowledge; and
   - the level of vulnerability of the affected Indigenous Peoples community.

As per these criteria projects are classified into any of the four categories: A, B, C and F1. The criteria and categories are further explained in ***Table 5.1*** below:

[1] ADB safeguard categories for environment, involuntary resettlement and indigenous peoples

(http://www.adb.org/site/safeguards/safeguard-categories)

Table 5.1 ADB Safeguard Categories

Category/ Criteria	Environment	Involuntary Resettlement	Indigenous People
A	A proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA), including an environmental management plan (EMP), is required.	A proposed project is likely to have significant involuntary resettlement impacts. A resettlement plan, which includes assessment of social impacts, is required.	A proposed project is likely to have significant impacts on indigenous peoples. An indigenous peoples plan (IPP), including assessment of social impacts, is required.
B	The proposed project's potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE), including an EMP, is required.	A proposed project includes involuntary resettlement impacts that are not deemed significant. A resettlement plan, which includes assessment of social impacts, is required.	A proposed project is likely to have limited impacts on indigenous peoples. An IPP, including assessment of social impacts, is required.
C	A proposed project is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.	A proposed project has no involuntary resettlement impacts. No further action is required.	A proposed project is not expected to have impacts on indigenous peoples. No further action is required.
F1	A proposed project involves the investment of ADB funds to or through a financial intermediary. The financial intermediary must apply and maintain an environmental and social management system, unless all of the financial intermediary's business activities have minimal or no environmental impacts or risks.	A proposed project involves the investment of ADB funds to or through a financial intermediary. The financial intermediary must apply and maintain an environmental and social management system, unless all of the financial intermediary's business activities are unlikely to generate involuntary impacts.	A proposed project involves the investment of ADB funds to or through a financial intermediary. The financial intermediary must apply and maintain an environmental and social management system, unless all of the financial intermediary's business activities unlikely to have impacts on indigenous peoples.

Based on site specific environmental and social impacts identified, the project is categorized as ***Category 'B'*** on both environment and social criteria, and as described below:

- The proposed Project's potential adverse environmental impacts are mostly site-specific and the impacts can be addressed with implementation of proper mitigation measures. The detailed assessment with regard to same is presented in ***Chapter 8*** on impact assessment.
- The proposed project does not involve any involuntary resettlement as the project is being developed on mix of government and private land which mostly comprises of agricultural fallows and waste land (open scrub). There are no settlements on these lands.
- The proposed project will have negligible impact on indigenous people as the census record does not report presence of Scheduled Tribe population within the project footprint area.
- While there were globally threatened species and migratory species and species listed as Schedule I of Indian Wildlife Protection Act, 1972 within the project area the following facts needed to be considered.

    - The site is at a far distance of 16 km from the Gandhi Sagar Wildlife Sanctuary and Reservoir (IBA Code-IN-MP-06, IBA Criteria (A4i-≥1% biogeographic population), A4iii (≥20,000 water birds).
    - There are reports of Lesser Adjutant *Leptoptilos javanicus* (IUCN v2015.4 Vulnerable) and flamingos *(Phoenicopterus roseus)* (IUCN v2015.4 Least Concern) from this sanctuary. This reservoir is also famous for large numbers of the migratory Bar-headed Goose *Anser indicus* (IUCN v2015.4 Least Concern).
    - During the first phase of the long term monitoring (February 2016) 20 migratory species were recorded from the study area and in the second phase of Long term monitoring (March 2016), 13 migratory species have been recorded. However, review of the migratory routes clearly suggests that none of the major migratory routes pass through the project area.
    - Some of the migratory species from Gandhi Sagar Wildlife Sanctuary and Reservoir may use the study area as their foraging area due to the presence of habitats in small and large waterbodies. However given the major congregations of the water birds in the reservoir, any impacts on species visiting the wind farm, as a spill over, are unlikely to be significant and will certainly not impact species abundance within congregations in the region. The wind farm area is not a critical habitat for migratory birds.
    - Even though there were threatened species observed at the site (one EN and 3 VU species) all these species are resident, widely distributed and abundant in the region and any mortality is likely to be very low because of low abundance in the study area and hence will not cause any decline of populations of these species.

- The low level of mortality can be further reduced with appropriate mitigation measures available. These include placing bird markers on insulators and insulating conductors where they cross-over electric poles.

Conclusion

It is to be noted that while IUCN threatened species are observed in the area, all through the actual ground surveys conducted at ESIA Study (July 2015), initial bird and bat survey (Nov. 2015) and long term bird and bat study-First Phase (March 2016), it is concluded that critical habitats (1)as per ADB's SPS 2009 are not triggered. The wind farm area does not hold a regionally important population of any of the threatened species. Nor does the wind farm hold a significant percentage of the global population of any migratory species. Furthermore no species found in the wind farm site is endemic.

The project certainly does not qualify for Category A (*A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works*.) From our justification in categorizing the project as Category B and based on the ecological assessment during the ESIA, the initial study in November 2015 and the first phase of the long-term study in February 2016, we maintain that

a. There is no evidence that any of the impacts are long term (as the birds start showing avoidance behaviour) and affect any area larger than the site or its facilities.
b. All impacts are not irreversible as there is no anticipated impact on population of species considered and mortality of these species can be reduced through evidence based mitigation action;
c. Impacts are not diverse but very specific and identifiable; and
d. Impacts are not unprecedented. Mortality of species has occurred in the area in the past, through electrocution by existing transmission lines evacuating conventional sources of energy and previously operational wind farms in the area.

The project study area does not fall under any legally protected area or natural habitat, and hence requirements suggested in ADB SPS 2009 regarding legally protected area[2] and the requirements therein is not triggered

(1)**Critical Habitat:** A subset of both natural and modified habitat that deserves particular attention. Critical habitat includes areas with high biodiversity value, including habitat required for the survival of critically endangered or endangered species; areas having special significance for endemic or restricted-range species; sites that are critical for the survival of migratory species; areas supporting globally significant concentrations or numbers of individuals of congregatory species; areas with unique assemblages of species or that are associated with key evolutionary Processes or provide key ecosystem services; and areas having biodiversity of significant social, economic, or cultural importance to local communities. Critical habitats include those areas either legally protected or officially proposed for protection, such as areas that meet the criteria of the World Conservation Union classification, the Ramsar List of Wetlands of International Importance, and the United Nations Educational, Scientific and Cultural Organization's world natural heritage sites. 6 As defined by the Word Conservation Union's Red List of Threatened Species or as defined in any national legislation.

5.2.2 Other

Equator Principles Financial Institutions (EFPIs) are required to categorise projects according to the magnitude of its potential impacts based on the environmental and social screening criteria of IFC as per the following understanding:

- **Category A**: Projects with potential significant adverse social or environmental impacts that are diverse, irreversible or unprecedented;
- **Category B**: Projects with potential limited adverse social or environmental impacts that are few in number, site-specific, largely reversible, and readily addressed through mitigation measures; or
- **Category C**: Projects with minimal or no adverse social or environmental impacts.

With reference to the IFC's environmental and social screening criteria, it is anticipated that the proposed Project will fall under '***Category B***' for the following reasons:

- **Potentially limited reversible:** Environmental and social impacts of the project are anticipated during the construction phase will encompass increase noise & vibration and air quality during the site preparation including setting of batching plants, labour camps, excavations for WTGs, Transmission Line Towers, vehicular transport, Impact on terrestrial ecology in and around WTG's; Internal and external transmission line towers, pooling substations; Impact on fauna and wildlife present project influence area close to various WTGs. Occupational health and safety; community health and safety during material and WTGs transportation is envisaged; The Project footprint for most of the WTGs is limited to the immediate vicinity and any site-specific environmental and social impacts can be readily addressed through appropriate mitigation measures proposed in ESMP.

- **Unprecedented:** The 25 WTGs are part of the larger project of 180 MW and hence is not an unprecedented activity.

- **Limited adverse impacts on the baseline**: Wind energy development is a non-polluting source of energy and thus is not likely to lead to any adverse impacts on the baseline environment during operation phase. In terms of social impacts, the land required is comprised of mix of revenue and private land (the exact details of the same are presently not available). 25 WTGs location surveyed didn't involve any settlements and no physical displacement is envisaged. Impact will be limited to access to land used for grazing and positive impacts on livelihood opportunities.

5.3 SCOPING METHODOLOGY

For this ESIA study, scoping has been undertaken to identify the potential Area of Influence for the project to identify potential interactions between the project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to prioritize these impacts in terms of their likely significance. This stage is intended to ensure that the impact assessment focuses on issues that are most important decision-making and stakeholder interest.

It is to be noted here that during the period of ESIA study, project is in the planning, pre-Construction and construction phase, therefore, the scoping exercise includes all the phases of the project, i.e., planning and pre-construction, construction, operation and maintenance and decommissioning into consideration.

The scoping exercise was undertaken on the basis of the information available on the project, the discussions with the project team and the prior understanding of consulting firm team about wind power projects. Potential impacts have been identified through a systematic process whereby the features and activities (both planned and unplanned) associated with the operation and maintenance and decommissioning phases of the project have been considered with respect to their potential to interact with resources/ receptors. Potential impacts have each been classified in one of three categories:

- **No interaction**: where the project is unlikely to interact with the resource/ receptor (e.g., wholly terrestrial projects may have no interaction with the marine environment);
- **Interaction likely, but not likely to be significant**: where there is likely to be an interaction, but the resultant impact is unlikely to change baseline conditions in an appreciable/detectable way; and
- **Significant interaction**: where there is likely to be an interaction, and the resultant impact has a reasonable potential to cause a significant effect on the resource/receptor.

As a tool for conducting scoping, the various project features and activities that could reasonably act as a source of impact were identified, and these have been listed down the vertical axis of a Potential Interactions Matrix. The resources/receptors relevant to the Baseline environment have been listed across the horizontal axis of the matrix.

Each resulting cell on the Potential Interactions Matrix thus represents a potential interaction between a project feature/activity and a resource/ receptor.

The proposed wind power project will involve the key activities during its life cycle which will include planning and pre-construction, construction,

operation and maintenance and decommissioning phases as detailed in ***Chapter 2 Section 2.4***.

5.4 SCOPING RESULTS

The completed Potential Interactions Matrix for Project activities and likely impacted resources/ receptors is presented in ***Table 6.1***.Those cells that are coloured white are 'scoped out' for no further consideration in the ESIA Process.

Those interactions that are grey are also 'scoped out', but the ESIA report includes a discussion that presents the evidence base (e.g., past experience, documented data, etc.) used to justify the basis upon which this decision was made. Those interactions that are shaded black are retained for further consideration in the ESIA Process.

Interactions that are likely to lead to significant impacts are presented in ***Table 5.3*** and will be the focus of the impact assessment. Owing to site conditions there are certain possible interactions that will not take place. As a result these interactions have been "scoped out" and are presented in ***Table 5.4***.

5.4.1 Cumulative Impacts

A cumulative impact is one that arises from a result of an impact from the Project interacting with an impact from other similar activities to create an additional impact.

It was observed during site reconnaissance survey, that project is a prat of a larger wind farm of 180 MW. During the reconnaissance it was observed that 41 WTGS have already been erected in the project AoI. However the existing wind turbines were located at minimum distance of 1-2 km from the proposed MEIL's WTGs, and view of same and experience of impact zone, cumulative impacts was scoped out.

Table 5.2 Interaction Matrix for the proposed Project's life cycle

Environmental and Social Resources/ Receptors / Project Phase and Activity	Land use	Soil/Land Environment	Ambient Air Quality	Water Environment	Ambient Noise Quality	Ecology	Occupational Health and Safety	Demography (Influx and Displacement	Local Economy and Employment	Natural /Common Property Resources	Land based Livelihoods	Community Health and Safety	Labor and Human Rights	Social Infrastructure and Services	Culture and heritage
Land Purchase	■														
Clearance of vegetation from identified activity areas		■				▒									
Establishment of Labour camp, batching plant, storage areas for WTG parts and other equipment and construction materials	▒	■	▒	▒	▒	▒	■						■		
Upgrading/construction of access roads	▒	■	▒		▒	▒	■						■		
Mobilization of labour and equipment		▒	▒		▒	▒	■		▒				■		
Internal road construction (connecting WTGs) within Wind farm site	▒	■	▒		▒	▒	■						■		
WTG components and raw material transportation to site		▒	▒		▒	▒	■					■	■		
Site clearance, foundation excavation and construction at each of WTG sites	▒	■	▒	▒	▒	▒	■		▒				■		
Construction of Substation complex and SCADA complex	▒	■	▒	▒	▒	▒	■						■		
Erection of internal electrical lines inside wind farm site	▒	■	▒		▒	▒	■						■		
WTGs erection and substation installations		■	▒		▒	▒	■						■		
WTG commissioning					■		■								
Transmission Line Erection	■	■	■		■	▒	■				■	▒	■		
Operations					■			▒							
Scheduled maintenance activities (WTGs, sub-station, electrical lines, storage yard, SCADA building)		▒			▒		■	▒							
Replace WTG turbines with new ones					■		■	▒	■				▒		

Environmental and Social Resources/ Receptors / Project Phase and Activity	Land use	Soil/Land Environment	Ambient Air Quality	Water Environment	Ambient Noise Quality	Ecology	Occupational Health and Safety	Demography (Influx and Displacement	Local Economy and Employment	Natural /Common Property Resources	Land based Livelihoods	Community Health and Safety	Labor and Human Rights	Social Infrastructure and Services	Culture and heritage
Remove WTG parts and ancillary facilities															
Remove internal electrical lines															
Restoration of wind farm site land															

***Note**: The activity-impact interaction matrix has considered one single project component, i.e. the wind farm site.*

= Represents "no" interactions is reasonably expected
= Represents interactions reasonably possible but none of the outcome will lead to significant impacts
= Represents interactions reasonably possible with one of the outcomes leading to potential significant impact

Table 5.3 Identified interactions that are likely to result in significant impacts

S. No.	Interaction (between Project Activity and Resource/Receptor)	Justification for Expectation of Potentially Significant Impacts
1	Change in land use	The major landuse in the project area is agricultural. As a result of the Project, this practice will be changed, especially during the construction phase, and in the location of WTGs and associated facilities. This will create impacts which will have effects on the local community.
2	Impacts on Land and Soil Environment	Construction activities will lead to soil erosion and compaction. Further, waste, both hazardous and non-hazardous will be generated during the Project life cycle. In a probable event of improper waste disposal, contamination of soil and water resources might take place.
3	Impact on Water Resources	Decreased water availability in water bodies of the area might arise owing to diversion of this water for construction related activities or for use by labor Surface water contamination due to improper disposal of sewage at wind farm site can contaminate local water resources; Impact on surface water quality due to runoff from storage area in events of spills/leaks, especially during monsoon, is probable.
4	Increased Ambient Noise Levels	Generation of noise due to construction and operation of the wind farm will take place. Local communities and farmers might be disturbed by high ambient noise in the environment
6	Impacts on Nearby Establishments (Shadow Flicker)	There are a few structures within 500 m from the Project boundary at certain WTG locations which might experience shadow flicker. For these receptors the number of hours in a year they are likely to experience shadow flicker has been assessed.
7	Ecological Impacts	No forest land will be diverted for the project as was confirmed by the District Forest Officer; Removal of vegetation is causing impact on ecology of the area; Habitat destruction during temporary laying of wires adjacent to the ROW of internal electrical lines; Construction activities will lead to temporary disturbance to the wildlife present in the area; The operation of wind farm may result in collisions of birds and bats with wind turbine rotor blades, potentially causing bird and bat mortality or injury.
8	Social and Community health and Safety Impacts	Transportation of WTG components, other construction materials and increased vehicular movement will lead to traffic hazards for community residing close to the access roads;
9	Land based Livelihood – owing to construction of external transmission lines – details awaited	The diversion of the cultivable land for non-agricultural use will reduce the availability of land for land based livelihood practices.
10	Local Employment Opportunities	The project is expected to create employment opportunities in the area, in the form of direct employment in the project during the construction phase and operations phase for unskilled and semi-skilled labourers and security guards and indirect income opportunities such as demand for provision stores and other shops and businesses

11	Occupational health and safety of workers	Occupational health hazards due to dust and noise pollution; Safety risk due to wrong handling of construction machinery, working at height; Exposure of workers to Electromagnetic field (EMF) while working in proximity to charged electric power lines during operation and maintenance.
12	Labour Rights and Welfare	The construction activities are expected to employ a considerable number of labour, local and migrant. In keeping with this, specific attention will have to be paid for ensuring that the project meets the requirements of the applicable rules and regulations, such as the Inter State Migrant Workmen (Regulation of Employment and Conditions of Service) Act 1979 and the Contract Labour (Regulation and Abolition) Act 1970 The wind farm assets will be guarded by security personnel who would be armed. Such armed security workforce will have the potential for human rights violation.
13	Public safety and Human rights	The construction activities are expected to employ a considerable number of labor, local and migrant. This will create possible violation of human and labor rights.
14	Accidental Impacts – Blade throw and Natural disasters	The Project area falls in these hazard zones: • Seismic Zone II which is defined as a low damage risk zone and vulnerable to earthquakes of intensity MSK VI or less (as defined by the BMTPC). • High damage risk zone – B (V_b= 47 m/s) for wind and cyclone and • areas not prone to flooding Owing to equipment defects/malfunctions or natural disasters such as storms, cyclones, earthquakes and lightning failure in the rotor blade can occur which can result in the 'throwing' of a rotor blade which may affect public safety.

Table 5.4 Scoped- out interactions during the proposed Project's life cycle

S. No.	Impact Title	Reason for Scoping-out
1	Impact on ambient air quality operations phase	Wind farm operations have no emissions and hence same has been scoped out..
2	Impact on cultural resources and heritage structures	There are no reported archaeological or heritage site in project footprint area. Based on the site assessment, no local shrines, graveyards, mosques, other places of community worship or cultural attachment could be identified or falling within the WTG footprint area. The consultations with local people also did not reveal any cultural significance of any natural landscape that would be modified in construction activities of the project.
3	Impact on indigenous people	The census record does not report presence of Scheduled Tribe population within the project footprint area.

6 ENVIRONMENTAL AND SOCIAL BASELINE

Baseline refers to the physical, biological, cultural and human conditions that will prevail in the absence of the project, including interactions amongst them. Establishing baseline helps in understanding the prevailing environmental, ecological and socio-economic status of the study area. It provides requisite information of the biophysical and social environment for decision makers to take appropriate measures regarding the project.

Establishing baseline provides the background environmental and social conditions for prediction of the future environmental characteristics of the area before setting up of the project. It also helps in environmental and social management planning and provides a basis to finalize a strategy for minimizing any potential impact due on surrounding environment due to setting up of the project.
This section establishes the baseline environmental, ecological and socio-economic status of the proposed wind farm site and surrounding area to provide a context within which the impacts of the proposed wind farm project are to be assessed.

6.1 LOCATION AND ADMINISTRATIVE SETTING

The project is located in Mandsaur district which forms the Northern projection of Madhya Pradesh and lies between the parallels of 23 43′ 50″ to 25 02′ 55″ North latitude and between the meridians of 74 42′ 30″ to 75 50′ 20″ East longitude.

The proposed project site is spread across the Shamgarh tehsil, at a distance of 80 km north-east of Mandsaur town. The area surrounding the site comprises of rural setup with the primary land use being rain fed agriculture. The site is located on undulating terrain and the project area is spread across eleven villages: Jamuniya, Sagoria, Bhagori, Akali shivdas, Barkheda Uda, Nariya Buzurg, Khankhari, Semli Hada, Manpura, Badariya Amra, Chhayan, and Takrawad.

The Project contains 25 WTGs and the area comprises largely of undulating land with small rolling hills with average elevation of 467 m above the Mean Sea Level (MSL) with a variation of 450 m to 501m above MSL.

Details about location and access have already been provided in Chapter 2 of this report.

6.2 *AREA OF INFLUENCE*

For the purpose of the baseline establishment and impact assessment, an Area of Influence (AoI) has been identified. This sub section provides an understanding of the AoI thus identified and the reasons for the same.

6.2.1 *Study Area*

The study area considered for ESIA includes an area within 5 km radius from farthest of WTGs. The study area of 5 km has been selected based on the location of Project site and its footprint, nature and spatial distribution of potential social and environmental impacts (based on similar type of projects).

Project footprint Area

The Project Footprint is the area that may reasonably be expected to be physically touched by Project activities, across all phases. Physically, there is no demarcation or fencing for the Project Site boundary and hence it is contiguous with the rest of the area.

The Project Footprint for Project includes land used for the erection of WTGs, substation, storage of materials, site office, access roads, and internal and external transmission lines.

Project Area of Influence (AOI)

The effects of the Project and Project activities on a particular resource or receptor will have spatial (distance) and temporal (time) dimensions, the scale of which is dependent on a number of factors. These factors are incorporated in the definition of the Project's *Area of Influence (AoI)*.

The *AoI* considered for the existing Project with respect to the environmental and social resources was based on the following reach of impacts:

- **Environmental parameters:** Project site boundary, immediate vicinity, access road and surroundings, i.e. a study area of approximately 5 km (hereafter referred to as the AoI) distance from project line has been used to depict these parameters;
  - **Air Quality:** Dust emissions, fugitive dust –typically up to 100 m from operations and maintenance area;
  - **Noise:** Noise impact area (defined as the area over which an increase in environmental noise levels due to the Project can be detected) – typically 1 km from operations (this includes a distance of 10 times the size of the rotor diameter of the WTG);
  - **Land environment:** The impacts on soil and land- typically up to 100 m from project foot print area;
  - **Ecological Environment (Terrestrial and Aquatic):** This includes: (a) the direct footprint of the project comprising the wind farm; (b) The areas immediately adjacent to the project footprint within which a zone of ecological disturbance is created through increased dust, human

presence and project related activities (e.g., trampling, transportation activities).;

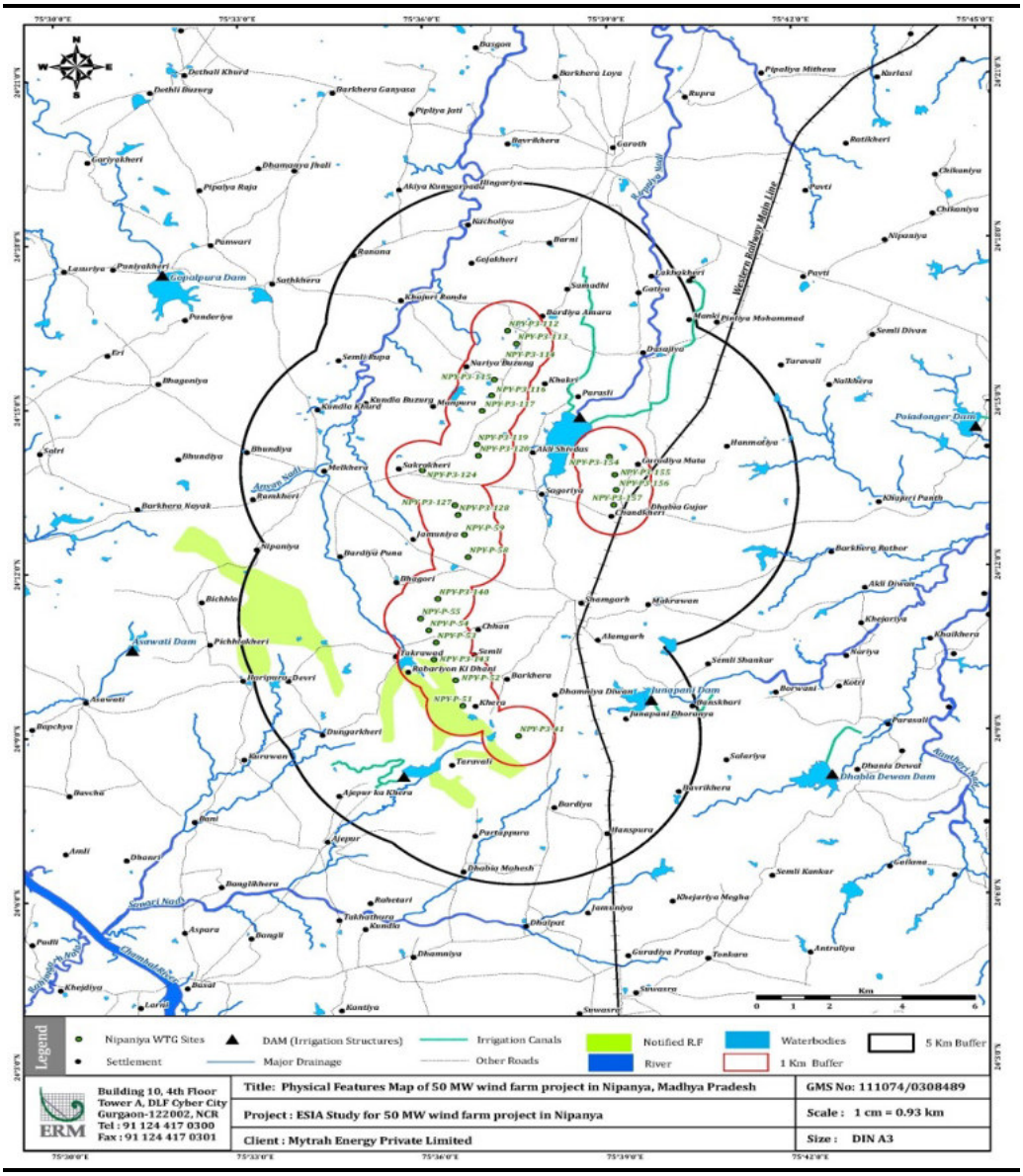
- **Social and Cultural:** the AoI for the project is identified as the area within a 5 km radius from the project footprint area, comprising of 39 villages.

Core and Buffer Zone

This AoI is in turn, divided into a core and buffer zone. This division of the AoI into two zones is based on the understanding that the majority of the impacts from the project (during the mobilization, construction, operations and decommission phase) would be contained within a 1 km radius from the Project Footprint in terms of spread and intensity, with the buffer zone appearing to have limited interaction with the project.

Physical Feature map of the Project is shown in ***Figure 6.1 .***

Figure 6.1 Physical feature map pf the Project Area



6.3 ENVIRONMENTAL BASELINE METHODOLOGY

The following sub sections provide an understanding of the methodology followed for the establishment of the environmental baseline.

ERM undertook a site visit (17th July to 20th July, 2015) to understand the site setting, environmental and social sensitivities and to identify the relevant local stakeholders. The site visit included a walkover of the site and associated facilities with the INOX team. Limited consultation with the local community, local community representatives, local NGOs and local government officials was conducted to understand the local environmental and social issues in the area and to receive feedback from stakeholder on these issues. Following this, a site visit was undertaken by ADB as part of the project's due diligence. This site visit included a visit and walk through of a sample of the WTG locations and consultations with security personnel and the local community.

A reconnaissance survey using available recent satellite imagery of the study area around the Project was initially conducted to identify environmental and social sensitive receptors located within the study area.

For transmission towers, a linear corridor of 50 m either side of the proposed transmission line was considered for the study. The primary area is planned to cover 55towers with a total width of 14.8 m on either side along the centre line of the transmission line corridor.

As part of this site visit, primary data was collected from sensitive locations and other places inside the AoI and concerned government departments and other relevant agencies were also contacted in order to obtain information. The following sub sections provide an understanding of the same.

Primary Baseline Data Collection

M/s Avon Food Lab Pvt. Limited, recognized by Ministry of Environment, Forests and Climate Change, Government of India) was engaged for collection of baseline information on ambient noise quality during the month of July (17 July- 22 July, 2015).

The primary baseline data was collected for aspects detailed out in ***Table 6.1.***

Table 6.1 Primary Baeseline Data Collection

S.No.	Environmental Attribute	No. of Locations/Area	Frequency	Remarks
1	Ambient Noise Quality	5	Once during the monitoring period	Noise levels were monitored on hourly basis for 2 hours at four (05) locations for 24 hours at one (06) locations.
2	Groundwater Quality: (As per IS 10500-2012) pH, temperature, turbidity, colour, TDS, TSS, total hardness, Calcium, magnesium, total alkalinity, chloride, sulphate, nitrite, nitrate, fluoride, sodium, potassium, salinity, total nitrogen, Nitrate, Iron, Phosphate, DO, BOD, COD, phenol, heavy metals, oil and grease, total coliform and faecal coliform.	1	Once during the monitoring period	Ground water samples were collected from the handpump of Saskiya Madhmik Vidhyalaya in the village of Barkheda-Uda, which lies in the study area.
3	Surface Water Quality: (As per CPCB Water Quality Criteria) pH, Conductivity, DO, COD, BOD, TDS, Calcium,	2	Once during the monitoring period	Surface water samples were collected from the village ponds of Barkheda Uda and Jamuniya. Both these

S.No.	Environmental Attribute	No. of Locations/Area	Frequency	Remarks
	Magnesium and Free Ammonia			villages lie in the Study Area.

Wind power projects have limited impact on air quality during construction phase due to the nature of activities and wide spread location and are typically benign to the ambient air quality during their operation phase and hence ambient air baseline quality monitoring was not carried out.

Secondary Environmental Baseline Data Collection

Secondary environmental baseline data collection involved identifying and collecting existing published materials and documents. Information on various environment aspects (like geology, hydrology, drainage pattern, ecology etc. and, meteorology were collected from different institutions, government offices and literatures etc. Secondary data was collected for the aspects as given in ***Table 6.2.***

Table 6.2 Secondary Environmental Baseline Data Collection

S. No.	Attribute	Source of Data Collection
1	Meteorological data	India Meteorological Department (IMD)
2	Geology, geomorphology, hydrogeology and hydrology	Geological Survey of India (GSI) and State Ground Water Board
3	Land use	Through Satellite Imageries
4	Natural Hazards	Building Materials and Technology Promotion Council of India (BMTPC) Meteorological Department

Environmental and social baseline data was collected through primary surveys as well as through secondary sources by literature survey and discussions with the concerned departments/agencies. Details of data collected are summarized in subsequent sections.

6.4 ENVIRONMENTAL BASELINE FINDINGS

6.4.1 Land cover and use

The land is primarily used for agricultural practices in the Mandsaur district as well as in the project AoI contributing to 76.82% of geographical extent, followed by wasteland of 14.75%.

Towards the south west and south of the Project AoI lies forest land comprising of deciduous and scrub forest. Three of the WTGs NPY-P- 51 (240m, W), NPY-P- 52 (180 m, w) and NPY-P3-143 (100 m, S) are located near the forests. These forests contribute to 3.84% of the total geographical extent of the AOI.

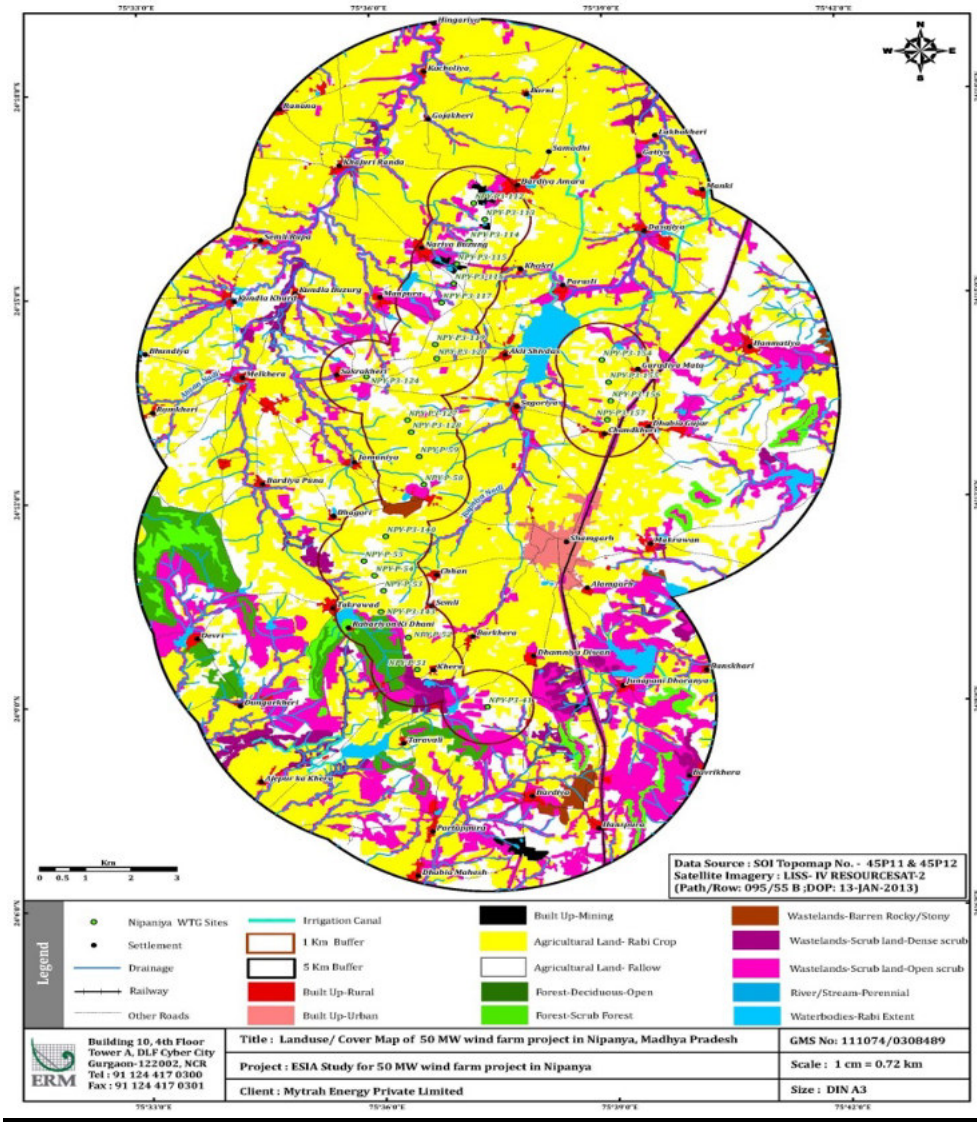
The other land uses in the area are of Built up area comprising of rural settlements, urban contributing 2.67 % followed by water bodies contributing 1.93% of the total geographical extent.

The land use details of the project AoI are presented in ***Table 6.3*** and represented in ***Figure 6.2.***

Table 6.3 Landuse break detail

Level –I	Level –II	Level –III	Area (Sq. km)	% of Geographical Area
Built up	**Built-up**	Rural Settlement	4.65	1.74
		Built Up-Urban	1.86	0.70
		Built Up-Mining	0.63	0.23
		Sub- Total	***7.14***	***2.67***
	Cropland	Rabi Crop	140.79	52.56
	Fallow Land	Current Fallow	64.98	24.26
		Sub- Total	***205.77***	***76.82***
Wasteland	**Barren Rocky/Stony waste**	Barren Rocky/Stony waste	1.18	0.44
	Wastelands-Scrub land	Land with Dense scrub	4.43	1.66
		Land with Open scrub	33.88	12.65
		Sub- Total	***39.50***	***14.75***
	Waterbody	Waterbodies-Reservoir/Tanks-Rabi extent	4.47	1.67
	River	Waterbodies-River/Stream-Perennial	0.71	0.27
		Sub- Total	***5.18***	***1.93***
Forest	**Deciduous (Dry/Moist/Thorn)**	Open	6.59	2.46
	Scrub Forest	Scrub Forest	3.69	1.38
		Sub- Total	**10.28**	***3.84***
Total		***Total***	**267.87**	***100.00***

Figure 6.2 ***Land use in the Project AoI***



6.4.2 Topography

The district forms a part of the Malwa plateau which forms a major part of western Madhya Pradesh and consists of Deccan trap rocks. The district has an upland and undulating topography and the rivers Chambal, Sivna and Awan provide the drainage.

The Project lies towards the north-east of the district**.** ***Figure 6.3*** presents contour map of the study area. Figure ***6.4*** presents the DEM profile of the study area. The two maps indicate that there is an increase in elevation from north to south of the project AoI of the range of 433-501 m above MSL. The contour levels of WTGs footprint area vary in the range of 440 – 485 m above MSL. Furthermore the increase in north-south elevation is not uniform as the landscape is fairly undulating with hillocks in between.

Figure 6.3 Contour Map of the Project Area

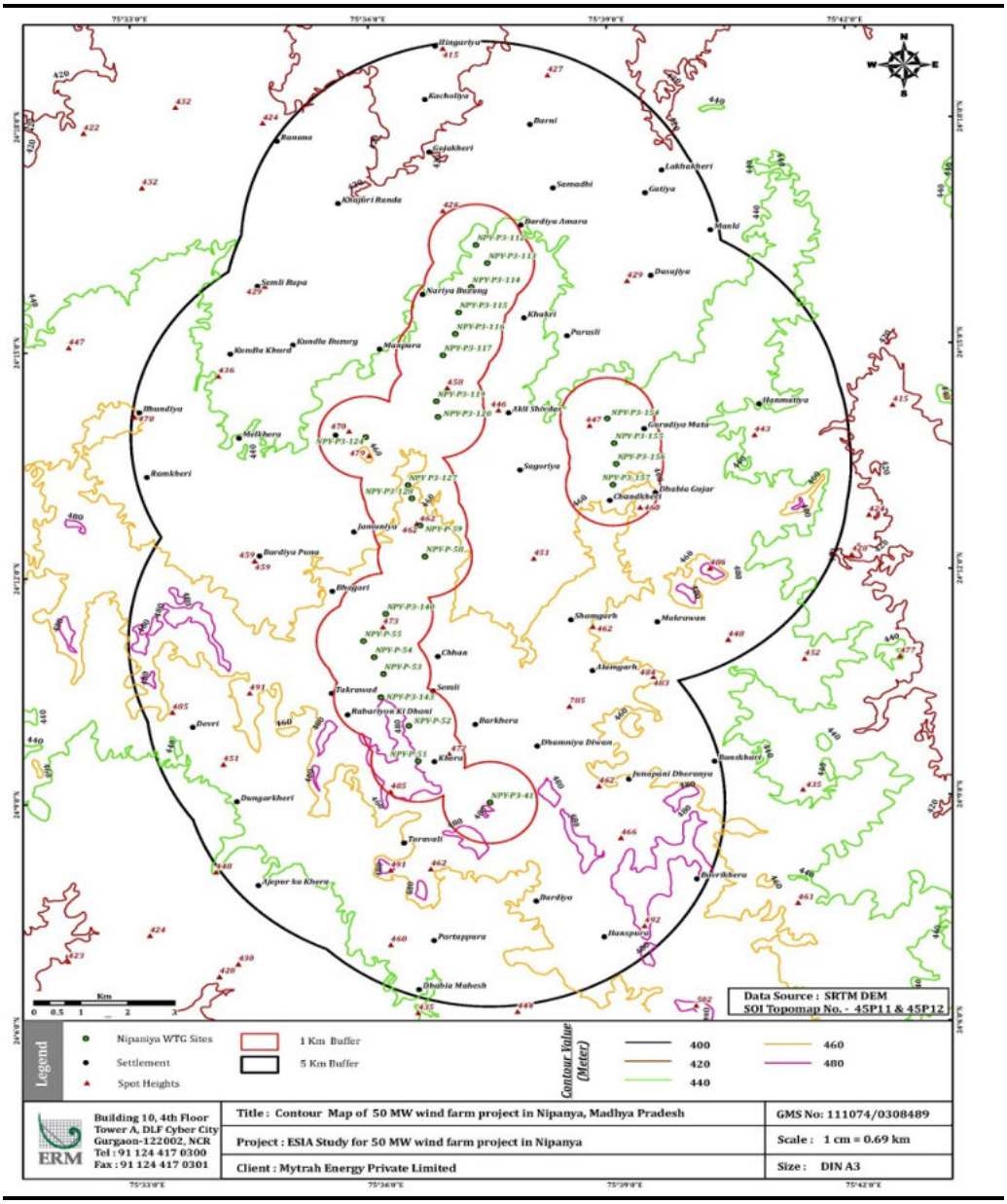
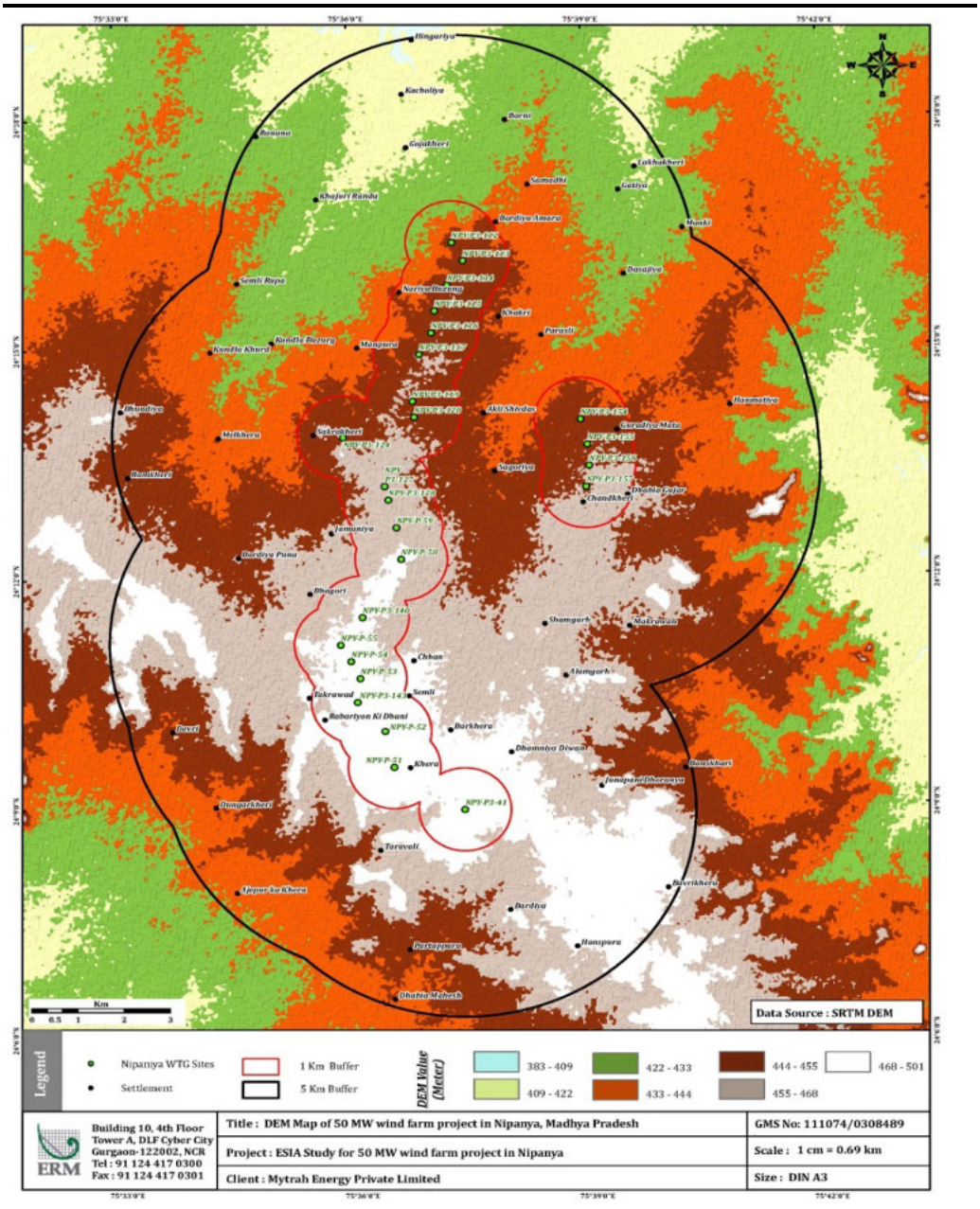


Figure 6.4 DEM of the Project area



6.4.3 Geology

Predominant geological formations in the Mandsaur district comprise of alluvium, Deccan trap basalts, Vindhyan shale, sandstone and limestone. Major parts of the district are covered by black cotton soil, which is derived from weathering and disintegration of basaltic lava flow. Major lithological units in the district are sandstones and shales with minor limestone units. Pink and Grey shale are exposed in Mandsaur and Malhargarh tehsils. These are soft and at places contain bands of white and pink clay. There is also sporadic occurrence of bands within shale of the Delhi system.[1]

[1] http://www.weeklyscience.org/UploadedArticle/110.pdf

Few abandoned stone quarries were observed in the Project area.

6.4.4 Hydro-geology

Major water bearing formation of the Mandsaur district are sandy alluvium, weathered and vesicular basalt, flow contacts and fractured sandstone. Ground water in general occurs under unconfined to semi-confined conditions. As per the District Ground Water Information Booklet for Mandsaur district prepared by the Central Ground Water Board (CGWB) three of the blocks in the district namely Mandsaur, Malhargarh and Sitamau[1], are listed as over-exploited in terms of groundwater usage and two of the blocks Garoth and Bhanpura falls under semi-critical category. As further division of the blocks have taken place recently so Shamgarh tehsil falls in parts of earlier Sitamau and Garoth. The exact recent bock level status of ground water availability was not available. It is advised that the Project utilises an alternate source of water supply for construction and operation stages.

6.4.5 Hydrology and Drainage pattern

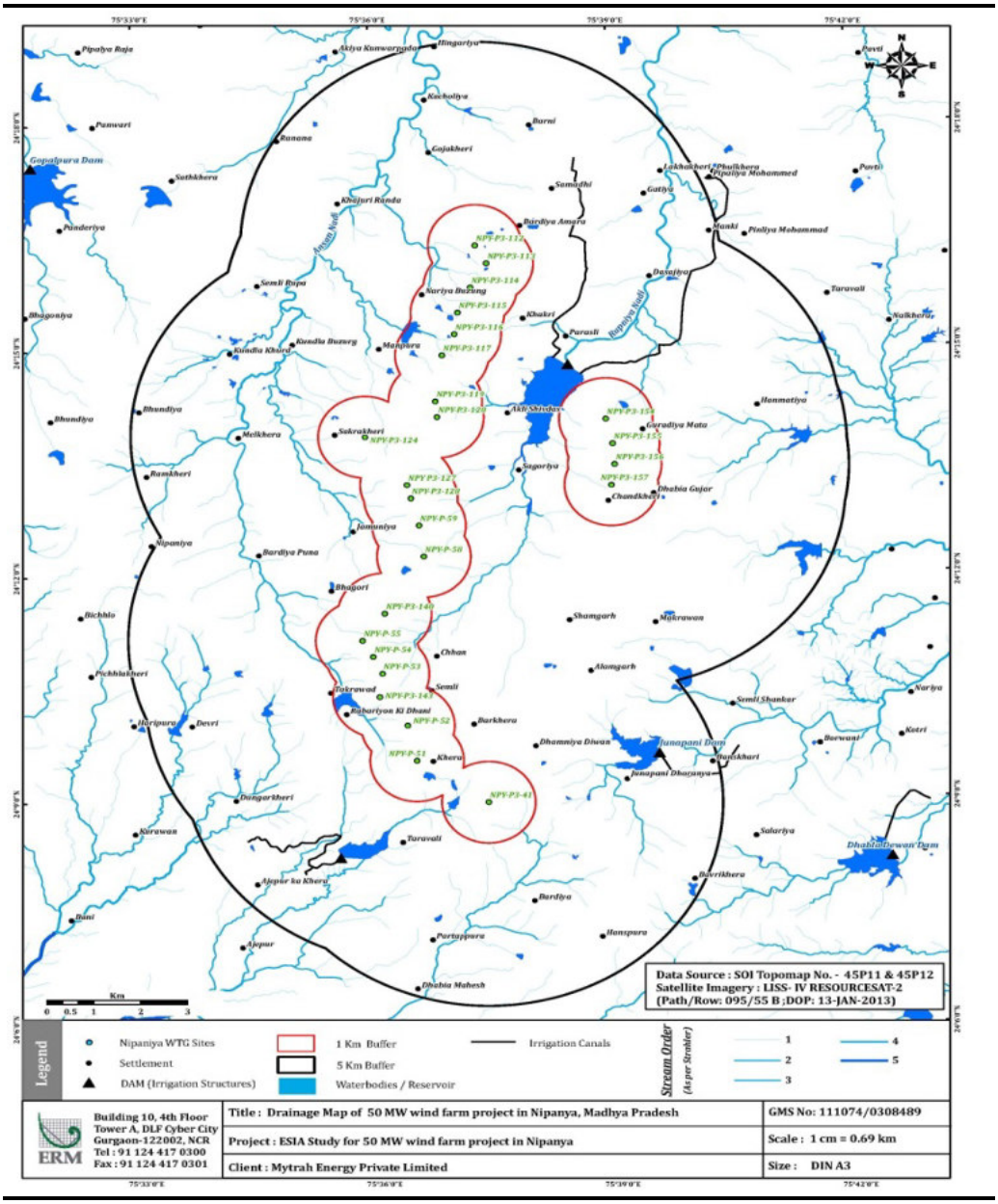
Mandsaur district has three rivers, namely: Chambal, Sivna and Awan for drainage. There are several natural lakes or ponds across the district.

The AoI has two rivers in the east and the west side: Rupaniya and Ansan respectively which have their source in the reservoir of the Gandhi Sagar dam located around 50 km north-west of the Project Area. The Project's footprint area is criss crossed by drainage from these two rivers. Other than these bigger streams and several smaller streams are located in the Project area. There is also a large reservoir near Akli Shivdas village and smaller check dams type water bodies near Takrawad, Manpura and Nariya Buzurg village.

Figure 6.5 elaborates the drainage in the study area.

[1] The District Ground Water Information Booklet of Mandsaur is a 2009 document and as per the document the Shamgarh monitoring well used by CGWB was located in Sitamu.

Figure 6.5 Drainage Map of the Project Area



6.4.6 *Climate and Meteorology*

The climate of the district is characterised by hot summer and general dryness throughout the year except during the southwest monsoon season, i.e., June to September. There are clearly marked four seasons. May is generally the hottest month with the mean daily maximum temperature at 39.8 ^{o}C and the mean daily minimum at 25.4 ^{o}C; however day temperatures in the summer can go up above 45 ^{o}C. January is the coldest month with the mean daily maximum temperature at 35 ^{o}C and mean daily minimum at 9.30 C.

Rainfall

As per the district's website the average annual rainfall in the Mandsaur is 786.6 mm. The heaviest rainfall in 24 hours recorded at any station in the district was 323.9 mm at Garoth in 1945 June 29.

Table 6.4 Rainfall for Mandsaur district, in mm (2009-2013)

Year/ Months	2009	2010	2011	2012	2013	Average
Jan	0	0	0	0.00	0.00	0.00
Feb	0	1.3	0	0.00	18.2	3.90
Mar	0	0	0	0.00	7.3	1.46
Apr	0	0	0	0.20	0.0	0.04
May	0	0	0	4.0	0.0	0.80
Jun	36	50	256	5.3	140.3	97.52
Jul	374.3	288.2	295.8	338.7	556.9	370.78
Aug	158.8	211.2	322.9	412.2	278.8	276.78
Sep	92.8	67.5	177.7	144.0	74.8	111.36
Oct	41.1	0.2	0	0	34.3	15.12
Nov	18.1	58.0	0	0	0.0	15.22
Dec	3.8	0.4	0	0	0.0	0.84
Total Annual	724.9	676.8	1052.4	904.4	1110.6	893.82

Source: India Metrological Department at http://www.imd.gov.in/section/hydro/distrainfall/webrain/mp/mandsaur.txt

The data presented in the table above shows that the annual rainfall in Mandsaur has been showing a high degree of variation in the last five years. Further, the months of June through September are where the rainfall is most intensive.

6.4.7 Natural Hazards

The Building and Material Council of India (BMTPC) has published hazard maps of India[1]. As per these maps the study area falls under the respective hazard zones:

Seismic

The study area falls in Zone II: Low Damage Risk Zone which corresponds to MSK VI or less severe earthquakes.

Wind

The Project area falls in High Damage Risk Zone – B (V_b=47 m/s). Thus, the Project shall accordingly have provisions of construction of structure to counter wind and cyclonic conditions.

[1] Natural Hazard maps can be found on the BMTPC website here:

http://www.bmtpc.org/topics.aspx?mid=56&Mid1=178

Flood

The Project site and study area do not fall under flood prone areas.

6.4.8 Noise Quality

Noise Level was recorded at 11 locations in the study area during the monitoring period. Monitoring was performed for 24 and 2 hours at 6 and 5 locations each respectively. The ambient noise monitoring locations for 24 Hour and 2 Hour monitoring are given in Table ***6.5*** and ***Table 6.6*** and ***Figure 6.6*** respectively. These locations capture the baseline conditions prevailing at nearest settlements to the WTG locations.

Table 6.5 Details of 24 Hour Ambient Noise Monitoring Location

S.N	Location	Geographical Coordinates (UTM)		Distance and Direction w.r.t Project Site (approx.)	Justification of the Sampling Location
		mE	mN		
1	NPY-P-53	561047	2674067	At the respective WTG location	Monitoring done to get representative samples for the Project area.
2	NPY-P-54	560663	2674487	At the respective WTG location	
3	NPY-P-55	561113	2675097	At the respective WTG location	
4	Near NPY-P3-119	562368	2681152	450 m, S	
5	Near NPY-P3-124	561043	2679107	500 m, S	
6	Near PY-P3-127	561956	2679207	600 m, NE	

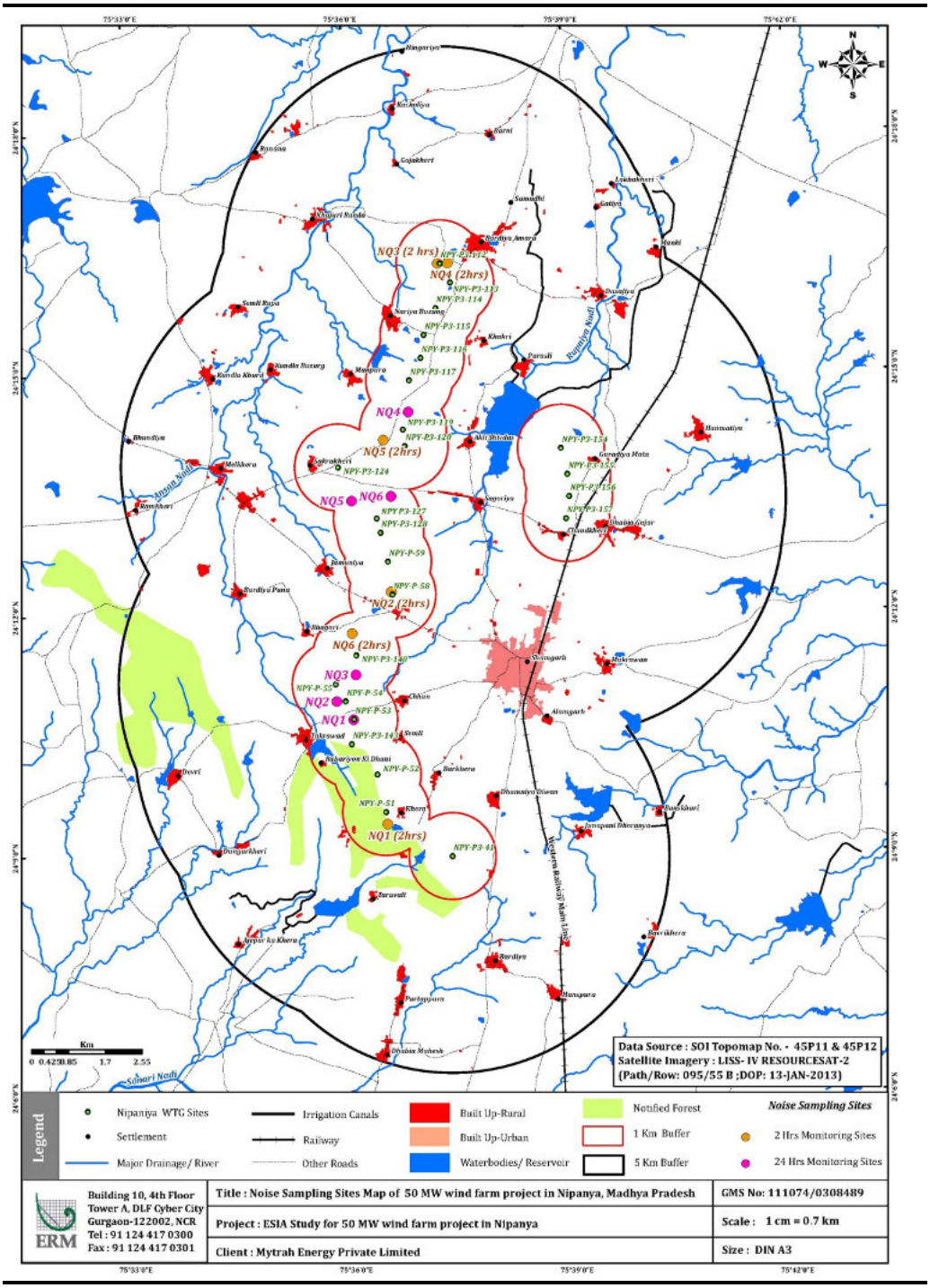
Table 6.6 Details of 2 Hour[1] Ambient Noise Monitoring Location

S.N	Location	Geographical Coordinates (UTM)		Distance and Direction w.r.t Project Site (approx.)	Justification of the Sampling Location
		mE	mN		
1	NPY-P-51	561812	2671655	271 m south of NPY-P-51	Close proximity to Barkheda Uda village
2	NPY-P-58	561942	2677008	190 m south of NPY-P-58	Cluster of sensitive receptors nearby
3	NPY-P3-112	563068	2684573	50 m west of PY-P3-112	Proximity to Bardiya Amra village
		563298	2684580	180 m east of PY-P3-112	Monitoring done at the northern periphery of the Project boundary to get representative samples
4	NPY-P3-119	561783	2680510	500 m south-west of PY-P3-119	Monitoring done near the eastern periphery of the Project boundary to get representative samples

[1] 2 hour monitoring was carried to record the representative noise levels at those locations where it was not possible to put up noise monitoring station for 24 hours due to lack of security for the monitoring station.

S.N	Location	Geographical Coordinates (UTM)		Distance and Direction w.r.t Project Site (approx.)	Justification of the Sampling Location
		mE	mN		
5	NPY-P3-140	561029	2676053	500 from PY-P3-140 and NPY-P-56	Monitoring done inside the Project boundary to get representative samples

Figure 6.6 Noise Quality Monitoring Locations



Methodology

Noise monitoring was carried out for 24 hours (one time) and 2 hours (one time) during monitoring period. For the locations where 24 hour monitoring has been performed, day time Leq has been computed from the hourly sound pressure level values measured between 0600 to 2200 hours and night time Leq has been computed from the hourly sound pressure level values measured between 2200 to 0600 hours.

Observations

The recorded noise levels in the study area are summarized in ***Table 6.7***and ***Table 6.8.***

Table 6.7 Ambient Noise Levels in the Study Area during Monitoring Period (24 Hr monitoring)

S.No.	Locations	Noise level (dB(A))		Applicable CPCB Standard (dB(A))- Residential Landuse	
		Leq Day	Leq Night	Day time	Night time
1	NPY-P-53	50.4	41.6	55	45
2	NPY-P-54	51.2	38.4	55	45
3	NPY-P-55	49.8	37.5	55	45
4	Near NPY-P3-119	50.2	42.6	55	45
5	Near NPY-P3-124	49.8	42.5	55	45
6	Near PY-P3-127	52.2	43.2	55	45

Note: Day time is considered from 6 am to 10 pm and night time is considered from 10 pm to 6am.
CPCB limits for residential area during daytime and night time are 55dB (A) and 45 dB (A) respectively, commercial area during daytime and night time are 65dB (A) and 55 dB (A) respectively and industrial area during daytime and night time are 75dB (A) and 70 dB (A) respectively.
CPCB limits for residential area during daytime and night time are 55dB (A) and 45 dB (A) respectively, commercial area during daytime and night time are 65dB (A) and 55 dB (A) respectively and industrial area during daytime and night time are 75dB (A) and 70 dB (A) respectively.

Table 6.8 Ambient Noise Levels in the Study Area during Monitoring Period (2 Hr monitoring[1])

S. No.	Locations	Noise level (dB(A))		Applicable CPCB Standard (dB(A))- Residential Landuse
		Leq Hrly (Hr 1)	Leq Hrly (Hr 2)	Day time
1	NPY-P-57	48.6	49.4	55
2	NPY-P-59	49.8	50.3	55
3	PY-P3-112	54.2	55.1	55
		46.4	47.7	55

[1] 24 hours monitoring could not be carried out due to security issues in thses locations.

S. No.	Locations	Noise level (dB(A))		Applicable CPCB Standard (dB(A))- Residential Landuse
		Leq Hrly (Hr 1)	Leq Hrly (Hr 2)	Day time
4	PY-P3-119	56.1	55.8	55
5	PY-P3-140	46.2	48.2	55

The equivalent ambient noise level for day time (Leq day) and night time (Leq night) at the monitoring location (24 hours) were observed to be below the prescribed corresponding limits for a residential area. For the 2 hours day time monitoing also all locations were within the prescribed CPCB limits except at PY-P3-119, however this can be attributed to vehicles passing near by and construction activities ongoing near the monitoring location. As can be observed from the 24 hours monitoring carried out near PY-P3-119 (***Table 6.5***) the ambient noise was well within the standard limits for both day and night time .

6.4.9 Water Resources and Quality

Water Availability

The study area mostly relies on groundwater for their water requirements, both domestic and agricultural. Several wells were also observed amongst agricultural fields in the study area which are the primary source of irrigation. At some places tube wells/bore wells are also utilised for irrigation as there are very few canals in the area. Village ponds/catchments are mostly rainfed and are used for domestic purposes as washing of clothes and for domestic animals.

Water Quality

Water quality assessment was done to understand the baseline water quality (surface as well as ground water) of the study area. Details of water sampling locations are presented in the ***Table 6.9.***

Table 6.9 Details of Water Sampling Locations

S. No.	Location	Station Code	Geographical Location		Type of Sample	Justification for Location of Sample	Nearest WTG	Distance and Direction of nearest WTG
			m E	m N				
1	Saskiy Madhmik Vidhyalaya Barkheda-uda Village	GW - 01	562883	2672599	Groundwater (Handpump)	Represents the ground water quality in the Project area	NPY-P--51	1.2 km south-west
2	Near	SW - 01	5614	2673	Surface	Represent	NPY-P--52	400 m

S. No.	Location	Station Code	Geographical Location		Type of Sample	Justification for Location of Sample	Nearest WTG	Distance and Direction of nearest WTG
			m E	m N				
	Barkheda-uda Village (Pond)		05	139	water	s the surface water quality in the Project area		south-east
3	Near Jamuniaya Village (Pond)	SW - 02	561657	2676625	Surface water	Represents the surface water quality in the Project area	Near NPY-P-58	110 south-east

Groundwater quality results are presented in ***Table 6.10.***

Table 6.10 Ground Water Quality in the Study Area

S. No.	Parameter	Unit	Results	Detection Limit	IS: 10500 Standard for Drinking Water	
			GW - 01 Saskiy Madhmik Vidhyalaya Barkheda-uda Village (Handpump)		Acceptable Limit	Permissible Limit in the absence of alternate source
1	pH	-	6.91	-	6.5-8.5	No Relaxation
2	Temperature	° C	26.0	-	-	-
3	Conductivity	µS/cm	1102	-		
4	Turbidity	NTU	<1	-	1	5
5	Colour	Hazen	<1	-	5	15
6	Total Alkalinity	mg/L	150	-	200	600
7	Total Dissolved Solids	mg/L	738	-	500	2000
8	Total Suspended Solids	mg/L	BDL	-		
9	Salinity	ppt	0.5450	-	200	600
10	Oil & Grease	mg/L	BDL	1		
11	DO	mg/L	2.67	-		
12	Chlorides	mg/L	199.93	-	250	1000
13	Total Hardness	mg/L	340	-	200	600
14	Sulphate	mg/L	31.5	-	200-	400-
15	Fluoride	mg/L	0.8	0.1	1.0	1.5
16	Nitrate	mg/L	BDL	0.3	45-	No Relaxation -
17	Mineral Oil	mg/L	BDL	0.1	0.5	No Relaxation
18	Cyanide	mg/L	BDL	0.02	0.05	No Relaxation

S. No.	Parameter	Unit	Results	Detection Limit	IS: 10500 Standard for Drinking Water	
			GW - 01 Saskiy Madhmik Vidhyalaya Barkheda-uda Village (Handpump)		Acceptable Limit	Permissible Limit in the absence of alternate source
19	Chemical Oxygen Demand	mg/L	BDL	4		
20	Biochemical Oxygen Demand (3 days at 27 ^{o}C)	mg/L	BDL	0.1		
21	Phenolic Compound	mg/L	BDL	0.001	0.001-	0.002
22	Sodium Absorption Ratio (SAR)	-	1.1083	-		
23	Iron (Fe)	mg/L	BDL	0.3	0.3	No Relaxation
24	Phosphate	mg/L	BDL	-		
25	Arsenic (As)	mg/L	BDL	0.01	0.01	0.05
26	Mercury (Hg)	mg/L	BDL	0.001	0.001	No Relaxation
27	Lead (Pb)	mg/L	BDL	0.01	0.01	No Relaxation
28	Cadmium (Cd)	mg/L	BDL	0.002	0.003	No Relaxation
29	Chromium $^{+6}$	mg/L	BDL	0.01		
30	Total Chromium (Cr)	mg/L	BDL	0.01	0.05	No Relaxation
31	Copper (Cu)	mg/L	BDL	0.01	0.05	1.5
32	Zinc (Zn)	mg/L	BDL	0.2	5	15
33	Selenium (Se)	mg/L	BDL	0.01	0.01	No Relaxation
34	Poly Chlorinated Biphenyls (PCBs)	mg/L	BDL	0.0005	0.5	No Relaxation
35	Poly aromatic hydrocarbon (PAH)	mg/L	BDL	0.0001	0.1	No Relaxation
36	Potassium (K)	mg/L	BDL	-		
37	Aluminium (Al)	mg/L	BDL	0.01	0.03	0.2
38	Calcium (Ca)	mg/L	68.0	-	75	200
39	Magnesium (Mg)	mg/L	42.5	-	30	100
40	Barium (Ba)	mg/L	BDL	-	0.7	No Relaxation
41	Molybdenum (Mo)	mg/L	BDL	0.02	0.7	No Relaxation
42	Total coliform	MPN/100ml	70	-	Shall not be detectable in any 100 ml sample	
43	Faecal coliform	MPN/100ml	6	-	Shall not be detectable in any 100 ml sample	

BDL:Below Detection Limit Above Desirable Limits Above Permissible Limits

Surface water quality results are presented in ***Table 6.11.***

Table 6.11 Surface Water Quality in the Study Area

S. No.	Parameter	Unit	Results	
			SW - 01 Near Barkheda-uda Village (Pond)	SW – 02 Near Jamuniaya Village (Pond)
1	pH	-	7.7	7.2
3	Conductivity	µS/cm	155	164
7	Total Dissolved Solids	mg/L	104	110
11	DO	mg/L	3.67	4.47
19	Chemical Oxygen Demand	mg/L	8	6
20	Biochemical Oxygen Demand (3 days at 27 °C)	mg/L	2	1.5
22	Sodium Absorption Ratio (SAR)	-	-	-
26	Boron	mg/L	-	-
38	Calcium (Ca)	mg/L	3.14	11.2
39	Magnesium (Mg)	mg/L	2.8	4.3
42	Total coliform	MPN/100ml	-	-
44	Free Ammonia	mg/L	BDL	BDL

Surface water characteristics were assessed against water quality criteria as per CPCB guidelines for aquatic resources. Surface water samples collected from the Jamuniya village pond can be best classified as 'Class D' (Propagation of Wild life and Fisheries) and that of Barkheda Uda village pond can be classified as 'Class E' (Irrigation, Industrial Cooling, Controlled Waste disposal)

Table 6.12 shows the categorisation of various classes of waters as per the CPCB norms.

Table 6.12 Primary Water Quality Criteria for Designated-Best-use-Classes

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Outdoor bathing (Organised)	B	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Propagation of Wild life and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less

Designated-Best-Use	Class of water	Criteria
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH betwwn 6.0 to 8.5 Electrical Conductivity at 25°C micro mhos/cm Max.2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/l
	Below-E	Not Meeting A, B, C, D & E Criteria

Source: CPCB Water Quality Criteria can be found at: http://www.cpcb.nic.in/Water_Quality_Criteria.php

6.5 ECOLOGY

6.5.1 Introduction

The ecological assessment of the wind farm area (core zone) and surrounding 5km radius (buffer zone) was carried out during 17th July to 20th July, 2015 to understand possible ecological sensitivities. The entire wind farm area and study area was surveyed to enumerate flora and fauna found in the study area, their sensitivity with respect to the project site and understand and establish the ecological baseline of the study area to understand impacts of the project on the species and habitats in surrounding areas. The temperature variation during survey days varied from 24°C to 40°C . The weather was slightly overcast to clear. Extreme weather conditions such as sand storm and minor showers of rains were experienced on two of the four survey days. During summer, the average maximum temperature 32.2° C and the average minimum temperature is 19.4° C. The highest temperature ever recorded was 44.0°C on May 2007 and the lowest temperature ever recorded was 2.4°C on December, 2007. The overall climatic conditions are not very suitable for good growth of the plants. The climate of the project site is sub-tropical with three well defined seasons. The rainy season is from mid-June to September. During this season, the area receives most of the rains due to south-west monsoon. Some winter rains are also there due to retreating monsoon. The rainfall of the area varies between 312.40 and 953.40 mm with an average annual rainfall of 859.5 mm. Mandsaur district receives 90.5% of annual rainfall is received during monsoon season June to November. Only 9.5% of annual rainfall takes place between October to May period.

The ecological surveys were conducted with following objectives:

Flora

- Identification of floral species (terrestrial), sensitive habitats, endangered species and forestland falling within the study area (including project site);
- Enumeration of tree species present at wind farm area ***(core zone)*** and surrounding 5 km radius area***(buffer zone)***;

- Classification of flora for any endangered or protected species or endemic floral species prevailing in the study area (including project site) based on field survey;
- Identification of areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value; and
- Identification of aquatic flora in the water bodies falling in the study area.

Fauna

- Identification of fauna (terrestrial and aerial aquatic), based on spotting, pug marks, droppings, nesting, etc.;
- Identification and classification of any species recognized as critically endangered or endangered (in accordance with the IUCN Red List, or according to the schedules of the Wildlife (Preservation) Act 1972 and amendments);
- Identification of areas which are important or sensitive for ecological reasons including their breeding, nesting, foraging, resting, over wintering areas including wildlife migratory corridors /avian migratory routes; and
- Identification and assessment of aquatic ecological resources within the study area.

6.5.2 *Approach and Methodology*

Floral Analysis

The major vegetation habitats identified in the wind farm area and 5 km buffer area are open scrub, grasslands and agricultural lands. Habitat specific vegetation survey was undertaken to enumerate the trees, shrubs and herbs in the study area.

Faunal Analysis

Herpetofaunal

Intensive search was carried out along the hedges of all the aquatic habitats. Open wells located in the study area were checked to identify and list the amphibians. Status of reptiles was assessed using Intensive Time Constrained Search Methods[(1) (2)] covering different micro habitats surveyed within the core and buffer zones of the study site.

Avifauna

Avifaunal species were enumerated by habitat surveys at the sample plots. Avian nomenclature used Standard field guides [(3)].

(1) Welsh, H.H., jr. 1987. Monitoring herpetofauna in woodlands of north western California and south west Oregon: a comparative strategy. Pp. 203-213. In. Multiple – Use Management of Califirnia's hardwood resources. T.R. Plumb, N.H. Pillisbury (eds. Gen. Tech. Regional Environmental Planning. PSW – 100) US Department of Agriculture, Forest Service.

(2)Welsh, H.H. Jr. and Lind, A. 1991. The structure of the herpetofaunal assemblage in the Douglas-fir/hardwood forests of northwestern California and south western Oregon. Pp: 395-411. In: Wildlife and vegetation of unmanaged Douglas-fir forests. (Tech.Coords). L.F. Ruggiero, K.B. Aubry, A.B. Carey and M.H. Huff. Ge. Tech. Rep. PNW-GTR-285. Portland, OR: US. Department of Agriculture, Forest Service.

(3) Birds of India, Srilanka, Pakistan, Nepal, Bhutan, Bangladesh and Maldives. 2000. Krys Kazmeierczak and Ber Van `Perlo. Om Field Guides

Mammals

Habitat survey for mammals was conducted. Identification followed standard literature. (1)(2)

Secondary literature from published books and research publications were also consulted for the flora and fauna of the study area. Discussions were held with the officials of State Forest department. The enumerated list of faunal species were assessed using IUCN Red data list (2015 v 2.0) and species listed in schedule 1-6 of Wildlife Protection Act, 1972 to confirm their conservation status.

6.5.3 The Study Area

The approach to wind farm area is from the Mandaur Suvasara Road and through a left turn before Suvasara to reach Shamgarh. The wind farm intersects the Shamgarh-Melkhera Road. The Nipaniya Wind farm consisting of 25 WTGs is part of Inox 180 MW wind park spread in the region falling into villages Nariya Buzurg, Bardiya Amara, Semli hada, Chhayan, Sagoria, Manpura, Akali Shivdas, Jamuniya, Takaravad and Barkheda Uda. The region is part of Malwa Plateau and falls in the catchment of Chambal river which flows in a north and north-east direction joining the Gandhisagar Dam.

The forest types in the study area based on Champion and Seth system of classification are;

Group 5 : Tropical Dry Deciduous Forest
- Sub Group 5A : Southern Tropical Dry Deciduous Forest
- Sub Type 5A/C3 : Southern Tropical Dry Mixed Deciduous Forest
- Sub Type 5 B/C3 : Northern Tropical Dry Mixed Deciduous Forest

(Degradation stage of dry deciduous forest)
- DS1 : Dry Deciduous Scrub Forest
- DS2 : Dry Savannah Forest
- DS4 : Dry Grass Land

Seral Type :-
- IS2 : Khair Type

Edaphic Climax Type :-
- E1DS1 : Kardhai Scrub Forest

The vegetation classification of the study area is described in ***Table 6.13.***

Table 6.13 Vegetation Classification of the Region

Area Type	Classification
Plant Diversity Centers of India[1]	Semi –arid zone
Biogeographic Province of India[1]	Semi arid-Gujarat Rajputana
Phyto-geographical regions of India[2]	Deccan Plateau
Agro Ecological Sub Region (Indian Council of	Subregion :13, AESR :5.2, Western Malawa

(1) Prater. S. H. 2005. The Book of Indian Animals. Bombay Natural History Society and Oxford University press 12th Edn. pp. 316.

(2) Menon, V. 2003. A field guide to Indian Mammals. Dorling Kindersley (India) Ltd. New Delhi. 201 p.

Area Type	Classification
Agricultural Research) [3]	Plateau, Potential cropping system :3
Agro-Climatic Region (Planning Commission)[3]	Subzone :24,Agro climatic zone:9.3,Region : Central plateau, Potential cropping system :3
Agro Climatic Zone (National Agricultural Research Project)[3]	Malawa plateau Agro climatic Zone

Source: [1]Wildlife Institute of India, [2]H.J. Chaudhary & S.K. Murty 2000 Plant Diversity and Conservation in India-an overview Bishen Singh Mahendrapal Singh Pubs. [3]Agriculture Contingency Plan, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India

Following habitats are found within the core are and 5 km buffer area;

6.5.4 Habitats and Associated Vegetation

The major habitats in the study area are open scrub, agricultural lands, water bodies, and homestead plantation. These habitats are presented in ***Figure 6.7*** and described below;

Open Scrub

Open scrub forms the major vegetation types in the study area. The area is mainly dominated by tree species of *Butea monosperma, Prosopis juliflora, Acacia nilotica* followed by isolated patches of *Azadirachta indica, Prosopis cineraria, Madhuca longifolia* species. Shrubs and Herb species are dominated by *Calotropis gigantea*, *Lantana camara, Carissa spinarum, Datura metal, Jatropha curcas, Nerium indicum, Woodfordia fruticose, Ziziphus nummularia, Cassia tora, Argemone maxicana, Xanthium strumarium, Tribulus terrestris* and *Solanum nigerum* in most dominant in the open scrub areas. Grasses such as *Apluda mutica, Cynodon dactylon, Eragrostis tenella, Heteropogon contortus, Themeda caudate* and *Themeda triandra* can be seen in Open scrub area.

Agricultural Fields

Most of the agricultural fields were sown during the study period. Crops of ground nut, were commonly seen during the study period. Black gram, Rice, Jowar and Maize are also grown in the area. Weeds such as *Calotropis* species, *Lantana* are also observed in the agricultural fields. Farms of oranges can also be seen in the Study Area.

Homestead Plantation

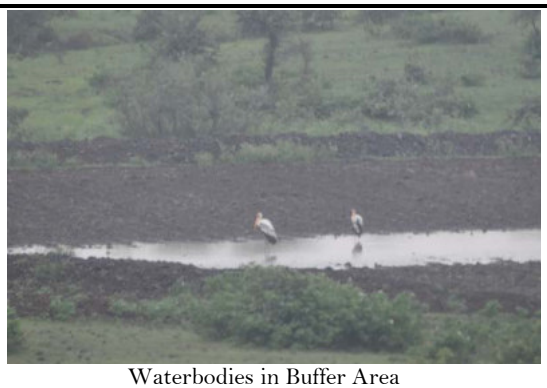
Homestead plantation of *Mangifera indica, Aegle marmelos, Albizzia procera, Ficus religiosa, Ficus benghalense, Madhuca indica, Moringa oleifera, Eucalyptus lanceolatus, Phoenix sylvestris* and *Azadirachta indica* are seen planted near the habitation. *Delonix regia*, *Syzygium cuminii, Tamarindus indica, Acacia nilotica, Cassia siamea, Ficus racemosa*, *Madhuca longifolia*, *Pongammia pinnata*, *Bauhinia purpurea, Pithecolobium dulce* can also be observed planted in these areas. Climbers such as *Vitis latifolia, Vallaris solanaceae* and *Smilax macrophylla* can be commonly seen.

Water Bodies

Ipomea aquatic and *Eichhornia crassipes* are seen as most dominant species observed in the water bodies.

Figure 6.7 Habitat surveyed in the Study Area

WTG Locations in Agricultural Field



Waterbodies in Buffer Area

Open scrub modified to Agricultural land

Source: Site and surrounding areas survey by ERM during 17th -20TH July, 2015

6.5.5 Faunal Assessment

Faunal species from the study area were recorded based on direct sightings, indirect evidences such as dung, droppings, scats, pugmarks, scratch signs, burrows, nests etc. and consultation with Forest Department officials and local community. During consultation with communities, pictorial representations of species were used in form of Field guides and other literatures of the faunal species of India. The species occurring within the study area are discussed in the following sections:

Herpetofauna

The Herpetofaunal (amphibian and reptilian) species found in the study area are discussed below and given in ***Figure 6.8***.

Amphibians

A total of four (04) species belonging to 2 families were observed from the study area. None of the species are of conservation significance. The details of the species are given in ***Table 6.14***

Table 6.14 Amphibians observed/recorded from the Study Area

Sn	Common Name	Zoological Name	Family	Occurrence	WPA Schedule / IUCN Status
1	Indian Skipper Frog	*Euphlyctis cyanophlyctis*	Dicroglossidae	Frequent	LC /Not Listed
2	Common Indian Toad	*Duttaphrynus melanostictus*	Bufonidae	Common	-/ LC
3	Indian Pond Frog	*Euphlyctis hexadactylus*	Dicroglossidae	Common	-/LC
4	Indian Bull Frog	*Hoplobatrachus tigerinus*	Dicroglossidae	Frequent	-/LC

Notes: LC-Least Concern,

Reptiles

A total of sixteen (16) species belonging 9 families to were observed from the study area. One (01) species Indian Python (*Python molorus*) is listed as Near Threatened as per IUCN category. The details of reptiles are shown in ***Table 6.15***.

Table 6.15 Reptiles observed/reported from the Study Area

Sn.	English / Popular Name	Scientific Name	Family	Occurrence	WPA Schedule / IUCN Status
1	Python	*Python molorus*	Pythonidae	Rare	I / NT
2	Brahminy Worm Snake	*Ramphotyphlops braminus*	Tylopidae	Rare	IV/LC
3	Beaked Worm Snake	*Tyhlops acutus*	Tylopidae	Rare	IV/LC
4	Common Sand Boa	*Eryx conica*	Uropeltidae	Frequent	IV/LC
5	Black Cobra	*Naja naja oxiana*	Elapidae	Rare	II/LC
6	Common Indian Krait	*Bungarus fasciatus*	Elapidae	Common	IV/LC
7	Rat snake	*Ptyas mucosa*	Colubridae	Frequent	IV/LC
8	Buffed-striped Keelback	*Amphiesma stolata*	Colubridae	Frequent	IV/LC
9	Common Indian Trinket Snake	*Elaphe helena helena*	Colubridae	Frequent	IV/ LC
10	Checkered Keelback Water Snake	*Xenchrophis piscator*	Colubridae	Frequent	II/ LC
11	Common Wolf Snake	*Lycodon aulicus*	Colubridae	Frequent	IV/ LC
12	Russell's Viper	*Daboia russelii*	Viperidae	Frequent	IV/ LC
13	Saw-scaled viper	*Echis carinata*	Viperidae	Frequent	IV/LC
14	Keeled Grass Skink	*Eutropis carinata*	Scincidae	Frequent	-/ LC
15	Indian Garden Lizard	*Calotes versicolor*	Agamidae	Common	-/-
16	Flat tailed Gecko	*Hemidactylus platyurus*	Gekkonidae	Frequent	-/-

Notes: LC-Least Concern, NT-Near Threatened

Figure 6.8 Herpetofaunal Species observed within the Study Area

Indian Skipper Frog (*Euphlyctis cyanophlyctis)*

Garden Lizard (*Calotes vesicular)*

Source: Site and surrounding areas survey by ERM during 17th -20TH July, 2015

Avifaunal and Aquatic Birds

A total of 86 species were recorded from the study area.

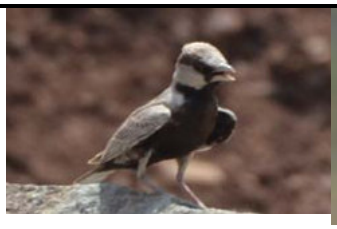
Avifaunal species such as Black-shouldered Kite (*Elanus caeruleus*), Black Kite (*Milvus migrans*), Short-toed Snake Eagle (*Circaetus gallicus*), Eurasian Marsh Harrier (*Circus aeruginosus*), Montagu's Harrier (*Circus pygargus*), Shikra (*Accipiter badius*), White-eyed Buzzard (*Butaster teesa*), Steppe Eagle (Aquila nipalensis), Common Kestrel (*Falco tinnunculus*), Laggar Falcon (*Falco jugger*) and Indian Peafowl (*Pavo cristatus*), all Sch. I species of Wildlife Protection Act, 1972 was observed at the wind farm and surrounding 5 km buffer area.

There were un-confirmed reports of the presence of White-rumped Vulture (*Gyps bengalensis*) and Indian Vulture (*Gyps indicus)* which are listed as Critically Endangered and Egyptian Vulture (*Neophron percnopterus*) listed as Endangered species as per IUCN 2015, ver.2.

The study was undertaken during monsoon season hence, a migratory season survey (Oct. to Feb) is required to be undertaken. Secondary reports of presence of seven (07) migratory species are reported from community consultation and some species bear protection from killing under Convention of Migratory Species (CMS) to which India is a signatory. Aquatic migratory bird presence could not be confirmed at site due to the season of the survey.

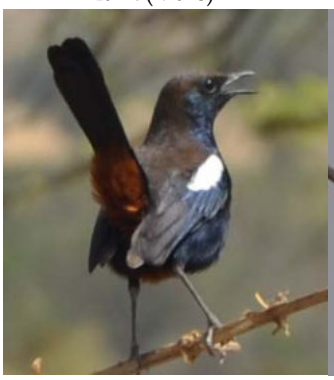
The list of species from the area are listed in ***Table 6.16*** and represented in ***Figure 6.9***.

Figure 6.9 Avifaunal Species observed within the Study Area



Purple Sunbird

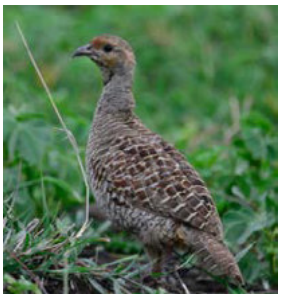
Ashy-crowned Sparrow-Lark (Male)



Ashy-crowned Sparrow Lark (Female)

Indian Roller

Indian Robin



Plain Prinia

Small Green Bee-eater

Grey Francolin

Yellow-eyed Babbler

Pied Cuckoo

Long Tailed Shrike

Crested Lark

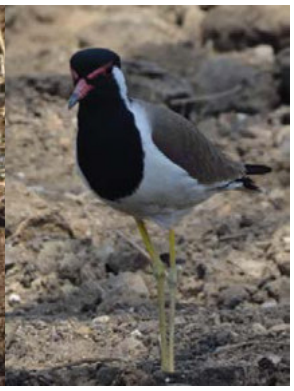
Laughing Dove

Cattle Egret

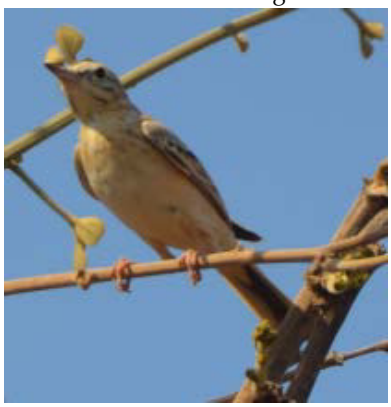
Red-vented Bulbul

Chestnut-bellied Sandgrouse

Yellow-wattled Lapwing

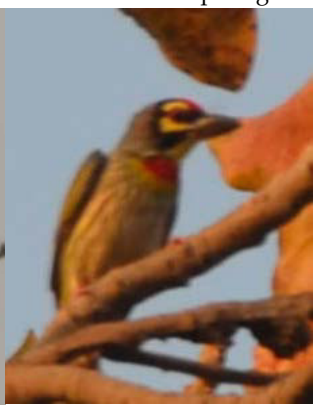


Red-wattled Lapwing



Desert Wheatear

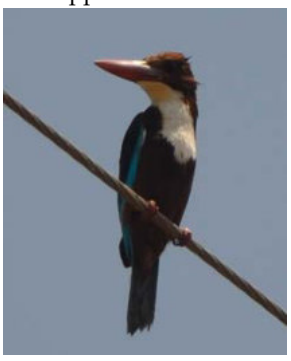
Shikra



Coppersmith Barbet

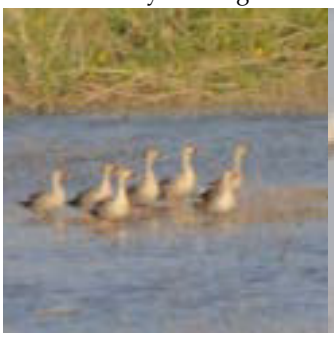
Black-winged Stilt

Brahminy Starling



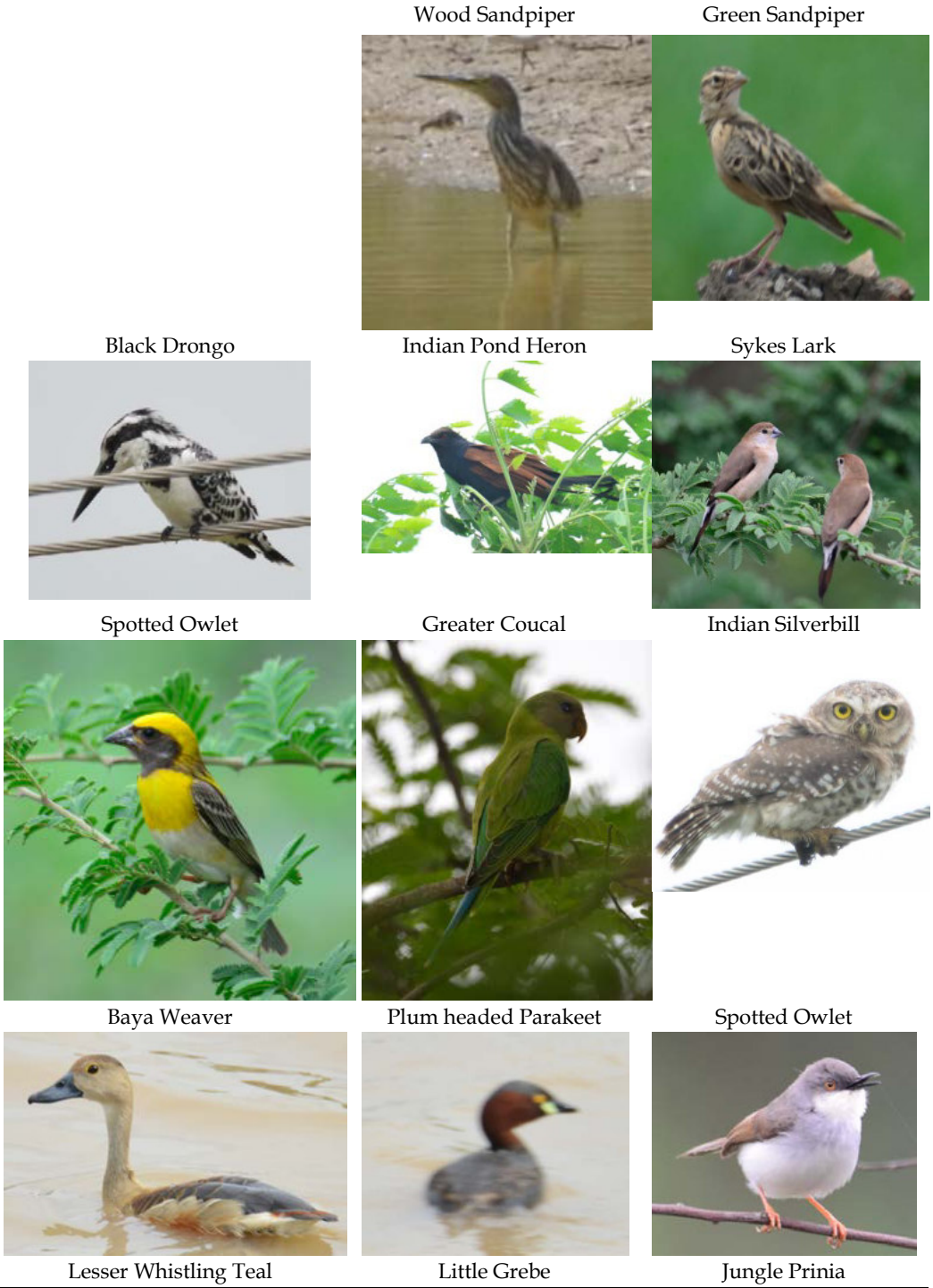
White-throated Kingfisher

Indian Peafowl (Female)



Spot-billed Duck

Cotton-pygmy Goose



Source: Site and surrounding areas survey by ERM during 17th -20th July, 2015

Table 6.16 Avifaunal Species Observed/reported in the Study Area

Sn	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status	
						IUCN	WPA,72
1	Rosy Starling	*Pastor roseus*	Sturnidae	Migratory	T	LC	IV
2	Grey Francolin	*Francolinus pondicerianus*	Phasianidae	Resident	T	LC	IV
3	Large Grey Babbler	*Turdoides malcolmi*	Leiothrichidae	Resident	T	LC	IV
4	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	Resident	A	LC	IV
5	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	Resident	A	LC	IV

Sn	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status	
						IUCN	WPA,72
6	Chestnut-bellied Sandgrouse	*Pterocles exustus*	Pteroclididae	Resident	T	LC	IV
7	Cotton-pygmy Goose	*Nettapus coromandelianus*	Anatidae	Resident	A	LC	IV
8	Great Egret	*Ardea alba*	Ardeidae	Resident	A	LC	IV
9	Intermediate Egret	*Mesophoyx intermedia*	Ardeidae	Resident	A	LC	IV
10	Little Egret	*Egretta garzetta*	Ardeidae	Resident	A	LC	IV
11	Cattle Egret	*Bubulcus ibis*	Ardeidae	Resident	T	LC	IV
12	Indian Pond Heron	*Ardeola grayii*	Ardeidae	Resident	A	LC	IV
13	Desert Wheatear	*Oenanthe deserti*	Muscicapidae	Resident	T	LC	IV
14	Spotted Owlet	*Athene brama*	Strigidae	Resident	T	LC	IV
15	Laggar Falcon	*Falco jugger*	Accipitridae	Resident	T	NT	I
16	Black Kite	*Milvus migrans*	Accipitridae	Resident	T	LC	I
17	Indian Eagle Owl	*Bubo bengalensis*	Strigidae	Resident	T	LC	IV
18	Common Kestral	*Falco tinnunculus*	Falconidae	Migratory	T	LC	IV
19	Black Shouldered Kite	*Elanus axillaris*	Accipitridae	Resident	T	LC	I
20	Common Myna	*Acridotheres tristis*	Sturnidae	Resident	T	LC	IV
21	Short-toed Snake Eagle	*Circaetus gallicus*	Accipitridae	Resident	T	LC	I
22	Long tailed Shrike	*Lanius schach*	Laniidae	Resident	T	LC	IV
23	Green Bee-eater	*Merops orientalis*	Meropidae	Resident	T	LC	IV
24	House Sparrow	*Passer domesticus*	Passeridae	Resident	T	LC	IV
25	Greater Coucal	*Centropus sinensis*	Cuculidae	Resident	T	LC	IV
26	House Crow	*Corvus splendens*	Corvidae	Resident	T	LC	IV
27	Jungle Crow	*Corvus macrorhynchos*	Corvidae	Resident	T	LC	IV
28	Eurasian Thick knee	*Burhinus oedicnemus*	Burhinidae	Resident	T	LC	IV
29	Eurasian Marsh Harrier	*Circus aeruginosus*	Accipitridae	Migratory	T	LC	I
30	Spot Billed Duck	*Anas poecilorhyncha*	Anatidae	Resident	A	LC	IV
31	White-eyed Buzzard	*Butaster teesa*	Accipitridae	Resident	T	LC	I
32	Montagu's Harrier	*Circus pygargus*	Accipitridae	Resident	T	LC	I
33	Shikra	*Accipiter badius*	Accipitridae	Resident	T	LC	I
34	White Eyed Buzzard	*Butastur teesa*	Accipitridae	Resident	T	LC	I
35	Yellow legged Buttonquail	*Turnix tanki*	Turnicidae	Resident	T	LC	IV
36	Indian peafowl	*Pavo cristatus*	Phasianidae	Resident	T	LC	I
37	White breasted Water hen	*Amaurornis phoenicurus*	Rallidae	Resident	A	LC	IV
38	Common Coot	*Fulica atra*	Rallidae	Resident	A	LC	IV
39	Red Wattled Lapwing	*Vanellus indicus*	Charadriidae	Resident	T	LC	IV
40	Yellow Wattled Lapwing	*Vanellus malabaricus*	Charadriidae	Resident	T	LC	IV
41	Wood Sandpiper	*Tringa glareola*	Scolopacidae	Migratory	A	LC	IV
42	Green Sandpiper	*Tringa ochropus*	Scolopacidae	Migratory	A	LC	IV
43	Steppe Eagle	*Aquila nipalensis*	Accipitridae	Migratory	T	LC	I
44	Spotted Dove	*Spilopelia chinensis*	Columbidae	Resident	T	LC	IV
45	Eurasian Collared Dove	*Streptopelia decaocto*	Columbidae	Resident	T	LC	IV
46	Laughing Dove	*Spilopelia senegalensis*	Columbidae	Resident	T	LC	IV

Sn	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status	
						IUCN	WPA,72
47	Rose ringed Parakeet	*Psittacula krameri*	Psittaculidae	Resident	T	LC	IV
48	Plain Prinia	*Prinia inornata*	Cisticolidae	Resident	T	LC	IV
49	Asian Koel	*Eudynamys scolopaceus*	Cuculidae	Resident	T	LC	IV
50	Indian Nightjar	*Caprimulgus asiaticus*	Caprimulgidae	Resident	T	LC	IV
51	Asian Palm Swift	*Cypsiurus balasiensis*	Apodidae	Resident	T	LC	IV
52	House Swift	*Apus nipalensis*	Apodidae	Resident	T	LC	IV
53	Indian Roller	*Coracias benghalensis*	Coraciidae	Resident	T	LC	IV
54	Common Kingfisher	*Alcedo atthis*	Alcedinidae	Resident	T	LC	IV
55	Pied Kingfisher	*Ceryle rudis*	Cerylidae	Resident	A	LC	IV
56	White Throated Kingfisher	*Halcyon smyrnensis*	Halcyonidae	Resident	A	LC	IV
57	Common Hoopee	*Upupa epops*	Upupidae	Resident	T	LC	IV
58	Coppersmith Barbet	*Megalaima haemacephala*	Megalaimidae	Resident	T	LC	IV
59	Indian Grey Hornbill	*Ocyceros birostris*	Bucerotidae	Resident	T	LC	I
60	Black-naped Oriole	*Oriolus chinensis*	Oriolidae	Resident	T	LC	IV
61	Rufous Tailed Lark	*Ammomanes phoenicura*	Alaudidae	Resident	T	LC	IV
62	Ashy crowned Sparrow Lark	*Eremopterix griseus*	Alaudidae	Resident	T	LC	IV
63	Oriental Skylark	*Alauda gulgula*	Alaudidae	Resident	T	LC	IV
64	Red rumped Swallow	*Cecropis daurica*	Hirundinidae	Resident	T	LC	IV
65	Black Drongo	*Dicrurus macrocercus*	Dicruridae	Resident	T	LC	IV
66	Red vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	Resident	T	LC	IV
67	Red Whiskered Bulbul	*Pycnonotus jocosus*	Pycnonotidae	Resident	T	LC	IV
68	Red Throated Flycatcher	*Ficedula albicilla*	Muscicapidae	Resident	T	LC	IV
69	Zitting Cisticola	*Cisticola juncidis*	Cisticolidae	Resident	T	LC	IV
70	Common Tailer Bird	*Orthotomus sutorius*	Cisticolidae	Resident	T	LC	IV
71	Indian Robin	*Saxicoloides fulicatus*	Muscicapidae	Resident	T	LC	IV
72	Pied Bush Chat	*Saxicola caprata*	Muscicapidae	Resident	T	LC	IV
73	Paddyfield Pipit	*Anthus rufulus*	Motacillidae	Resident	T	LC	IV
74	Purple Sunbird	*Cinnyris asiaticus*	Nectariniidae	Resident	T	LC	IV
75	Purple rumped Sunbird	*Leptocoma zeylonica*	Nectariniidae	Resident	T	LC	IV
76	Indian Silverbill	*Lonchura malabarica*	Estrildidae	Resident	T	LC	IV
77	White Wagtail	*Motacilla alba*	Motacillidae	Resident	T	LC	IV
78	Western Yellow Wagtail	*Motacilla flava*	Motacillidae	Resident	T	LC	IV
79	Jungle Prinia	*Prinia sylvatica*	Cisticolidae	Resident	T	LC	IV
80	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	Resident	A	LC	IV
81	Lesser Whistling Teal	*Dendrocygna javanica*	Anatidae	Resident	A	LC	IV
82	Baya Weaver	*Ploceus philippinus*	Ploceidae	Resident	T	LC	IV
83	Plum headed Parakeet	*Psittacula cyanocephala*	Psittaculidae	Resident	T	LC	IV
84	Brahminy Starling	*Sturnia pagodarum*	Sturnidae	Resident	T	LC	IV
85	Pied Cuckoo	*Clamator jacobinus*	Cuculidae	Migrant	T	LC	IV

Sn	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status	
						IUCN	WPA,72
86	Yellow-eyed Babbler	*Chrysomma sinense*	Sylviidae	Resident	T	LC	IV

Source: Site and surrounding areas survey by ERM during 17th -20th July, 2015
Note: A- Aquatic, T-Terrestrial,, LC-Least Concern, NT-Near Threatened, IUCN-International Union for Conservation of Nature, WPA-Wildlife Protection Act ,1972,

Additionally, an initial bird and bat survey was undertaken in during 16th to 24th November 2015 to understand the impact of the proposed wind farm, by monitoring migratory birds and resident species of conservation significance during the current migratory season (October to March) in the wind farm area.The survey included vantage point surveys from 8 vantage point locations to understand actual collision and avoidance behaviour. The surveys are also important in inventorying migratory birds visiting various water bodies near the wind turbine locations and tracking their movement between the waterbodies. Also 12 water bodies were also surveyed to understand how many migratory species visit the wind farm area and adjoining 5 km radial area from the wind farm area.

Vantage Point Surveys of Bird Flight Activity

Vantage point survey was undertaken at 8 locations in order to enumerate species at risk of collision with WTG and electrocution with transmission lines.
Target species were selected based on these three criteria in the survey

- Species listed as Threatened in IUCN (as Critically Endangered, Endangered and Vulnerable)
- Species listed as Sch. I as per Indian Wildlife Protection Act, 1972
- Species known to be winter visitors (migratory status)

This survey was done from eight (08) vantage points distributed within the wind farm. Data on migratory birds, raptors and species of conservation importance (Schedule I or IUCN Threatened category) were recorded. However as majority of the common species were using the height class below 10m, only the target species viz., all raptors, threatened or species of conservation significance, migratory birds and others species that tend to foray into the risk zone (Refer ***Figure 6.10***) were used in the analysis.

Species of conservational significance observed at the wind farm area are Egyptian Vulture (*Neophron percnopterus*) (Endangered (EN) IUCN v2015.4) and Woolly-necked Stork (*Ciconia episcopus*) and Sarus Crane (*Grus antigone*) (Vulnerable (VU); IUCN v2015.4);

Some species observed during the vantage point survey such as Short toed snake eagle (*Circaetus gallicus*), Common Kestral (*Falco tinnunculus*), Shikra (*Accipiter badius*), Black winged Kite (*Elanus caeruleus*), Oriental Honey Buzzard (*Pernis ptilorhynchus*), Black kite (*Milvus migrans*), Indian Grey

Hornbill (*Ocyceros birostris*) are listed as Sch. I species as per Indian Wildlife Protection Act, 1972.

These three (03) IUCN listed species and (07) species listed as Sch. I of IWPA, 1972 mentioned above are resident. They do fly within the high risk zone of a WTG (44.5 to 139.5 m); the length of a blade is 47.5m and the hub height of the WTG is 92 m, birds are therefore at risk between 44.5m to 139.5 m in the vicinity of a WTG);

In order to get a holistic picture of birds at risk of collision or that use the risk zone, the data collected from the eight VPs, waterbody surveys and casual or opportunistic observations on the target and other species were combined and used to indicate species that face high risk of collision.

The high risk zone is the air space or area covered by the diameter of the rotor (95 m) for the entire area of the wind farm harbours 25 WTGs spread over the area.

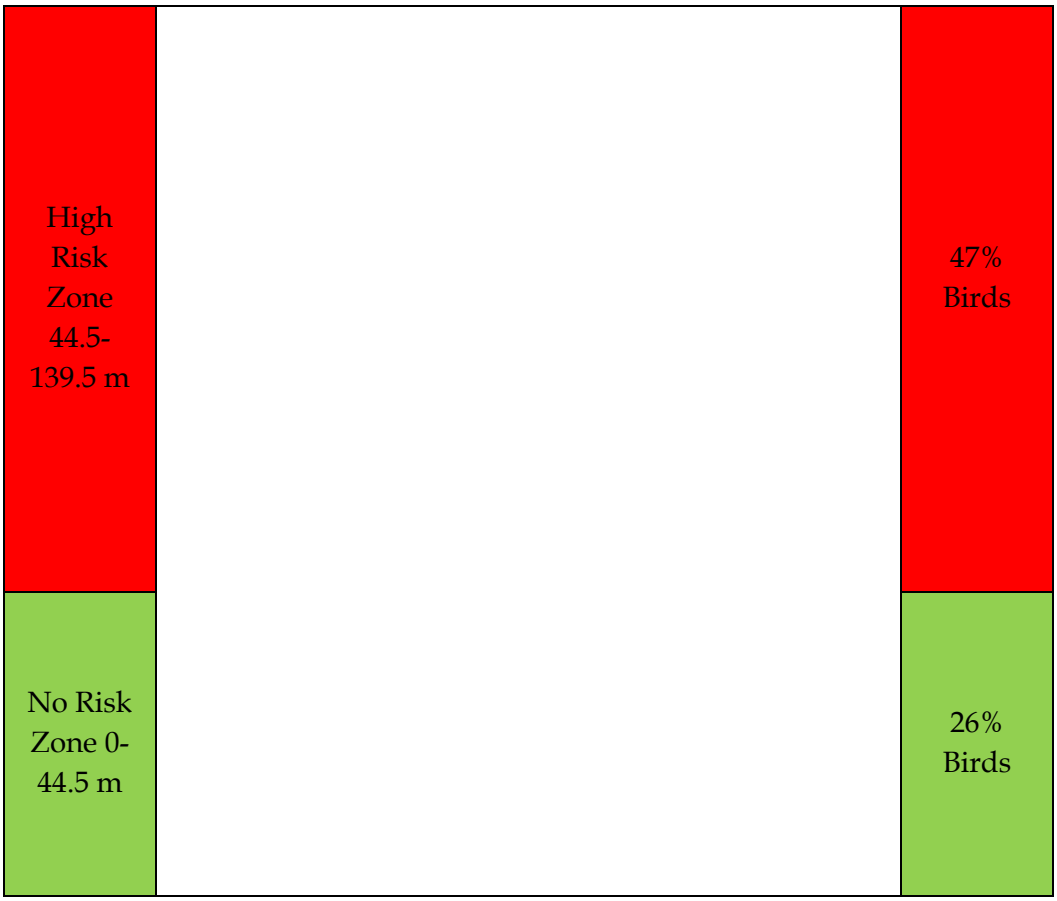
The INOX WTG has a hub height of 92m and a rotor radius of 47.5 m. This means that operational WTGs will have an impact zone extending from 44.5 m to 139.5 m. The risk zones can be classified into: No Risk Zone (NRZ) and High Risk Zone (HRZ). Using the above information, the various levels of risk zones were determined to be:

- No Risk Zone: 0-<44.5 m and >139.5m
- High Risk Zone: 44.5 m-139.5 m

The bird data collected through different surveys described above were grouped into different zone classes to establish the total number of birds and species that are in the high risk zone and face the risk of collision.

A schematic representation of the risk zones is shown in ***Figure 6.10***

Figure 6.10 Schematic representation of Risk Zones to Birds and Bats



Note: For representation purpose only, dimensions are not to scale.

The risk of collision analysis is given in***Table 6.17***. and represents the observations of bird species flying in the high risk zone and any observed target species. Target species include migratory species, threatened and protected species as per IUCN red-list v2015.4 and the Indian Wildlife Protection Act of 1972 (IWP).

Table 6.17 ***Target Bird Species and Birds Flying in the High Risk Zone and their Mean Flight Height***

Sn	Family/Species name	Common Name	IUCN/WPA	No. of birds	Minimum Height (m)	Mean height (m)	Maximum Height (m)	±SD
	Accipitridae							
1.	*Accipiter badius*	Shikra	LC/Sch I	6	100	111.25	125	13.15
2.	*Circaetus gallicus*	Short- toed snake eagle	LC/Sch I	19	70	168.06	375	90.8
3.	*Elanus caeruleus*	Black-winged kite	LC/Sch I	51	5	39.07	200	44
4.	*Milvus migrans*	Black kite	LC/Sch I	3	20	73.33	400	46.19
5.	*Neophron percnopterus*	Egyptian Vulture	EN/Sch I	3	80	90	100	14.14
6.	*Pernis ptilorhynchus*	Oriental Honey Buzzard	LC/Sch I	1	-	100	100	0
	Anatidae							
7.	*Anas acuta*	Northern Pintail	LC/Sch IV	253	100	120.83	200	34.38

Sn	Family/Species name	Common Name	IUCN/WPA	No. of birds	Minimum Height (m)	Mean height (m)	Maximum Height (m)	±SD
8.	*Anas poecilorhyncha*	Indian Spot Billed Duck	LC/Sch IV	9	0	15	30	21.21
9.	*Anser indicus*	Bar-headed Goose	LC/Sch IV	8		10		
10.	*Tadorna ferruginea*	Ruddy Shellduck	LC/Sch IV	2	60	80	100	28.28
11.	*Ardea cinerea*	Grey Heron	LC/Sch IV	4	5	42.5	130	58.95
	Bucerotidae							
12.	*Ocyceros birostris*	Indian Grey Hornbill	LC/Sch I	5	15	28.75	60	59.22
	Ciconiidae							
13.	*Anastomus oscitans*	Asian Openbill Stork	LC/Sch IV	1		100		
14.	*Ciconia episcopus*	Woolly-necked Stork	VU/Sch IV	27	5	77.5	150	44.85
15.	*Ciconia nigra*	Black Stork	LC/Sch IV	182	5	119	400	110.08
16.	*Mycteria leucocephala*	Painted Stork	NT/Sch IV	87	70	190	400	106.61
	Emberizidae							
17.	*Emberiza bruniceps*	Red-headed Bunting	LC/Sch IV	46	2	10.33	50	15.14
18.	*Emberiza melanocephala*	Black-headed Bunting	LC/Sch IV	10		3		
	Falconidae							
19.	*Falco tinnunculus*	Common Kestrel	LC/Sch I	19	4	31.67	85	27.24
	Gruidae							
20.	*Grus antigone*	Sarus Crane	VU/Sch IV	1	-	70	70	0
	Laridae							
21.	*Sterna aurantia*	River Tern	NT/Sch IV	206	3	33.66	150	34.43
	Motacilladae							
22.	*Motacilla cinerea*	Grey wagtail	LC/Sch IV	1	0	15	15	0
	Muscicapidae							
23.	*Saxicola leucurus*	Common Stonechat	LC/Sch IV	4	1	1.75	3	0.96
	Phalacrocoracidae							
24.	*Phalacrocorax carbo*	Great Cormorant	LC/Sch IV	39	120	120	120	0
	Recurvirostridae							
25.	*Himantopus himantopus*	Black - winged Stilt	LC/Sch IV	2		100		
	Strigiformes							
26.	*Athene brama*	Spotted Owlet	LC/Sch IV	2	-	5	5	0
	Threskiornithidae							
27.	*Platalea leucorodia*	Eurasian Spoonbill	LC/Sch IV	16	30	77.5	150	58.52
28.	*Threskiornis melanocephalus*	Black Headed Ibis	NT/Sch IV	39	5	34.36	100	35.11

Source: ERM Bird and Bat Initial Bird and Bat survey from 16th November to 24th November 2015

The identified species in ***Table 6.18*** has been divided into groups by flight height characteristics. The table also identifies each group by the risk zone to determine which types of birds are at a higher risk for collision with the operational wind turbines.

Table 6.18 Flight Height Characteristics of Species Recorded in the Wind Farm

S. No.	Groups	Families	No. of birds	Mean Height (m)	± SD	Range Min-Max	Risk Zone
1.	Raptors/ Birds of Prey	Accipitridae Strigiformes	104	77.30	51.89	4-375	HRZ
2.	Aquatic Birds	Anatidae Ciconiidae Ardeidae Gruidae Recurvirostridae Motacilladae Phalacrocoracidae Threskiornithidae Laridae	877	75.33	49.29	0-400	HRZ
3	Arboreal	Muscicapidae	4	1.75	1.41	1-3	NRZ
4	Arboreal	Emberizidae	56	6.67	5.19	2-50	NRZ
5	Arboreal	Bucerotidae	5	28.75	31.81	15-60	NRZ

Source: ERM Bird and Bat Initial Bird and Bat Survey from 16th November to 24th November 2015

The group of raptors/birds of prey represented by the families Accipitridae and Strigiformes were observed to have the mean flight height (77.30m) within the HRZ. Similarly aquatic birds represented by the families Anatidae, Ciconiidae, Ardeidae, Gruidae, Recurvirostridae, Motacilladae, Phalacrocoracidae, Threskiornithidae and Laridae also have the mean flight height (75.33 m) within the HRZ. The other arboreal families (Muscicapidae, Emberizidae and Bucerotidae) of birds recorded were observed to have mean flight height within the NRZ (<44.5m).

Analysis of the vantage point data has identified nine (09) bird families at risk of collision with wind turbines. Six raptors fall in the high risk zone and are the most sensitive. Raptors are also protected under the Indian Wildlife Protection Act, 1972 and amendments, so their protection status makes them a higher concern for estimating collision risk.

12 migratory species were recorded during the vantage point surveys and among those 7 species (Northern Pintail, Bar headed goose, Ruddy Shellduck, Black Stork, Common Kestrel, River Tern, Great Cormorant and Black Winged Stilt) observed to have mean flight height within HRZ.

Six IUCN Red Listed Threatened species (IUCN v2015.4.) *viz*. Egyptian Vulture (Endangered), Sarus Crane (Vulnerable), Woolly necked Stork (Vulnerable), were recorded during the Vantage Point surveys and mean flight height of all the species were found to be within HRZ.

The groups are listed in ***Figure 6.11*** below along with their risk zone, mean height and range.

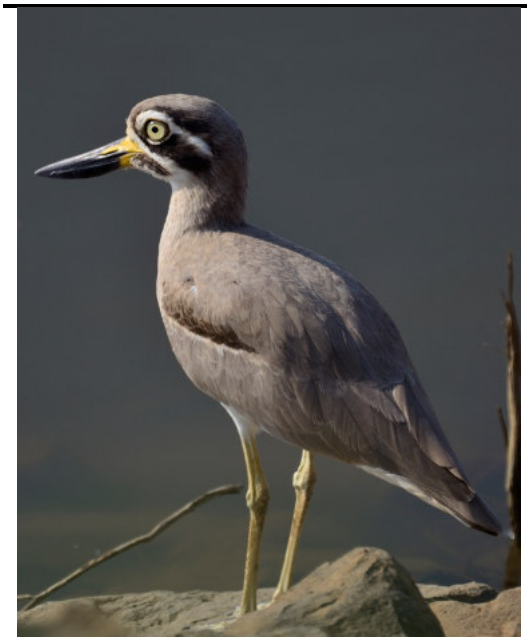
Table 6.19 Sensitive Bird Species at Risk of Collision in the Wind Farm

S. No.	Species	No/Low Risk (0-29m)	High Risk (30-130m)	No/Low Risk (<131 m)	Total number of birds
	Raptors				
1.	Shikra		6		6
2.	Spotted Owlet	2			2
3.	Short- toed snake eagle		7	12	19
4.	Black-winged kite	32	17	3	51
5.	Common Kestrel	11	8		19
6.	Black kite	1	2		3
7.	Egyptian Vulture		3		3
8.	Oriental Honey Buzzard		1		1
	Aquatic Birds				
9.	Northern Pintail		184	69	253
10.	Indian Spot Billed Duck	5	4		9
11.	Asian Openbill Stork	1			1
12.	Bar-headed Goose	8			8
13.	Grey Heron	3	1		4
14.	Woolly-necked Stork	13	14		27
15.	Black Stork	26	60	96	182
16.	Sarus Crane		1		1
17.	Black -winged Stilt		2		2
18.	Grey wagtail	1			1
19.	Painted Stork		12	75	87
20.	Great Cormorant		39		39
21.	Eurasian Spoonbill		12	4	16
22.	River Tern	107	90	9	206
23.	Ruddy Shellduck		4		4
24.	Black Headed Ibis	16	23		39
	Others				
25.	Red-headed Bunting	45	1		46
26.	Black-headed Bunting	10			10
27.	Common Stonechat	4			4
28.	Indian Grey Hornbill	4	1		5
TOTAL		**289**	**492**	**268**	**1048**

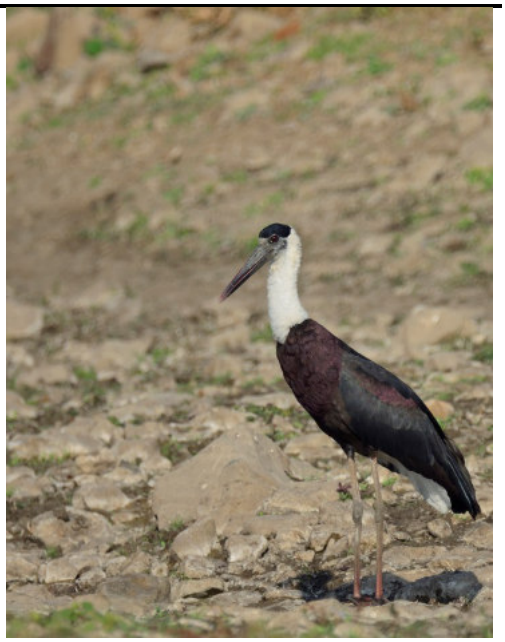
Source: ERM Initial Bird and Bat survey from 16th November to 24th November 2015

The species-level analysis of collision risk for identified bird species has yielded 557 of 1049 (~53%) individuals at low risk, and 492 of 1049 (47%) individuals at high risk of collision. Some of the recorded birds are shown in ***Figure 6.11***.

Figure 6.11 Terrestrial and Aquatic avifaunal species of conservational significance



Great Thick knee



Woolly necked Stork

River Tern

Isabiline Wheatear

Sarus Crane

Painted Stork

Short toed snake eagle

Common Stonechat

Eurasian spoonbills

River tern

Black Shouldered Kite

Common Kestral

Red Headed Bunting

Black Headed Bunting

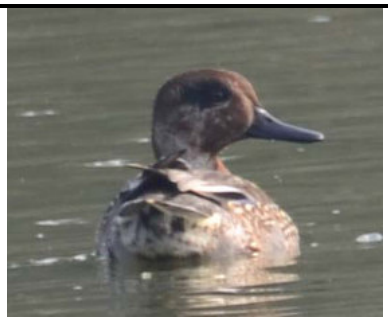
Source: Site and surrounding areas survey by ERM during 16th to 24th November 2015.

Waterbird Survey

A total of 12 small and large water bodies were surveyed within the study area. In addition to migratory species, protected and threatened species were enumerated. Water bird survey is important in order to enumerate migratory species visiting the area and their abundance.

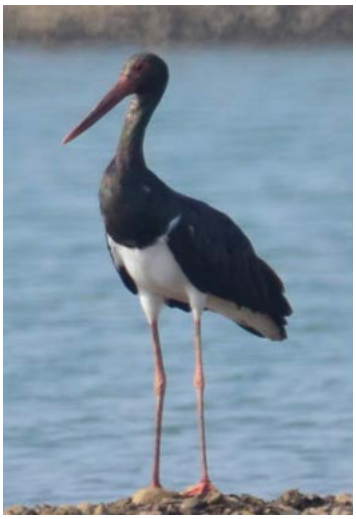
A total of 39 species of water birds were enumerated from the water bodies, in which 18 species were migratory/winter visitor while 21 species were resident. Woolly-necked Stork (*Ciconia episcopus*) and Sarus Crane (*Grus antigone*) were listed as Vulnerable (IUCN v2015.4) as per IUCN Redlist. The photographic presentation is given in ***Figure 6.12***.

Figure 6.12 Some of the Migratory avifaunal species recorded in the Study Area

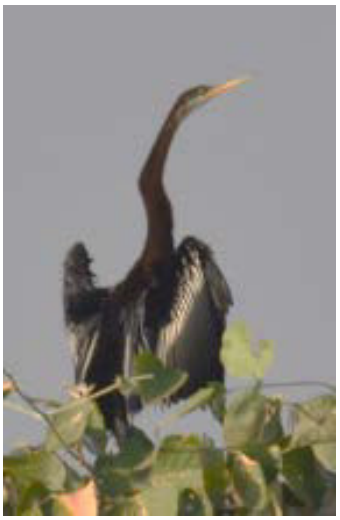


Common Teal

Little Stint



Black Stork



Oriental Darter

Eurasian Coot

Common Pochard

Kentish Plover

Common Redshank

Black headed Gull

Great crested Grebe

Bar headed Geese

Greylag Goose

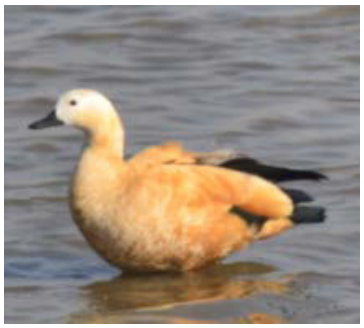
Knob billed duck

Northern Pintail

Black tailed Godwit

Red Crested Pochard

Little ringed Plover



Ruddy Shelduck

Osprey

Brown headed Gull

Source: Site and surrounding areas survey by ERM during 16th to 24th November 2015.

Major movement between water bodies were observed during the survey, however, movement of migratory species during their migrations southwards were not observed at the wind farm area.

Among the waterbodies surveyed, many species were seen moving between;

- Nariya Pond and Parasali reservoir
- Takravad Pond and Deori Pond
- Junapani Pond and Vijaynagar Pond

Parasali reservoir being the largest water body in the study area harbours the largest diversity of migratory as well as resident species. Some WTGs falling within paths of the inter waterbody movement may pose a risk of collision for these migratory species .

The water birds recorded in the study area are listed in ***Table 6.20.***

Table 6.20 List of Bird Species Recorded at the Waterbodies

Sn.	Family	Common Name	Scientific name	Resident/ Migrant	WPA Sch.	IUCN
1.	Anatidae	Bar-headed Goose	*Anser indicus*	Winter visitor	IV	LC
2.	Anatidae	Common Pochard	*Aythya ferina*	Winter visitor	IV	LC
3.	Anatidae	Common Teal	*Anas crecca*	Winter visitor	IV	LC
4.	Anatidae	Knob-billed duck	*Sarkidiornis melanotos*	Resident	IV	LC
5.	Anatidae	Greylag Goose	*Anser anser*	Winter visitor	IV	LC
6.	Anatidae	Spot Billed Duck	*Anas poecilorhyncha*	Resident	IV	LC
7.	Anatidae	Northern Pintail	*Anas acuta*	Winter visitor	IV	LC
8.	Anatidae	Northern Shoveler	*Anas clypeata*	Winter visitor	IV	LC
9.	Anatidae	Red-crested Pochard	*Netta rufina*	Winter visitor	IV	LC
10.	Anatidae	Ruddy Shelduck	*Tadorna ferruginea*	Winter visitor	IV	LC
11.	Anhingidae	Darter	*Anhinga melanogaster*	Winter visitor	IV	LC
12.	Ardeidae	Great Egret	*Casmerodius albus*	Resident	IV	

Sn.	Family	Common Name	Scientific name	Resident/ Migrant	WPA Sch.	IUCN
13.	Ardeidae	Grey Heron	*Ardea cinerea*	Resident	IV	LC
14.	Ardeidae	Little egret	*Egretta garzetta*	Resident	IV	LC
15.	Ardeidae	Pond Heron	*Ardeola grayii*	Resident	IV	LC
16.	Burhinidae	Eurasian Thick-knee	*Burhinus oedicnemus*	Resident	IV	LC
17.	Cerylidae	Pied Kingfisher	*Ceryle rudis*	Resident	IV	LC
18.	Charadriidae	Kentish Plover	*Charadrius alexandrinus*	Winter visitor	IV	LC
19.	Charadriidae	Little Ringed Plover	*Charadrius dubius*	Resident	IV	LC
20.	Charadriidae	Yellow-wattled Lapwing	*Vanellus indicus*	Resident	IV	LC
21.	Ciconiidae	Black Stork	*Ciconia nigra*	Winter visitor	IV	LC
22.	Ciconiidae	Painted Stork	*Mycteria leucocephala*	Resident	IV	NT
23.	Ciconiidae	Woolly-necked Stork	*Ciconia episcopus*	Resident	IV	VU
24.	Gruidae	Sarus Crane	*Grus antigone*	Resident	IV	VU
25.	Laridae	River Tern	*Sterna aurantia*	Winter visitor	IV	NT
26.	Motacilladae	Grey wagtail	*Motacilla cinerea*	Winter visitor	IV	LC
27.	Motacilladae	White Wagtail	*Motacilla alba*	Winter visitor	IV	LC
28.	Motacilladae	White-browed Wagtail	*Motacilla maderaspatensis*	Resident	IV	LC
29.	Pandionidae	Osprey	*Pandion haliaetus*	Winter Visitor	I	LC
30.	Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	Resident	IV	LC
31.	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*	Resident	IV	LC
32.	Podicipedidae	Great Crested Grebe	*Podiceps cristatus*	Winter visitor	IV	LC
33.	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	Resident	IV	LC
34.	Pteroclididae	Chestnut-bellied Sandgrouse	*Pterocles exustus*	Resident	IV	LC
35.	Rallidae	Eurasian Coot	*Fulica atra*	Resident	IV	LC
36.	Recurvirostridae	Black -winged Stilt	*Himantopus himantopus*	Winter visitor	IV	LC
37.	Scolopacidae	Black tailed Godwit	*Limosa limosa*	Winter visitor	IV	NT
38.	Threskiornithidae	Black Headed Ibis	*Threskiornis melanocephalus*	Resident	IV	NT
39.	Threskiornithidae	Eurasian Spoonbill	*Platalea leucorodia*	Resident	IV	LC

Source: Site and surrounding areas survey by ERM during 16th to 24th November 2015.

Summary of the Findings of Initial Bird and Bat Survey

The key findings of the study are listed in the following bullets:

- The vantage point data showed the presence of 2 threatened species; Egyptian Vulture (*Neophron percnopterus*) (Endangered (EN) IUCN v2015.4) and Woolly-necked Stork (*Ciconia episcopus*) (Vulnerable (VU); IUCN v2015.4). These two species were observed to fly at height of 44.5-139.5 m and thus may be at risk of collision with WTG blade and tower.
- Seven Schedule I species (Shikra, Short- toed snake eagle, Black-winged kite, Common Kestrel, Black kite, Egyptian Vulture, Oriental Honey Buzzard) , seven migratory species (Northern Pintail, Bar headed goose, Ruddy Shelduck, Black Stork, Common Kestrel, River Tern, Great Cormorant and Black Winged Stilt) were observed to have mean flight height within High Risk Zone.

- Waterbody survey data shows 18 species of migratory species visiting the wind farm area during the migratory season (October to March)
- The globally threatened and protected species observed within the study area are widespread across the Indian sub-continent and occur with lower abundance and fast declining population trend. We have observed impacts of electrocution on migratory species and some globally threatened species fly in the high risk zone of the WTGs. However collision impacts from this wind farm through collision and electrocution are unlikely to be diverse, irreversible or unprecedented, all necessary for classifying project as Category A. Impacts from the wind farm on these are very specific and only relevant for collision risks and electrocution. Secondly impacts can be reversed by mitigation (bird safe technology on transmission poles). Any residual impacts consequent to these mitigation actions are likely to be absorbed by the population which are unlikely to show any declines of population abundance or distribution and long term population viability will be retained (with the exception of cumulative impacts of many wind farms operating in the same area together). And finally as wind farms have been operating in this central India region for several years now impacts of collisions and electrocution are not unprecedented.

Mammals

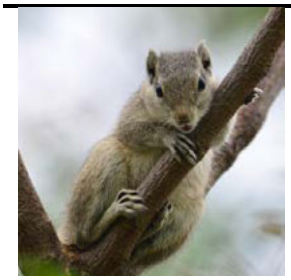
A total of 12 species of 12 genera belonging to 10 families were observed/ reported from the study area. One (01) species Indian Pangolin (*Manis crassicaudata)* is categorized as Near Threatened as per IUCN categorization and listed as Sch. I species, as per Wildlife Protection Act, 1972. A list of species observed/reported from the study area are given in ***Table 6.21*** and represented in ***Figure 6.13***.

Table 6.21 Details of Mammals observed/ reported from the Study area

Sn.	English Name	Scientific Name	Family	Occurrence	WPA Schedule / IUCN Status
1	Jackal	*Canis aureus*	Canidae	Frequent	II/LC
2	Bengal Fox	*Vulpes bengalensis*	Canidae	Frequent	II/LC
3	Bonnet Macaque	*Macaca radiata*	Cercopithecidae	Common	II/LC
4	Grey Langur	*Semnopithecus entellus*	Cercopithecidae	Rare	II/LC
5	Blue Bull (Nilgai)	*Boselaphus tragocamelus*	Bovidae	Common	III/LC
6	Indian Pangolin	*Manis crassicaudata*	Manidae	Rare	I/ NT
7	Indian Grey Mongoose	*Herpestes edwardsii*	Herpestidae	Frequent	II/LC
8	Jungle Cat	*Felis chaus*	Felidae	Frequent	II/LC
9	Five Striped Squirrel	*Funambulus pennantii*	Sciuridae	Common	IV/LC
10	Striped Hyaena	*Hyaena hyaena*	Hyaenidae	Rare	III/NT
11	Indian Flying Fox	*Pteropus giganteus*	Pteropodidae	Common	V/LC
12	Indian Hare	*Lepus nigricollis*	Leporidae	Common	IV /LC

Notes: IUCN-International Union for Conservation of Nature, WPA-Wildlife Protection Act ,1972, LC-Least Concern, NT-Near Threatened

Figure 6.13 Mammalian Species observed within the Study Area



Five Striped Squirrel

Grey Langur

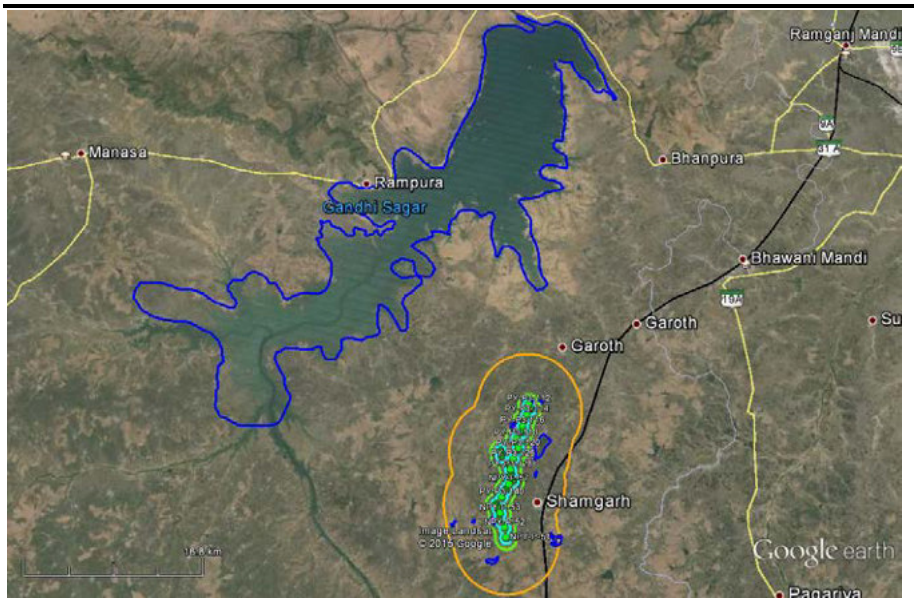
Blue Bull (Nilgai)

Source: Site and surrounding areas survey by ERM during 17th -20TH July, 2015

6.5.6 *Protected Area*

IBA Gandhi Sagar Wildlife Sanctuary and Reservoir (IBA Code-IN-MP-06, IBA Criteria (A4i-≥1% biogeographic population), A4iii (≥20,000 water birds) is at a distance of 16 km north west of Project site. Gandhi sagar reservoir draws a large number of migratory and non-migratory birds throughout the year. This reservoir can easily qualify for A4iii criteria, i.e. congregation of 20,000 or more water birds. There are reports of Lesser Adjutant *Leptoptilos javanicus* (Vulnerable, IUCN 2015 v 2.0) and flamingos *Phoenicopterus* spp (the greater flamingo (*Phoenicopterus roseus*) is LC, IUCN 2015 v2.0 and the lesser flamingo (*Phoenicopterus minor*) is NT, IUCN 2015 v 2.0. This reservoir is also famous for large numbers of the Bar-headed Goose (*Anser indicus*). Although no proper census of this species has been conducted, its population could reach the 1% threshold determined by Wetlands International (2002). As the water expanse is very large and difficult to assess, the number and species composition of other waterfowl is also not known, but some species may cross the 1% population threshold. The location of the Gandhi Sagar Dam with respect to study area is given in ***Figure 6.14.***

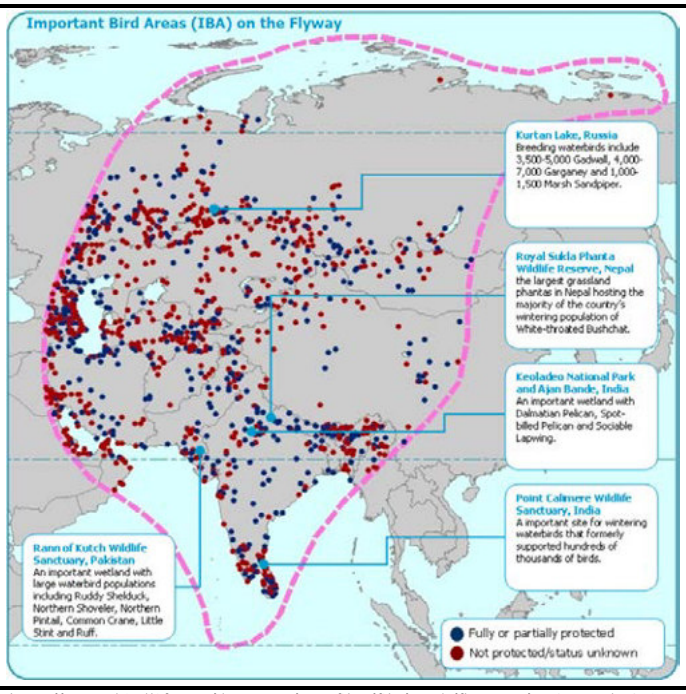
Figure 6.14 Gandhi Sagar Reservoir and Study Area



Source: Google earth image dated 23Oct. 2013 accessed on 11.Sept.2015

6.5.7 *Migratory Routes*

The Central Asian flyway covers the entire Indian mainland. The IBAs as shown in the map (Refer Figure 6.15) below denote the major congregation's areas of these migratory birds for stop overs and migration further south. An initial bird and bat survey (Nov. 2015) was also undertaken during the migratory season (Oct-Feb) is to understand the migratory species visiting the wind farm area and 5 km radial area from wind farm.A total of 18 migratory species were observed from the surrounding water bodies. During the first phase of the long term monitoring (February 2016) 20 migratory species were recorded from the study area and in the second phase of Long term monitoring (March 2016), 13 migratory species have been recorded. Some of the migratory species from Gandhi Sagar Wildlife Sanctuary and Reservoir may use the study area as their foraging area due to the presence of habitats in small and large waterbodies. However given the major congregations of the water birds are in the reservoir, any impacts on species visiting the wind farm, as a spill over, are unlikely to be significant and will certainly not impact species abundance within congregations in the region. The wind farm area is not a critical habitat [(1)] for migratory birds.Figure 6.15 Map showing Central Asian Flyway and IBA with respect to India

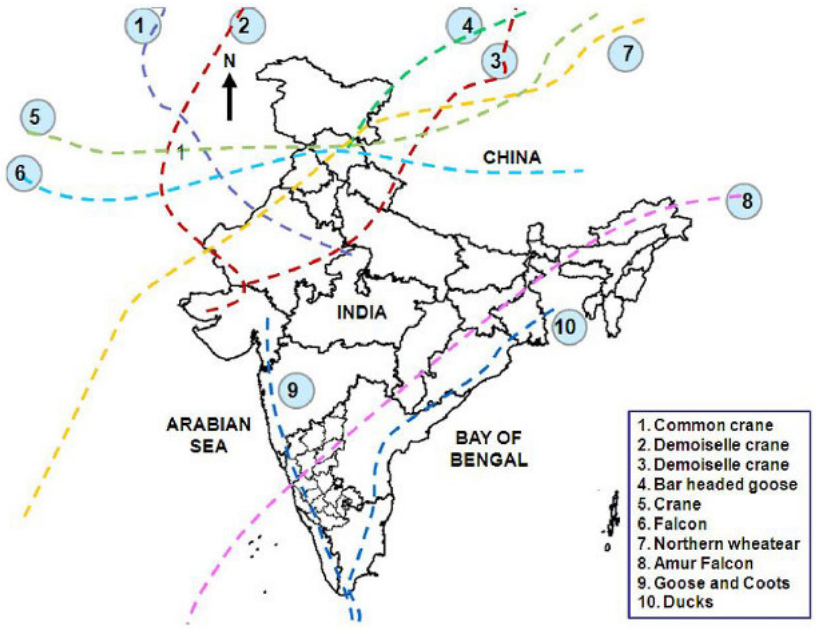


Source: http://www.birdlife.org/datazone/userfiles/file/sowb/flyways/7_Central_Asia_Factsheet.pdf

(1)Critical Habitat: A subset of both natural and modified habitat that deserves particular attention. Critical habitat includes areas with high biodiversity value, including habitat required for the survival of critically endangered or endangered species; areas having special significance for endemic or restricted-range species; sites that are critical for the survival of migratory species; areas supporting globally significant concentrations or numbers of individuals of congregatory species; areas with unique assemblages of species or that are associated with key evolutionary Processes or provide key ecosystem services; and areas having biodiversity of significant social, economic, or cultural importance to local communities. Critical habitats include those areas either legally protected or officially proposed for protection, such as areas that meet the criteria of the World Conservation Union classification, the Ramsar List of Wetlands of International Importance, and the United Nations Educational, Scientific and Cultural Organization's world natural heritage sites. 6 As defined by the Word Conservation Union's Red List of Threatened Species or as defined in any national legislation.

Major migratory routes passing through India suggest no major pathway through the project site as shown in in ***Figure 6.16***. However, presence of Gandhi Sagar Dam in close proximity may attract some migratory birds to the study area, but due to presence of larger habitat at Gandhi Sagar Reservoir the numbers are relatively less and any collision risk to the migratory bird can be mitigated by implementation of appropriate mitigation measures.

Figure 6.16 Map showing major migratory routes with respect to India



Source: Ramachandra T.V, Durga Madhab Mahapatra, M. Boominathan, K. Sankara Rao and Harish R. Bhat, 2011. Environmental Impact Assessment of the National Large Solar Telescope Project and its ecological impact in Merak area., CES Technical Report : 123, Energy & Wetlands Research Group, Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560 012. doi:http://wgbis.ces.iisc.ernet.in/biodiversity/pubs/ces_tr/TR123/index.htm

6.6 SOCIAL

6.6.1 Socio-Economic Data Collection Methodology

This section provides an understanding of the administrative set up of the district, the demographic profile of the villages in the study area, the social groups present, the land use pattern in the area, the livelihood profile of the community, the common property resources, the social and physical infrastructure available in terms of the education and health infrastructure, the water supply for irrigation and drinking purposes, sanitation facilities and connectivity. This is to provide a basic understanding of the socio-economic setting of the area and allow for the identification of areas/attributes which may require in depth analysis through the need assessment during the later stages of the project life cycle. The purpose of the baseline is also to allow for the

In keeping with the nature of the project and its potential impacts on the local community, the social baseline for the AoI has been established on the basis of the visual observations made during the site survey, stakeholder consultations undertaken and a review of the secondary information available in the public domain. No quantitative primary data has been collected for the impact assessment. The following sub section provides an understanding of the methodology followed for the social baseline data collection.

Review of Secondary Information

For the purpose of establishing the social baseline for the study area, a review of the secondary information available in the public domain was undertaken. The list of secondary sources of information used is as follows:

- Department of Public Relation, Madhya Pradesh (http://www.mpinfo.org/)
- Maps of India
- Census of India, 2011
- Mandsaur District Statistical Handbook, 2011
- Agricultural Contingency Plan, 2012, Mandsaur District

Site Survey and Stakeholder Consultations

As part of the baseline data collection process, consultations were undertaken with the local stakeholders identified for the project. The following ***Table 6.22***provides a list of the consultations undertaken as part of the site visit.

Table 6.22 Consultations undertaken for the Project

Date	Stakeholder Details
17-07-2015	Discussion with villagers of Jamuniya village
17-07-2015	Discussion with a patwari of the area, Mr. Mukesh Salvi, to understand the system of land-selling in the area
17-07-2015	Discussion with the Sarpanch of Barkheda Huda panchayat and her family (in Chhayan village)
17-07-2015	FGD with women group (Chhayan)
18-07-2015	FGD with local community (Takrawad)
18-07-2015	FGD with local community (Sagoriya)
19-07-2015	Discussions with villagers of Barkheda Uda
19-07-2015	Discussions with Mr. Arjun Singh – A farmer who sold his land for WTG
19-07-2015	FGD with local community (Bardiya Amra)
19-07-2015	FGD with local community (Aakli Shivdas)
19-07-2015	Discussion with Bhil tribe members (Bhagori)

As part of these consultations an attempt was made to develop an understanding of the stakeholder group's key concerns and expectations from the project, the stakeholder group's perception of the project and to triangulate the secondary information available on the area.

Figure 6.17 Stakeholder Consultations Undertaken

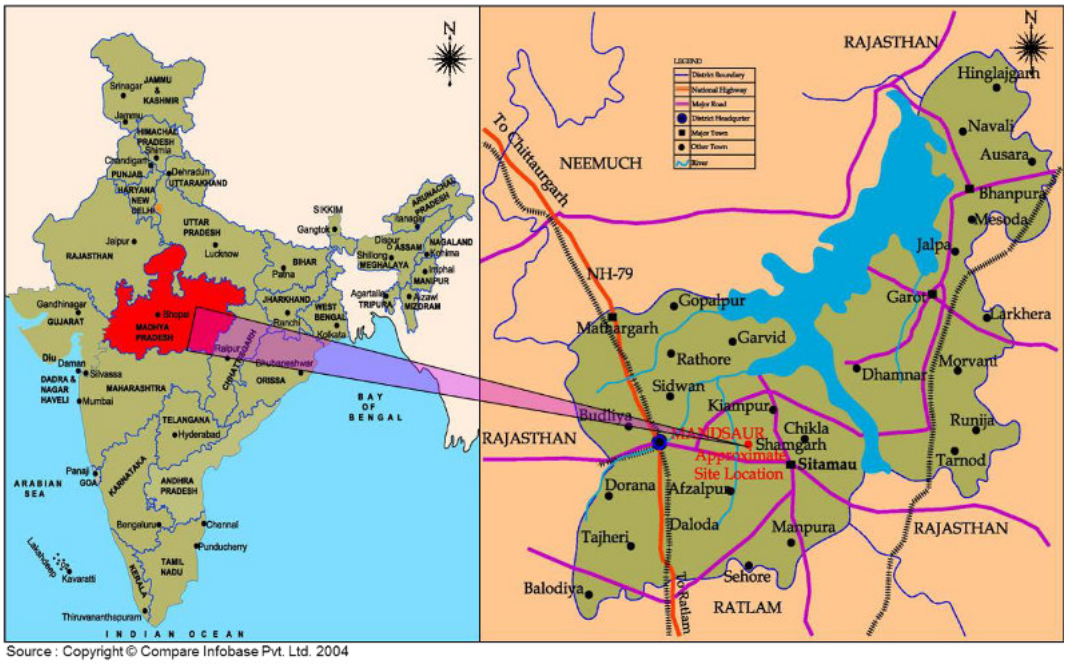
Source: ERM Site Visit, July 2015

Details of various stakeholders consulted are provided in the ***Section– Stakeholder Identification and Engagement***, of this report.

6.6.2 State Profile: Madhya Pradesh

Madhya Pradesh, as the name suggests, is located in the centre of the country and is the second largest state in India (in terms of geographical area). It shares a boundary with Rajasthan in north-west, Gujarat in south-west, Maharashtra in south, Chhattisgarh in south-east and Uttar Pradesh in north east. The state administers 3,08,252 sq. km. of area which is 9.37% of the total geographical area of the country and its accounts for 6% population of India, according to the provisional data of Census 2011. The capital of the state is Bhopal.

Figure 6.18 Madhya Pradesh and Mandsaur



Source : Copyright © Compare Infobase Pvt. Ltd. 2004

The state of Madhya Pradesh is divided into 51 districts, 364 Tehsils, 313 development Blocks and 52,117 populated villages.

Figure 6.19 Administrative Structure of Madhya Pradesh

Source: Department of Public Relation, Madhya Pradesh

The state comprises of a population of 72,626,809 individuals, which is predominantly rural, forming 72.37% of the state's total population. The decadal population growth has reduced from 24.34% during 1991-2001 to 20.35% during 2001 to 2011. The sex ratio in the state is 931, which has increased from 920 in the past decade; however it is still lower than the sex ratio of India, being 940 females per 1000 males. The population density of India is 382 persons/sq. km. while that of Madhya Pradesh is 236 persons/sq. km., which

is considerably lower for a state with second largest geographical area in the country.

Table 6.23 Madhya Pradesh Demographic Profile

Attribute	Number	% of India
Area (sq. km)	3,08,252	9.37
Total population	7,26,26,809	6.0
Males	3,76,12,306	6.03
Females	3,50,14,503	5.97
Sex ratio	931	NA
Percentage of rural Population	72.37	NA
Percentage of urban population	25.63	NA
Population density	236	NA
Percentage of SC population	15.6	NA
Percentage of ST population	21.1	NA
Total literacy rate	69.32	NA
Male Literacy rate	78.73	NA
Female Literacy Rate	54.49	NA
Rural Literacy	63.94	NA

Source: Census of India, 2011 data

The literacy rate of Madhya Pradesh is nearly 70% (of which the rural literacy stands at 63.94%) which is slightly lower than that of the country, at 74.04%. The male literacy rate is relatively higher, at 78.73% while the female literacy rate is 54.49% which is quite low when compared to the national female literacy rate of 65.46.

Madhya Pradesh ranks 1st amongst all States and Union Territories with regards to Scheduled Tribe (ST) population and 12th in terms of Scheduled Caste (SC) population. The proportion of ST population in the state is 21.1%, and SC population is 15.6%.

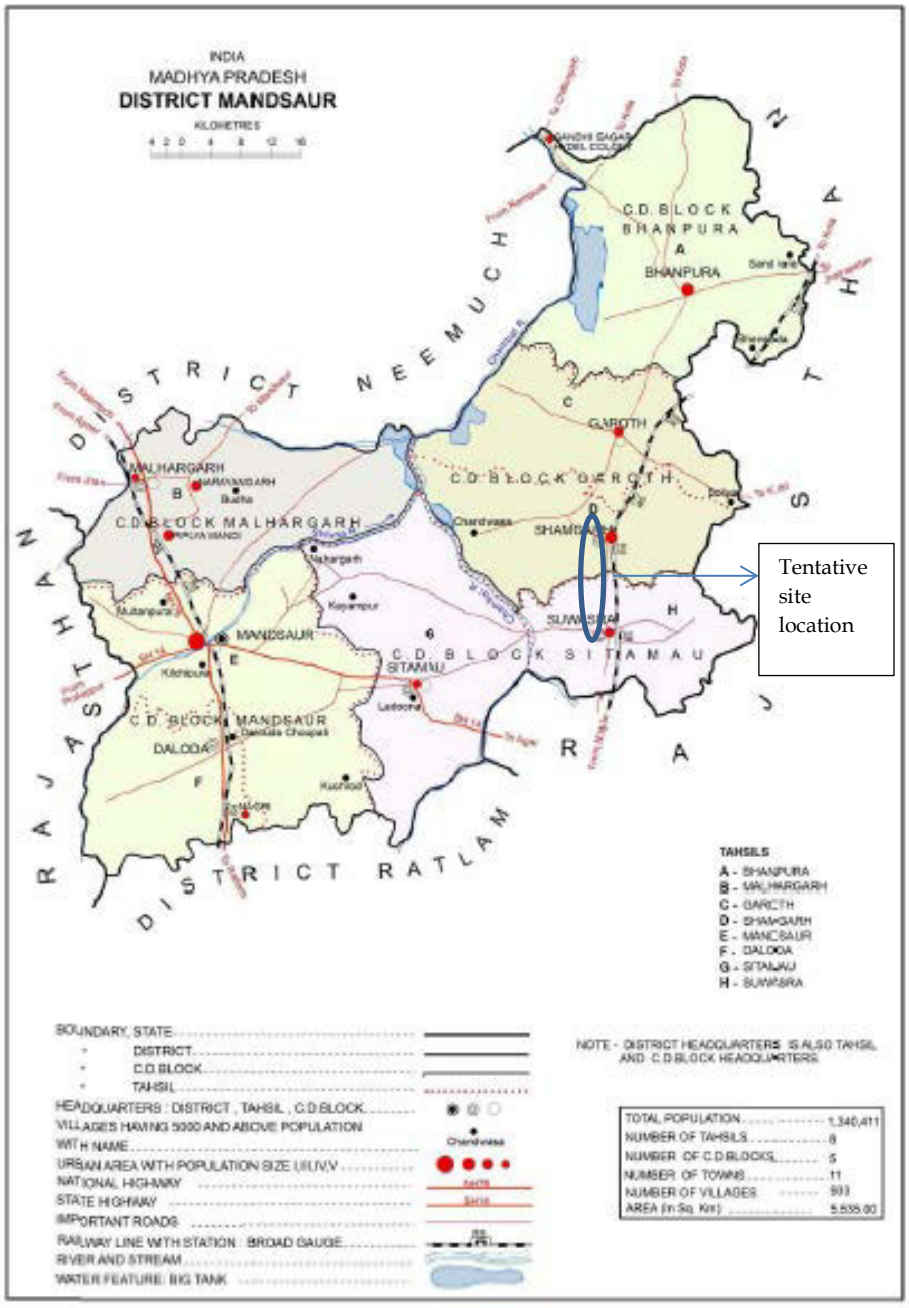
6.6.3 District Profile: Mandsaur

Mandsaur district lies in north-west Madhya Pradesh and is characterized by a rich archaeological heritage. It shares a boundary with the state of Rajasthan on two sides and Neemuch and Ratlam are the adjoining districts of Madhya Pradesh.

The district is divided into 4 Development Blocks, head-quartered at Mandsaur, Malhagarh, Sitamau and Garoth. In addition, there are 8 tehsils in the district, namely, Mandsaur, Malhagarh, Garoth, Shamgarh, Dalauda, Bhanpura, Suwasra and Sitamau.[1] ***Figure 6.20*** helps in understanding the various sub-divisions of the district.

[1] http://www.mandsaur.nic.in/overview.htm

Figure 6.20 Mandsaur District divisions



Source: Mandsaur District Statistical Handbook, 2011

The district and covers an area of 5535 sq. km, which forms 1.7% of the total area of Madhya Pradesh[1], with a population of 13,40,411 individuals, which accounts for 1.84% population of Madhya Pradesh. The population growth over the decade has been 13.24%, which has significantly reduced from the population growth of last decade (23.70%).

Table 6.24 Mandsaur district Demographic Profile vis-à-vis Madhya Pradesh

Attribute	Madhya Pradesh	Mandsaur District
Population	72,626,809	1,340,411

[1] http://www.census2011.co.in/census/district/300-mandsaur.html

Attribute	Madhya Pradesh	Mandsaur District
Population Density	236	242
% of SC population	15.6	18.6
% of ST population	21.1	2.5
Sex Ratio	931	963
% total literacy rate	69.32	71.8
% female literacy rate	54.49	57.9
% rural population	63.94	79.29

Source: Census of India 2011 data

The population density has increased to 242 persons/sq. km from 214 persons /sq. km in the last decade. The Scheduled Caste people form 18.6% population of Mandsaur, while the proportion of Scheduled Tribe population is quite low at 2.5%, when compared to the state. The sex ratio of the district, at 963, is quite higher than the state figure of 931 and the country's sex ratio of 940 females per thousand males. However, the child sex ratio in 2011 has reduced to 927 girls per 1000 boys from 946 girls per 1000 boys of 2001 census data.

The status of literacy in the district also reflects a slightly better scenario than that of the state. The total literacy rate of the district is 71.8%, while the female literacy rate is 57.9%, against the state figures of 69.32% and 54.49% respectively. Rural population forms the majority in the district, with 79.29% living in the villages.

6.6.4 Tehsil Profile: Garoth, Malhagarh, Mandsaur and Shamgarh

The four tehsils of Garoth, Malhagarh, Mandsaur and Shamgarh comprise of nearly 60% of the population of Mandsaur district. In terms of SC population, Malhagarh has the maximum share of 21.4% while Mandsaur tehsil has the lowest (15.8), while the other two tehsils have nearly equivalent proportion. The ST population in the tehsils is nearly equal, except in Garoth and Shamgarh, where the ST population accounts for 0.9% and 0.7%. In terms of sex ratio, Malhagarh tehsil exhibits relatively higher number of females per 1000 males (981), while Shamgarh registers the lowest sex ratio (954).

Table 6.25 Demographic Profile of Tehsils

Attribute	**Mandsaur District**	Garoth Tehsil	Malhagarh Tehsil	Mandsaur Tehsil	Shamgarh Tehsil
Population	13,40,411	1,35,181	2,03,923	3,36,388	1,25,848
% of District Population	100	10.1	15.2	25.1	9.4
% SC population	18.6	19.8	21.4	15.8	19.5
% ST population	2.5	0.9	2.6	2.0	0.7
Sex Ratio	963	964	981	963	954
% Total literacy rate	71.8	67.3	74.3	77.3	66.6
% Female literacy rate	57.9	51.8	59.5	66.0	51.6

Source: Census of India, 2011

6.6.5 Area of Influence Profile

The core zone for the baseline studies is considered within the 1 km radius from the project and the buffer zone is the area in the 5 km radius. The core, the buffer zone and the project footprint together comprise the "AoI" of the project, which is spread across villages spanning 4 tehsils of Mandsaur district. The concentration of villages is higher in Shamgarh and Garoth tehsils as compared to Malhagarh and Mandsaur tehsils.

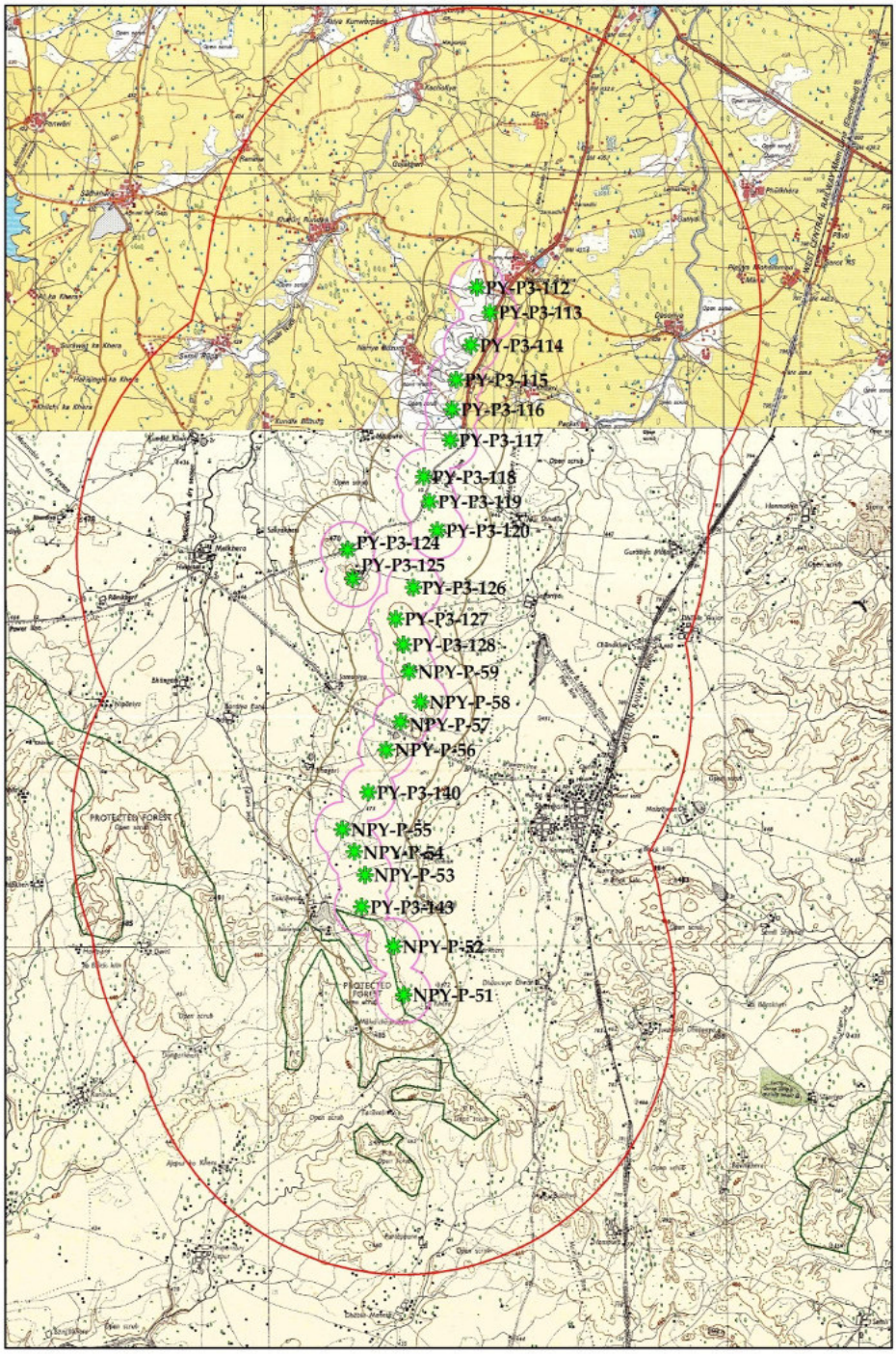
The ***Figure 6.21*** illustrates the AoI of the project, denoting the boundaries marking, 1 km and 5 km (used for ESIA) from the project marked in the toposheet. The villages lying in the core and buffer zone of the AoI are also listed below in ***Table 6.26***.

Table 6.26 Core and Buffer Area Villages

S. No.	Core Area Villages	Tehsil	S. No.	Buffer Area Villages	Tehsil
1.	Aaklishivdas (consulted)	Shamgarh	1.	Baradiya Puna	Shamgarh
2.	Bardiya Amra (consulted)	Garoth	2.	Barni	Shamgarh
3.	Barkheda Uda (consulted)	Shamgarh	3.	Bhangdi	Shamgarh
4.	Bhagori (consulted)	Shamgarh	4.	Chandkhedi	Shamgarh
5.	Chhayan (consulted)	Shamgarh	5.	Dasoriya	Garoth
6.	Jamuniya (consulted)	Shamgarh	6.	Dhablagujar	Shamgarh
7.	Khankhari	Shamgarh	7.	Dhamaniya Diwan	Shamgarh
8.	Makdichaoda	Shamgarh	8.	Ghatya	Garoth
9.	Manpura	Shamgarh	9.	Guradiya Mata	Garoth
10.	Nariya Buzurg	Shamgarh	10.	Hingoriya	Malhargarh
11.	Sagoriya (consulted)	Shamgarh	11.	Junapani Dhoranya	Shamgarh
12.	Semli	Mandsaur	12.	Kachhaliya	Garoth
13.	Takrawad (consulted)	Malhargarh	13.	Khajuri Runda	Garoth
			14.	Kundla Buzurg	Shamgarh
			15.	Kundlakhurd	Shamgarh
			16.	Lakhakhedi	Garoth
			17.	Manki	Garoth
			18.	Melkheda	Shamgarh
			19.	Nipaniya	Shamgarh
			20.	Parasali	Shamgarh
			21.	Pipaliya Mohammad	Garoth
			22.	Ranayara	Garoth
			23.	Sakariya Khedi	Shamgarh
			24.	Semli Rupa	Garoth
			25.	Tarawali	Shamgarh

Source: ERM India Pvt. Ltd

Figure 6.21 Physical Features and AoI demarcation



Source: ERM India Pvt. Ltd

Table 6.27 Demographic Profile of AoI

Village	No of HHs	Population	Average HH size	Sex Ratio	% SC	% ST	% Lit	% F Lit
Core Area								
Aaklishivdas	247	1211	5	1005	32.4%	0.2%	59.0%	42.4%
Bardiya Amra	658	3114	5	987	37.5%	1.7%	71.8%	60.9%
Barkheda Uda	229	1015	4	911	6.7%	0.0%	64.5%	44.3%
Bhagori	109	513	5	1060	0.0%	12.5%	58.6%	34.1%
Chhayan	91	310	3	925	22.3%	22.6%	80.7%	68.4%
Jamuniya	312	1529	5	963	32.7%	0.0%	64.1%	44.6%
Khankhari	77	363	5	1063	6.6%	1.9%	70.7%	62.2%
Makdichaoda	105	521	5	1059	16.3%	0.0%	53.0%	42.3%
Manpura	138	640	5	1065	30.8%	0.0%	58.2%	40.5%
Nariya Buzurg	264	1334	5	959	35.2%	1.1%	68.8%	51.7%
Sagoriya	477	2015	4	999	28.2%	0.0%	64.2%	44.5%
Semli	313	1470	5	992	14.4%	37.4%	75.4%	59.6%
Takrawad	662	2935	4	935	8.4%	4.0%	75.8%	59.8%
Core Total	**3,682**	**16,970**	**5**	**979**	**22.6%**	**2.3%**	**68.0%**	**52.6%**
Buffer Area								
Buffer Total	**5,669**	**25,577**	**5**	**958**	**22.3%**	**2.8%**	**65.1%**	**48.3%**
AoI Total	**9,351**	**42,547**	**5**	**966**	**22.4%**	**2.6%**	**66.3%**	**50.0%**

Source: Census of India, 2011

The core zone of the AoI comprises of 13 villages while the buffer zone has 25 villages, as listed in ***Table 6.26***. The core zone has 3,682 households supporting a population of 16,970 individuals. The average size of the households is uniform across the core and the buffer zone. 5 core zone villages exhibit positive sex ratio, where Manpura village has the highest positive sex ratio of 1065 females per 1000 males.

The buffer zone comprises of 5,669 households supporting a population of 25,577 individuals. The buffer zone exhibits a sex ratio of 958 females per 1000 males, which is lower than the district figure of 963 but better than the state figure of 931 females per 1000 males.

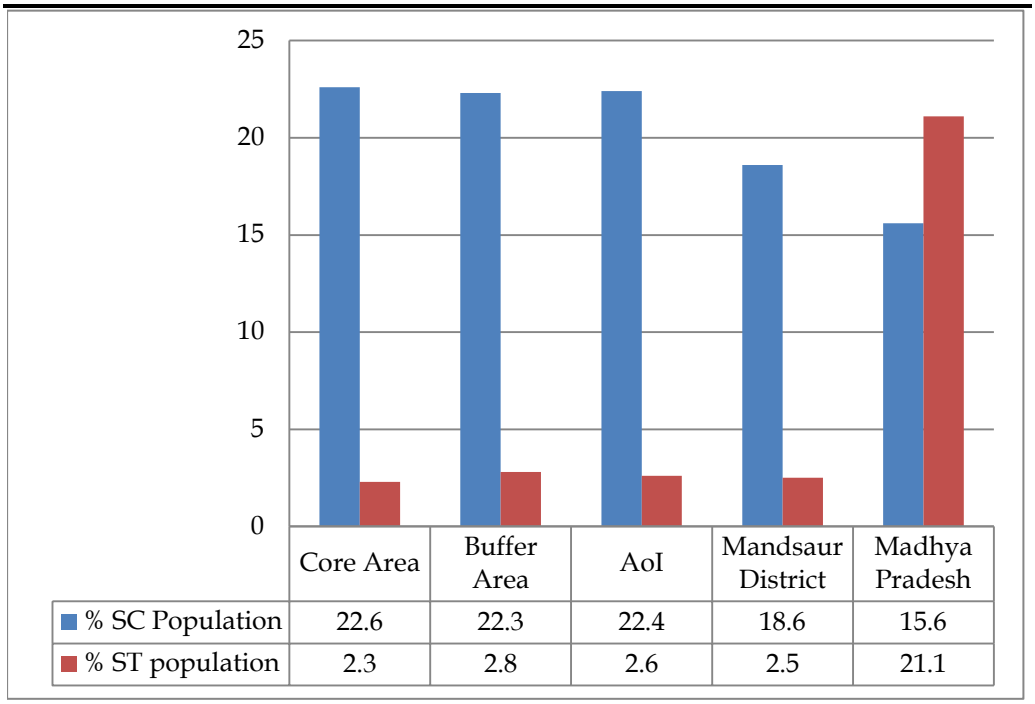
The population density in the AoI is higher in the core zone (231 persons/sq. km) than that in the buffer zone (218 persons/sq. km) and these figures are in coherence with the state and the district figures. In terms of total literacy and female literacy, both core and buffer zones are nearly at par. The proportion of SC population varies in the core and the buffer zone is also nearly equal with 22.6% and 22.3% figures respectively, and so is the ST population distribution with 2.3% and 2.8% ST population in the core and the buffer zone respectively.

Social Stratification

The majority of population in the AoI falls in the rural category, with the presence of only one town, Shamgarh. The buffer zone has the maximum proportion of SC population, when compared to the core zone, tehsil or the district. The proportion of SC population varies across the core zone villages,

with complete absence of SC population in Bhagori to 35.2% contribution in Nariya Buzurg. The major sub castes of SC population inhabiting the area are Thakur, Meena, Patel Porwal, Chamar, Balai, Seth, Suthar, Harijans, Nai, Bairagi, Lohar and Telis. The livelihood pattern of SC population does not significantly differ from the General community, however, according to the discussions with the local community, they possess smaller landholdings and their dependence is higher over agriculture labour and wage labour.

Figure 6.22 ***Proportion of SC/ST Population in the villages of AoI vis-à-vis Tehsil/District***



	Core Area	Buffer Area	AoI	Mandsaur District	Madhya Pradesh
% SC Population	22.6	22.3	22.4	18.6	15.6
% ST population	2.3	2.8	2.6	2.5	21.1

Source: Census of India, 2011

While Madhya Pradesh has a very high proportion of ST population (21%), the presence of ST population is relatively low in the district, and the AoI. ST population has a contribution of 2.3% in the core zone and 2.8% in the buffer zone. Semli village, lying in the core zone, has the highest ST population amongst all core zone villages, with a share of 37.4%. The Bhil tribe inhabits Bhagori village, which according to social consultations, has community based distribution of households.

Box 6.1 Bhil Tribe

The Bhil tribe is one of the largest tribes in India and primarily spread across the states of Rajasthan, Madhya Pradesh, Maharashtra and Gujarat. While the tribe has its own cultural and religious customs and traditions, it was reported during the site visit that the Bhil community in the AoI is integrated into the mainstream community. The Bhil tribe was reported to be primarily residing in the Bhagori village. The settlement pattern of the village was clustered around social groups, there was not reported to be any restrictions on movement or use of village property or common property resources including temples, grazing lands and water resources.

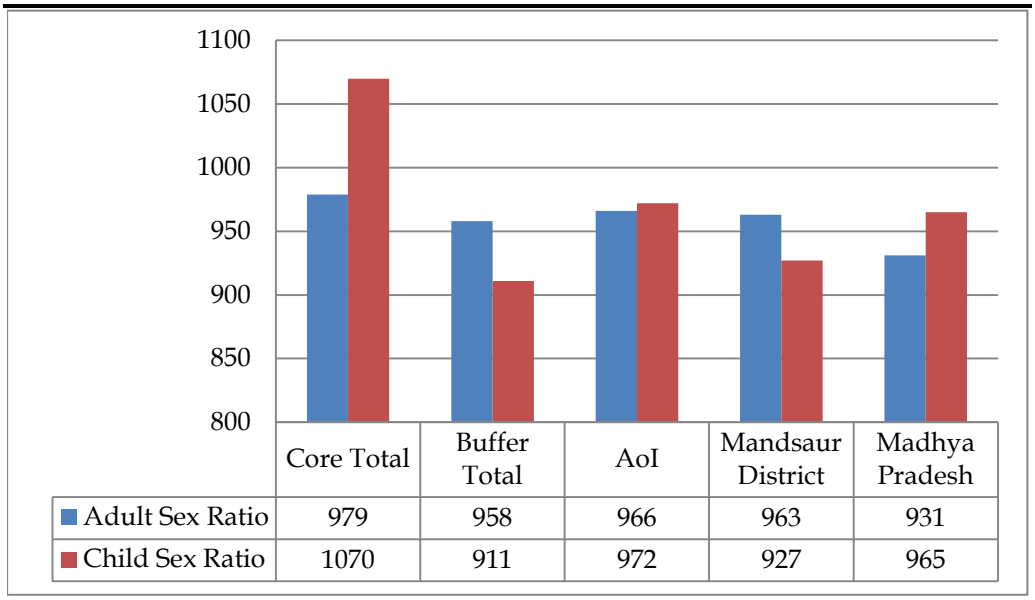
The main occupation of the Bhil tribe is agriculture, however, the land holdings amongst the community were reported to be slightly lower (2-3 Bigha average) than that of the general community. The tribe has access to the mainstream education, health and justice system, participates in religious festivals such as Diwali, Holi and Raksha Bandhan and is part of the Gram Panchayat of the village. Nevertheless, the tribe has their own traditional leadership in the form of group elders, who play an important role in decision making and conflict resolution

Gender: Role in Society

India, culturally has been a patriarchal society and the AoI also invariably shows similar trends. While the core zone exhibits an adult sex ratio of 979 females per 1000 males and a child sex ratio of 1070 girls per 1000 boys; the buffer zone, district and the state figures of sex ratio (both adult and child) are skewed in the favour of males. The probable reason for the trend can be attributed to higher infant mortality rates among girls or cultural preference of a particular sex leading to sex selective abortions, which causes an imbalance in the gender composition in the region and the country, at large.

The consultations suggest that early marriage and child marriage, minimal participation of women in household or economic decision making, lesser economic freedom, etc., are entrenched in the social system. The women are entirely responsible for household chores and additionally take up jobs as agricultural or construction labourers, however they are perceived to be less efficient than their male counterparts and consequentially are paid lesser wages. The women lack direct access to bank accounts and their wages are collected and managed by their husbands. Furthermore, the women are also responsible for fetching fuelwood and water in villages, where the distance are within 2 km from their respective villages.

Figure 6.23 Comparison of Adult and Child Sex Ratios across AoI, Tehsil and District



	Core Total	Buffer Total	AoI	Mandsaur District	Madhya Pradesh
Adult Sex Ratio	979	958	966	963	931
Child Sex Ratio	1070	911	972	927	965

Source: Census of India, 2011

. Majority of the women reportedly did not have any education, while majority of the girls are attending schools in their respective villages.

There are no formal women's groups in the region (except those formed by microfinance institutions to regulate micro-lending) and the women, as reported during social consultations, are keen to undergo vocational trainings and start income generating activities, especially during the lean agricultural season.

Box 6.2 Role of Women as Leaders

The community consultations have established the fact that the women in the area still have a long way to go when it comes to independence of thought and practice. As a step towards women empowerment, many females are elected for Leadership roles like that of a *Sarpanch* (Head of Village Panchayat), but in reality they are just dummy candidates while their roles and responsibilities are carried out by the males of the family. Such was a case observed in Chhayan village, where a woman was elected as the Sarpanch of the Barkheda Uda Panchayat (covering villages – Chhayan, Semli Heda, Maakdi Chamunda, Devji ka khera and Barkheda Uda). However, during community consultations and on a visit to her house, it was brought to light that her son was solely carrying out all her official responsibilities. In fact, she did not verbally participate in the discussion about the community and preferred to stay out of the room while her husband and her son actively engaged in the discussion.

Source: ERM Site visit, July 2015

Land use pattern

The area has an agrarian economy and hence the dependence on land resource is high. The table for land utilization reiterates the heavy dependence of people on agriculture, making it one of the primary sources of their livelihood.

Table 6.28 Land use break up in the AoI

Villages	Total Area (in Ha)	Net Area Sown	Forest Area	Area under Non-Agricultural Uses	Barren & Un-cultivable Land	Permanent Pastures & Other Grazing Land	Culturable Waste Land	Current Fallows
Core Zone								
Aaklishivdas	485.69	409.83	0	4.14	46.34	3.24	13.91	0
Bardiya Amra	488	321	0	1	31	97	17	0
Barkheda Uda	389	356	0	13	1	3	5	4
Bhagori	842.84	724.45	0	68.53	4.66	29.98	1	0
Chhayan	509.22	276.52	58.78	3.93	159.27	0	5.03	0.03
Jamuniya	540	437	0	7	22	31	31	3
Khankhari	298.36	198.7	0	2.75	72.2	17.14	3.54	0
Makdichaoda	465.41	268.04	0	5.67	130.42	41.44	9.55	4.73
Manpura	497.81	15.11	27.61	76.28	14	5.28	82.76	88.97
Nariya Buzurg	453	225	0	18	1	25	3	176
Sagoriya	167.98	119.1	0	0	30.11	13.05	0	3.1
Semli	457.08	283.05	0	6.89	106.38	14.17	22.86	11.48
Takrawad	502.74	381.92	0	50.42	46.34	5.1	8.9	2.46
Total	**6,097.13**	**4,015.72**	**86.39**	**257.61**	**664.72**	**285.4**	**203.55**	**293.77**
Buffer Zone								
Total	**13,212.61**	**9,636.61**	**118.71**	**582.12**	**839.25**	**585.19**	**291.8**	**907.89**
AoI Total	**19,309.74**	**13,652.33**	**205.1**	**839.73**	**1,503.97**	**491.08**	**870.59**	**1,201.66**

Source: Census of India, 2011

Box 6.3 Land Use Category Definitions

LAND USE STATISTICS
CONCEPTS & DEFINITIONS

A: NINE-FOLD CLASSIFICATION:

1. **Forest Area:** This includes all land classified either as forest under any legal enactment, or administered as forest, whether State-owned or private, and whether wooded or maintained as potential forest land. The area of crops raised in the forest and grazing lands or areas open for grazing within the forests remain included under the "forest area".

2. **Area under Non-agricultural Uses:** This includes all land occupied by buildings, roads and railways or under water, e.g. rivers and canals, and other land put to uses other than agriculture.

3. **Barren and Un-culturable Land:** This includes all land covered by mountains, deserts, etc. Land, which cannot be brought under cultivation except at an exorbitant cost is classified as unculturable whether such land is in isolated blocks or within cultivated holdings.

4. **Permanent Pasture and other Grazing Land:** This includes all grazing land whether it is permanent pasture/meadows or not. Village common grazing land is included under this category.

5. **Land under Miscellaneous Tree Crops, etc.:** This includes all cultivable land, which is not included in 'Net area sown' but is put to some agricultural use. Land under casuring trees, thatching grasses, bamboo bushes and other groves for fuel, etc. which are not included under 'Orchards' are classified under this category.

6. **Culturable Waste Land:** This includes land available for cultivation, whether taken up or not taken up for cultivation once, but not cultivated during the last five years or more in succession including the current year for some reason or the other. Such land may be either fallow or covered with shrubs and jungles, which are not put to any use. They may be accessible or inaccessible and may lie in isolated blocks or within cultivated holdings.

7. **Fallow Lands other than Current Fallows:** This includes all land, which was taken up for cultivation but is temporarily out of cultivation for a period of not less than one year and not more than five years.

8. **Current Fallows:** This represents cropped area, which is kept fallow during the current year.

9. **Net Area Sown:** This represents the total area sown with crops and orchards. Area sown more than once in the same year is counted only once.

B. DEFINITIONS OF SOME COMMONLY USED TERMS:

(i) Geographical Area: The latest figures of geographical area of the State/Union Territories are as provided by the Office of the Surveyor General of India.

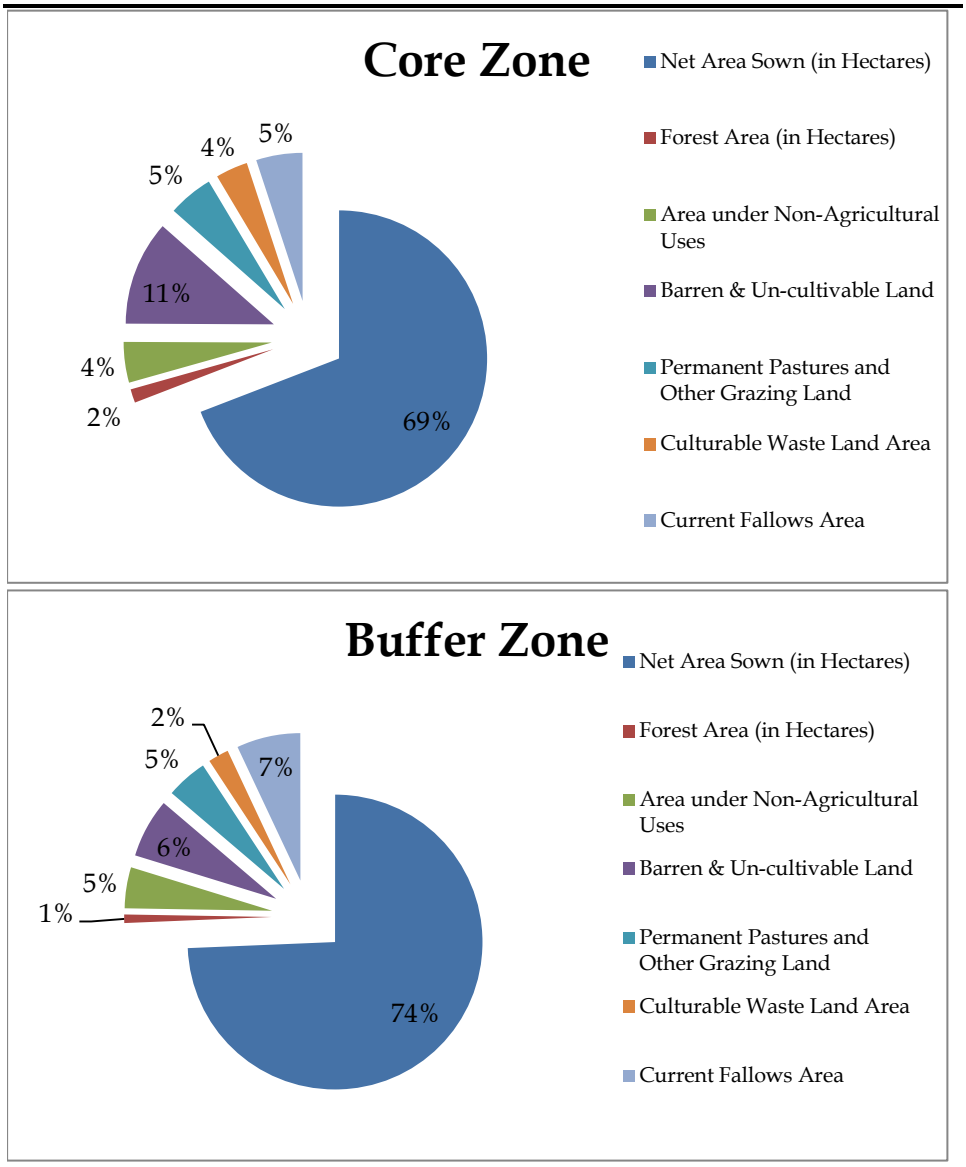
(ii) Reporting Area for Land Utilisation Statistics: The Reporting area stands for the area for which data on land use classification is available. In areas where land

iii

Source: http://eands.dacnet.nic.in/LUS-2010-11/Concept.pdf

The ***Table 6.28*** denotes that a significant proportion of land area in core zone comes under net sown area (66%), out of which nearly 37% is unirrigated while the rest (63%) area is irrigated by canal in Bardiya Amra and tanks and tube-wells in rest of the core area villages. Nearly 4% area in the AoI comes under culturable waste land, which comes under Government land.

Figure 6.24 Proportion of Land use in AoI



Source: Census of India, 2011

In the buffer zone, the net sown area forms 74 % area out of which 46% of the area is unirrigated and 54% area is irrigated by canal in Barni and Bhangdi and by wells, tube-wells, tanks and other sources in rest of the villages. The area comprises of 6% barren and uncultivable land, which can be considered for residential and industrial purposes.

Literacy Profile

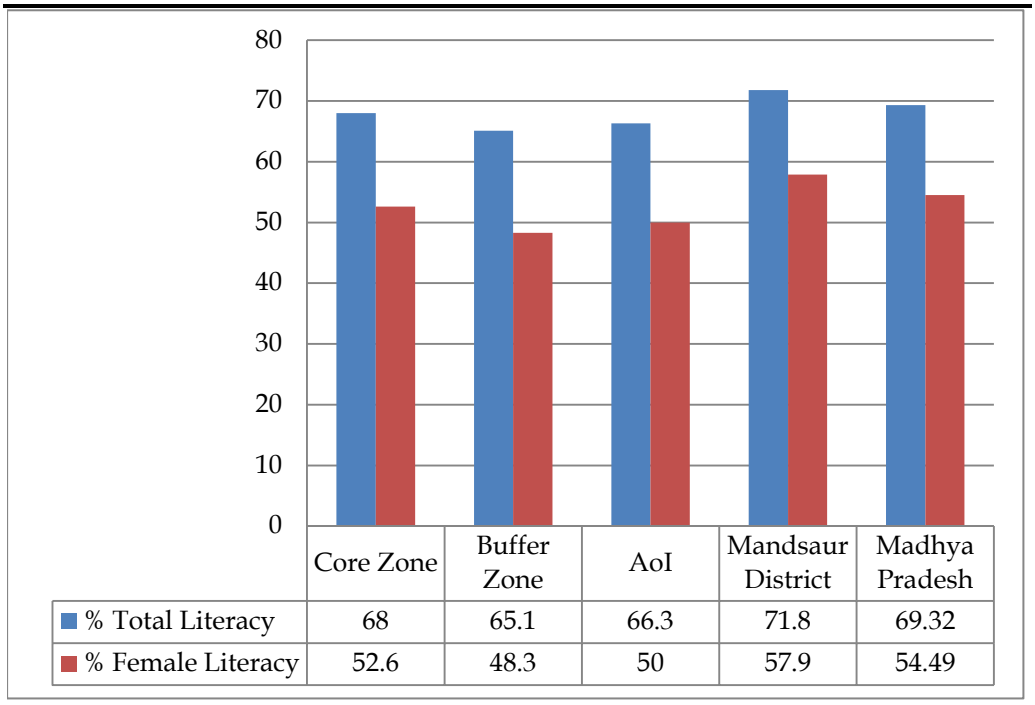
The status of literacy in the AoI is nearly similar in terms of total literacy; however the female literacy in core zone reflects a better picture as compared to buffer zone. The total literacy in the core and buffer zone is 68.0% and 65.1% respectively, are lesser that the state and the district figures of 69.32% and 71.8% respectively.

The social consultations suggest that the girls are given equal opportunity to study, as boys; however, some communities are averse to sending adolescent

girls to co-educational schools and prefer all-girls schools. In some communities, child marriages are prevalent, which results in girls dropping out of school and getting involved in household activities. In some of the villages, the girls have benefitted from the government's welfare scheme, under which many girls have got funds to purchase bicycles. This scheme is helping the girls to commute to schools catering to higher grade levels located in nearby villages and is helpful in reducing dropout rates

The boys usually complete school education and those belonging to financially affluent families go for graduate courses in colleges or join technical courses like Industrial Training Institutes (ITIs), while others are pulled into work to support their respective families economically.

Figure 6.25 ***Comparative Overview of the Literacy Rate across AoI, District and State***



	Core Zone	Buffer Zone	AoI	Mandsaur District	Madhya Pradesh
% Total Literacy	68	65.1	66.3	71.8	69.32
% Female Literacy	52.6	48.3	50	57.9	54.49

Source: Census of India, 2011

Livelihood Profile

The AoI is categorized by nearly 58% working population (main and marginal workers) in Core zone and 55% working population in buffer zone. Majority of the working population of the AoI (67%) comes under "Main Workers", i.e., being employed for more than 6 months in a year. The core zone houses nearly 70% of Main workers while the proportion goes a little lower to 66% in buffer zone. There is a significant ratio of dependent population (Non-working population in the AoI (41.9% in core and 45% in buffer zone) which includes children, the older folks as well as unemployed youth.

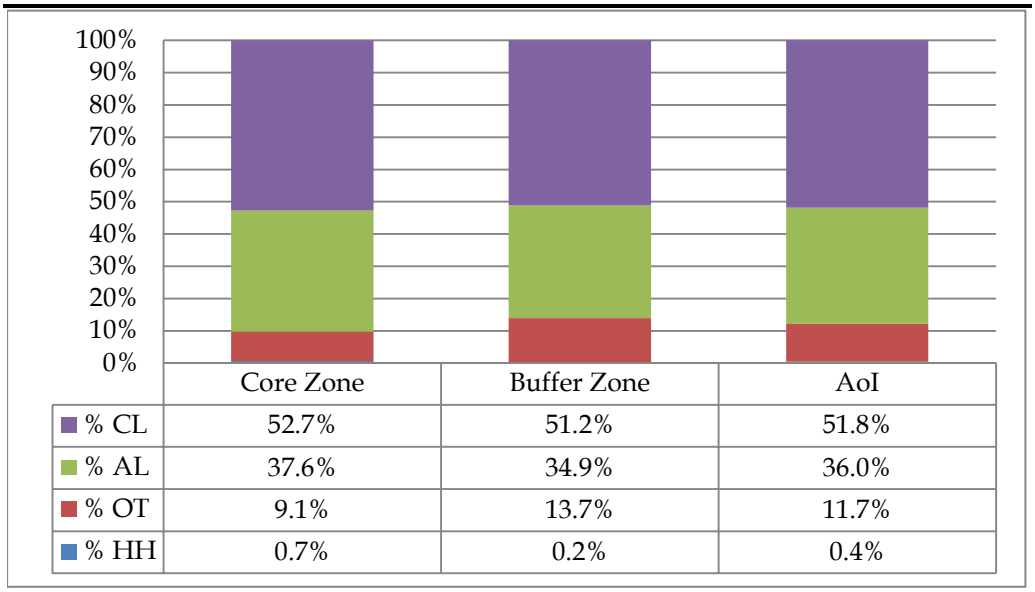
Table 6.29 Proportion and break-up of working population in the AoI

Villages	WPR	Main (% of WPR)	Marg (% of WPR)	Non Work (% of Total Population)
Core Zone				
Aaklishivdas	61.2%	56.3%	43.7%	38.8%
Bardiya Amra	59.0%	36.2%	63.8%	41.0%
Barkheda Uda	60.4%	49.6%	50.4%	39.6%
Bhagori	54.8%	47.7%	52.3%	45.2%
Chhayan	58.1%	99.4%	0.6%	41.9%
Jamuniya	53.1%	61.5%	38.5%	46.9%
Khankhari	57.0%	54.6%	45.4%	43.0%
Makdichaoda	50.1%	57.9%	42.1%	49.9%
Manpura	59.7%	54.5%	45.5%	40.3%
Nariya Buzurg	54.0%	84.7%	15.3%	46.0%
Sagoriya	64.2%	89.6%	10.4%	35.8%
Semli	50.9%	91.9%	8.1%	49.1%
Takrawad	60.9%	99.0%	1.0%	39.1%
Core Total	58.1%	70.0%	30.0%	41.9%
Buffer Zone				
Total	55.0%	66.0%	34.0%	45.0%
AoI Total	56.2%	67.6%	32.4%	43.8%

Source: Census of India, 2011

Out of the main working population, majority of the population can be categorized as cultivators or agricultural labourers, endorsing the fact that the region has agrarian economy. Only 9% population in core area and 14% population in buffer area are involved in "Other work", such as construction labourers, assisting in shops in and around Shamgarh town and an increasing number are hired as labourers and Security guards at Wind turbine sites (INOX and the other projects being developed in the area) . However, while this number is increasing, its present significance could not be established at the time of the assessment, as a number of projects are in planning stage. The proportion of Household workers is negligible, both in the core and the buffer zone.

Figure 6.26 Distribution of Main Working Population in the AoI



	Core Zone	Buffer Zone	AoI
% CL	52.7%	51.2%	51.8%
% AL	37.6%	34.9%	36.0%
% OT	9.1%	13.7%	11.7%
% HH	0.7%	0.2%	0.4%

Source: Census of India, 2011

The following categories comprise the main occupational activities within the AoI:

- Farm Based Activities (cultivators, agricultural labourers and livestock rearing);
- Non-farm based activities (contractual labour for construction)

Farm Based Livelihoods

As can be seen from ***Figure 6.26***, approximately 88% of the main working population in the AoI is dependent upon farm based activities for their livelihood. The farm based activities comprise of agriculture, agricultural labour and livestock rearing. The area is irrigated by canals, wells and tube-wells as well through the additional supply of electricity (for irrigational purposes only) for a period of 6-10 hours per day, varying across villages.

Figure 6.27 Agriculture in AoI

Source: ERM Site Visit, July 2015

The primary crops in the region comprise of Maize, Pulses (Urad, Moong,) and Soybean amongst Kharif crops (monsoon crops from July/August to September/October) and Wheat, Gram, Mustard, Coriander, Fenugreek, Onion, Tomatoes, Chillies, Fenugreek and Linseed being the Rabi crops (winter crops from November to April/May). In addition, the people also cultivate vegetables like eggplant, cauliflower, cabbage, turnip, carrot, cucumber and garlic.

The dependence on monsoons for agriculture is high, especially during the summer months of May and June. The depth of ground water usually varies between 100-600 ft., however the quality of water deteriorates after 150-200 ft., making it unfit for human consumption.

Table 6.30 Productivity and related costing of major crops in AoI

Crop	Agricultural Season	Costing per Bigha	Production	Price per quintal	Proceeds from 1 Bigha land
Soybean	June-October	Rs. 5,000-6,000	3-5 quintals	3000-4000	9,000-20,000
Wheat	November-April	Rs. 4,000-10,000	8-15 quintals	1100-1500	8,800-22,500
Maize	June-October		10 quintals		
Pulses	June-October		3-4 quintals		
Tomatoes	June-September	25,000			1,00,000
Oranges	3 years with mixed cropping + 2 years as the sole crop	50,000			25,000-1,00,000

Source: Community Consultations undertaken by ERM India, July 2015
Note: 1 bigha= 0.25 ha

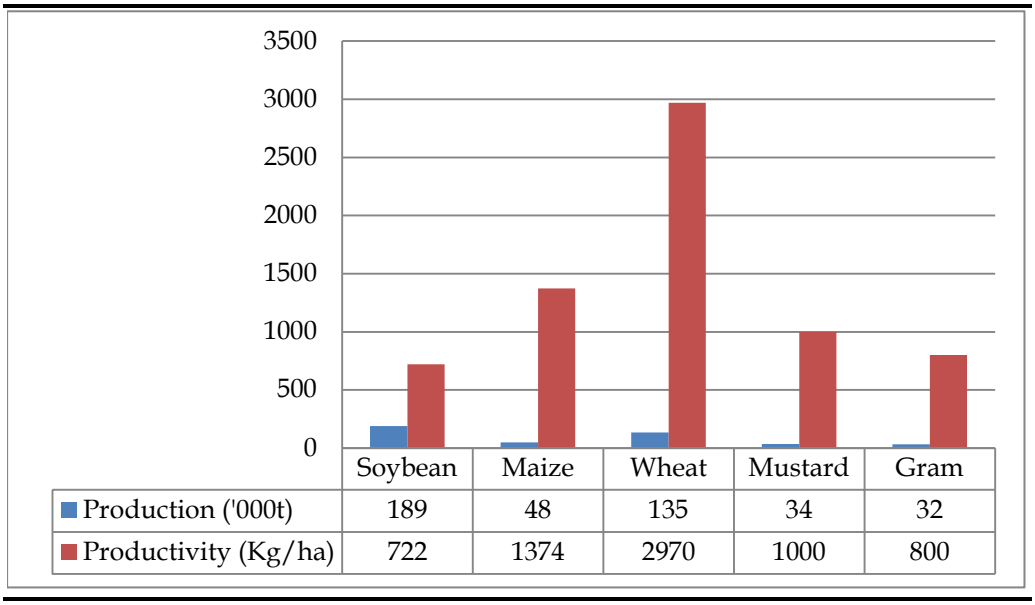
The social consultations revealed that in terms of productivity, soybean is one of the stable cash crops in the region and is cultivated on a mass scale. Wheat has the highest relative productivity amongst all major crops grown in the area. on the other hand, vegetables such as tomatoes and chillies., have higher cost of labour and maintenance while the productivity is low, as there is higher probability of infection.

The social consultations also point towards the fact that the farmers of certain villages like Barkheda Uda and Bardiya Amra have received trainings on advanced agricultural practices by local NGOs

Box 6.4 Case Study on Orange cultivation In Bardiya Amra

While conducting community consultations in Bardiya Amra, the consulting firm's team met a farmer engaged in cultivation of oranges, in addition to other crops. Discussions with him revealed that a lot of people take up orange cultivation in the area. The fruition generally takes 5 years from sowing, where during the first 3 years mixed cropping is practiced while orange is the stand-alone crop during the subsequent 2 years. The cost of cultivation varies because of the large life-cycle and depending on rainfall over the 5 years. Going by a conservative estimate, Rs. 50,000 can be allocated as the cost of cultivation of 1 Bigha (0.25 hectares) land (80-150 saplings) under favourable conditions, which leads to a sale varying between Rs. 50,000 to 1,00,000, depending upon the prices offered in the year of sale. Thus any procurement of land under orange cultivation is likely to have a significant impact on the land owners.

Figure 6.28 Production and Productivity of Major Crops in Mandsaur district between 2004 - 2008



	Soybean	Maize	Wheat	Mustard	Gram
Production ('000t)	189	48	135	34	32
Productivity (Kg/ha)	722	1374	2970	1000	800

Source: Agricultural Contingency Plan, 2012, Mandsaur District

The people retain a part (varies according to seasons, economic situation of family and crop grown) of the crop produce for self-consumption while the excess is sold in Shamgarh and Garoth *Mandis* (local markets at the village or gram panchayat level), which are the nearest from most villages. The people follow share-cropping system of agriculture, where pre-decided proportions of the produce are divided amongst the owner and the cultivator. In addition,

the agricultural labourers working on the fields receive a part of the wheat produce in addition to their wages.

In addition to agriculture, livestock holdings play an important part in the livelihoods of the community, in terms of providing extra income in addition to meeting the nutritional intake of the household. The main livestock holdings in the area comprise of cows, buffaloes, goats and sheep. While there are no reported household maintaining livestock holdings for solely commercial purposes, most of the household are reported to be engaged in the sale of surplus buffalo milk to the neighbouring villages. while cow milk is reported to be used for self consumption. It is reported by the local community that each household engaging in sale of milk earns approximately 1500-2000 INR per month (INR 30 per litre).

However, it was brought to light during community consultations that some people are moving away from animal husbandry because of the diminishing amount of fodder available, especially during summer as well as the growing availability of and inclination towards jobs.

Non-Farm Based Livelihoods

As can be seen in the ***Figure 6.26*** and according to the consultations with the local community the non-farm based livelihoods act as a supplementary source of income to the families in the area, with the households relying on this income to buffer against the fluctuations in agriculture and to provide sustenance during the non-cultivation periods (summer). The non-farm based livelihoods in the area primarily comprise of casual labour involved in construction of houses in nearby villages and Shamgarh district. The stakeholder consultations also suggested migration of people, either alone or with family, to the cities of Jaipur, Jodhpur, etc., during the agriculturally lean periods. According to the consultations undertaken, it is understood that the families who undertake migration are primarily landless households. These families undertake migration for atleast 6-9 months, with most preferring to migrate permanently or for a year or more. However, the households with small land holdings (1 Ha and below) also have one or more family members migrating for supplementary income. This migration is short spanned, for 1-6 months, with the family members returning frequently to the villages. The income from this migration is used to supplement the income from agriculture.

The setting up of Wind Power plants in the area is also providing employment opportunities, presently only to a member of the family whose land is bought by the company for WTG. However, job security and regular payment of wages are some of the challenges being faced, as shared by the people during consultations.

Box 6.5 Employment generated by Wind Farms in the area

The social consultations in the area have established that the Wind Power companies promise and provide jobs to one member of the land-selling family. The job role is mostly of a security guard, for each WTG. However, it was revealed during some consultations that there have been cases of non-payment of salaries (for a period ranging from 2-3 months) as well as re-integration of the role of security guards after WTG erection, in a manner that one guard is being appointed for 2-4 WTGs lying in close proximity (depending on case to case basis). Thus, there is lack of clarity on the duration of employment during the land purchase process, as well as the untimely/non-payment of wages by the contractor is also slowly instilling dissatisfaction amongst people. While it is reported that individuals have verbally communicated their concerns, no written grievances have been filed. Also, there is no documentation of the communication from the local community

Social and Physical Infrastructure

This sub section provides a brief understanding of the social and physical infrastructure in the area. Physical infrastructure includes infrastructure which are essential for maintenance and supply of basic services and amenities resulting in economic and social well-being. On the other hand, Social Infrastructure is one of the most important indicators of human development in any society, with the indices of health and education facilities occupying a a central place in policy formulation and development planning. It should be noted that, in keeping with the proposed project activities and its potential impacts, this section provides a brief overview of the social and physical infrastructure in the area. If a detailed analysis of any attribute is required in the future, the same will have to be undertaken separately.

Housing

Of the total population in the AOI, 97.16% are reported to be residing in structures that are owned by the families themselves. A majority of the households are in the form of one room (59.82%), with the main bedroom being separated from the rest of the household. Only 2.62% of the households were reported to have three or more rooms. The following table provides an understanding of the proportion of households in the AoI according to the type of houses and living conditions.

Table 6.31 Type of Residence (% of total population)

Zone	Total	Good	Liveable	Dilapidated
Core Zone	98.54	49.98	46.24	2.32
Buffer Zone	97.19	40.43	55.28	1.47
AoI	97.62	43.46	52.41	1.74

Source: Housing Census 2011

Of the households in the AoI, majority are reported to be residing in liveable or good structures (95.87%), while only 1.74% are reported to be living in dilapidated structures. The livable structures are most commonly characterised by mud or unburnt brick walls (65.67% of the households) with hand made tile roofs (55.99%) and mud floors (85.01%).

In terms of good quality houses only 20.58% of the structures were reported to be made of burnt bricks walls and 1.92% had concrete roofs. However, it should be noted that this is not necessarily a reflection of the financial situation of the households. From the visual observations in the field and previous understanding of the area, it is understood that only the households who have large land holdings or are generally well off have concrete houses made of burnt bricks and stones. Most of the households, including those in the middle income categories traditionally prefer mud and unburnt brick houses with mud flooring and hand made tile roofs.

Water Supply and Sanitation

The AoI is characterised by poor sanitation facilities with open drains, nurturing flies and mosquitos, leading to diseases amongst people. The status of water availability also varies across the villages and the scenario becomes troublesome during summer months of April to June.

Figure 6.29 Water Supply in AoI

Source: ERM Site Visit, July 2015

The following table provides an understanding of the sources of water in the AoI.

Table 6.32 Sources of Water for drinking and Household Consumption

Source	Core Zone	Buffer Zone	AoI
Tapwater from treated source	**4.88**	**2.81**	**3.47**
Tapwater from untreated source	**2.05**	**9.17**	**6.91**
Covered Well	**1.41**	**7.73**	**5.72**
Un-covered Well	**64.20**	**68.92**	**67.42**
Handpump	**24.55**	**11.12**	**15.38**
Tubewell/Borehole	**1.67**	**0.13**	**0.62**
Spring	**0**	**0.01**	**0**
River/Canal	**0.01**	**0**	**0**

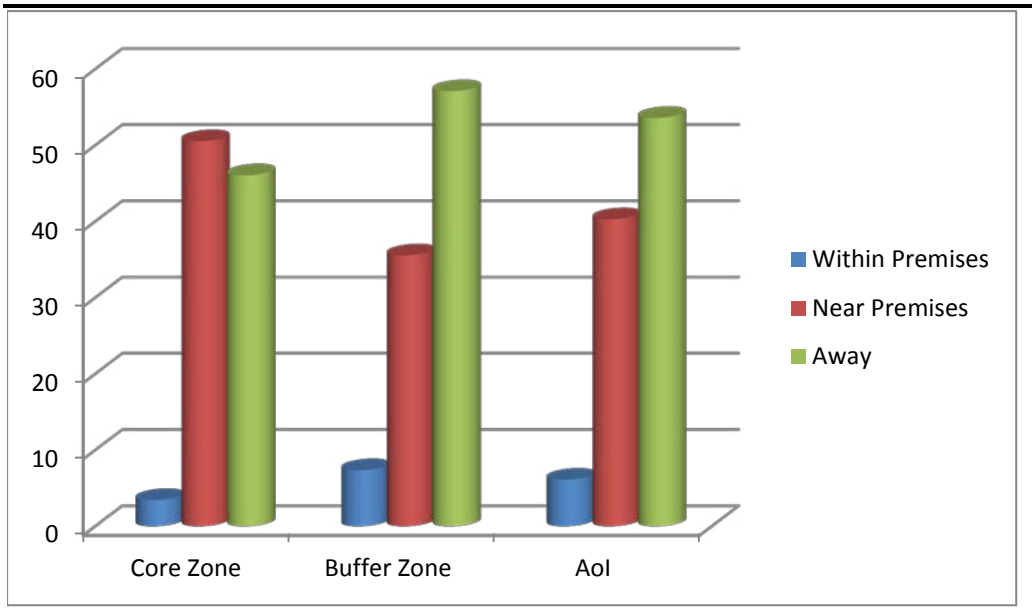
Source	Core Zone	Buffer Zone	AoI
Tank/Pond/Lake	**0.04**	**0.02**	**0.03**
Other	**1.21**	**0.09**	**0.44**

Source: Housing Census 2011

The primary source of water for drinking and household purposes in the AoI is un-covered wells, followed by handpumps. Only 10.38% of the households in the AoI reported to having access to tap water, of which 3.47% reported to have access to water from treated sources.

The ground water is available in most of the villages at about 100 ft. during monsoons and early winters, however; the quality of water degrades with increase in the depth. Furthermore, majority of the households in the AoI reported to have travel beyond 500 metres for water. The following figure provides an understanding of the proportion of households according to the distance at which water is available.

Figure 6.30 Distance of Water Sources (% of total population)



Source: Housing Census 2011
Note: Near Premises: within a range of 500 metres in rural areas
Away: more than 500 metres in rural areas

In some villages, the people have to order water tanks for household consumption during the summer months and pay an amount between Rs. 300-500 per tank, depending on the distance.

The local community has very limited access to sanitation facilities, with 94.38% of the households reporting to not having access to toilet facilities. It is reported that while community toilets exist, most have gone defunct.The following table provides a summary of the number of toilets in the AoI.

Table 6.33 Access to Toilets (% of total population)

Types	Core Zone	Buffer Zone	AoI
Flush/pour Flush Latrine Connected to piped sewer	1.59	0.84	1.08

Types	Core Zone	Buffer Zone	AoI
system			
Flush/pour flush latrine connected to septic tank	6.18	2.67	3.78
Flush/pour flush latrine connected to other system	0.68	0.32	0.44
Pit Latrine with slab/ ventilated improved pit	0.27	0.19	0.21
Pit Latrine without slab/ open pit	0.03	0.09	0.07
Night soil disposed into open drain with open pit	0.05	0.01	0.03
service latrine with night soil removed by human	0	0	0
service latrine with night soil serviced by animal	0	0.01	0.01

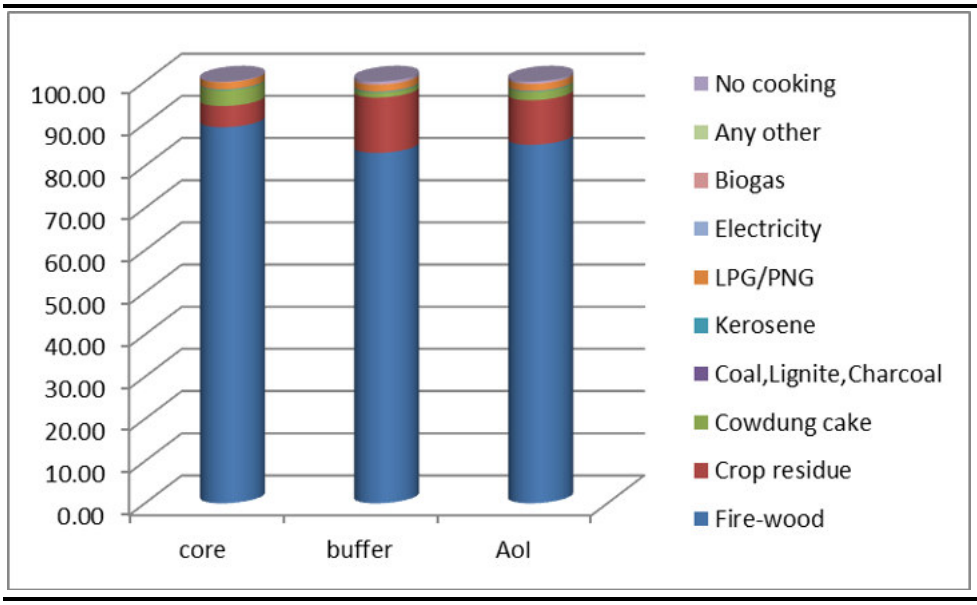
Source: Housing Census 2011

The most common form of toilets in the AoI is the flush/pour flush latrine with septic tanks, with 3.78% of the population reporting to having access to such facilities. However, it should be noted that thes figures are based on the Survey of India Housing Census 2011. Since then the Central Government of India has launched the Swachh Bharat campaign, for increasing hygiene and sanitation. One of the goals of this campaign is to facilitate the construction and use of toilets. While this is expected to significantly increase the number of households having access to sanitation it does not seem a very attractive proposition to the villagers because of partial cost coverage (which still requires the households to pay approx. 10000-15000 Rs per toilet) under the scheme. nevertheless, a number of households are reported to have constructed toilets in the AoI, which would get reflected in the 2021 Census.

Cooking Fuel

The following figure provides an understanding of the sources of cooking fuel in the AoI.

Figure 6.31 Sources of Cooking Fuel (% of total population)



Source: Housing Census 2011

As can be seen from the above figure, the most dominant source of fuel wood in the AoI is Firewood followed by Crop residue and cowdung cakes. This is

reported to be resultant from the cost implications of using LPG/PNG instead of firewood and cow dung cakes and the availability of LPG/PNG in the area. Even the houses, who have access to LPG/PNG prefer to use firewood and cow dung cakes for everyday cooking and only a few select dishes are cooked on LPG/PNG gas stoves.

Education

According to Census of India, Primary Schools provide education from class 1st to 5th, Middle Schools cater to children studying from classes 6th to 8th, Secondary School provides education to students of classes 9th and 10th and similarly, senior secondary school teaches children studying in classes 11th and 12th. One interesting fact here is that, a composite school with classes 1st to 12th, will be treated as four separate units and will be counted separately as a Primary, Middle, Secondary and Senior Secondary school. [1]

The AoI is characterised by the presence of co-educational primary schools across all the villages lying in the AoI, however, as pointed out during community consultations, all-girls schools are preferred by the community for adolescent girls. There is a dearth of Middle, Secondary and Senior Secondary schools in the area, with 3 Middle schools and 1 Secondary School in the core area (comprising of 6 villages) and 20 Middle Schools, 2 Secondary Schools and 1 Senior Secondary school in the buffer zone (comprising 32 villages).

Table 6.34 Availability of Schools in the AoI

Village Name	Government Primary school (P)	Government Middle school (M)	Government Secondary School (S)	Government Senior Secondary school (SS)
Core Villages				
Aaklishivdas	1	0	0	0
Bardiya Amra	1	0	0	0
Barkheda Uda	2	0	0	0
Bhagori	1	1	1	0
Chhayan	1	0	0	0
Jamuniya	1	0	0	0
Khankhari	1	0	0	0
Makdichaoda	1	0	0	0
Manpura	1	1	0	0
Nariya Buzurg	2	0	0	0
Sagoriya	1	0	0	0
Semli	1	1	0	0
Takrawad	1	1	0	0
Total	**15**	**4**	**1**	**0**
Buffer Villages				
Total	**33**	**19**	**2**	**1**
AoI Total	**48**	**23**	**3**	**1**

Source: Census of India, 2011

[1] http://www.censusindia.gov.in/2011census/dchb/DCHB%202011-Concepts%20&%20Definitions%20Village%20and%20Town%20Directory.pdf

According to the consultations undertaken with the local community and teachers, it is understood that a number of children do not continue education beyond the primary level (standard 8th). One of the main reasons attributed to this is the lack of village level facilities at the middle and higher levels of education. Due to this increased distance and its associated cost and safety (for girls) concerns, a number of families do not continue the children's education.

Health Facilities and Health Seeking Behaviour

The health facilities in the AoI are characterised by a three tier health infrastructure. The health facilities available at the village level comprise of Primary Health Sub Centres and Public Health Centres (PHC). While the sub centres cater to a population of 5,000 individuals, the PHCs are for a population of 10,000-30,000 individuals. While the PHCs are mostly for OPD (Out Patient Department) and basic IPD (In Patient Department) cases, sub centres usually have a delivery room and 2 resident nurses (one male and one female). Each PHC has 5-6 sub centres under them. In turn, a cluster of 6-10 PHCs come under a CHC (Community Health Centre), which caters to a population exceeding 1 lakh, and also provides emergency services. The CHCs in turn report to the public hospitals at the district level.

The villages of the AoI have access to 1 Sub Health Centre in Bhagori village in core zone and 6 Sub Health Centres in the buffer zone. The area has a high incidence of diseases like Malaria, Typhoid and Jaundice in addition to the joint pains, common cold and fever. The following table provides a brief understanding of the main diseases and the number of deaths resultant from the same in the state.

Table 6.35 Main Diseases and Number of Deaths in Madhya Pradesh (2013)

Social and Physical Infrastructure		*Social and Physical Infrastructure*
Acute Diarrhoeal Diseases	535012	89
Malaria	73129	39
Acute Respiratory Infection	1312395	213
Japanese Encephalities	0	0
Viral Hepatitis	14055	11

Source: Central Bureau of Health Intelligence, Ministry of Health and Family Welfare

The Doctors from Government hospital visits the villages, as reported during community consultations, however; the people visit the Government hospital of Shamgarh in case of serious illness and usually commute by hiring a vehicle. The Auxiliary Nurse Midwife (ANM) guides the women of the villages regularly and there is a high adoption of institutional deliveries in the area, with the provision of Ambulance in the village to facilitate commutation of women to Government hospital at the time of delivery.

In keeping with the nature of the project and its potential impacts, the discussion on the health in the community has been restricted to a preliminary

understanding. If needed, a detailed assessment of the health status and health seeking behaviour of the community may be undertaken for the project.

Markets and Banks

Shamgarh is the closest market or *mandi* for the people residing in AoI villages, where the purchase of agricultural inputs and sale of agricultural produce takes place. Shamgarh has banks and ATMs and being at a convenient distance of nearly 5 km from all AoI villages, it acts as a hub of all economic activities.

It was revealed through social consultations, that the people of Sagoriya and Jamuniya villages receive credit support from Bandhan Microfinance. The people are provided with loans up to Rs. 15,000 to 20,000, which they must repay in weekly instalments of Rs. 325-350, spread over a 12 month period depending on the loan size. The microfinance organization representatives visit the village on weekly basis (mostly on Saturdays) and operate through the Self Help Group (SHG) model.

7 STAKEHOLDER IDENTIFICATION, INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

The subsequent section sheds light on the parameters of identification of and engagement with the key stakeholders, in order to assess the impact of the project on them. The stakeholders have been identified as the individuals or institutions which are being affected, since the inception of the project running down to years of operation and are critical in deciding the way the Wind Power project is shaping in the Study area.

"Stakeholder Analysis" is understood as the process of identifying the individuals or groups that are likely to affect or be affected by a proposed project, and sorting them according to their impact on the project and the impact the project will have on them. This information is then used to assess the manner in which the interests of the stakeholders should be addressed in the project plan, policy, program, or other action.

The importance of such an analysis lies in the role played by this understanding in the assessment of the socio-political environment surrounding the project. It allows for the:

- Identification of key stakeholders, their primary groupings and sub groupings;
- Identification of the interests, concerns and potential risks surrounding the stakeholders, as well as conflicts of interests (if any);
- Identification of relations between stakeholders that may enable "coalitions" of project sponsorship, ownership and co-operation as well as the mechanisms which may have a role in influencing other stakeholders;
- Key groups/ individuals to be pin pointed who need to be informed about the project;
- Identifying stakeholders (those who are likely to have an adverse impact on the project) and taking appropriate measures to combat their influence;
- Identification of the impact and influence of the project on the stakeholders and of the stakeholders on the project;
- Generation of information essential to the planning, implementation and monitoring of the project; and;
- Development of a framework for participatory planning and implementation of various project activities.

7.1 STAKEHOLDER IDENTIFICATION AND CHARACTERIZATION

A stakeholder is "a person, group, or organization that has a direct or indirect stake in a project/organization because it can affect or be affected by the Project/organization's actions, objectives, and policies". Stakeholders thus vary in terms of degree of interest, influence and control they have over the project. While those stakeholders who have a direct impact on or are directly

impacted by the project are known as Primary Stakeholders, those who have an indirect impact or are indirectly impacted are known as Secondary Stakeholders. Keeping in mind the nature of the project and its setting, the stakeholders have been identified and listed in the table given below.

Table 7.1 Stakeholder Group Categorization

Category	Primary Stakeholder	Secondary Stakeholder
Community	• Local Community • Vulnerable Groups • Opinion Holders and Community Leaders	
Institutional Stakeholders	• Local Gram Panchayats	• Political Parties
Government Bodies	• Regulatory Authorities • District Administration	• State Administration
Other Groups	• Contractors and Sub Contractors • Contractual workers	• Media • Other wind power developers and investors

7.1.1 Stakeholder Mapping

"Stakeholder mapping" is a process of examining the relative influence that different individuals and groups have over a project as well as the influence of the project over them. The purpose of stakeholder mapping is to:

- Identify each stakeholder group;
- Study their profile and the nature of the stakes;
- Understand each group's specific issues, concerns as well as expectations from the project
- Gauge their influence on the Project;

On the basis of such an understanding, the stakeholders are categorised into High Influence/Priority, Medium Influence/ Priority and Low Influence/Priority.

The stakeholder engagement starts in the early stages of the project, and also needs to be included in the impact assessment and risk identification process, and continues across the life cycle of the project. The stakeholder analysis also shapes the stakeholder engagement strategy for the project, and needs to be continuously updated. Stakeholder analysis also helps to integrate the impacts and risk identified in the project designing and during the implementation stages to help company better addresses the associated impacts with the project.

Table 7.2 Stakeholder Profile and Opinions

Relevant Stakeholders	Profile	Concern and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
Primary Stakeholders					
Local Community	The WTGs are being erected on private land and in close proximity to agricultural fields and villages and hence the local community forms an important stakeholder group. There are 13 villages in the core area (lying within a radius of 1km from WTGs) and 25 villages in the buffer zone (within 5 km radius from buffer zone). The population residing in the AoI is 42,547 individuals out of which nearly 22% population belongs to Scheduled Caste and a mere 3% to Scheduled Tribe. The residents of Study area will be primary impacted by the project and in turn have a higher probability to affect the project the most. The community has an agrarian economy where cultivators and agricultural labours form a major proportion, followed by construction and other labours. The industrial development in the AoI is low and there is high rate of unemployment amongst youth, which is largely unskilled.	The expectations and concerns of this group from the project: • Receiving benefits from the project in terms of employment and development of infrastructure and the community • Steady employment with Wind Projects and timely payment of wages to the people employed as security guards • Minimal disturbance to the community with regards to access issues, pollution and influx of migrant workers	• The local community's involvement has been reduced to minimal by the project. The stakeholder consultations revealed that no formal village meetings have been conducted by the project officials to apprise the villagers about the forthcoming WTGs in and around their villages. The land-sellers have been approached through local people and there has been no involvement of the PRI members in the land deals. • The social consultations have also established that generally, agriculturally less productive land is being sold for the WTG locations. The land-sellers are selling it at prices higher than the market price and the proceeds are being used for paying off debts or meeting household expenses. • The stakeholder group may have a significant role to play in the public opinion formation towards the project.	• The project is part of a larger INOX project and can prove to be potential employers of the people in the area. • The need-driven CSR activities can help number of other wind power projects already exist in the area, the project can play a critical role in the development of the community through economic opportunities and CSR projects	Influence of Stakeholder: Low/Medium Influence of Project: High/Medium
Vulnerable Groups	This group comprises of those groups/households considered to be vulnerable due to their social, political or economic status in society. This group in the study area is primarily comprised of ST population, women population and	The key expectations and concerns of the group from the project include: • Receiving benefits from the project in terms of economic opportunities	• This group's influence on the project stems from the group being part of a larger community	• The project may play a critical role in the development of these groups, by identifying specific opportunities and programmes for	Influence of Stakeholder: Low Influence of Project: High

Relevant Stakeholders	Profile	Concern and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
	the families below the poverty line. However, based on the understanding of the project and its activities, the vulnerable groups are not likely to be severely impacted due to the project activities.	and development programmes • Access to the economic opportunities and development programmes because of their status in the society • Minimal disturbance to the community in regards to access issues, pollution and influx of migrant workers		the group	
Opinion Holders and Community Leaders	This stakeholder group is comprised of those individuals of the local community who hold traditional and rational power. These stakeholder group members include the elders, community and political leaders in the village and play a critical role in the decision making in the local community	The expectations and concerns of this group from the project: • Receiving benefits from the project in terms of employment and development of infrastructure and the community • Regular updates on the project activities and the opportunities from the same • Minimal disturbance to the community in regards to access issues, pollution, sound of moving Wind Turbines, and influx of migrant workers	• This group, though powerful enough to affect the functioning of the Wind Power plants in their vicinity hasn't been taking any concrete steps towards exercising great control over the project. • This stakeholder group may play an important role in the public opinion formation, implementation of the CSR activities planned or might intervene if the salary issue of the security guards remains as erratic.	• These groups due to their social status, may already have access to a number of economic benefits from the other wind power projects, and thus may not be completely dependent upon the Project for access to development opportunities	Influence of Stakeholder: Medium Influence of Project: Medium
Local Gram Panchayats	This stakeholder group is comprised of the lowest level of local governance. The gram panchayats consist of one or more revenue villages and are the lowest level of decision making bodies for development activities in the villages	The expectations and concerns of this group from the project: • Receiving benefits from the project in terms of employment and development of infrastructure	• The wind power projects are not legally required to obtain a NoC from the Gram Panchayats for setting up the project, however, this stakeholder group is crucial in the smooth functioning of the project. The involvement of Panchayat	• The project can play an important role in the development of the villages by undertaking CSR activities in collaboration with the Gram Panchayat,	Influence of Stakeholder: High Influence of Project: Medium

Relevant Stakeholders	Profile	Concern and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
		• Implementation of community development programmes in consultation with the Gram Panchayat and the local community • Preference to the local community in contractor and employment opportunities from the project • Regular updates on the project activities and the opportunities from the same • Minimal disturbance to the community in regards to access issues, pollution and influx of migrant workers	members has been kept limited by the Project officials but since the process of land procurement is still in progress, Panchayat members can influence the decision making process of the land sellers and the entire community, at large • This stakeholder may also play an important role in the implementation CSR activities planned and the execution of other plans such as stakeholder engagement and grievance management	especially in areas where there is a paucity of government funds	
Regulatory Authorities	This stakeholder group is comprised of the central, state and district level regulatory authorities. These authorities influence the project in terms of establishing policy, granting permits and approvals for the project, monitoring and enforcing compliance with the applicable rules and regulations	The key expectations and concerns of the group from the project include: • Project's compliance to the regulatory requirements • Timely disclosure of information and provisioning of updated through the life of the project	• The failure of the project to comply with the various rules and regulations applicable is instrumental for the timely implementation of the project • This stakeholder group is also critical for various permits/clearances required for the commissioning of the project	• The influence of the project on the stakeholders pertains to the role the project will play in the development of wind energy in the area	Influence of Stakeholder: High Influence of Project: Low
District Administration	This stakeholder group is comprised of the government bodies at the district level. These bodies are vested with funds and decision making authority through the decentralization process. Accordingly the bureaucracy, the Block Development Officers, Block Health Officers,	The key expectations and concerns of the group from the project include: • Project's compliance to the regulatory requirements • Timely disclosure of information and	• This stakeholder group is critical for the obtaining of the various permits/clearances required for the commissioning of the project and its smooth functioning thereafter • This group serves as important points of contact between the state	The influence of the project on the stakeholders pertains to the role the project will play in the development of wind energy in the area	Influence of Stakeholder: High Influence of Project: Low

Relevant Stakeholders	Profile	Concern and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
	Tehsildaar, Patwari, and Revenue Officer have become extremely influential.	provisioning of updates throughout the life of the project	level authorities and the local community		
Contractors and Sub-Contractors	This stakeholder group is comprised of INOX and agencies/organizations retained by INOX for the various stages of the project. . • M/s Anand - WTG Foundation work • Malwa Construction Company- Road Construction • DR Engineers- ##KV Unit Sub Station work • Nilkanth Engineers- Loading/unloading work • KSA Power Infra Pvt Ltd. - 33KVA Sub Station Civil and Electrical • Kailash Dev Infra Build India Pvt Ltd- 220 KVA line and Substation Civil and Electrical • M/s Sumitra Construction- WTG Erection and Cable Termination • AP Secure Service Pvt Ltd- Security Service • M/s. Tech Support Infrastructure Pvt Ltd- 33 KVA Line • M/s Anant Electricals and Engineers- 33 KVA line work • M/S Golshai India Power Pvt Ltd- Electrical Unit Sub Station work	The primary concerns and expectations of the group from the project include: • the role of the project in continued economic opportunity and work generation • avoidance of any reputational risks associated with the project due to any future community unrest or project activities • clarity in terms of scope of work, expectations, key performance indicators and timelines • timely and adequate disclosure of information to allow the project activities to be carried out • fair business opportunities and contract closure • business continuity	• this stakeholder group is critical for the smooth functioning and timely implementation of the project • this group may also play an important role in the formation of public opinion towards the project	The influence of the project on the group pertains to the role of the project in business opportunities and the process of contract closure	Influence of Stakeholder: High Influence of Project: High
Contractual workers	This group is comprised of skilled and semi-skilled workers, involved in the project on a contractual basis. This group is most likely to be comprised of the semi-skilled workers involved in the	The primary concerns and expectations of the stakeholder group pertaining to the project is as follows: • the role of the project in	• this stakeholder group is critical for the smooth functioning and timely implementation of the project • this group may also play an important role in the formation of	The influence of the project on the group pertains to the roles of the project in the continuance of economic opportunities, timely	Influence of Stakeholder: Medium Influence of

Relevant Stakeholders	Profile	Concern and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
	foundation activities, access road construction and security of the WTGs. 30% of these workers are likely to be local, from the neighbouring villages with the remaining workers being migrants, depending upon skill requirement	continued economic opportunity, work generation and a source of income • timely settlement of dues and payments in keeping with the legal requirements • continued work opportunities • safety at work	public opinion towards the project	payment of wages and ensuring the health and safety of the workers	Project: High
Secondary Stakeholders					
Village Institutions	This stakeholder group is comprised of health and education institutions at the village level. The institutions in the immediate vicinity of the project are the primary schools in the villages	The main concerns and expectations of the group from the project pertain to: • Adequacy of community development activities in the area • Contribution of the project towards the overall development of the area • Involvement in the formulation and implementation of the community development activities • Timely and adequate disclosure of information pertaining to the project	• The influence of the group on the project pertains to the role of the played by these institutions in the opinion formation and implementation of community development programmes and CSR activities	• The influence of the project on the group pertains to the role of the project in the development of these institutions	Influence of Stakeholder: Low Influence of Project: Medium
Political Parties	This stakeholder group is comprised of political parties which are active in the area. this group plays a critical role in the sensitization of the population and the creation of the public opinion	The key expectations and concerns of the group from the project include: • the role of the project in the overall development of the area • the impact of the project on	The influence of this stakeholder group on the project pertains to the role of the political parties in the formulation of public opinion towards the project	The influence of the project on the group is expected to be extremely limited, pertaining to the role of the project in the development of the area	Influence of Stakeholder: Low Influence of Project: Low

Relevant Stakeholders	Profile	Concern and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
		the local community • adequate community development activities throughout the life of the project • Timely disclosure of information pertaining to the project activities			
State Administration	The state administration is comprised of the state level agencies of the various departments/authorities such as industries department, revenue department, labour department and land department etc.	The main expectations and concerns of the stakeholder group from the project include: • Compliance to the regulatory requirements for the project • Project's role in the development of the area • Timely disclosure of information pertaining to the project activities	This stakeholder group is also critical for the obtaining of the various permits/clearances required for the commissioning of the project	The influence of the project on the stakeholders pertains to the role the project will play in the development of wind energy in the state	Influence of Stakeholder: High Influence of Project: Low
Media	The media, comprising of both print and visual media, has a significant presence in the district. They are known to have played an extremely important role in generating awareness amongst the community.	The main expectations and concerns of the stakeholder from the project include: • Compliance to the regulatory requirements for the project • Project's role in the development of the area • Maintenance of positive relationship with the local community and other stakeholders • Timely disclosure of information in regards to the project activities	The influence of the stakeholder group on the project is likely to pertain to the opinion formation amongst other stakeholders towards the project	The influence of the project on the stakeholder is likely to be extremely limited due to the nature of the project activities	Influence of Stakeholder: Low Influence of Project: Low
Other Wind Power Developers	This stakeholder group is comprised of companies involved in development and	The main expectations and concerns of the stakeholder	The influence of the stakeholder group on the project is likely to pertain to the	The influence of the project on the stakeholders pertains	Influence of Stakeholder:

Relevant Stakeholders	Profile	Concern and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
and Investors	financing of wind power projects in the area. This group includes companies such as GreenInfra, Renew and Panama Wind.	from the project include: • Project's role in the development of the are and the formulation of public opinion towards wind energy • The creation of undue expectations from other projects due to project activities	development of public opinion towards wind power projects in the area	to the role the project will play in the development of wind energy in the state and the formulation of public opinion towards wind energy	Low Influence of Project: Low

7.2 *ENGAGEMENT PROCESS PRE IMPACT ASSESSMENT*

As has been mentioned above, the Project is part of a larger project being set up by INOX. According to the discussions undertaken with the local community and the project team, it is understood that the engagement by the project proponent with the local community was restricted to negotiations with land owners. These negotiations were undertaken with the individual land owners, with the help of the intermediaries in the area. According to the consultation with the local community, these meetings provided a basic understanding of the project and the purpose of the land procurement.

7.3 *ENGAGEMENT AS PART OF THE IMPACT ASSESSMENT*

This sub section provides an understanding of the engagement activities undertaken as part of the ESIA process.

Figure 7.1 Consultations undertaken as part of the ESIA Process

Source: ERM Site Visit, July 2015

For the purpose of the ESIA for the project, the consulting firm's team undertook consultations with a number of stakeholders.

Table 7.3 Consultations undertaken as part of the ESIA

Date	Stakeholder Group
17-07-2015	Discussion with villagers of Jamuniya village
17-07-2015	Discussion with a patwari of the area, Mr. Mukesh Salvi, to understand the system of land-selling in the area
17-07-2015	Discussion with the Sarpanch of Barkheda Huda panchayat and her family (in Chhayan village)
17-07-2015	FGD with women group (Chhayan)
18-07-2015	FGD with local community (Takrawad)
18-07-2015	FGD with local community (Sagoriya)
19-07-2015	Discussions with villagers of Barkheda Uda
19-07-2015	Discussions with Mr. Arjun Singh – A farmer who sold his land for WTG
19-07-2015	FGD with local community (Bardiya Amra)
19-07-2015	FGD with local community (Aakli Shivdas)
19-07-2015	Discussion with Bhil tribe members (Bhagori)

7.3.1 Key Issues Identified

As part of these consultations an attempt was made to develop an understanding of the stakeholder group's key concerns and expectations from the project, the group's perception of the project and wind power projects in general and to triangulate the secondary information available in the area.

- As part of these consultations, some key issues and concerns pertaining to the project were reported to comprise of untimely wages, delayed payment for erection of transmission towers and the temporary nature of employment in the project. The local villagers as well as some land sellers have reported delay in the salary of security guards by 2-3 months and the payment for transmission towers. According to the INOX representatives, this was due to a delay in payment to the contractors, which was rectified by INOX at the earliest and the guards were paid arrears. The delay in the payment for transmission line towers was reported to be resultant from the INOX policy of the payment being divided into three parts. Due to the heavy rains in the last month, INOX had been unable to complete the erection of the towers, due to which the second and third instalments were not released. The local community also cited instances of removal of security guards, who were employed for some months. INOX reported that this was due to the fact that during the construction phase, each WTG has 2 guards (on rotation basis) for the protection of the equipment, however, once the construction of the WTG is completed, only one guard is required and during the operations phase, one guard is needed for 2-3 WTGs. However, the local community was not informed of this fact.
- The local community members also reported that due to the fact that INOX had been unable to complete the erection of the WTGs on time, the material (primarily wires) left at the transmission line construction site was not allowing the land owners to cultivate that land and was thus resulting in a loss of opportunity and temporary economic displacement which would not be compensated by the Project.
- Furthermore, the Panchayat members expressed dissatisfaction with the fact that they are not being involved in the process of land transaction, neither through the company and nor by the villagers. The villagers in most cases do not even know about a probable erection of WTG near their villages, until the land deal is done. According to the discussions undertaken with the Panchayat members in the villages, the members were also not fully aware of the legal provisions in place for wind power projects and the role of the Gram Panchayat in the same.
- It was also reported that while the District Circle Rate in the area is 7-8 lakh per hectare for unirrigated land, however, the prevailing market rate in the district is reported to be lower, ranging around 4-5 lakh per hectare. This difference is reported by the local community and the land record officer to be resultant from the Circle Rate being influenced by government policies and directives, which may not necessarily reflect a negative shift in the land rates in the area.

These issues in turn will be discussed by MEIL with INOX, and solutions will be sought in consultation with the local community, as part of the ongoing stakeholder engagement.

8 IMPACT ASSESSMENT

8.1 INTRODUCTION

This section assesses the manner in which the Project will interact with elements of the physical, ecological or social environment to produce impacts to resources/ receptors. It has been organized as per the various phases of the project life cycle to understand the risks and impacts associated with each phase.

8.2 SCOPE OF THE ASSESSMENT

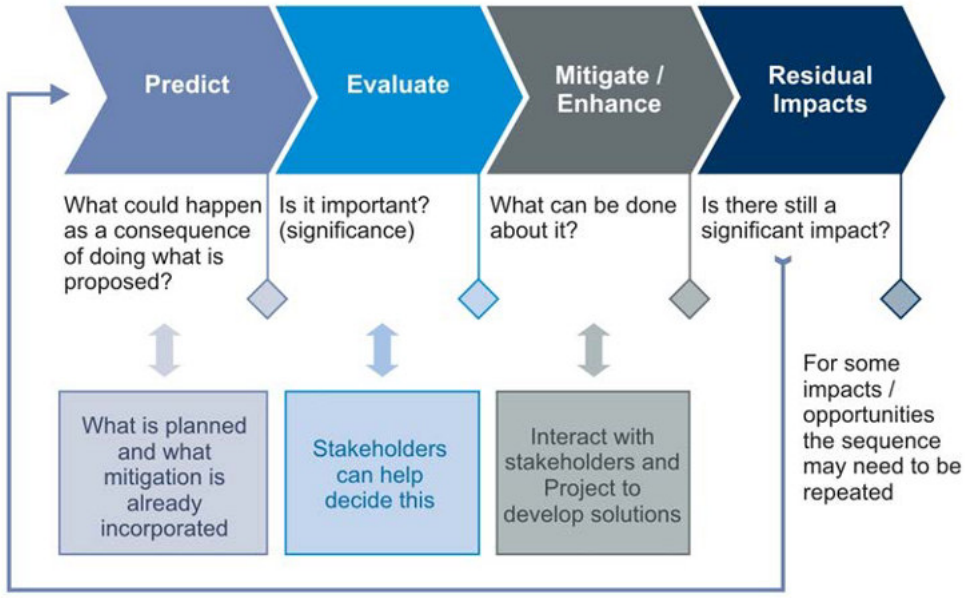
The scope of the assessment captures the understanding on the envisaged risks and impacts assessed during the scoping exercise of this impact assessment study as well as the risks identified during subsequent physical baseline assessment and impact evaluation process. The key environmental and social issues and risks identified are further elaborated in the following sections.

8.3 ASSESSMENT METHODOLOGY

Impact identification and assessment starts with scoping and continues through the remainder of the IA Process. The principal IA steps are summarized in ***Figure 8.1*** and comprises of

- **Impact prediction:** to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities.
- **Impact evaluation:** to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor.
- **Mitigation and enhancement:** to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- **Residual impact evaluation:** to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

Figure 8.1 Impact Assessment Process



Prediction of Impacts

Prediction of impacts was carried out with an objective to determine what is likely to happen to the environment as a consequence of the Project and its associated activities. From the potentially significant interactions identified in Scoping, the impacts to the various resources/receptors were elaborated and evaluated.

Evaluation of Impacts

Each impact was described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in ***Table 8.1.***

Table 8.1 Impact Characteristic Terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect)	Direct Indirect Induced
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.)	Local National Global
Duration	The time period over which a resource/ receptor is affected.	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)	[no fixed designations; intended to be a numerical value or a qualitative description of "intensity"]

Characteristic	Definition	Designations
Frequency	A measure of the constancy or periodicity of the impact.	[no fixed designations; intended to be a numerical value or a qualitative description]

The definitions for the *type* designations are given in ***Table 8.2.*** Definitions for the other designations are resource/receptor-specific.

Table 8.2 Impact Type Definitions

Type	Definition
Direct	Impacts that result from a direct interaction between the Project and a resource/ receptor
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project.

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is likelihood. The likelihood of an unplanned event occurring was designated using a qualitative scale, as described in ***Table 8.3.***

Table 8.3 Definitions for Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions (probability less than 20%)
Possible	The event is likely to occur at some time during normal operating conditions (probability greater than 20% and less than 50%)
Likely	The event will occur during normal operating conditions (probability greater than 50%

Once an impact's characteristics were defined, each impact was assigned a 'magnitude'. Magnitude is typically a function of a combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent
- Duration
- Scale
- Frequency

In case of unplanned events only, magnitude incorporates the 'likelihood' factor discussed above. Magnitude essentially describes the intensity of the change that was predicted to occur in the resource/receptor as a result of the impact. As discussed above, the magnitude designations themselves are universally consistent, but the descriptions for these designations vary on a resource/receptor-by-resource/receptor basis. The universal magnitude designations are:

- Positive

- Negligible
- Small
- Medium
- Large

In the case of a positive impact, no magnitude designation (aside from 'positive') was assigned. It was considered sufficient for the purpose of the IA to indicate that the Project was expected to result in a positive impact, without characterising the exact degree of positive change likely to occur. In the case of impacts resulting from unplanned events, the same resource/ receptor-specific approach to concluding a magnitude designation was followed, but the 'likelihood' factor was considered, together with the other impact characteristics, when assigning a magnitude designation.

In addition to characterising the magnitude of impact, the other principal impact evaluation step was definition of the sensitivity/ vulnerability/ importance of the impacted resource/receptor. There are a range of factors that was taken into account when defining the sensitivity/ vulnerability/ importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors were also considered when characterising sensitivity/ vulnerability/importance, such as legal protection, government policy, stakeholder views and economic value. The sensitivity/ vulnerability/importance designations used herein for all resources/receptors are:

- Low
- Medium
- High

Once magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor have been characterised, the significance was assigned for each impact. Impact significance is designated using the matrix shown in ***Figure 8.2.***

Figure 8.2 Impact Significance

		Sensitivity/Vulnerability/importance of Resource/Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/ vulnerability/ importance designations that enter into the matrix. ***Box 8.1*** provides a context of what the various impact significance ratings imply.

Box 8.1 Context of Impact Significances

An impact of **negligible** significance is one where a resource/ receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/ receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards/ guidelines.

An impact of **moderate** significance has an impact magnitude that is within applicable standards/guidelines, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

It is important to note that impact prediction and evaluation takes into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the IA Process).

Identification of Mitigation and Enhancement Measures

Once the significance of an impact has been characterised, the next step was to evaluate what mitigation and enhancement measures are warranted. For the purposes of this IA, the consulting firm adopted the following Mitigation Hierarchy:

- **Avoid at Source, Reduce at Source:** avoiding or reducing at source through the design of the Project.
- **Abate on Site:** add something to the design to abate the impact.
- **Abate at Receptor:** if an impact cannot be abated on-site then control measures can be implemented off-site.
- **Repair or Remedy:** some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.
- **Compensate in Kind, Compensate Through Other Means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries, access, recreation and amenity space).

The priority in mitigation was to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Management and Monitoring

The final stage in the IA Process was the definition of the basic management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards/ guidelines; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted. This is covered in ***Chapter 9*** under environmental and social management plan (ESMP)

8.4 KEY POTENTIAL RISKS

Based on the Potential Interactions Matrix for Project activities and likely impacted resources/ receptors for construction phase of the proposed project as shown in ***Table 5.2*** following areas of impacts have been identified.: The identified interactions that are likely to result in significant impacts has been shown in ***Table 5.3*** has been discussed in detail in this chapter and the scoped out interactions as shown in ***Table 5.4*** has been left out with the justifications provided there in or discussed very briefly.

8.4.1 Key environmental risks

- Change in Land use
- Impacts on Land and Soil Environment;
- Impact on Water resources and quality;
- Ambient Air Quality;
- Ambient Noise Level;
- Impact on nearby establishments in terms of shadow flicker

8.4.2 Impact on Ecology;

- Impact on habitat of herpetofaunal species, resident avifaunal species and mammals;
- Construction activity leading to habitat disturbance;
- Laying of approach roads leading to road kills
- Mortality of Avifaunal and bat species due to collision risk

8.4.3 Key Social risk

- Community health and safety impacts
- Occupational health and safety of workers; and
- Potential impact on labour working conditions;

Drawing on the outcomes of scoping, the following *Sections 9.5* to *9.7* present the detailed assessment of the key potential environmental and social impacts associated with the seismic survey.

8.5 KEY ENVIRONMENTAL RISKS

8.5.1 *Change in Land Use*

For the purpose of assessment of impacts on land use of the area, the following Project activities leading to alteration in land use of the area during the Project life cycle were considered:

- Construction of temporary structures such as construction site office, store yard, batching plant;

- Construction/ upgradation of access roads;
- Vehicular movement for transportation of WTG components and construction materials;
- Movement of construction equipment like cranes, excavators, dumpers, trucks; and
- Erection of WTGs and associated transformer yard and permanent site office.

Criteria

For the assessment of land use, the sensitivity and magnitude criteria outlined in ***Table 8.4*** and ***Table 8.5*** have been used respectively.

Table 8.4 Sensitivity Assessment Criteria for Land Use

Land Use Sensitivity	Criteria
Low	The Project footprint is present in wasteland with no human settlement
Medium	The Project is present in agricultural land or combination of agricultural land and wasteland or residential land.
High	The Project is present in any forest land, or national park or of national Importance covered by international and/or national designation.

Table 8.5 Criteria for Impact Magnitude for Assessment of Impact to Land Use

Magnitude	Criteria
Negligible	An imperceptible, barely or rarely perceptible change in landuse characteristics. The change may be short term.
Small	A subtle change in landuse character over a wide area of a more noticeable change either over a restricted area or infrequently perceived. The change may be short term.
Medium	A noticeable change in landuse character, frequently perceived or continuous and over a wide area; or a clearly evident change over a restricted area that may be infrequently perceived. The change may be medium to long term and may not be reversible.
Large	A clearly evident, frequently perceived and continuous change in landuse characteristics affecting an extensive area. The change may be long term and would not be reversible.

Context

Currently, majority of the project area is primarily used for agricultural purposes. The WTGs are to be located on waste land (open scrub) and agricultural fallows. The diversion of land for erection of WTGs, Pooling Substation and other facilities as access roads, storage yard, labour accommodation facility etc will lead to a permanent change in land use. The laying of transmission lines and its towers is also expected to create disturbance to agricultural activities for a short period of time. Agricultural areas are avoided for siting of temporary facilities such as labor camp and batching plant

The project activities which may alter the land use of the area during the project life cycle for over a period of time are given below:

Table 8.6 Periodic alteration of land use

SN.	Activity	Duration
1	Siting of site office, labor camp, batching plant, storage yard	Temporary (10-11 months)
2	Access road construction/strengthening and its consequent usage	Permanent
4	WTG erection, PSS, transmission towers with transmission lines	Permanent

As the land procurement and planning of construction is executed prior to construction activity, the amount of land where land use pattern will be affected is known beforehand and mostly will be change across the lifecycle of the project. *As a result impact assessment of land use change has been carried out for the entire Project life cycle and has not been performed separately for construction and operation phases.*

Embedded/ in-built control

The impacts during the construction activity will be short term and the construction of the Project will be executed in a phased manner (approximately 10 -12 months). Additionally, the contractors will be instructed to avoid any unnecessary disturbance to nearby surrounding features or land parcels. Further, construction activities and land disturbance will be restricted to the footprint of the Project components and remaining area to be kept undisturbed to the extent possible. After completion of the construction work, areas utilised for labour camp and batching plant will be restored to their original form.

Significance of Impact

As the main land use of the Project Area as per the land use map presented in Section 7.4.1 is mainly agricultural either crop or fallow, the land resource sensitivity is medium. The impact magnitude is assessed as medium based on the spread of the project (about 62.5 acres (25.29 ha) of land for WTGs, 75 km of access roads, 3.26 acres (1.3 ha) for poling substation). As a result, the impact significance is assessed to be **moderate.**

Additional Mitigation Measures

The following mitigation measures shall be implemented to minimize potential impacts on land use:

- Construction activities should be restricted to designated area.
- Labours should be trained not to disturb flora around the construction site.
- Waste should not be allowed to litter in and around the project area
- On completion of construction activities, land used for temporary facilities shall be restored to the extent possible.
- The land use in and around the permanent project facilities shall not be disturbed.

Residual impact Assessment

The evaluation of significance is done for the activities that can have an impact on land use that can be identified at planning stage and consequently adequate mitigation measures can be adopted. The impact on land use is majorly envisaged during construction stage and some of the areas will get back to its original landuse post construction.

Table 8.7 Impact on land use as a result of the Project

Impact	Change in Land use during construction				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to WTG footprint and associated facilities				
Frequency	Construction phase of Project				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **moderate.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible to minor.**				

Significance of Residual Impact

The residual impact is expected vary from **negligible to minor** post implementation of mitigation measures.

8.5.2 Impacts on Land and Soil Environment

For the impact assessment, following phases of the project cycle were considered for potential impacts on soil and land capability. The phase wise project activities are listed below that may result in land and soil impacts:

Construction phase:

- Establishment of access roads;
- Selective clearing of vegetation in areas designated for WTG erection and other surface infrastructure;
- Stripping and stockpiling of soil layers;
- Digging for WTG foundations and electrical poles;
- Storage of materials as well as transport of construction material; and
- General building/construction activities.

Operational phase:

- Monitoring of WTG operations;
- Routine maintenance activities at WTG locations;
- Storage of oil and lubricants onsite.

Decommissioning:

- Removal of WTGs;
- Removal of infrastructure from soil surfaces; and
- Increased traffic on roads to transport dismantled WTG components and waste materials.

Soil Quality Criteria

For the assessment of soil quality, the sensitivity and magnitude criteria outlined in ***Table 8.8*** and ***Table 8.9*** respectively have been used.

Table 8.8: Sensitivity Assessment Criteria for Soil quality (compaction, erosion and contamination)

Sensitivity Criteria	**Contributing Criteria**	
	Environment	*Social*
Soil Quality related criteria as compaction, erosion and contamination	The extent to which the soil and quality plays an ecosystem role in terms of supporting biodiversity. This includes its role as in supporting a lifecycle stage	The extent to which the soil a quality provides a use (agricultural use) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation
Low	• The soil quality does not support diverse habitat or populations and/or supports habitat or population of low quality.	• The soil quality has little or no role in provisioning of services as agricultural uses for the local community.
Medium	• The soil quality supports diverse habitat or population of flora and fauna and supports habitats commonly available in the Project AoI.	• The soil has local importance in terms of provisioning services as agricultural services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality ie ready availability across the AoI.
High	• The soil quality supports economically important or biologically unique species or provides essential habitat for such species.	• The soil is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional level for provisioning services.

Table 8.9 Criteria for Impact Magnitude for Assessment of Impact to Soil

Magnitude Criteria	Negligible	Small	medium	Large
Soil compaction, erosion and contamination	• Qualitative-No perceptible or readily measurable change from baseline conditions • Scale-Localized area as Particular activity areas • Time-Short duration (few days) or one time as temporary	• Perceptible change from baseline conditions but likely to easily revert back to earlier stage with mitigation • Scale- -Project site, activity areas and immediate vicinity not impacting any sensitive receptor • Short term-Only during particular activities or phase of the project lifecycle as civil works or construction phase (few months)	• Clearly evident (e.g. perceptible and readily measurable) change from baseline conditions and/or likely take time to revert back to earlier stage with mitigation • Scale- Project site, activity areas and immediate vicinity impacting sensitive receptor/s • Long term-Spread across several phases of the project lifecycle (few years)	• Major (e.g. order of magnitude) change in comparison to baseline conditions and/or likely difficult or may not to revert back to earlier stage with mitigation • Scale- Regional or international; • Permanent change

Table 8.10 Impacts on land and soil environment during the project life cycle

SN.	Impact	Project stage at which the impact may occur		
		Construction	Operation and maintenance	Decommissioning
1	Soil Erosion	Yes	No	No
2	Soil Compaction	Yes	No	Yes
3	Impact on Land due Improper waste disposal	Yes	Yes	Yes
4	Soil contamination due to Leaks/spills	Yes	Yes	Yes

The impacts which are likely to occur during different stages of the project and create effects on the land and soil environment of the project area (coloured green) are mentioned next.

Construction Phase

Soil Erosion

Context

During the construction phase, top soil will be susceptible to erosion to some extent due to site clearance activities. The scale of site clearance activities would be small at WTG footprints at different parcel of lands, whereas in areas of new internal road construction, excavated loose soil would be susceptible to erosion. The removal of stabilized top soil would result in slope destabilization and increased soil erosion.

Few WTGs as NPY-P-52, NPY-P-58, NPY-P-59 and PY-P3-113 are located within 500 m of water bodies so impacts of soil erosion on waterbodies will contribute to increase in dissolved and suspended solids. Soil erosion also contributes to the higher levels of particulate matter in ambient air quality.

Embedded/in-built control

- Using existing roads to access the site to the extent possible;
- Construction materials and wastes will be stored in designated areas.
- Stripping of topsoil shall not be conducted earlier than required; (vegetation cover will be maintained for as long as possible) in order to prevent the erosion (wind and water) of soil;
- Topography shall be restored to the extent possible and re-vegetated to prevent soil erosion to the extent possible;

Significance of Impact

As soil is being used for agricultural activities in the project AoI the sensitivity is assessed as medium. The impact magnitude is assessed as small. Based on the above after incorporating the embedded control the impact significance is considered to be **minor.**

Additional Mitigation Measures

The following mitigation measures shall be implemented to minimize potential impacts of soil erosion:

- Bunds shall be constructed to prevent soil erosion especially for the construction sites which are near to the water bodies or have slopes.
- All excavations should be filled before rainy season.
- The disturbed areas and soil stock piles should be kept moist to the extent possible to avoid wind erosion of soil

Table 8.11 Soil Erosion during construction phase

Impact	Soil erosion				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project area (specifically construction areas)				
Frequency	As per the construction schedule				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Significance of Residual Impacts

The significance of residual impacts will be **negligible** on proper implementation of mitigation measures.

Soil Compaction

Context

The project will undertake the soil compaction activity to ensure soil stability during the establishment of storage areas for WTG components, access road, installation of batching plant, establishment of substation, pooling substation etc. During construction activities, there would be compaction of soil in the project area during movement of vehicles/ construction machinery and work force movement. In addition, laying of electrical wires in the agricultural field during erection of internal and external transmission lines will also lead to the compaction of agricultural soil to certain extent.

The soil compaction would lead to impact the soil physical properties such as reduction in pore spaces, water infiltration rate and soil strength etc and soil in the area is used for agriculture.

Embedded/in-built control

The routes for movement of heavy machinery shall be designated to avoid the soil compaction in other areas;

Significance of Impact

As soil is being used for agricultural activities in the project AoI the sensitivity is assessed as medium. The impact magnitude is assessed as small. Based on the above the impact after incorporating the embedded control the impact significance is considered to be **minor.**

Additional Mitigation Measures

The following mitigation measures shall be implemented to minimize potential impacts of soil compaction:

- Clear demarcation of areas should be done for parking of heavy vehicles/equipment and not allowed to park anywhere.
- Heavy parts of WTGs should only be transported from the store yard to the WTG locations once it ready to be used.
- After completion of project activities, in the heavy soil compaction areas, the soil shall be ploughed again to reduce the soil compaction.

Table 8.12 Soil Compaction during construction phase

Impact	Soil compaction				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project area (specifically construction areas)				
Frequency	As per the construction schedule				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Significance of Residual Impacts

The significance of impact will be **negligible** post implementation of mitigation measures.

Impact on land due to improper waste disposal

Context

General construction waste generated onsite will comprise of surplus or off-specification materials such as concrete, wooden pallets, steel cuttings/filings, packaging paper or plastic, wood, metals etc. Municipal domestic wastes consisting of food waste, plastic, glass, aluminium cans and waste paper will also be generated by the construction workforce at any canteen facility/ rest area which shall be constructed for them. A small proportion of the waste generated during construction phase will be hazardous and may include used oil, hydraulic fluids, waste fuel, grease and waste oil containing rags. If improperly managed, solid waste could create impacts on land.

Embedded/in-built control

- The construction contractors will have control over the amount and types of waste (hazardous and non- hazardous) produced at the site. Workers will be strictly instructed about random disposal of any waste generated from the construction activity;
- Construction contractor should ensure that no unauthorized dumping of used oil and other hazardous wastes is undertaken from the site;

Significance of Impact

Based on the above the impact after incorporating the embedded control the impact significance is considered to be **minor.**

Additional Mitigation Measures

- Municipal domestic waste generated at site to be segregated onsite;
- Ensure hazardous waste containers are properly labelled and stored onsite provided with impervious surface, shed and secondary containment system;
- Ensure routinely disposal of hazardous waste through approved vendors and records are properly documented; and
- Disposal of hazardous wastes shall be done strictly as per the conditions of authorisation granted by MPPCB.
- Construction contractor should ensure daily collection and periodic (weekly) disposal of construction waste generated debris, concrete, metal cuttings wastes, waste/used oil etc.;
- Ensure hazardous waste is properly labelled, stored onsite at a location provided with impervious surface, shed and secondary containment system as per in accordance to Hazardous Wastes Rules, 2008
- The municipal waste from the labour camp shall only be routed through proper collection and handover to local municipal body for further disposal. The hazardous wastes shall be temporarily stored in labelled drums on impervious surface at designated area onsite and shall be disposed of through approved vendors in accordance to Hazardous Wastes Rules, 2008. The nearest Common Hazardous Waste transfer Station and Disposal Facility (CHWTSDF) is located at in the same state at Pithampur in Dhar district about 240 km south of project area.

Table 8.13 Impact on land due to Improper waste disposal during construction phase

Impact	Improper waste disposal (hazardous and non-hazardous)				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project area (specifically construction areas, labour camp, batching plant)				
Frequency	As per the construction schedule				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Significance of Residual Impacts

The significance of impact will be reduced to **negligible** on implementation of mitigation measures.

Soil Contamination due to Leaks/Spills

Context

Diesel storage will be provided at batching plant/storage yard onsite during construction phase. Other materials such as oil, paints and solvents will be stored in drums in storage area having impervious floors.

Soil contamination during the construction phase may result from leaks and spills of oil, lubricants, or fuel from heavy equipment, improper handling of chemical/fuel storage and wastewater. Such spills could have a long-term impact on soil quality, but are expected to be localised in nature.

Embedded/in-built control

- Spill control measures such as the storage and handling of chemicals and fuel in concrete areas with secondary containment will be implemented to minimize impacts in the event of a spill.

Significance of Impact

- Based on the above the impact after incorporating the embedded control the impact significance is considered to be **minor.**

Additional Mitigation Measures

- Use of spill control kits to contain and clean small spills and leaks.
- The sewage generated onsite will be treated and disposed through septic tanks and soak pits as per specifications given in IS 2470: 1995 (Part I and II).
- Transport vehicles and equipment should undergo regular maintenance to avoid any oil leakages; and
- Any unloading and loading protocols should be prepared for diesel, oil and used oil respectively and workers trained to prevent/contain spills and leaks.

Table 8.14 Soil contamination due to Leaks/spills during construction phase

Impact	Soil contamination due to Leaks/Spills			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Limited to Project area (specifically construction area footprint, batching plant)			
Frequency	Cannot be precisely determined			

Likelihood	Unlikely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Significance of Residual Impacts

The significance of impact will be reduced to **negligible** on implementation of mitigation measures.

Operation phase

The operational phase of the project will have limited impacts on soil in form of waste generation and soil contamination due to accidental spillages/ leakages.

Impact on land due to Improper waste disposal

Context

During operation phase, the waste generated from project will include domestic solid waste at SCADA building and substation and hazardous waste like waste oil and lubricants and oil containing jutes and rags will be generated during maintenance activities. The quantity of hazardous waste generated will be much lesser quantity than during the construction stage.

Embedded/in-built control

The waste generated will be disposed of through approved vendors in accordance with *Hazardous Waste Rules, 2008*. The hazardous wastes will be stored onsite at separate designated covered area provided with impervious flooring and sent for disposal to nearest TSDF located at Pithampur in Dhar district of the same state. During operation phase, the quantity of municipal waste and hazardous waste generated is less and probability of the hazardous waste generation is only during WTG maintenance and therefore occasional. The waste generated would be routed through proper collection and containment.

Significance of Impact

- Based on the above the impact after incorporating the embedded control the impact significance is considered to be **negligible.**

Additional Mitigation measures

As the embedded controls are sufficient to address the impact no mitigation measures are deemed necessary.

Residual Impact Assessment

Table 8.15 Improper waste disposal during operation phase

Impact	Improper waste disposal (hazardous and non-hazardous)				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project footprint area				
Frequency	Operation phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Significance of Residual Impacts

The significance of residual impacts will be **negligible**.

<u>Soil Contamination due to Leaks/Spills</u>

Context

There are chances of spillage of oil during maintenance work such as lubricating oils from gearbox systems, hydraulic systems of the turbine etc. The accidental spillages at oil/lubricants and hazardous waste storage areas may cause contamination of soil and ground water.

Embedded/in-built control

- Ensure oil/ lubricants are stored on impervious floor in the storage area having secondary containment;
- Use of spill control kits to contain and clean small spills and leaks during O&M activities; and
- The guidelines and procedures shall be prepared and followed for immediate clean-up actions following any spillages.

The probability of the impact is only during WTG maintenance and therefore occasional. In case of accidental spillage, the impacts will be confined to the WTG land parcels and storage area.

Significance of Impact

- Based on the above the impact after incorporating the embedded control the impact significance is considered to be **negligible.**

Additional Mitigation measures

As the embedded controls are sufficient to address the impacts additional mitigations measures are not deemed necessary.

Residual Impact significance

Table 8.16 soil contamination due to Leaks/Spills during operation phase

Impact	Soil contamination due to Leaks/Spills				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to WTG locations, sub-station and storage yard				
Frequency	Cannot be precisely determined				
Likelihood	Unlikely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

The significance of impact will be **negligible**.

Decommissioning Phase

The decommissioning activities will cause following impacts on soil:

- Soil compaction due to the increased vehicular and workforce movement, dismantling and storage of WTG components on the adjacent land, removal of internal electric lines/ poles etc.
- Waste will be generated in form of dismantled WTG components and demolition debris from WTG foundations, storage yard and substation

complex. Electric components such as transformers, insulators, wires will be generated. The waste will be mainly of inert nature;
- The possibility of soil contamination during decommissioning phase is very less though may occur due to leakage from machinery and transportation vehicles and during collection of remaining oil/ lubricants in the WTGs.

Embedded/in-built control

- The decommissioning of the wind farm will be carried out in a planned manner.
- During decommissioning phase, the quantity of waste generated will be high. The waste will be routed through proper collection, storage and disposal. The waste will be evaluated for its recycling/ reuse/ scrap value and disposed off accordingly.

Impact Significance

The overall significance of impacts on soil environment due to decommissioning activities is assessed as **minor.**

Additional Mitigation Measures

Following mitigation measures are proposed to reduce the impacts of wind farm decommissioning activities on soil environment:

- The vehicular movement during decommissioning activities should be restricted to the designated route path;
- The demolition/ dismantling waste should not be left over in the project area and to be collected and stored at designated area only for further segregation and disposal.

Significance of Residual Impacts

Table 8.17 Impact to Soil and Land environment during decommissioning phase

Impact	Impact on soil and land environment from decommissioning activities				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project area				
Frequency	Decommissioning phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact will be **negligible** to **minor.**				

The significance of impact will vary from **negligible to minor** on implementation of mitigation measures.

8.5.3 Impact on Water Resources

The impacts of proposed project on water environment are assessed with respect to following:

- Decreased water availability form the water resources of the area due to usage of water for carrying out project activities; and
- Decreased water quality due to wastewater release and spills/leaks from project activities.

Criteria

For the assessment of water quality, the sensitivity and magnitude criteria outlined in ***Table 8.18*** and ***Table 8.19*** respectively have been used.

Table 8.18 Sensitivity Assessment Criteria for Water Resources (Surface water and Ground water)

Sensitivity Criteria	Contributing Criteria	
	Environment	*Social*
Water Resources -Surface water and ground water (quality/quantity related criteria)	The extent to which the water resource plays an ecosystem or amenity role in terms of supporting biodiversity either directly or indirectly, particularly with respect to dependent ecosystems.	The extent to which the water resource provides or could provide a use (drinking water, agricultural uses, washing and other domestic or industrial, use as waterways) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation.
Low	The water resource does not support diverse aquatic habitat or populations, or supports aquatic habitat or population that is of low quality.	The water resource has little or no role in terms of provisioning services as agricultural water source, other domestic uses as washing, bathing, industrial use and waterways for the local community. The groundwater resource is not currently abstracted and used in the vicinity of the Project, but is of sufficient quality and yield to be used for that purpose in the future

Sensitivity Criteria	Contributing Criteria	
		(and there is a reasonable potential for future use).
Medium	The water resource supports diverse populations of flora and / or fauna but available in the surface water bodies in the region.	The surface water resources have local importance in terms of provisioning services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality. The groundwater resource is an important water supply, and is currently used, but there is capacity and / or adequate opportunity for alternative sources of comparable quality.
High	The water resource supports economically important or biologically unique aquatic species or provides essential habitat for such species	The surface water resources are wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional or transboundary watershed level for provisioning services The groundwater resource is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional or national level for water supply or contribution to groundwater dependent ecosystems (e.g. transboundary rivers).

Table 8.19 Criteria for Impact Magnitude for Assessment of Impact to Surface and Ground water Resources

Magnitude Criteria	Negligible	Small	Medium	Large
General Criteria	No perceptible or readily measurable change from baseline conditions.	Perceptible change from baseline conditions but likely to be within applicable norms and standards for mode of use.	Clearly evident (e.g. perceptible and readily measurable) change from baseline conditions and / or likely to approach and even occasionally exceed applicable norms and standards for mode of use.	Major changes in comparison to baseline conditions and / or likely to regularly or continually exceed applicable norms and standards for mode of use.
Water Quantity	There is likely to be negligible (less than 1% of lean	The Project will consume surface water, but the	The Project will consume surface water, and the	The Project will consume surface water, and the

Magnitude Criteria	Negligible	Small	Medium	Large
	season flow) or no consumption of surface water by the Project at any time	amounts abstracted are likely to be relatively small in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)	amounts abstracted are likely to be significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)	amounts abstracted are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)
	There is likely to be negligible or no abstraction, use of or discharge to the groundwater by the Project at any time.	The Project will consume groundwater or deliver discharge to groundwater, but the amounts abstracted / discharged are likely to be relatively small in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).	The Project will consume groundwater or discharge to groundwater, and the amounts abstracted / discharged are likely to be significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).	The Project will consume groundwater or discharge to groundwater, and the amounts abstracted / discharged are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).
Water Quality	Discharges are expected to be well within statutory limits	Discharges are expected to be within statutory limits	Occasional breach(es) of statutory discharge limits (limited periods) expected	Repeated breaches of statutory discharge limits (over extended periods) expected
	Abstractions from or discharge to aquifer(s) are unlikely to cause water quality issues.	Groundwater quality be within ambient levels or allowable criteria or may exceed for 1-2 parameters which is common occurrence due to geological regime of the area. Abstraction or discharge to aquifer(s) may cause small but local changes in water quality in the aquifer system. These can be considered potential short-term localized	Groundwater quality exceeds ambient levels or allowable criteria for key parameters. Abstraction or discharge to aquifer(s) are expected to cause potential localized effects on groundwater quality which are likely to be fairly long lasting and / or give rise to indirect ecological and / or socio-economic impacts.	Groundwater quality exceeds ambient levels or allowable criteria. Abstractions or discharge to aquifer(s) are expected to cause potentially severe effects on groundwater quality which are likely to be long-lasting (e.g. years or permanent) and / or give rise to indirect ecological and / or socio-economic impacts.

Magnitude Criteria	Negligible	Small	Medium	Large
		effects on groundwater quality which is likely to return to equilibrium conditions within a short (months) timeframe.		

Construction Phase

Impact on water availability

Context

Water will be required for civil works during the construction of the foundation for all WTGs estimating 100 m^3 of water for each WTG foundation and about 2-4. m^3/day of water for domestic requirement. This water demand will be met through procurement of water tankers sourcing water from open wells in villages of Asawati, Pitchna and Orwal under Shamgarh Tehsil .

There are surface water bodies within 500 m of WTG locations of NPY-P-52, NPY-P-58, NPY-P-59 and PY-P3-113. These water bodies may get impacted due to the construction activities related to WTG foundations.

Embedded/in-built control

- Water tankers with proper permissions will be utilized for water sourcing;

Impact Significance

The sensitivity of water resource in the area is considered as medium due to the extensive usage of ground water resource for irrigation and other purposes by the locals. The direct negative impact on water resources due to usage by construction activities will be short term and limited mainly to construction phase of the project. Also the requirement will be in a phased manner so based on the above the impact is assessed to be **minor**.

Additional Mitigation Measures

Following mitigation measures are proposed for conservation of water resources of the area:

- Bunds shall be constructed on the water body side to prevent wash away of sediment load to the water bodies;
- Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water;

- Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers.
- Recycling/reusing to the extent possible.

Table 8.20 Decreased water availability

Impact	Impact on water availability				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project area				
Frequency	Construction phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Residual Impact Significance

The significance of impact will be **negligible** on implementation of mitigation measures.

Impact on Water Quality

Context

There is a potential for contamination of surface and groundwater resources resulting from improper management of sewage, accidental spills/leaks at the storage areas and also washing away of construction materials into the water bodies.

Embedded/in-built control

- The provisions of septic tank and soak pits will be provided (as per specifications given in IS 2470 1995 Part I and Part II) onsite for treatment and disposal of sewage, thereby minimizing the impacts of wastewater discharge. Planning of toilets, soak pits and septic tanks, waste collection areas should be away from natural drainage channels;
- Use of licensed contractors for management and disposal of waste and sludge;
- Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.

Impact Significance

As mentioned in the context, there are few surface water bodies in vicinity of few WTG foot print area which could be directly impacted from project activities. There may also be chances of ground water contamination during the rains. Based on the above the impact is assessed to be **minor**.

Additional Mitigation Measures

- Ensure proper cover and stacking of loose construction material at Batching plant site and WTG's site to prevent surface runoff and contamination of receiving water body;
- Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets. Open defecation and random disposal of sewage will be strictly restricted;

Residual Impact Significance

Table 8.21 Impact on water quality

Impact	Impact on water quality				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project area				
Frequency	Construction phase				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Residual significance of impacts during construction phase will be **negligible** post implementation of mitigation measures.

Operation Phase

Impact on Water Availability

Context

Around 2-3 m^3/day water is required during operation phase to meet domestic requirements of O&M staff and for use in the SCADA building and sub-station complex.

Embedded/in-built control

- Water demand for domestic usage will be met through tankers and drinking water will be through bottled potable water purchased.
- Optimising water usage in the SCADA building and substation area by application of water conservation measures such as sensor based taps, low flush urinals etc.;

Impact Significance

The overall significance of impacts on water availability due to operational activities is assessed as **negligible.**

Additional Mitigation measures

As the impact is sufficiently addressed by the embedded controls additional mitigation measures are not foreseen for this impact.

Residual Impact Significance

Table 8.22 Impact on water availability during operation

Impact	Impact on water availability				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to site office, sub-station area				
Frequency	Operation phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

The significance of the residual impact will be **negligible**.

Impact on Water Quality

Context

During operation phase, there will be no wastewater generation from the power generation process. Only sewage would be generated from substation and SCADA building and this will also be of negligible quantity. The estimated sewage generation from project site will be less than 2 m^3/day.

Embedded/in-built control

- The drainage and sewerage system will be provided for the collection and treatment of waste water at SCADA building and substation areas.
- No wastewater discharge on open land will be practiced.

Impact Significance

The overall significance of impacts on water quality due to operational activities is assessed as **negligible.**

Additional Mitigation Measures

As the impact is sufficiently addressed by the embedded controls the requirement of additional mitigation measures is not foreseen for this impact.

Residual Impact Significance

Table 8.23 Impact on water quality during operation phase

Impact	Decreased water quality				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to substation and CMS building				
Frequency	Operation phase				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

The significance of the residual impacts will be **negligible**.

8.5.4 *Impact on Air Quality*

The impact assessment with respect to air quality of the study area has been undertaken for the project activities described below:

- Construction activities including site preparation, construction of WTG foundation, erection of internal and external transmission line, construction of office building;
- Transportation of WTG components, construction material, construction machinery and personnel;
- Operation of batching plant;
- Operation of DG sets for emergency power backup;
- Operation and maintenance activities during operation phase; and
- Decommissioning activities.

Criteria

For the assessment of air quality, the sensitivity and magnitude criteria outlined in ***Table 8.24*** and ***Table 8.25*** respectively have been used.
The air quality impacts associated with the construction activities have been assessed qualitatively, using professional judgement and based on past experience from similar projects.

Table 8.24 Sensitivity Criteria for Air quality

Sensitivity Criteria	Contributing Criteria	
	Human Receptors	*Ecological Receptors*
Low	Locations where human exposure is transient.[1]	Locally designated sites; and/or areas of specific ecological interest, not subject to statutory protection (for example, as defined by the project ecology team).
Medium	Few Receptors(settlements) within 500 m of project activity area as roads, batching plant, WTG s etc.	Nationally designated sites.
High	Densely populated receptors (settlements) within 500 m of project activity area as roads, batching plant, WTG s etc.	Internationally designated sites.

Table 8.25 Criteria for Impact Magnitude for Assessment of Impact to Air Quality (Construction Phase)

Magnitude Criteria	Negligible	Small	Medium	Large
Air Quality	• Soil type with large grain size (eg sand);	• Soil type with large grain size (eg sand);	• Moderately dusty soil type (eg silt);	• Potentially dusty soil type (eg clay, which will be

[1] As per the NAAQS and World Bank/IFC guidelines, there are no standards that apply to short –term exposure, eg one or two hours, but there is still a risk of health impacts, albeit less certain.

Magnitude Criteria	Negligible	Small	Medium	Large
	and/or No emissions/dust generation due to Project across all phases	and/or • Limited emissions/dust generations for short duration	and/or • Dust generation and emissions from Projects for long duration	prone to suspension when dry due to small particle size); and • Significant process emissions from Project for the entire Project cycle.

Construction Phase

Air quality will largely get impacted from the following sources during the construction phase:

- Fugitive dust emissions from site clearing, excavation work, cutting and levelling work at WTG sites and access/ internal roads, stacking of soils, handling of construction material, transportation of material, emission due to movement of vehicles and heavy construction machinery etc.;
- Vehicular emissions due to traffic movement on site and on access roads;
- Particulate emissions from operation of batching plant;
- Exhaust emissions from construction machineries, other heavy equipment like bull dozers, excavators, and compactors;
- Emissions from emergency power diesel generator used during construction activity.

Receptors

There are about 12 receptors located within 500 m from the WTG locations. Details of the receptors can be referred from **Table 2.4.**

Embedded/in-built control

- Batching plat will be located 10-12 km away rom habitation;
- Preventive measures such as storage of construction material in sheds, covering of construction materials during transportation will be undertaken, for reducing dust as part of the embedded controls.
- Emissions from the emergency DG set and other stationary machines will be controlled by ensuring that the engines are always properly tuned and maintained.
- Minimize stockpiling by coordinating excavations, spreading, re-grading and compaction activities;
- Speed of vehicles on site will be limited to 10-15 km/hr which will help in minimizing fugitive dust emissions due to vehicular movement; and
- Idling of vehicles and equipment will be prevented

Impact Significance

The receptor sensitivity has been assessed as medium based on the receptors located near some WTGs. The impact on air quality will be local and short-term, restricted to the construction period. The overall impacts are assessed to be **minor.**

Additional Mitigation Measures

- Burning of any waste material shall be prevented;
- Labours shall be provided with gas connection to prevent burning of fuel wood for cooking purposes;
- Work shall be ceased or phased down if excess fugitive dust is observed. Source of dust shall be investigated and proper suppression measures ensured;
- Proper maintenance of engines and use of vehicles with Pollution Under Control (PUC) Certificate shall be ensured;

Residual Impact Significance

Table 8.26 Impact on air quality during construction phase

Impact	*Ambient Air quality*				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Project footprint area, access roads, batching plant and surroundings				
Frequency	Construction phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

The residual impact due to the Project on air quality will be **negligible** post implementation of Mitigation measures.

Operation Phase

Source of Impacts

As the project is a renewable and clean energy development project, the operation phase will be largely free from air emissions.

Decommissioning Phase

The decommissioning activities will have limited impact on the air quality of the area and will be mainly in form of dust emissions due demolition of office building. The increased vehicular movement for transportation of dismantled WTGs, demolition debris, scrap materials will also generate fugitive dust emissions.

Significance of Impact

The impact on air quality during decommissioning phase of the project is assessed to be **minor.**

Additional Mitigation Measures

Same as set out in the construction phase needs to be implemented.

Residual Impact Significance

Table 8.27 Impact on air quality during decommissioning phase

Impact	*Ambient Air quality*				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Project footprint area, access roads, batching plant and surroundings				
Frequency	Construction phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

The residual impact due to the project on air quality will be **negligible** post implementation of mitigation measures.

8.5.5 Impact on Ambient Noise Levels

Context

For the purpose of impact assessment on ambient noise levels in the area, following project activities were considered:

- Construction activities including site preparation, construction of WTG foundation, erection of transmission line, construction of SCADA building and substation;
- Transportation of WTG components, construction material, construction machinery and personnel;
- Operation of DG sets;
- Operation of batching plant; and
- Operation of the WTGs;

Criteria

For the assessment of air quality, the sensitivity and magnitude criteria outlined in ***Table 8.24*** and ***Table 8.29*** respectively have been used. Noise standards notified by the MoEFCC vide gazette notification dated 14 February 2000 as amended in 2010 based on the *A* weighted equivalent noise level (L_{eq}) for residential areas will be followed (***Table 8.30***), which are similar to the noise emission criteria specified in the WB/IFC EHS Guidelines, as presented in ***Table 8.31***, has been used for assessment of noise impacts. In order to assess the significance of the impact, noise impact should not exceed the levels presented in ***Table 8.31***, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 8.28 Sensitivity Criteria for Ambient Noise

Sensitivity Criteria	Contributing Criteria	
	Human Receptors	*Ecological Receptors*
Low	Industrial Use or transient receptors.	Locally designated sites; and/or areas of specific ecological interest, not subject to statutory protection (for example, as defined by the project ecology team).
Medium	Residential and Recreational Space	Nationally designated sites.
High	Educational/ Religious/ Medical Facilities	Internationally designated sites.

Table 8.29 Criteria for Impact Magnitude for Assessment of Impact to Ambient noise levels

Magnitude Criteria	Negligible	Small	Medium	Large
Noise Quality	• Predicted noise levels are at or less than 3 dB (A) above the relevant limits / thresholds (Refer Table 9.30)*. • Short term exposure (Few	• Predicted noise levels are 3 to less than 5 dB (A) above the relevant limits / thresholds (Refer Table Table 9.30)*. • Short term exposure (< 1	• Predicted noise levels are between 5 and 10 dB (A) above the relevant limits / thresholds (Refer Table Table 9.30)*. • Medium Term Exposure (1 to	• Predicted noise levels are more than 10 dB (A) above the relevant limits / thresholds(Refer Table Table 9.30) • Long term

Magnitude Criteria	Negligible	Small	Medium	Large
	hours in a day and not continuous)	month)	6 months)	exposure (> 6 months)

Table 8.30 Ambient Air Quality Standards in respect of Noise[1]

Area Code	Category of Area	Limits in dB(A) L_{eq}*	
		Day Time	Night Time
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	***Residential Area***	***55***	***45***
(D)	Silence Zone	50	40

Note:

1. *Day time shall mean from 6.00 a.m. and 10.00 p.m.*
2. *Night time shall mean from 10.00 p.m. and 6.00 a.m.*
3. *Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.*
4. *Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.*

** dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. A "decibel" is a unit in which noise is measured. "A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear. Leq: It is an energy mean of the noise level over a specified period.*

[1] *[Source: Schedule of The Noise Pollution (Regulation and Control) Rules, 2000 vide S. O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.)]*

Table 8.31 Noise Emission Criteria[1]

Location	Noise Level Limit (dB(A)	
	Daytime (0700 – 2200 hrs)	Night-time (2200 – 0700 hrs)
Industrial; commercial	70	70
Residential; institutional; educational	55	45

[1] Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organisation (WHO), 1999.

Receptors

There are 24 receptors across 10 WTGs as can be referred from ***Table 2.4*** on WTG profiling as well as presented in ***Figure 8.3***. Three of the WTGs NPY-P- 51 (240m, W), NPY-P- 52 (180 m, W) and PY-P3-143 (100 m, S) are located near the forest existing in the AoI. High ambient noise levels during construction phases might be a cause of discomfort for the inhabitants as well as fauna in the forest area. The impact assessment for higher ambient noise has been performed considering this factor.

Construction Phase

Embedded/in-built control

- Batching plant will be located away from village settlement;
- Normal working hours of the contractor to be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it should be limited to activities which do not generate noise;
- Only well-maintained equipment should be operated on-site;

Significance of Impact

Based on the receptor sensitivity criteria table, the resource sensitivity is assessed as medium for all the locations. Peak construction works generating noise are expected to last for not more than 1 month at any particular location and construction activities will be limited to daytime only. Based on the scattered activity areas and consulting firm's previous experiences, impact of construction activities will be limited within 500 m of the WTGs locations and within 100 m from the road network, which will be developed/upgraded and used for man and material movement within and outside the project area. The impact on noise quality during construction phase of the project is assessed to be **minor to moderate.**

Additional Mitigation Measures

- DG set with acoustic enclosures only shall be used;
- If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components shall be carried out to bring down the noise and placing such machinery far away from the households as possible;
- Machinery and construction equipment that may be in intermittent use should be shut down or throttled down during non-work periods;
- Minimal use of vehicle horns in the area needs to be encouraged;

Residual Impact Significance

Table 8.32 Increased ambient noise during construction phase

Impact	Noise generation from construction activities and transportation of man/material				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to within 500 m of WTGs and associated facilities and surroundings				
Frequency	Construction phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

	Significance of impact is considered **minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible to minor.**				

The significance of the residual impact will be **negligible to minor** based on the location post implementation of mitigation measures.

Operation Phase

Context

The emanation of noise form the operation of WTGs is of the following two types: (a) mechanical noise, from interaction of turbine components; and (b) aerodynamic noise, produced by the flow of air over blades. Mechanical sounds originate from the relative motion of mechanical components and the dynamic response among them. Sources of such sounds include:

- Gearbox
- Generator
- Yaw drives
- Cooling fans
- Auxiliary equipment (e.g. hydraulics)

Aerodynamic sound is typically the largest component of wind turbine acoustic emissions. It originates from the flow of air around the blades. Aerodynamic sound generally increases with rotor speed.

The Project will have 25 WTGs of INOX WT 2000 DF 100 make, with a rated capacity of 2.0 MW each with 100 m rotor diameter and 80 m hub height. The noise generation from the turbines have been taken into consideration during strong wind conditions (with wind velocity ≥ 7 m/s at 10 m height), moderate wind conditions (with wind velocity = 5 m/s at 10 m height) and normal wind conditions (with wind velocity = 3 m/s at 10 m height) for the noise assessment. Based on the available information from the turbine manufacturer, following are the noise generation due to the wind turbines (***Table 8.33***):

Table 8.33 Noise Generation from WTGs

Wind Condition	Wind Velocity at 10 m height (m/s)	Noise Generation [dB(A)] at Hub Height
Strong	≥ 7	105.6
Moderate	5	99.6
Normal	3	95.3

Source: Windpro database

Embedded/in-built control

- Regular maintenance of WTGs;

- Periodic monitoring of noise near to the sources of generation to ensure compliance with design specification;

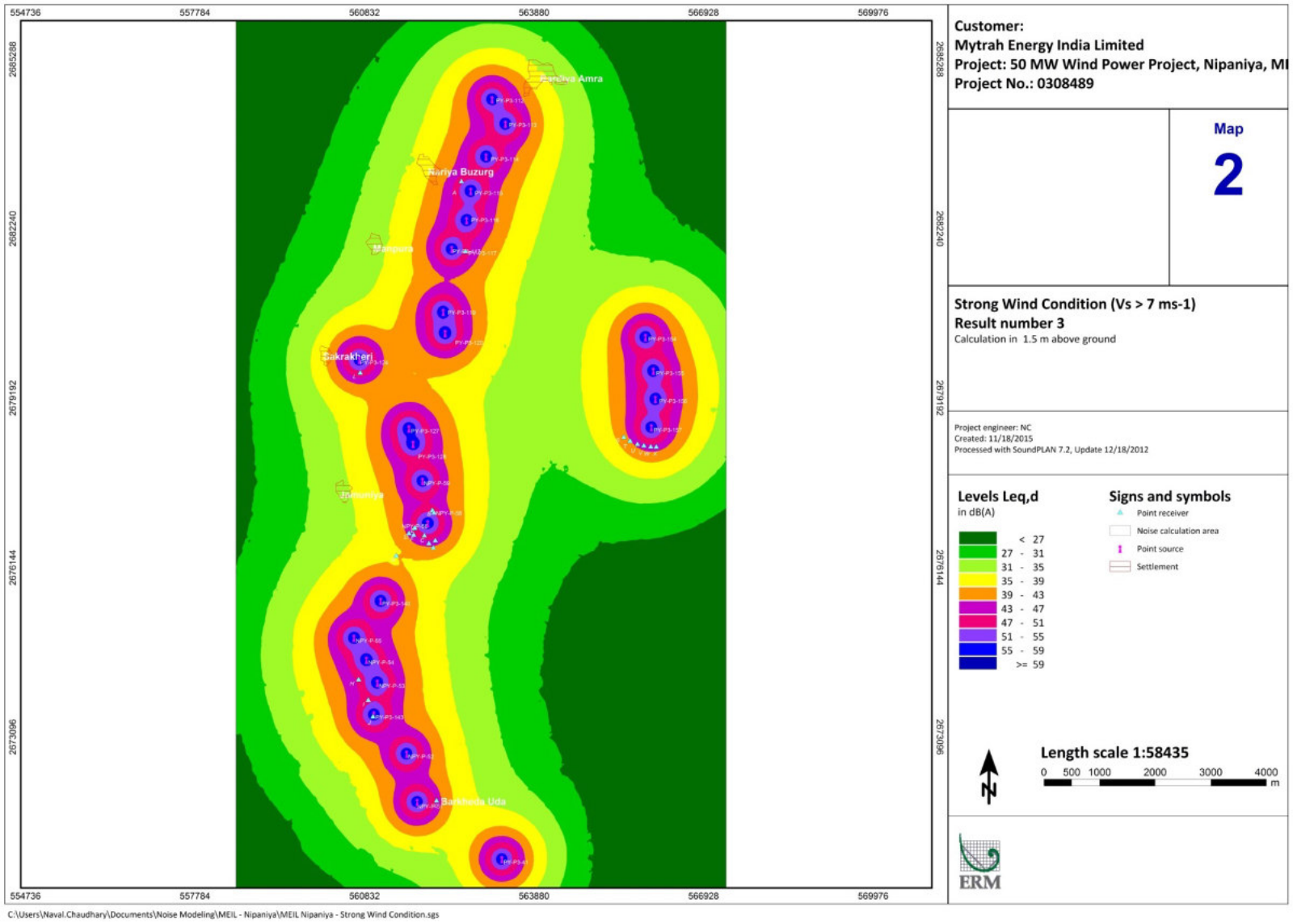
Prediction of Impacts

Methodology: The environmental noise prediction model SoundPlan 7.2 was used for modelling noise emissions from the WTGs. In order to consider worst case scenario (with strong wind conditions), it has been assumed that the WTGs are operational at standardised wind speed of ≥ 7 m/s at 10 m height. Operating of WTGs with 100% usage scenario was modelled to cover the operation phase of the Project. In addition, to represent a worst-case scenario for the assessment, all WTGs were assumed to be operating simultaneously and for 24 hours. Noise generation had been considered at the hub height of 80 m above ground. As a conservative approach to the assessment, atmospheric absorption during sound transmission was not included in the assessment. Local terrain has been considered for putting noise sources as well as receptors in the model.

Other two scenarios have been modelled with moderate and normal wind conditions, with an assumption that the WTGs are operational at standardised wind speed of 5 m/s and 3 m/s at 10 m height. All other assumptions were considered similar to the worst case scenario.

Predicted Noise Levels at Receptors: The predicted noise levels within the study domain during daytime with strong, moderate and normal wind conditions

Figure 8.3 xx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566928
569976
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2682240
2679192
2676144
2673096
Bareliya Amra
Nariya Buzurg
Manpura
Bakrakheri
Jhiloniya
Barkheda Uda
C:\Users\Naval.Chaudhary\Documents\Noise Modeling\MEIL - Nipaniya\MEIL Nipaniya - Strong Wind Condition.sgs
Customer:
Mytrah Energy India Limited
Project: 50 MW Wind Power Project, Nipaniya, MI
Project No.: 0308489
Map
2
Strong Wind Condition (Vs > 7 ms-1)
Result number 3
Calculation in 1.5 m above ground
Project engineer: NC
Created: 11/18/2015
Processed with SoundPLAN 7.2, Update 12/18/2012
Levels Leq,d
in dB(A)
< 27
27 - 31
31 - 35
35 - 39
39 - 43
43 - 47
47 - 51
51 - 55
55 - 59
>= 59
Signs and symbols
Point receiver
Noise calculation area
Point source
Settlement
Length scale 1:58435
0 500 1000 2000 3000 4000
m
N
ERM

Figure 8.4 xx

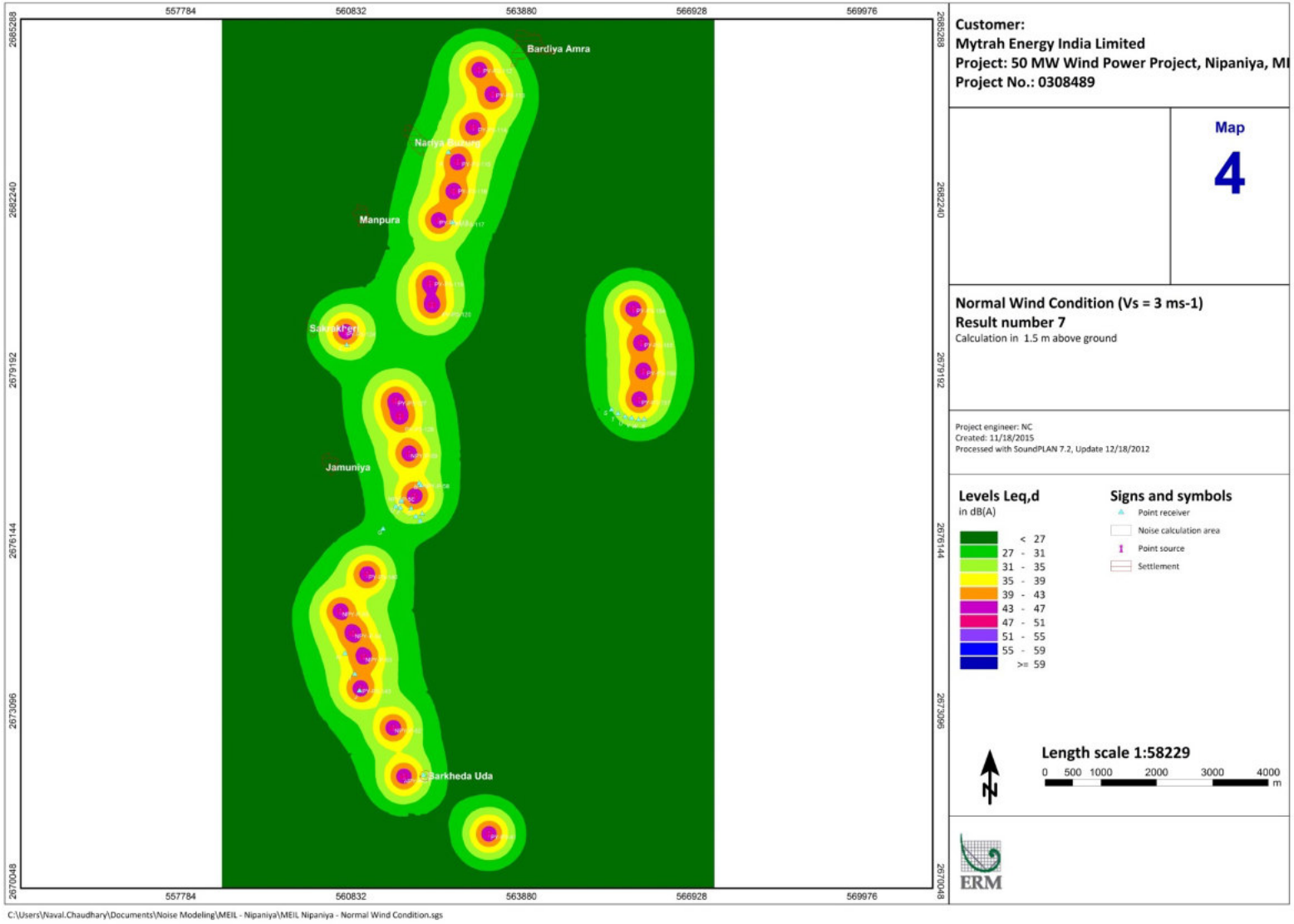
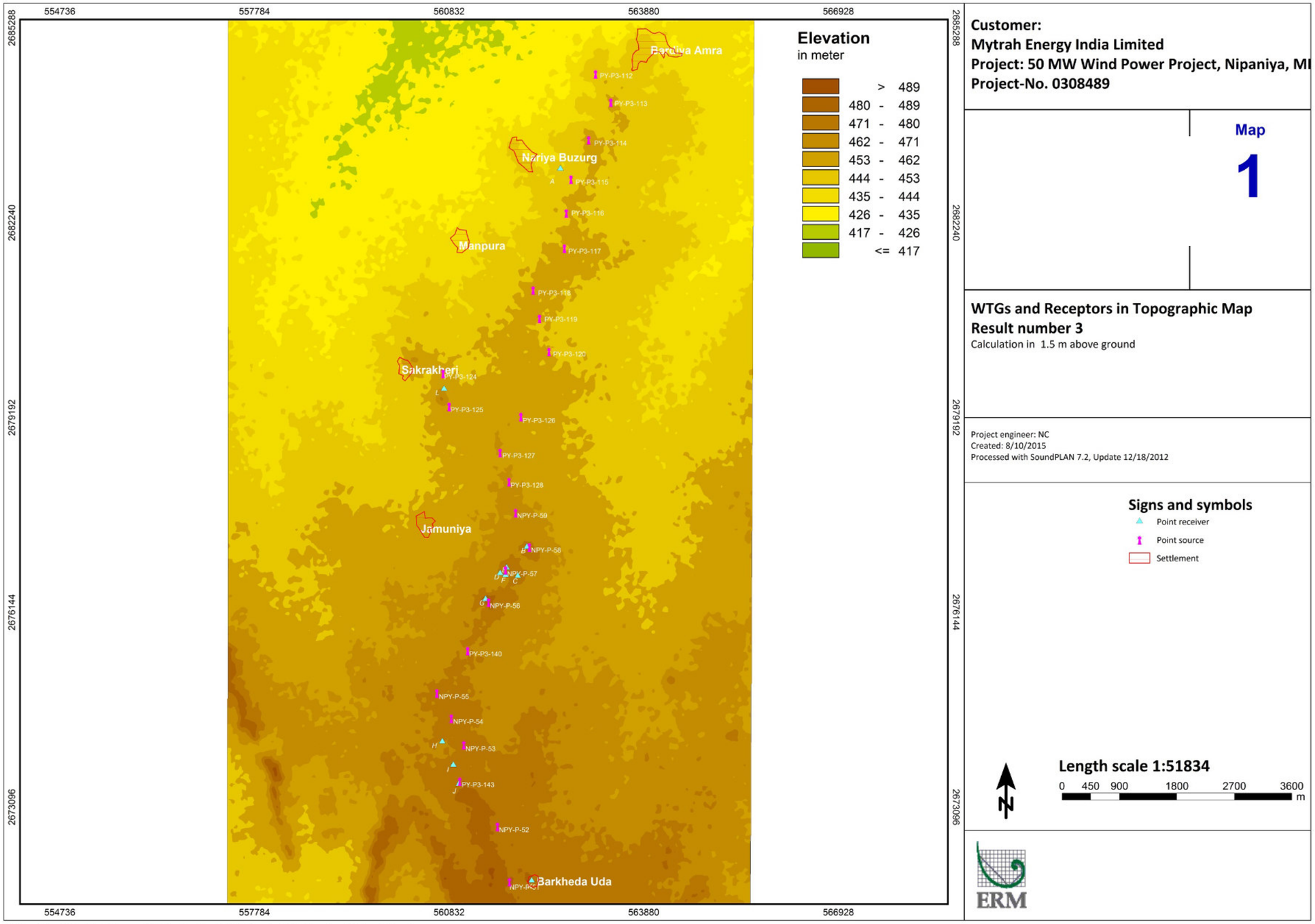


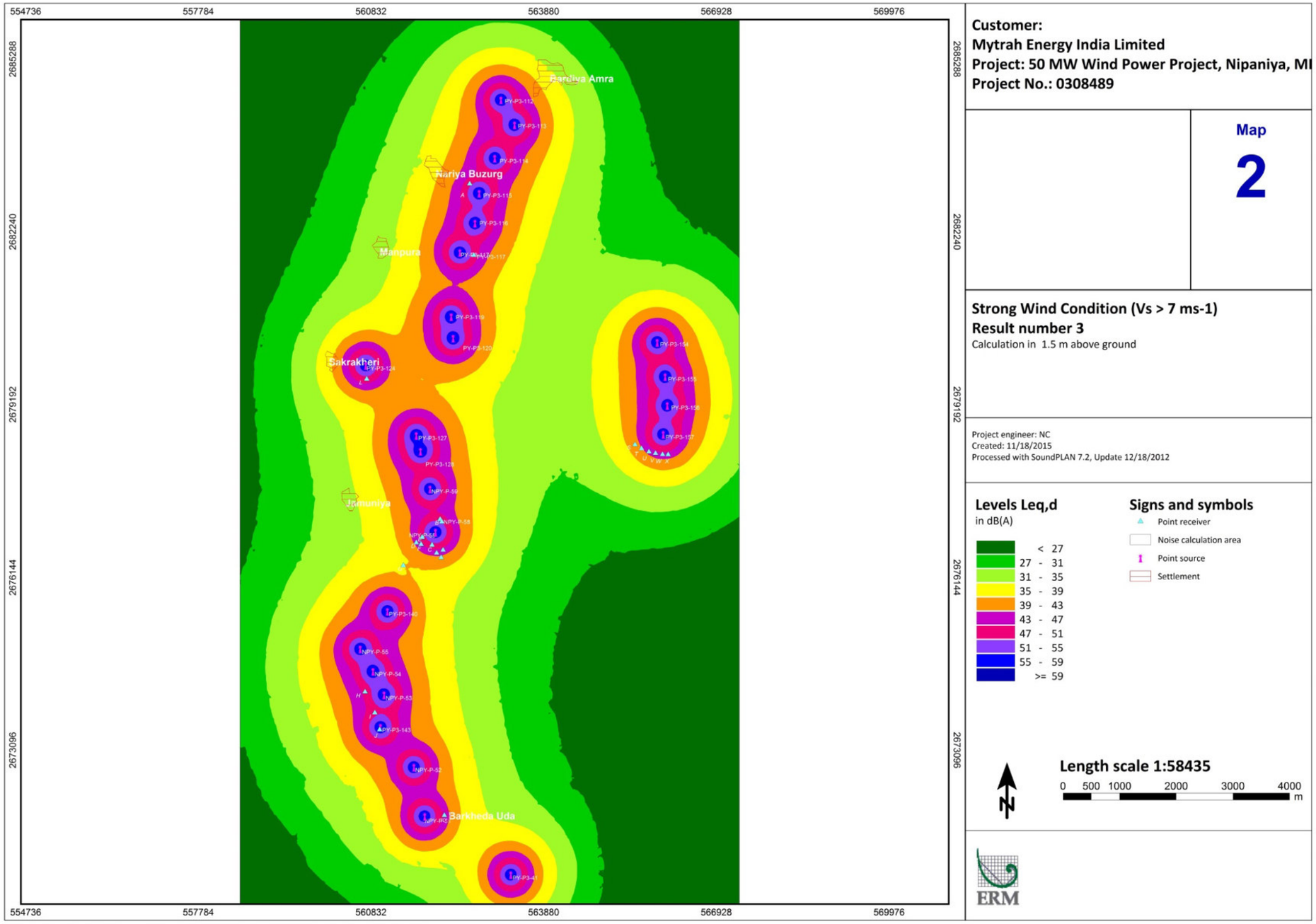
Figure 8.6, respectively. Predicted noise levels at 12 receptors within the study domain have been presented in ***Table 8.34***.

Figure 8.5 *Project Wind Turbines and Noise Sensitive Receptors on topographic map*



C:\Users\Naval.Chaudhary\Documents\Noise Modeling\MEIL - Nipaniya\MEIL Nipaniya - WTGs and Receptors.sgs

Figure 8.6 Predicted Operation Phase Noise Levels of Project with Strong wind conditions



C:\Users\Naval.Chaudhary\Documents\Noise Modeling\MEIL - Nipaniya\MEIL Nipaniya - Strong Wind Condition.sgs

Figure 8.7 Predicted Operation Phase Noise Levels of Project with Moderate Wind Conditions during Daytime (Leq $_d$)

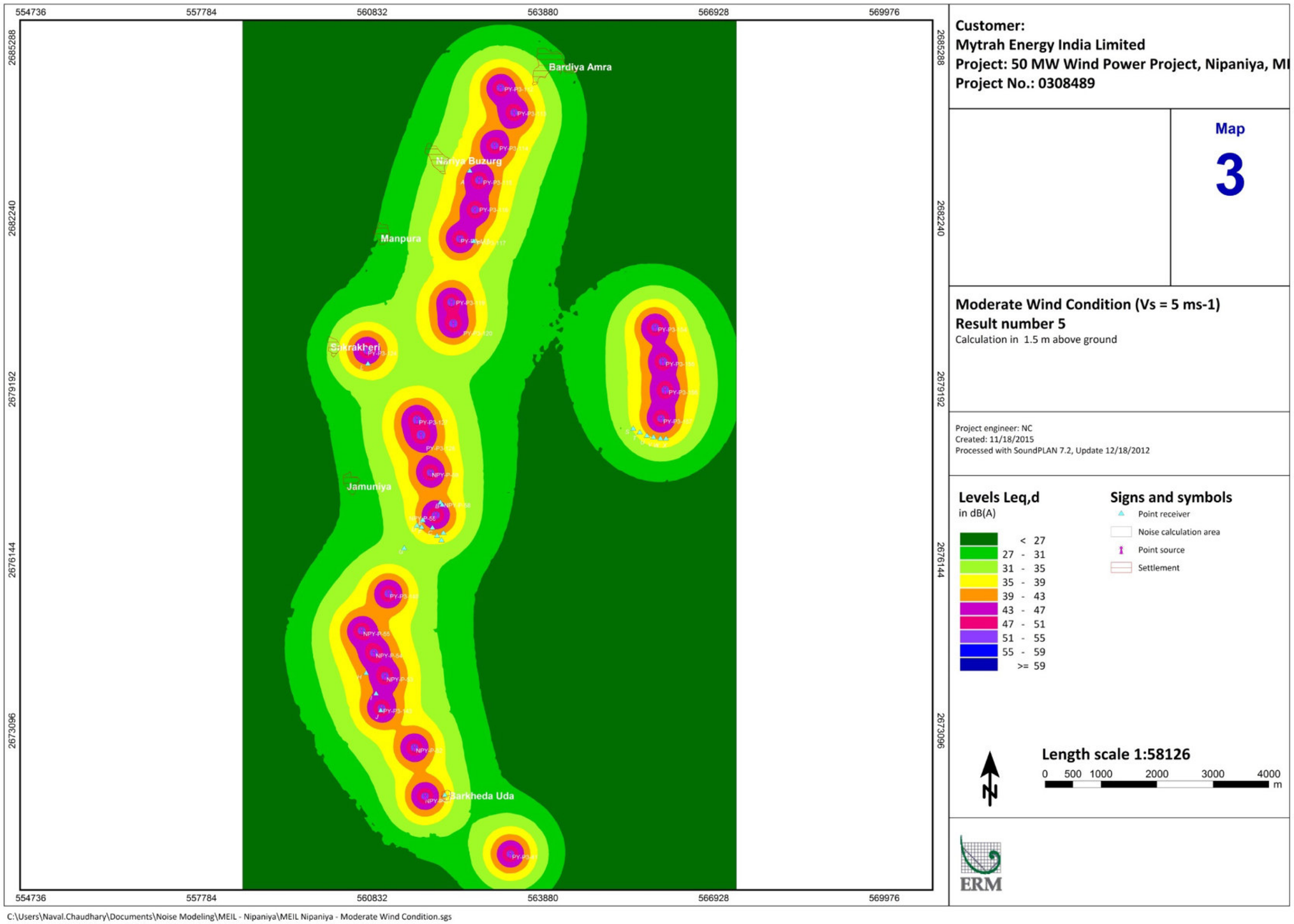


Figure 8.8 Predicted Operation Phase Noise Levels of Project with Normal Wind Conditions during Daytime (Leq $_d$)

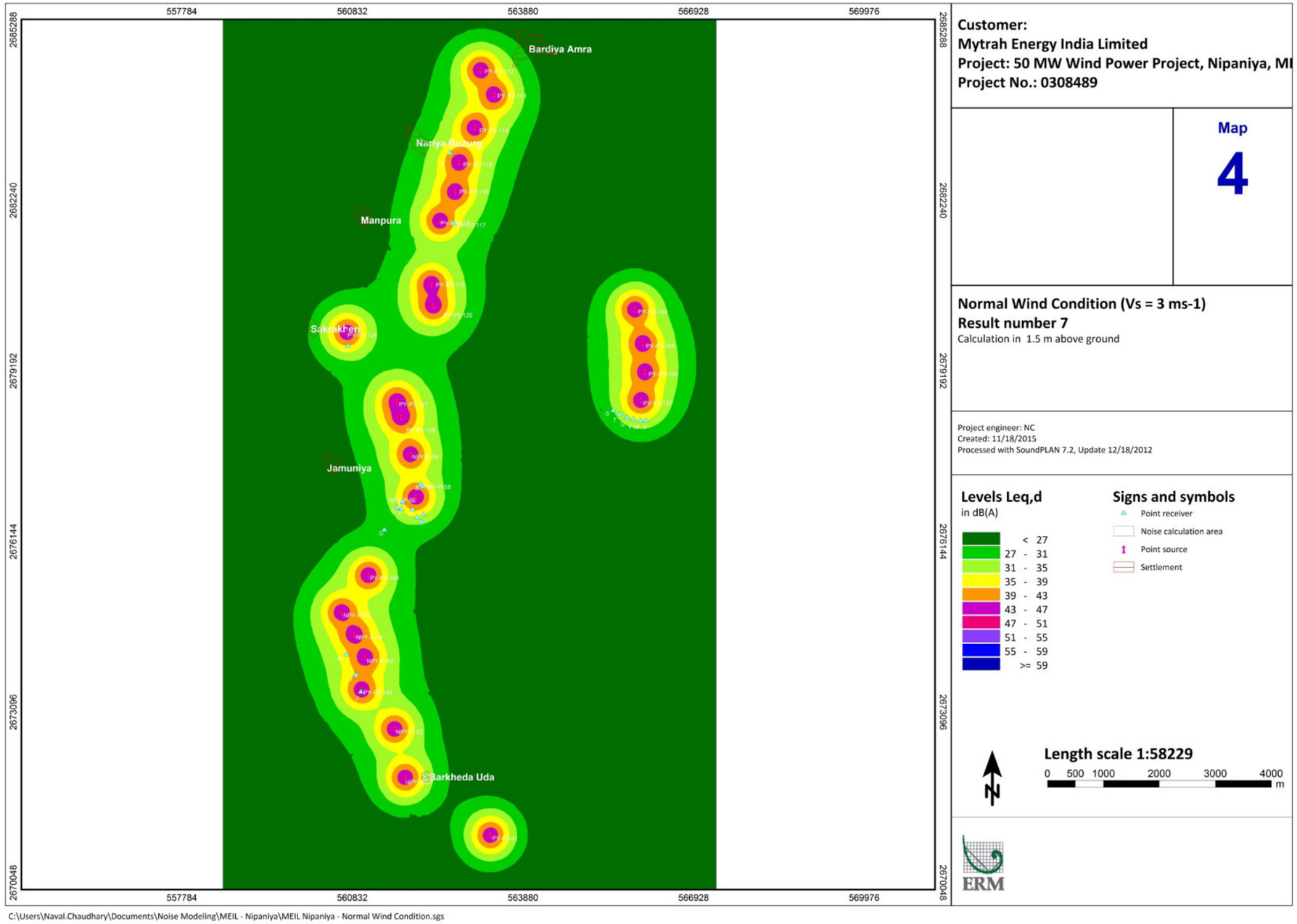


Table 8.34 Predicted Noise Levels at Noise Receptors during Operation Phase of Project with Strong, Moderate and Normal Wind Conditions

Receptor Code	Nearest WTG	Distance from WTG (m)	Baseline Sound Pressure Levels at Receptors, Leq (dBA)[1]		Predicted Sound Pressure Levels at Receptors, Leq (dBA) (Strong Wind)		Predicted Sound Pressure Levels at Receptors, Leq (dBA) (Moderate Wind)		Predicted Sound Pressure Levels at Receptors, Leq (dBA) (Normal Wind)		Total Sound Pressure Level (Baseline + Predicted), Leq (dBA) (Strong Wind)		Total Sound Pressure Level (Baseline + Predicted), Leq (dBA) (Moderate Wind)		Total Sound Pressure Level (Baseline + Predicted), Leq (dBA) (Normal Wind)		Applicable Standard (dB(A))[2] [3] as per Landuse	
			Leq day	Leq night	Leq day	Leq night	Leq day	Leq night	Leq day	Leq night	Leq day	Leq night	Leq day	Leq night	Leq day	Leq night	Day	Night
A	PY-P3-115	220	46.4		49.9	49.9	43.9	43.9	39.6	39.6	**51.5**	**49.9**	**48.3**	**43.9**	**47.2**	**39.6**	*55*	*45*
B	NPY-P-58	240	49.8		49.7	49.7	43.7	43.7	39.4	39.4	**52.8**	**49.7**	**50.8**	**43.7**	**50.2**	**39.4**	*55*	*45*
C	NPY-P-58	240	48.6		49.4	49.4	43.4	43.4	39.1	39.1	**52.0**	**49.4**	**49.7**	**43.4**	**49.1**	**39.1**	*55*	*45*
D	NPY-P-58	390	48.6		41.8	41.8	35.8	35.8	31.5	31.5	**49.4**	**41.8**	**48.8**	**35.8**	**48.7**	**31.5**	*55*	*45*
E	NPY-P-58	260	48.6		48.8	48.8	42.8	42.8	38.5	38.5	**51.7**	**48.8**	**49.6**	**42.8**	**49.0**	**38.5**	*55*	*45*
F	NPY-P-58	340	48.6		45.7	45.7	39.7	39.7	35.4	35.4	**50.4**	**45.7**	**49.1**	**39.7**	**48.8**	**35.4**	*55*	*45*
G	NPY-P-56	820	48.6		38.3	38.3	32.3	32.3	28	28	**49.0**	**38.3**	**48.7**	**32.3**	**48.6**	**28.0**	*50*	*40*
H	NPY-P-53	340	51.2	38.4	48.1	48.1	42.1	42.1	37.8	37.8	**52.9**	**48.5**	**51.7**	**43.6**	**51.4**	**41.1**	*55*	*45*
I	NPY-P3-143	350	50.4	41.6	49.9	49.9	43.9	43.9	39.6	39.6	**53.2**	**50.5**	**51.3**	**45.9**	**50.7**	**43.7**	*55*	*45*
J	NPY-P3-143	50	50.4	41.6	58.1	58.1	52.1	52.1	47.8	47.8	**58.8**	**58.2**	**54.3**	**52.5**	**52.3**	**48.7**	*55*	*45*
K	NPY-P-51	350	50.4	41.6	45.4	45.4	39.4	39.4	35.1	35.1	**51.6**	**46.9**	**50.7**	**43.6**	**50.5**	**42.5**	*55*	*45*
L	NPY-P3-124	240	49.8	42.5	49.2	49.2	43.2	43.2	38.9	38.9	**52.5**	**50.0**	**50.7**	**45.9**	**50.1**	**44.1**	*55*	*45*
M	NPY-P3-117	260			49.3	49.3	43.3	43.3	39	39	**49.3**	**49.3**	**43.3**	**43.3**	**39.0**	**39.0**	*55*	*45*
N	NPY-P3-58	260	48.6		49	49	43	43	38.7	38.7	**49.0**	**49.0**	**43.0**	**43.0**	**38.7**	**38.7**	*55*	*45*
O	NPY-P3-58	370	48.6		44.4	44.4	38.4	38.4	34.1	34.1	**44.4**	**44.4**	**38.4**	**38.4**	**34.1**	**34.1**	*55*	*45*
P	NPY-P3-58	210	48.6		50.5	50.5	44.5	44.5	40.2	40.2	**50.5**	**50.5**	**44.5**	**44.5**	**40.2**	**40.2**	*55*	*45*
Q	NPY-P3-58	480	48.6		42.1	42.1	36.1	36.1	31.8	31.8	**42.1**	**42.1**	**36.1**	**36.1**	**31.8**	**31.8**	*55*	*45*
R	NPY-P3-58	345	48.6		45.3	45.3	39.3	39.3	35	35	**45.3**	**45.3**	**39.3**	**39.3**	**35.0**	**35.0**	*50*	*40*

Receptor Code	Nearest WTG	Distance from WTG (m)	Baseline Sound Pressure Levels at Receptors, Leq (dBA)[1]		Predicted Sound Pressure Levels at Receptors, Leq (dBA) (Strong Wind)		Predicted Sound Pressure Levels at Receptors, Leq (dBA) (Moderate Wind)		Predicted Sound Pressure Levels at Receptors, Leq (dBA) (Normal Wind)		Total Sound Pressure Level (Baseline + Predicted), Leq (dBA) (Strong Wind)		Total Sound Pressure Level (Baseline + Predicted), Leq (dBA) (Moderate Wind)		Total Sound Pressure Level (Baseline + Predicted), Leq (dBA) (Normal Wind)		Applicable Standard (dB(A))[2] [3] as per Landuse	
			Leq day	Leq night	Leq day	Leq night	Leq day	Leq night	Leq day	Leq night	Leq day	Leq night	Leq day	Leq night	Leq day	Leq night	Day	Night
S	NPY-P3-157	500			41.2	41.2	35.2	35.2	30.9	30.9	**41.2**	**41.2**	**35.2**	**35.2**	**30.9**	**30.9**	*55*	*45*
T	NPY-P3-157	455			42.6	42.6	36.6	36.6	32.3	32.3	**42.6**	**42.6**	**36.6**	**36.6**	**32.3**	**32.3**	*55*	*45*
U	NPY-P3-157	400			44	44	38	38	33.7	33.7	**44.0**	**44.0**	**38.0**	**38.0**	**33.7**	**33.7**	*55*	*45*
V	NPY-P3-157	365			45.2	45.2	39.2	39.2	34.9	34.9	**45.2**	**45.2**	**39.2**	**39.2**	**34.9**	**34.9**	*55*	*45*
W	NPY-P3-157	360			45.4	45.4	39.4	39.4	35.1	35.1	**45.4**	**45.4**	**39.4**	**39.4**	**35.1**	**35.1**	*55*	*45*
X	NPY-P3-157	370			45	45	39	39	34.7	34.7	**45.0**	**45.0**	**39.0**	**39.0**	**34.7**	**34.7**		

[1] Predicted noise levels during day and night time will be same as the operation of WTGs has been considered 24 hours and no variation of wind speed during day and nighttime is considered in this assessment.

[2] IFC/WB EHS Guidelines: Noise Management dated April 30, 2007 gives, Noise level guidelines for Residential; institutional and educational receptors in daytime (07:22:00) and night time (22:00-7:00) as 55 and 45 one hour Leq dB(A) respectively. For industrial and commercial receptors it is 70 one hour Leq dB(A) for both night and day time.

[3] Noise standards notified by the MoEF vide gazette notification dated 14 February 2000 as amended in January 2010 based on the *A* weighted equivalent noise level (L_{eq}) for residential areas

Impact Significance

For moderate wind conditions, daytime noise levels will be within the applicable standards at all locations, whereas during night time, this will exceed at only three locations receptor I, J and L. Considering the impact magnitude criteria (refer to ***Table 8.29***), the impact magnitude will be negligible during daytime for all the receptors and small during night time (at receptor J which is an agricultural shed and not used for habitation, I and L which are huts). Therefore, the impact of noise on identified receptors due to operation of WTGs (in predominantly moderate wind condition) during **day** will be **negligible and** at **night time** has been estimated as **negligible to minor**, considering no barrier has been between the source and receptors.

It has also been noted from the DPR (INOX) that annual average wind speed at Nipanya Mast was recorded as 6.23 m/s at 80 m height, which is equivalent to approx. 5 m/s wind speed at 10 m height from ground and considering the same moderate wind condition will be prevailing in the area. Therefore, the impact magnitudes for moderate wind condition, during day and night time will be as follows:

- Daytime: negligible at all receptors
- Nighttime: negligible at 21 receptors to minor at 3 receptors

Mitigation Measures

To mitigate operational noise impacts following measures are proposed:

- Regular maintenance of WTGs;
- Periodic monitoring of noise near to the sources of generation to ensure compliance with design specification; and
- Quarterly monitoring of ambient noise levels (during day and night time)at identified residential receptors for determination of actual impact due to operation of WTGs;
- Only night time predicted noise levels are showing exceedance from the applicable standards and therefore, monitoring of noise during night time at impacted receptors inside the structure to check attenuation caused by the wall/roof material and its comparison with applicable standard;
- If the above two monitoring results confirm the impact and its level, then provide solid noise barriers near the receptors based on the impact magnitude.
- In case of complaints of higher noise levels and discomfort, received from the inhabitants of nearby settlements, possibility of putting noise barriers near to the receptor need to be considered.

Residual Impact

Impact	Noise generation from operation of the WTGs – Day time (moderate wind condition)		
Impact Nature	Negative	Positive	Neutral

Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to within 150 m of WTGs.				
Frequency	Entire Operation phase of Project				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered as **negligible for all the receptors.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Impact	Noise generation from operation of the WTGs – Night time (moderate wind condition)				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to within 500 m of WTGs.				
Frequency	Entire Operation phase of Project				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible to minor. (minor only at Receptor I, J and L)**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

The significance of the residual impact will be **negligible** based on the location post implementation of mitigation measures.

Decommissioning Phase

Similar impacts as during the construction Phase will be observed for ambient noise in the decommissioning phase.

8.5.6 *Impacts on Nearby Establishments (Shadow Flicker Assessment)*

Overview

Shadow flicker is a term used to describe the pattern of alternating light intensity observed when the rotating blades of a wind turbine cast a shadow on a receptor under certain wind and light conditions. Shadow flicker occurs under a limited range of conditions when the sun passes behind the hub of a wind turbine and casts an intermittent shadow over neighbouring properties.

Indian energy planning and environmental policies and legislation contains no specific shadow flicker requirements and recommendations. At present, only Germany has detailed guidelines on limits and conditions for calculating shadow impact.[1]

Box 8.2 International Guidelines for Shadow Flicker Assessment

According to the German guidelines, the limit of the shadow is set by two factors:
- The angle of the sun over the horizon must be at least 3 degrees;
- The blade of the WTG must cover at least 20% of the sun.

The maximum shadow impact for a neighbour to a wind farm according to the German guidelines is:
- Maximum 30 hours per year of astronomical maximum shadow (worst case);
- Maximum 30 minutes worst day of astronomical maximum shadow (worst case); and
- If automatic regulation is used, the real shadow impact must be limited to 8 hours per year.

In Sweden and Denmark there are no official guidelines as yet on shadow flickering, but for practical purposes, 10 hours (Denmark) and 8 hours (Sweden) real case (weather-dependent) shadow impact is used as the limit. In the UK, no official limits are in force, however an assessment must be made at all dwellings within ten rotor diameters of the turbine locations (PPS22 (2004) for England), TAN8 for Wales). In Ireland, a worst-case 30 hours per year, 30 minutes per day limit has been set.

Shadow flicker is most pronounced at sunrise and sunset when shadows are the longest, and at high wind speeds (faster rotating blades leading to faster flicker). A UK government report recommends that for inhabitants near wind turbines, shadow flicker should be limited to 30 hours in a year and 30 minutes in a day[2]. There is anecdotal evidence internationally that shadow flicker could lead to stress and headaches. There is also a fear that shadow flicker, especially in the range of 2.5-50 Hertz (2.5-50 cycles per second) could lead to seizures in epileptics and may also scare away livestock.

An analysis of those conditions that may lead to shadow flicker and the location of potential sensitive receptors (residential and community properties) is provided in this section. The timing and duration of this effect can be theoretically calculated from the geometry of the wind turbines, their

(1) [1] These are found in "Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergianlagen" (WEA-Shattenwurf-Hinweise).

(2) ([2]) Draft EIA Guidelines Wind Power Sector, prepared by Centre for Science and Environment, New Delhi

orientation relative to nearby houses and the latitude of the potential site, using specialised software such as WindPro 3.0.

The results provide the total number of hours in a year when a theoretical shadow flicker will occur. This is most pronounced during sunrise and sunset when the sun's angle is lower and the resulting shadows are longer. However the actual shadow flicker could be substantially lower compared to theoretical values because shadow flicker does not occur where there is vegetation or other obstructions between the turbines and the shadow receptors; if windows facing a turbine are fitted with blinds or shutters; or if the sun is not shining brightly enough to cause shadows.

The theoretical calculations done by WindPro does take into account the reduction in shadow flicker due to topographic features, however it does not take into account the reduction in shadow flicker due to these onsite factors i.e. vegetation. Simple geometry relating to the position of the sun and the angle of the turbine blades can also eliminate or significantly reduce the effects of shadow flicker. In addition, shadow flicker will only occur inside buildings where the flicker is occurring through a narrow window opening.

In India, at present there is no standard in case of non-forest land diversion for wind power projects. However, as per Ministry of Environment, Forests and Climate Change (MoEFCC) guidelines, a minimum distance of 300 m is recommended between windmill and highways or village habitation.

Weather conditions at the site, such as bright sunshine, will greatly enhance the occurrence and intensity of shadow flicker, whereas cloud density, haze or fog will cause a reduction. Receptors further away from the turbines which may have experienced a shadow flicker effect under bright sunshine conditions will, as a result of these weather conditions, experience either no effect or one which is greatly reduced in intensity.

The distance between receptors and turbines has a large effect on the intensity of shadow flicker. Shadow flicker intensity can be defined as the difference in brightness between the presence and absence of a shadow at any given location. This study does not examine variations in intensity but rather the occurrence in number of hours shadow flicker may occur, whether or not this is clearly distinct or barely noticeable. The assessment assumes a conservative worst case of bright sunshine conditions in all periods when flicker may occur.

Considering all of the above points, the likelihood of shadow flicker occurring is greatest when the circumstances listed below exist simultaneously.

- The receptor is at a position which is between 130° clockwise (1) and anticlockwise from north and located within 10 turbine rotor diameters of the wind turbine (~1000 m).

(1) It is acknowledged by this assessment however that India is at lower latitude than the European countries and therefore angles of shadow flicker may be narrower.

- The sun is shining and visible in the sky in line with the monthly mean sun-shine hours at nearby location.
- The wind speeds are between 3 m/s and 22 m/s and the turbine is therefore in operation.
- The turbine blades are perpendicular to the line between the sun and the observer or receptor most of time as per reported wind mast data.

Due to lack of data regarding epilepsy rates in India and operation levels below of 1 Hz for modern turbines, seizures caused by shadow flicker are considered to be extremely unlikely. The turbines (proposed to be used in this Project) being considered operate at a frequency outside the range where negative health effects may result (1). Potential effects on people are likely to be limited to nuisance.

Potential Significant Impacts

In India at present, there is no agreed level of shadow flicker identified as causing a significant effect. However, the Danish Wind Industry Association note on their website that in Germany, the rule of thumb is that 30 hours shadow flicker a year received at a property is acceptable (2). The 'Wind Energy Development Guidelines, 2006' published by the Irish Government Department of the Environment, Heritage and Local Government recommend that shadow flicker at neighbouring offices and dwellings within 500 m should not exceed 30 hours per year. A threshold of 30 hours per year has therefore been considered and applied for this assessment.

Assessment Methodology and Modelling

Shadow flicker calculations have been made using WindPro software. The model used in this analysis is very conservative and assumes the following conditions:

- the mean monthly sunshine hours have been taken from the India Meteorological Department (IMD) station at Ahmedabad covering the data period (1969 – 1993)[3];
- the wind turbines have been considered operational with wind speed more than 3 m/s and for the same wind mast data has been considered, which indicates that about 90% time of the year, the wind turbines will be operational;
- the blades of the wind turbines are perpendicular with northwest - southeast orientation have been considered based on the predominant

(1) See Health and Safety Executive/Local Authority Enforcement Liaison Committee (HELA) circular, entitled 'Disco Lights and Flicker Sensitive Epilepsy' (available at http://www.hse.gov.uk/lau/lacs/51-1.htm). It provides medical details on flicker frequencies likely to give rise to epileptic effects. It states: 'In 1971 the Greater London Council banned the use of flicker rates greater than 8 fps but to be effective the above figures show that any advice on restriction of flicker rate has to limit the frequency to below 5 fps.'

(2) www.windpower.org

(1) [3] Available in WindPro database of climatological data

wind direction available from the wind mast data at site, which could result in maximum possible size circular/ elliptical;
- there are no trees, buildings or vegetation on the surface which may obscure the line of sight between shadow receptor and turbine;
- the sun can be represented as a single point;
- Flicker is ignored if sun is less than 3° above horizon (due to atmospheric diffusion/ low radiation/ sheltering);
- structures identified within within settlements are considered as shadow receptors.

The following data inputs were used in this study:
- a digital elevation model of the site (National Aeronautic and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) Data at 30 m resolution);
- latitude and longitude at centre of the site used to calculate the position of the sun (calculated in GIS using UTM co-ordinates);
- mean monthly sun-shine hours recorded over a period of 25 years at a nearby IMD solar radiation station (Ahmedabad);
- turbine locations – coordinates (identified in GIS);
- turbine rotor diameter for INOX WT 2000 DF 100 make turbine is 100 m;
- height to bottom of Turbine hub for INOX WT 2000 DF 100 make turbines is 80 m;
- tilt angle of the 'window' (always assumed vertical);
- shadow receptors contain on openings measuring 0.9 m by 1.2 m facing towards the closest wind turbines; and
- height above ground level of the 'window' 0.9 m.

Receptors

The maximum horizontal distance between a receptor affected by shadow flicker and turbine location for example has been identified as being equal to the diameter of the turbine multiplied by ten. In this instance, turbine rotor diameter is 100 m; and therefore an area envelope of 1000 m from the nearest turbine is used in shadow flicker analyses. However, the shadow receptors have been taken into consideration falling within 500 m from each of the WTG as the impact of shadow flicker reduces with distance.

Figure 8.7 shows the study area of the assessment (within 500 m) of each of the proposed wind turbine location and the surrounding nearby settlements. A total of 23 receptor[1] have been identified as being within the study area of the wind farm (See ***Figure 8.7***) falling under different villages. All the shadow receptors considered in this study are located within 500 m from any of the WTG location. Project data overview has been presented in ***Annexure D*** which provides the details of WTGs in the study area as well as location details of the shadow receptors considered in this study.

(1) [1] Where any settlement was noticed within the study area, only 2-5 shadow receptors close to the WTGs were considered as shadow receptors. The vacant hutments around the WTGs were not being taken into consideration in this study.

The Model – WindPro Shadow

SHADOW is the WindPRO calculation module that calculates how often and in which intervals a specific neighbour or area will be affected by shadows generated by one or more WTGs. These calculations are worst-case scenarios (astronomical maximum shadow, i.e. calculations which are solely based on the positions of the sun relative to the WTG). Shadow impact may occur when the blades of a WTG pass through the sun's rays seen from a specific spot (e.g. a window in an adjacent settlement). If the weather is overcast or calm, or if the wind direction forces the rotor plane of the WTG to stand parallel with the line between the sun and the neighbour, the WTG will not produce shadow impacts, but the impact will still appear in the calculations. In other words, the calculation is a worst-case scenario, which represents the maximum potential risk of shadow impact. A calendar can be printed for any specific point of observation, which indicates the exact days, and time periods where shadow impact may occur.

Apart from calculating the potential shadow impact at a given neighbour, a map rendering the iso-lines of the shadow impact can also be printed. This printout will render the amount of shadow impact for any spot within the project area.

The calculation of the potential shadow impact at a given shadow receptor is carried out simulating the situation. The position of the sun relative to the WTG rotor disk and the resulting shadow is calculated in steps of 1 minute throughout a complete year. If the shadow of the rotor disk (which in the calculation is assumed solid) at any time casts a shadow reflection on the window, which has been defined as a shadow receptor object, then this step will be registered as 1 minute of potential shadow impact. The following information is required:

- The position of the WTGs (x, y, z coordinates)
- The hub height and rotor diameter of the WTGs
- The position of the shadow receptor object (x, y, z coordinates)
- The size of the window and its orientation, both directional (relative to south) and tilt (angle of window plane to the horizontal).
- The geographic position (latitude and longitude) together with time zone and daylight saving time information.
- A simulation model, which holds information about the earth's orbit and rotation relative to the sun.

The results of the shadow flicker assessment are shown in ***Figure 8.8*** and ***Table 8.35*** below and the supporting graphs provided in ***Annexure E***. The graphs shown in ***Annexure E*** illustrate the times of the year at each of the 23 receptors in the analysis where theoretical shadow flicker was predicted to occur.

Figure 8.9 Study Envelope for Shadow Flicker

Figure 8.10 Flicker Map of the Project

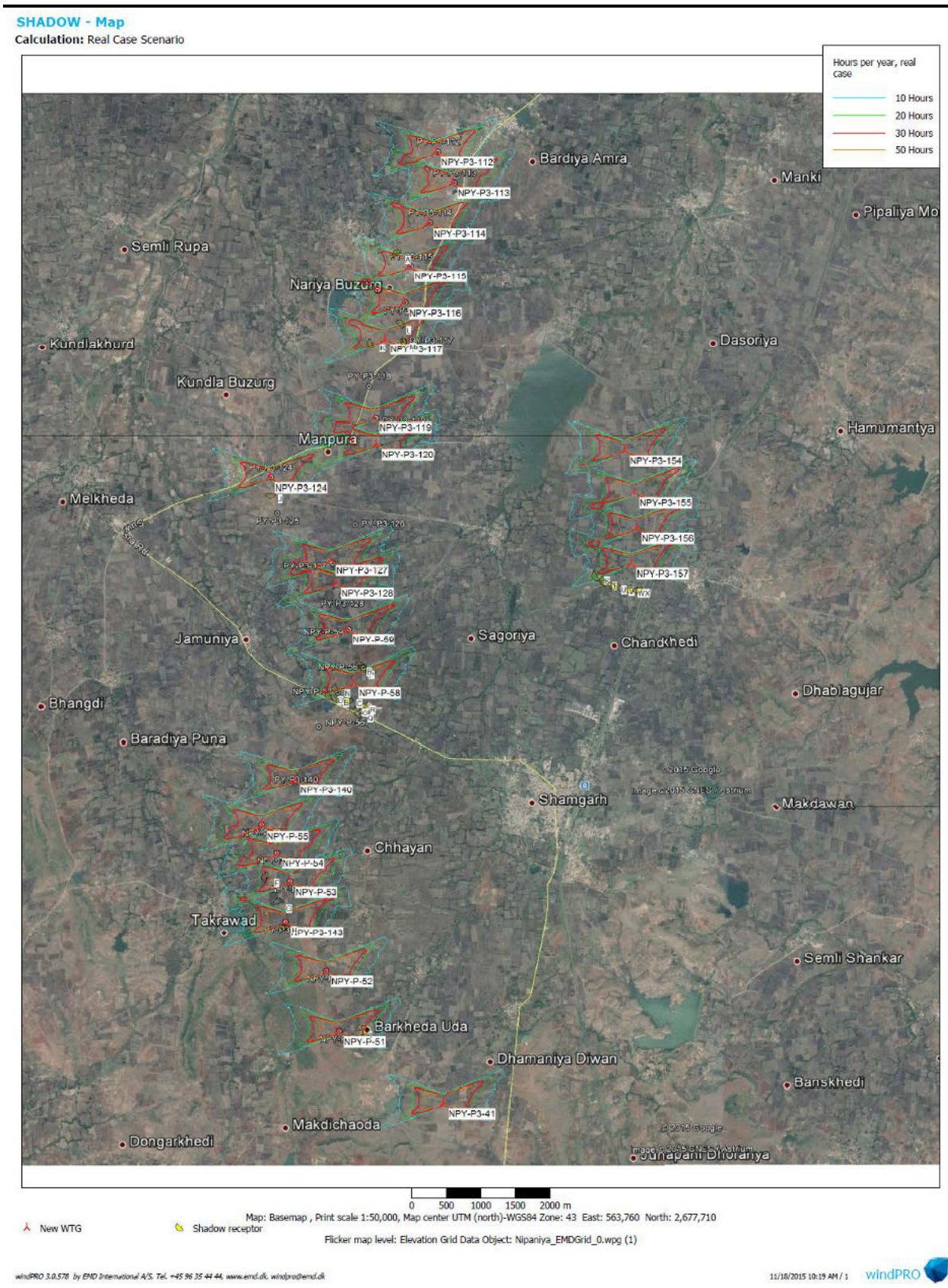


Table 8.35 Shadow Flicker Analysis at Each Receptor

Shadow Receptor	Type of Receptor	UTM Co-ordinates			Nearest WTG	Approximate Distance from Nearest WTG [m]	Direction from WTG (Degree)	Real Case Scenario
		X (m E)	Y (m N)	Z (m)				Shadow hours per year [hr/year] *
A	Pucca Structure (type could not be ascertained)	562,574	2,683,085	446.8	NPY-P3-115	240	316	30:08
B	Residential houses	562,050	2,677,168	474.9	NPY-P-58	240	23	0:00
C	Training institute	561,907	2,676,713	479.2	NPY-P-58	240	193	0:00
D	Cold storage/Warehouse	561,631	2,676,754	471	NPY-P-58	390	240	0:00
E	House	561,715	2,676,725	471.6	NPY-P-58	335	219	0:00
F	House	560,724	2,674,122	472	NPY-P-53	340	287	32:40
G	One hut and one house	560,899	2,673,754	471.1	NPY-P3-143	275	340	0:00
H	Shed type structure for agricultural storage	560,983	2,673,455	476.3	NPY-P3-143	50	191	7:39
I	House in village Barkheda Uda (Pucca and Semi Pucca)	562,126	2,671,944	478.7	NPY-P-51	350	83	32:50
J	Hut	560,754	2,679,641	462.3	NPY-P3-124	240	176	0:00
K	Structure 1 (NPY-P3-117)	562,215	2,681,815	449.9	NPY-P3-117	190	248	80:52
L	Structure 2 (NPY-P3-117)	562601	2682078	454.1	NPY-P3-117	290	45	26:05
M	Structure 3 (NPY-P3-117)	562646	2681827	452	NPY-P3-117	250	102	61:03
N	Structure 1 (WTG_NPY-P-58)	561734	2676853	479.1	NPY-P-58	250	246	60:18
O	Structure 2 (WTG_NPY-P-58)	561990	2676573	469.6	NPY-P-58	370	175	0:00
P	Structure 3 (WTG_NPY-P-58)	562082	2677123	477.2	NPY-P-58	210	34	0:00
Q	Temple (WTG_NPY-P-58)	562068	2676492	467.3	NPY-P-58	460	160	0:00

R	Structure 4 (WTG_NPY-P-58)	562103	2676624	467	NPY-P-58	340	152	0:00
S	Structure 1 (WTG_NPY-P3-157)	565,491	2,678,485	455.9	NPY-P3-157	500	232	26:29
T	Structure 2 (WTG_NPY-P3-157)	565,607	2,678,414	455	NPY-P3-157	460	222	0:00
U	Structure 3 (WTG_NPY-P3-157)	565,736	2,678,357	457.7	NPY-P3-157	400	211	0:00
V	Structure 4 (WTG_NPY-P3-157)	565,853	2,678,331	458.4	NPY-P3-157	360	208	0:00
W	Structure 5 (WTG_NPY-P3-157)	565,976	2,678,310	459	NPY-P3-157	350	180	0:00
X	Structure 6 (WTG_NPY-P3-157)	566,076	2,678,308	458	NPY-P3-157	370	161	0:00

*Figures highlighted and bold represent greater than 30 hours per year of shadow flicker
** WGS84 Zone: 43

Impact Assessment

Given the guidelines of 30 hours or less per year is considered to be acceptable, the operation of the wind farm theoretically results in shadow flicker impacts that could be considered as significant for the purposes of this study. The results show that theoretical shadow flickers in real case scenario occur at 6 shadow receptors. The maximum shadow flicker occurs at shadow receptor 'K', located close to the WTG *NPY-P-117*, with a maximum of 80:52 hr/year followed by receptor 'M' (located close to NPY-P3-117) with 61:03 hr/year and receptor 'N' with 60:18 hr/year (Close to NPY-P-58). The other affected receptors are 'I', 'F', 'and 'A' in decreasing order of hours/year of shadow flicker.

It is relevant to emphasise that predicted hours of shadow flicker effects are real case scenarios with certain assumptions. Assumptions made during the analysis include optimal meteorological, natural light and geometrical conditions for the generation of shadow flicker. The assessment does not account for trees or other obstructions that intervene between receptor and turbine during times when effects may occur. The assessment calculation is therefore an over estimation in the probability of effects. It should also be noted that for shadow effects to occur, properties need to be occupied, with blinds or curtains open and views to the wind turbine unobstructed. However, for the purposes of assessment, it has been assumed that all worst-case circumstances apply.

Mitigation Measures

There needs to be close monitoring through engagement with residents during the operational phase where there are predicted impacts from shadow flicker. The likelihood of direct line of sight to the location of proposed turbine locations can be assessed visually and the potential for using screening like higher fencing and planting trees can be explored at problem locations. The use of curtains can also be explored. If these prove effective and the impacts mitigated, the shutting down of turbines during certain environmental conditions, which meet the physical requirements for theoretical shadow flicker to occur, will not be required.

Should the impact of shadow flicker be identified, and the mitigation measures proposed above prove ineffective, further analysis can be carried out to identify the exact timings and conditions under which shadow flicker occurs, and a technical solution sought. This is likely to involve pre-programming the turbine with dates and times when shadow flicker would cause a nuisance for nearby receptors. A photosensitive cell can be used to monitor sunlight, and the turbine could potentially then be shut down, when the strength of the sun, wind speed and the angle and position of the sun combines to cause a flicker nuisance.

Table 8.36 Impact Significance of Shadow Flickering

Impact	Shadow Flickering during the Operation Phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Within 350 -400 m from the WTGs on the receptors located in the SE-NE and SW-NW orientation from the WTG/s.				
Frequency	during sunny days				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of Social Receptors	Low	Medium	High		
	Out of total receptors considered in the study only 6 are impacted show small impact (<100 hrs/year). Remaining shadow receptors indicate negligible impact (i.e. < 30 hrs/ year).				
Impact Significance	Negligible	Minor	Moderate	Major	
	Considering the overall impact magnitude and vulnerability of social receptors, the impact significance is assessed as **minor for the 6 receptors and negligible for rest of the receptors.**.				

Assessment of Residual Impacts

The results of the WindPro shadow flicker assessment show a real case estimate with certain assumptions and the mitigation measures above will be implemented for the identified properties that experiences shadow flicker.

Residual impacts following the application of required mitigation measures, as discussed above, is likely to result in **negligible** to **minor** impacts.

8.5.7 Impact Due to Climate change

Project Nipanya can be at a risk from the potential impacts of climate change as changes in wind speed, temperature, precipitation etc. For this MEIL has ensured the design by considering following data/ reports.

- Soil testing report
- Weather conditions – Rainfall, Temperature , wind speed , wind direction
- Total weight of Nazzle and Weight of Nacelle and blade.

Generally the past 20 years data is considered. Based upon the analysis, designing is done by manufacturer keeping in view all the adverse factors.

Climate Change impacting wind speed

One of the major impacting factor for viability of the project is the change in wind speed. Wind speed and cloudiness are strongly influenced by local temperature gradients as well as large-scale climate oscillations such as the El Nino Southern Oscillation (ENSO) and Madden-Julian Oscillation (MJO),

which could behave differently in the future[1]. Meehl et al. [2]report that peak wind speeds will likely increase with increasing temperatures, and Hazeleger[3] suggests that the trade winds in particular are likely to change.

In fact, understanding the impacts of climate change on both aerosols in the atmosphere and boundary layer wind speed are problematic because of the spatial scale of current General Circulation Models (GCMs). Studies have begun to elucidate the impact of climate change on wind and solar parameters, but the subject is less studied.

Preliminary evidence indicates the impact of climate change on wind is likely to be mild over a current project's 20-25 year lifetime[4]. There are hints in the models of modest change over 40 to 50 years[5].

Dr Pascal Storck, global manager of energy services at weather monitoring firm Vaisala, points to a number of studies that have examined the trends either historically, using data, or looking to the future with climate model projections. "The take-away from these studies is that there are probably trends in wind speed connected to climate change, but they are small, they vary regionally, and are not consistently of the same sign,".

Based on the above details, it is anticipated that wind speed changes would not occur in immediate 10 years.

8.6 KEY ECOLOGICAL IMPACTS

Criteria

The criteria of impact assessments were undertaken based on following impact assessment matrix as presented in ***Table 8.37*** for Habitats and ***Table 8.38*** for species.

[1] M. Rauthe, A. Hense, H. Paeth, A model intercomparison study of climate change-signals in extratropical circulation, Int J Clim, 24 (5) (2004), pp. 643–662

[2] Meehl GA, Stocker TF, Collins WD, Friedlingstein P, Gaye AT, Gregory JM, Kitoh A, Knutti R, Murphy JM, Noda A, Raper SCB, Watterson IG, Weaver AJ, Zhao Z.-C. Global Climate Projections. In: Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M, Miller HL, editors. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA; 2007.

[3] W. Hazeleger, Can global warming affect tropical ocean heat transport?, Geophys. Res. Lett., 32 (2005), p. L22701 http://dx.doi.org/10.1029/2005GL023450

[4] http://www.windpowermonthly.com/article/1358574/wind-gears-climate-change-impact

[5] Dr Michael Brower, president and CTO of renewable engineering consultancy AWS Truepower, http://www.windpowermonthly.com/article/1358574/wind-gears-climate-change-impact

Table 8.37 Habitat-Impact Assessment Criteria

Habitat Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	Small	Medium	Large
Negligible	Habitats with negligible interest for biodiversity.	Not significant	Not significant	Not significant	Not significant
Low	Habitats with no, or only a local designation / recognition, habitats of significance for species listed as of Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion.	Not significant	Not significant	Minor	Moderate
Medium	Habitats within nationally designated or recognised areas, habitats of significant importance to globally Vulnerable (VU) Near Threatened (NT), or Data Deficient (DD) species, habitats of significant importance for nationally restricted range species, habitats supporting nationally significant concentrations of migratory species and / or congregatory species, and low value habitats used by species of medium value.	Not significant	Minor	Moderate	Major
High	Habitats within internationally designated or recognised areas; habitats of significant importance to globally Critically Endangered (CR) or Endangered (EN) species, habitats of significant importance to endemic and/or globally restricted-range species, habitats supporting globally significant concentrations of migratory species and / or congregatory species, highly threatened and/or unique ecosystems, areas associated with key evolutionary species, and low or medium value habitats used by high value species.	Not significant	Moderate	Major	Critical
Negligible	Effect is within the normal range of natural variation				
Small	Affects only a small area of habitat, such that there is no loss of viability / function of the habitat				
Medium	Affects part of the habitat, but does not threaten the long-term viability / function of the habitat.				
Large	Affects the entire habitat, or a significant proportion of it, and the long-term viability / function of the habitat is threatened.				

Table 8.38 Species-Impact Assessment Criteria

Baseline Species Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	Small	Medium	Large
Negligible	Species with no specific value or importance	Not significant	Not significant	Not significant	Not significant

Baseline Species Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	Small	Medium	Large
	attached to them.				
Low	Species and sub-species of LC on the IUCN Red List, or not meeting criteria for medium or high value.	**Not significant**	**Not significant**	**Minor**	**Moderate**
Medium	Species on IUCN Red List as VU, NT, or DD, species protected under national legislation, nationally restricted range species, nationally important numbers of migratory, or congregatory species, species not meeting criteria for high value, and species vital to the survival of a medium value species.	**Not significant**	**Minor**	**Moderate**	**Major**
High	Species on IUCN Red List as CR, or EN. Species having a globally restricted range (ie plants endemic to a site, or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km2), internationally important numbers of migratory, or congregatory species, key evolutionary species, and species vital to the survival of a high value species.	**Not significant**	**Moderate**	**Major**	**Critical**
Negligible	Effect is within the normal range of variation for the population of the species.				
Small	Effect does not cause a substantial change in the population of the species, or other species dependent on it.				
Medium	Effect causes a substantial change in abundance and / or reduction in distribution of a population over one, or more generations, but does not threaten the long term viability / function of that population, or any population dependent on it.				
Large	Affects entire population, or a significant part of it causing a substantial decline in abundance and / or change in and recovery of the population (or another dependent on it) is not possible either at all, or within several generations due to natural recruitment (reproduction, immigration from unaffected areas).				

The wind farm area is devoid of any major or large vegetation patches. The construction area is government land, the associated ecological impacts of the construction phase are due to following construction activities;

- clearance of vegetation for storage yards;
- laying of WTG foundation and WTG installation
- laying of transmission lines and transmission towers
- laying of approach roads

8.6.2 Clearance of Vegetation

Context

The land clearance activities for the construction activities lead to the removal of vegetation at the WTG location and access roads. Vegetation clearance results in loss of habitat for several species of herpetofauna, birds and mammals thereby denying breeding, roosting and foraging sites. This is also true for terrestrial migrant species that forage within the wind farm area.

Embedded/ in-built control

The impacts during the construction activity will be short term and the construction of the Project will be executed in a phased manner (approximately 10 -12 months). Clearance of vegetation shall be limited to WTG erection site comprising of laydown and crane movement area. The clearance shall be limited to duration required and once the construction activities will cease, the vegetation will allowed to grow naturally.

Significance of Impact

The loss of habitat through vegetation clearance will be temporary prior to mitigation measures. Loss of habitat is at a small scale and does not affect the overall viability/functionality of the overall habitat for the species listed. The impact will furthermore not cause a significant change in the population of species as species recorded are abundant. The impact magnitude is thereby considered small. The transmission line route is selected as such that no tree will be be impacted. To the maximum extent, pruning of some trees may be required to maintain the required clearance for conductors. The habitat is considered of low sensitivity as it harbours species listed of Least Concern (LC) IUCV v2015.4 However as there are several Schedule I species within the wind farm area, species sensitivity is considered medium. Overall residual impact significance (refer to ***Table 8.39***) of habitat loss through vegetation clearance is assessed as ***minor***.

Additional Mitigation Measures

Following mitigation measures will further reduce the impact significance on the habitat and species to negligible.

- Vegetation clearance shall be limited to the project activity area;
- No major vegetation should be removed, alternate route should be planned in case any tree/large shrubs is falling within access road alignment;

- Top soil should be stored separately for restoration of the habitat;
- Strict prohibition on use of fuel wood and shrubs from nearby areas as kitchen fuel;
- Local grass species should be seeded in disturbed areas during monsoon period.

Residual impact significance

The impacts of vegetation clearance will be both direct and indirect and limited to construction phase of the project. Overall residual impact significance (refer to ***Table 8.39***) of the vegetation clearance will remain ***minor***.

Table 8.39 Impact of habitat loss due to Clearance of Vegetation

Impact	Clearance of vegetation				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Wind Farm area (specifically construction areas)				
Frequency	Construction phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Habitat)	Low	Medium	High		
Resource Sensitivity (Species)	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered negligible for habitats and **minor** for species**.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of residual impact for species is considered **minor.**				

8.6.3 Construction Activity

Context

The WTG foundation laying and WTG component installation will require camping/ of work force on site, movement of vehicles for transportation of men and material, construction noise due to excavation etc. These activities will cause habitat disturbance for several species within the wind farm area that will tend to then avoid this area. This moving away from the area could result in abandoning of traditional breeding, roosting and foraging sites and exposure to fresh predators thereby resulting in potential reduced breeding success, impacts on health and survival and higher mortality due to exposure to fresh predators or hunting/trapping by construction workers. Noise

generated by construction activities and vehicle movement may further disturb fauna movement in the nearby areas.

Embedded/ in-built control

The Labour force and the supervisory staff will be provided in-house and external trainings for the situations dealing with wildlife encounters and dos and don'ts while dealing with these situations. Selection of Labour camps, batching plants, equipment laydown areas will be made away from the areas where the wildlife movement is reported.

Significance of Impact

The impacts of construction of WTG foundation and installation of WTG will be both direct and indirect and limited to construction phase of the project. It is at a small scale and does not affect the overall viability/functionality of the overall habitat for the species listed. The impact will furthermore not cause a significant change in the population of species as species numbers are abundant. The impact magnitude is thereby considered small. The habitat is considered of low sensitivity as it harbours species listed as of Least Concern (LC) on IUCN Red List of Threatened Species. However as there are several Schedule I species within the wind farm area, species sensitivity is considered medium.Overall impact significance (Refer to ***Table 8.40***) is assessed as ***minor***.

Additional Mitigation measures

Following mitigation measures will further reduce the impact significance:

- It is suggested to start the project in phased manner, it is suggested to start the work on a set of WTG and then ;
- Construction activities should be avoided at night (0600 pm to 0600 am) in areas where several species of wildlife are active.
- Good housekeeping should be followed for construction activities, waste packaging material should be properly disposed;
- Efforts should be made to minimize construction noise
- Labour movement should be restricted between construction camps and construction sites;
- Camp and kitchen waste should be collected and disposed in a manner that do not attract wild fauna.
- Temporary barriers/danger ribbons should be installed on excavated areas;
- General awareness regarding fauna should be enhanced through trainings, posters etc. among the staff and labourers;
- Proper sanitation facilities should be provided at the labour camps; and
- Anti -poaching/hunting policy should be strictly enforced.

Residual Impact significance

With the implementation of the suggestive measures, the residual impacts on the habitat and species will be **negligible** to **minor**.

Table 8.40 Impact due to construction activities

Impact	Construction activities				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project area (specifically construction areas)				
Frequency	Construction phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Habitat)	Low	Medium	High		
Resource Sensitivity (Species)	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible** to habitat and **minor** to species**.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Largw
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor** for species**.**				

8.6.4 Laying of Approach Roads

Context and receptor

Approach roads are integral to any wind farm projects as they are established usually away from habitation and the main commutation routes. Biodiversity along these therefore tends to be higher. These approach roads are solely used for project related activities. These are generally unpaved and contribute to the dust deposition on the nearby vegetation. Movement of vehicles in unpaved roads often leads to dust deposition on nearby vegetation areas and may affect photosynthesis, respiration, transpiration and overall affect the productivity and hence, quality of habitat. In addition, the construction of new approach roads will lead to reduction in native species diversity of the area and may facilitate introduction of exotic and invasive species and subsequently their range expansion.

Approach roads will also lead to mortality of faunal species crossing the road (especially smaller mammals) and occasionally birds flying across.

Embedded/ in-built control

Road route alignment will be kept as such that no tree or major shrub species are required to be removed. Wherever, feasible existing village/cart road will be upgraded as approach road to minimize the disturbances.

Significance of Impacts

The impacts of laying approach roads will be both direct and indirect and limited to construction phase of the project. Impacts are at a small scale and do not affect the overall viability/functionality of the overall habitat for the species listed. The impact will furthermore not cause a significant change in the population of species as species numbers are abundant. The impact magnitude is thereby considered small. It is at a small scale and does not affect the overall viability/functionality of the overall habitat for the species listed. The impact will furthermore not cause a significant change in the population of species as species numbers are abundant. The impact magnitude is thereby considered small. The habitat and species is considered of low sensitivity as it harbours species listed as of Least Concern (LC) on IUCN Red List of Threatened Species. . Overall impact significance of the construction of approach roads (Refer to ***Table 8.41***) is assessed as ***negligible***

Additional Mitigation measures

The suggestive mitigation measures for minimization of impacts due to laying roads are;

- Construction activities should be planned and undertaken in a phased manner. It is suggested to proceed with sets of WTG together, instead of opening all the areas;
- Project related activities should be avoided during the night time.
- Damage to the natural topography and landscape should be minimized;
- Strict prohibition should be implemented on trapping, hunting or injuring wildlife within the subcontractors and should bring a penalty clause under contractual agreements;
- A minimum possible number of routes should be authorized for use during construction by the labourers and staff,
- Speed limit of the vehicles plying in these routes should be kept 20-25 km/hr to avoid road kill
- Where natural drainage crossing is envisaged at approach roads, culverts should be provided for crossing of herpetofauna species;

Residual Impact significance

With the implementation of the suggestive measures, the residual impacts will remain ***negligible***.

Table 8.41 Impact due to construction of approach road

Impact	Construction of Approach roads				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to approach roads and construction areas				
Frequency	Construction phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Habitat)	Low	Medium	High		
Resource Sensitivity (Species)	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible** for habitat and species.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Largw
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible** for Habitat and Species. **r.**				

Wind farm operations have direct and indirect impacts on the bird and bat communities. The impact during operation phase of the wind farm is discussed in the sections below.

8.6.5 Mortality of Avifaunal and bat species due to collision risk

Context

The general impacts of operation phase on the avifaunal and bat species are discussed in the sections below. A total of 55 species of birds were from the Study are. Egyptian Vulture (*Neophron percnopterus* IUCN 2015 ver. 2-EN) is observed in the study area. A total of ten (10) migratory species were reported in the study area from secondary sources. A total of 10 species are also listed in Sch. I of Wildlife Protection Act 1972 and thus are legally protected species.

As the ESIA study was undertaken in non migratory season and the presence of water body along with the proximity to Gandhi Sagar Reservoir, to understand the use of the study area by migratory birds during migratory season, an initial bird and bat survey was commissioned in November 2015. This study was conducted to assess the impacts of proposed Wind farm on two major faunal groups; the birds and bats. Collision risk is a significant impact, and, birds and bats may be injured or killed by collisions with turbines or rotor blades. The survey evaluated possible impacts of the on IUCN red-listed species present in the area such as Egyptian Vulture (*Neophron percnopterus*) (Endangered (EN) IUCN v2015.4) and Woolly-necked Stork (*Ciconia episcopus*) (IUCN v2015.4 Vulnerable (VU). In addition to this 18

species of the migratory birds were also observed from the study area during the initial bird and bat survey. A requirement was also felt to monitor the migratory bird use for rest of the migratory season. Monitoring was planned in two phases. The first phase monitoring was undertaken in February 2016 while the second phase is scheduled in March 2016. Some more migratory species were observed from the study area.

The survey also evaluated possible impacts on seven Schedule I species (Shikra, Short- toed snake eagle, Black-winged kite, Common Kestrel, Black kite, Egyptian Vulture, Oriental Honey Buzzard) , seven migratory species (Northern Pintail, Bar headed goose, Ruddy Shelduck, Black Stork, Common Kestrel, River Tern, Great Cormorant and Black Winged Stilt). These species were categorised based on flight height in High risk zone.

In absence of operational WTGs, carcass assessment and collision rate assessment were not undertaken.

Livestock carcass disposal is not frequent in the area. If there is any such carcass available, it is disposed by the "Bhil Community "which trades on the skin, flesh and bones of the carcass. There is likelihood that the carcass is left open for a longer periods of time to attract scavengers such as vultures. However, presence of Egyptian vultures suggests availability of carcass for feeding. The collision risk is indicated in the ***Figure 8.9***.

Figure 8.11 Collision Risk to Avifauna (Black Stork)

Source: Site and surrounding areas survey by ERM during 16th to 24th November 2015.

Bird Mortality due to electrocution and possible collision

The transmission line to be used for power evacuation from the WTG to sub-station may pose threat of electrocution to passing bird species. Some bird species tend to use these wires and poles for roosting can get electrocuted.

There are various technical modifications suggested by various avifaunal research and conservation organizations such as Birdlife International to minimize the electrocution of avifaunal species. These modifications are suggested in the mitigation measures.

Initial Bird and Bat survey in November 2015 identified possible risk of electrocution of migratory species and species of conservation significance with the 33 KV transmission line coming from the WTG. One such incident was observed during the Vantage point survey at Vantage point 5 where a migratory bird Black Stork (*Ciconia nigra*) (an IUCN v2015.4 Least concern and IWPA, 1972 listed Sch. IV species) got electrocuted (Refer ***Figure 8.10***). The species could not spot the transmission line as it did not try to avoid it. The species was immediately collected by the local inhabitants and taken away for food. The locals also informed that a few days earlier, another species got electrocuted at the same place which they identified as Greator Flamingo (*Phoeniconaias roseous*) (IUCN v2015.4 Least concern and IWPA, 1972 listed Sch. IV species) with the help of visual aids like field guide for birds. Survey undertaken in February 2016 does not record any such instance.

Figure 8.12 Electrocution of Migratory Species

Collision of Black Stork to 33 KV transmission line

Source: Site and surrounding areas survey by ERM during 16th to 24th November 2015.

Embedded/ in-built control

At present there are no embedded controls as the WTG are yet to be installed, the possible embedded controls can be banding the WTGs blade with orange colour, installation of aviation lamps etc.

Significance of Impacts

There is limited embedded control in the project design presently. The magnitude of the impacts of the WTGs and transmission lines through both collision and electrocution are likely to be long term though their impacts are small as they are likely to affect only a small part of the arial habitat (especially for migratory birds and vultures or other raptors) thereby not affecting overall habitat viability/functionality.

At least three threatened species, have been recorded in the study area.

Based on the above standard we categorize the wind farm area resource sensitivity to be **medium** for habitats as it harbours one Endangered species in limited numbers and **high** with respect to species, due to the predominance of Schedule I species and only one Endangered species and twenty (20) migratory species observed during the initial bird and bat survey (Nov. 2015) and long term bird and bat surveys.

Impacts to these species from collision risk and electrocution risk are categorized as **medium** as there is a risk of collision these may not cause a substantial change in their abundance and / or reduction in distribution of a population over one, or more generations. Also, the collision risk does not threaten the long term viability/function of that population given their widespread range and distribution. Though there is presence of migratory species, and two globally threatened species were observed in the study area, thearea does not qualify the criteria of critical habitat and project as a whole for Category A. The limited impact from the project can be further reduced by implementation of suggested appropriate mitigation measures such as livestock carcass management and electrical pole modification.

The electrocution risk of vultures and migratory species with the transmission line conductors is unlikely as there is sufficient space available between two conductors. The collision by migratory bird species with these conductors is also unlikely as the transmission route is far from waterbodies. The collision risk to endangered species Egyptian vulture is unlikely due to its low abundance in the area.

Additional Mitigation Measures

Following measures to be undertaken for reduction in bird and bat collision:

<u>Additional Mitigation Measures</u>

- To reduce collision risk, livestock carcass management is to be undertaken in the wind farm area. All carcasses detected inside the wind farm area are to be removed and dumped at designated livestock dumping locations. This will reduce the probability of vultures occurring in the wind farm area, thereby reducing the risk of collision with operating WTGs.
- Certain modification is required in the transmission line infrastructure as the same line will be developed by Inox for MEIL and the design is

expected to be same as used by Inox for other developers. This is discussed in section below.

- Herb layer restoration in the WTG area to prevent birds of prey flying in close proximity to the wind farm in search of prey.
- Implementation of the above mitigation measures will involve engagement with relevant stakeholders, such as, discussion with local communities, Madhya Pradesh Forest Department officials *etc.* for livestock carcass management. Likewise, once the mitigation measures have been implemented, in-house monitoring is required to assess the efficacy of the mitigation measures and identify other factors that might be responsible for residual bird and bat mortalities.

Avoidance

Following measure can be considered for avoidance of bird collision with wind turbine blades and electrocution with transmission lines:

Mitigation measures for collision risk

- Flash lamps on the WTGs will prevent bird collision at nights.
- Regular checking of the vacuums or holes in the towers to avoid nesting by any of the birds;

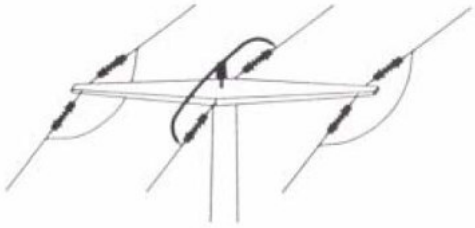
Mitigation measures for Modification of Poles and Conductor design

The bird electrocution is mainly when bird body/wings touches two phase of any power line.

- The transmission poles should be raised with suspended insulators to the extent possible in order to reduce the electrocution of bird species; and
- Marking overhead cables using diffractors and avoiding use over areas of high bird concentrations, for species vulnerable to collision. Bird-safe strain poles require insulating chains at least 60 cm in length should be adopted; uninsulated poles are causing risk of electrocution;
- Cross arms insulators and other parts of power lines shall be constructed so that birds find no opportunity to perch near energized power line that might be hazardous (DIN VDE 0120 1985 – Hass et al 2005) as suggested in ***Figure 8.11.***
- In order to mitigate and minimize the electrocution mortality of birds due to collision, line markers are used (***Box 8.3***), which reduces the risk by increasing the visibility of overhead lines to birds (Sporer *et al.* 2013). For more information on marks and their effectiveness please refer to APLIC (2012).
- Mitigating electrocution effectively is possible through either a) treating poles with insulating caps made of plastic for outdoor use of 130 cm in length - insulating power lines with tubing 130 cm in length. The conductors have to be spaced at a distance of at least 140 cm
- Bird-safe strain poles require insulating chains of at least 60 cm length. Hazardous construction can be mitigated by: a. lengthening of chain, b. installing perch rejecter (Upright "whisk brooms" - picture 3) on the cross arms

Figure 8.13 Electrical Pole Modification

Un insulated Pole chains

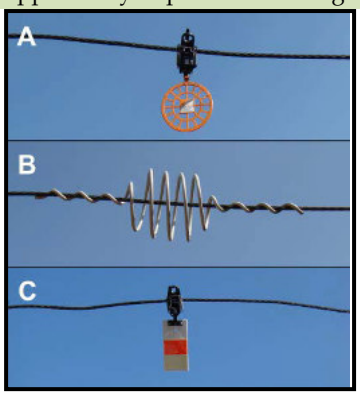


Bird-safe strain poles

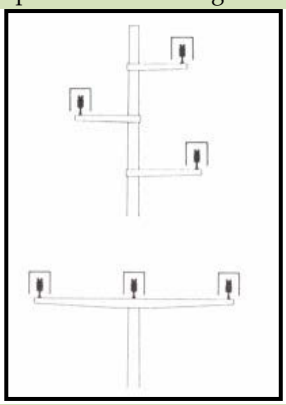
Box 8.3 Power-line markers and cross-arms insulators to minimize collision

Power-line markers used to reduce avian collision in a study in central North Dakota, USA, from 2006 to 2008: (A) BirdMark Flapper (P&R Tech), (B) Swan Flight Diverter (Preformed Line Products), (C) Firefly Flapper (P&R Tech) without moving parts. The scale of all 3 photos is 1m from left edge to right edge. Reproduced from Sporer et al. 2013

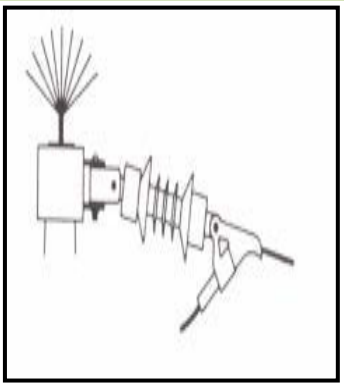
Cross-arms insulators and other parts of power lines shall be constructed so that birds find no opportunity to perch near energized power line that might be hazardous (DIN VDE 0120 1985)



Power line marker



Insulated Caps



Perch rejecter

Residual Impact significance

After implementation of mitigation measures, the significance of the residual impacts will be reduced to **minor** for both species and habitats.

Table 8.42 Impact on birds due to electrocution

Impact	Bird Collision Risk and Electrocution -Operation Phase			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Limited to Project Boundary (specifically WTG locations, substation, Across ROW of internal and external transmission line)			
Frequency	Operation phase			
Likelihood	Likely			

Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Species)	Low	Medium	High		
Resource Sensitivity (Habitat)	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor** for the Habitat while it is **Moderate** for Species				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Largw
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered negligible for Habitat and **minor.** for Species				

8.7 KEY SOCIAL IMPACTS

Criteria

For the assessment of social impacts, the sensitivity and magnitude criteria outlined in ***Table 8.43*** and ***Table 8.44*** respectively have been used.
The social impacts associated with the construction, operations and decommissioning stages have been assessed qualitatively and in some cases quantitatively (subject to availability of data), using professional judgement and based on past experience from similar projects.

Table 8.43 Impact Magnitude for Local Communities

	Extent / Duration / Scale / Frequency
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the area of influence and/or persists over many years. The impact may be experienced over a regional or national area.
Medium	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may potentially be regional in scale.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Negligible	Change remains within the range commonly experienced within the household or community.

Table 8.44 Receptor Sensitivity for Local Communities

Category	
High	Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the Project.
Medium	Some but few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the Project.
Low	Minimal vulnerability; consequently with a high ability to adapt to changes brought by the Project and opportunities associated with it.

On the basis of this understanding of magnitude and sensitivity, the significance of impacts will be assessed, as depicted in the table below.

Table 8.45 Impact Significance Matrix

Receptor Sensitivity	Impact Magnitude			
	Negligible	Small	Medium	Large
Low	Negligible	Negligible	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major
High	Negligible	Moderate	Major	Critical

8.7.2 Community Health and Safety

Context

The receptors for impacts on community health and safety include the local community within the study area who may be present in the vicinity of the project activities. This will include locals residing close to the WTGs, cultivators whose land is close to the WTGs, and those in the area for grazing purposes. The construction phase activities such as the erection of the WTGs, construction of the transmission line and substations and movement of material and personnel may result in impacts on the health and safety of the community. These activities will involve the use of heavy machinery and live transmission power lines. Furthermore, the movement of material and personnel via the access roads may result in injuries to people or livestock due to accidents.

According to the IFC EHS guidelines, the community health and safety risks associated with the construction, operations and decommissioning of onshore wind power projects are similar to those of most large industrial facilities and infrastructure projects. The main risks include structural safety of project infrastructure, life and fire safety, public accessibility and management of emergency situations.

Embedded/ In Built Control

INOX and MEIL both have a health and safety policy in place. The INOX policy will be applicable to all activities being undertaken as part of the project, including the sub-contractor activities. INOX has a safety supervisor on site who is responsible for daily monitoring of the project activities. MEIL will also be involved in monitoring of the project activities to ensure that the requirements of their health and safety standards are met.

Additional Mitigation Measures

In addition to the embedded measures, the following risk mitigation measures are suggested to minimize the risks/hazards of construction activities onsite:

- As part of the stakeholder engagement and information disclosure process, the community will be provided with an understanding of the activities to be undertaken and the precautions taken for safety
- As part of stakeholder engagement, the project will also propagate health awareness amongst the community, including setting up of health camps,
- The traffic movement for the project in the area will be regulated to ensure road and pedestrian (including livestock) safety
- The workers (both regular and contractual) on the project will be provided with trainings on the Health and Safety policy in place, and their role in the same and refresher courses will be provided throughout the life of the project

- Put in place a grievance mechanism to allow for the workers and community members to report any concern or grievance related to project activities

Residual Impact Assessment

The assessment of the residual impacts on community health and safety are given below.

Table 8.46 Impact Significance on Social and Community Health and Safety

Impact	*Social and Community Health and Safety*				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project Footprint area				
Frequency	Project lifecycle				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Moderate**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is considered **Minor**				

Significance of Residual Impacts

The significance of impact will be reduced to **minor** on implementation of mitigation measures.

8.7.3 Accidental Impacts- Blade-throw and Natural Disasters

Context

A failure of the rotor blade can result in the 'throwing' of a rotor blade, which may affect public safety. The overall risk of blade throw is extremely low. Further, there are chances of malfunction or destructions due to natural disasters such as storms, cyclones, earthquakes and lightning.

Receptors

Any communities lying in close proximity to the WTG are receptors of this type of impact. Blade throw risk for public safety is treated as extremely low as in the event of failure the blade can reach between 15-100 m from the wind turbine. Hence, micro-siting guidelines (2x D perpendicular to the predominant wind direction and 3 XD distance in the pre-dominant wind direction) keep this in mind for prescribing a safety setback distance.

The project area is not prone to storms and cyclones and does not fall in an active earthquake prone zone. The Project area falls in Zone III according to the Seismic Hazard Map of India. Zone III is defined as a zone having moderate damage risk zone and vulnerable to earthquakes of intensity MSK VII (as defined by *Building Materials and Technology Promotion Council*).

Embedded/built-in controls

The WTG design and micro-planning guidelines[1] reduces the likelihood of safety risks to public to a great extent. Reportedly, the WTGs have embedded lighting protection. The rotor blades are equipped with a lightning receptors mounted in the blade. The turbine is grounded and shielded to protect against lightning, however, lightning is an unpredictable force of nature, and it is possible that a lightning strike could damage various components notwithstanding the lightning protection deployed in the machine. The lightning may cause fire on the WTG but will have no potential to spread as there is no nearby human habitation and scanty vegetation.

Significance of Impact

Based on the above the impact after implementing the embedded controls is assessed to be **negligible**.

Mitigation/Management Measures

Although the embedded controls are sufficient to address the effects of accidental impacts, we suggest following measures to be included in the ESMS:

- The disaster management cell of the district and the nearest fire-service station should be involved in preparedness for emergency situation;
- Company should ensure it has adequate third party insurance cover to meet the financial loss to any third party due to such emergencies.

Table 8.47 Significance of impacts of accidents

Impact	Accidents and natural disasters			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Within 100 m of the WTGs. There are no communities in close proximity to any of the WTGs.			
Frequency	Operation phase.			
Likelihood	Unlikely			

[1] As per micrositing Guidelines by NIWE, the developor shall leave a distance of 2x D perpendicular to the predominant wind direction and 3 XD distance in the pre-dominant wind direction. This hould be applied for flat and compex terrain.

Impact Magnitude	Positive	Negligible	Small	Medium	Large
Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

8.7.4 Impacts on Economic Opportunities

Context

The receptors for impacts on livelihood profile and economic opportunities include the land sellers and local community within the study area. According to the information available, the land requirement for the project is mostly comprised of private land. However, the details of the impacts of the land procurement on the land holdings are presently not known, as the details of the land requirement are not available for review (***Section 3***).

The construction phase activities of the project including construction of access road, civil works, foundation activities, site clearance and security will involve semi-skilled and unskilled workers. According to the information available, approx. 30% of the contractual workforce will be comprised of local workers.

As discussed in the social baseline (***Section 6.6***), the main livelihood profile in the study area is farm based activities (agriculture and livestock rearing) and non-farm based activities (contractual labour for construction). Based on the discussions with the local community, it is understood that the establishment of the wind power project in the area has resulted in a shift of preferences of the local community from agriculture and livestock rearing for income, with the locals preferring to be employed by the wind power projects during the construction phase and as security personnel. This is primarily resultant from the uncertainities and fluctuations associated with agriculture and the relative stability in income expected from wind power projects and other non-farm based livelihoods. It is also important to note that the main source of non-farm based income in the area, apart from wind power projects is casual labour, with no other major projects or industries located in the area. the wind power projects have thus resulted in an increased exposure of the local community to the non-farm sector. The project is also likely to create a number of indirect economic opportunities in terms of hiring of tractors and cars, setting up of tea shops etc.

During the operations phase, the employment opportunities will be reduced and restricted mainly to the security personnel, housekeeping staff at the site office and any contractual workers required for maintenance activities.

Embedded/ In Built Control

The land procurement is being undertaken in keeping with the present District Circle rates, which is reported to be higher than the prevailing market rates in the area. Also, the project will give preference to the land losers for employment opportunities and has assured employment to at least one individual from each family for the security of the WTGs. However, this employment is likely only for the construction phase of the project, as during the operations phase, only one security guard will be hired for a group of WTGs.

Additional Mitigation Measures

The project is recommended to have the following additional mitigation measures in place:

- To the extent possible, the project should ensure that no land owner is rendered landless due to the land procurement for the project. For this purpose, post the completion of land procurement for WTGs, MEIL will undertake an audit of the land procurement process through a third party to ensure that the land procurement process was undertaken on the basis of willing-buyer willing seller arrangements and that no land owner was severely impacted by the same
- Depending upon the skill requirement, the local community should be given preference for employment, especially in semi-skilled and unskilled work
- The sourcing of local labour wherever possible should be made obligatory for the sub-contractors and in all major procurement activities
- Preference should be given to the vulnerable population in the AoI
- The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labour and resources.

Residual Impact Assessment

The assessment of the residual impacts on economic opportunities is given below.

Table 8.48 Impact Significance on Livelihood Profile and Economic Opportunities

Impact	***Economic Opportunity***				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional	International	
Impact Scale	Limited to Project Footprint area and Shamgarh Tehsil and Mandsaur District				
Frequency	Construction and Operation Phase of the Project				
Likelihood	likely				
Impact Magnitude	Positive	Negligible	small	Medium	Large

Impact	*Economic Opportunity*				
Resource/Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be **Positive**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is considered **Positive**				

Significance of Residual Impacts

The significance of the residual impact will be positive.

8.7.5 *Occupational Health and Safety*

Context

The receptors of the impacts on occupational health and safety include the workers, both regular and contractual working on the project. The construction phase activities such as construction of WTGs, access roads, transmission lines and other project components and maintenance activities in the operations phase are likely to result in a risk on the health and safety of the workers on the project.

According to the IFC EHS Guidelines, the occupational health and safety risks during the construction, operations and decommissioning of an onshore wind power project is generally similar to those of the large industrial facilities and infrastructure projects. The main risks of occupational health and safety include working at heights, working in confined spaces, working with rotating machinery, and falling objects

The details of the manpower requirements in each stage of the project are presently unavailable.

Embedded/In Built Control

INOX and MEIL both have a health and safety policy in place. The INOX policy will be applicable to all activities being undertaken as part of the project, including the sub-contractor activities. INOX has a safety supervisor on site who is responsible for daily monitoring of the project activities. MEIL also will be involved in monitoring of the project activities to ensure that the requirements of their health and safety standards are complied.

Additional Mitigation Measures

In addition to the embedded measures, the following risk mitigation measures are suggested to minimize the risks/hazards related to health and safety onsite:

- The workers (both regular and contractual) on the project will be provided with trainings on the Health and Safety policy in place, and their role in the same and refresher courses will be provided throughout the life of the project
- Establish a grievance redressal mechanism in place, to allow for the employees and workers to report any concern or grievance related to work activities
- Put in place measure to reduce the risk of prevalence of diseases, including screening of workers, undertaking health awareness amongst the workers, implementation of vector control programs, avoiding presence of unsanitary conditions and better facilities in the project site, such as safe drinking water, proper waste collection and disposal etc.

Residual Impact Assessment

The assessment of the residual impacts on occupational health and safety are given below.

Table 8.49 Impact Significance on Occupational Health and Safety

Impact	***Occupational Health and Safety***				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project Footprint area				
Frequency	Project life cycle				
Likelihood	likely				
Impact Magnitude	Positive	Negligible	small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be **Minor**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is considered **negligible to Minor**				

Significance of Residual Impacts

The significance of the impacts will be reduced to Minor on implementation of mitigation measures

8.7.6 Labour Rights and Welfare

Context

The projects will employ skilled, semi-skilled and unskilled workers, across the project lifecycle, which will include contractual and regular employees and local and migrant workers. The regular skilled workers are likely to be comprised of migrant workers, from different districts and states in the country, depending upon the need for technical expertise. The project is likely

to hire 345 contractual workers and 20 workers from MEIL and its subcontractors. The labour camp during the construction phase is located in Melkheda village, and has an accommodation capacity of 40-60 labourers. The remaining labourers will be residing in nearby villages on self-accommodation.

Embedded/In Built Control

MEIL, also as part of its sub-contractor agreements requires each contractor to have an EHS plan in place, as well as procedures for monitoring of the EHS performance of contractors and their workers. It was also reported that INOX regularly monitor the camp facilities, payment of wages and other regulatory requirements. However, the details of the monitoring process and components are presently not available..

Additional Mitigation Measures

The following additional mitigation measures are suggested in order to ensure compliance with labour laws/provisions as per the industry best practices:

- The labour camp and accommodation facility for regular employees should be constructed to meet the requirements of the applicable reference framework in terms of space per worker, water and sanitation facilities, first aid, lighting and ventilation etc. and regular monitoring should be undertaken to ensure compliance through the project lifecycle
- Inox should ensure that the accommodation facilities being used in the villages meet the requirements of the applicable reference framework discussed above;
- MEIL should ensure a monthly monitoring and regular auditing mechanism for monitoring the sub-contractors and suppliers with respect to compliance to the applicable reference framework, in terms of resources, migrant workers, child labour and forced labour, health and safety, payment of wages etc.
- Strengthening security personnel around labour camps in order to maintain adequate law and order and avoid any possible tensions between the migrant workforce and host community.
- Establish a grievance redressal mechanism in place, to allow for the employees and workers to report any concern or grievance related to work activities

Residual Impact Assessment

The assessment of the residual impacts on labour rights and welfare are given below.

Table 8.50 Impact Significance on Labour Rights and Welfare

Impact	***Labour Rights and Welfare***		
Impact Nature	Negative	Positive	Neutral
Impact Type	Direct	Indirect	Induced

Impact	*Labour Rights and Welfare*				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	The project will employ local workers primarily on a contractual basis, including semi-skilled and unskilled workers. Whereas the skilled workers, are expected to be mostly migrant workers and regular employees of INOX.				
Frequency	Project life cycle				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be **Moderate**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is considered **Minor**				

Significance of Residual Impacts

The significance of impact will be reduced to minor on implementation of mitigation measures

8.7.7 *Impact on Indigenous Communities/ Vulnerable Groups*

Context

As discussed in ***Section 6.6.5***, the study area is characterised by a SC population of 22.1% and ST population of 2.5%. The major sub castes of SC population inhabiting the area are Thakur, Meena, Patel Porwal, Chamar, Balai, Seth, Suthar, Harijans, Nai, Bairagi, Lohar, Telis, etc. while the main tribal population is of the Bhil tribe. The livelihood pattern of SC population does not significantly differ from the General community, however, they reportedly possess smaller landholdings and their dependence is higher over agriculture labour and wage labour. There may therefore be difficulties associated with members of SC/ST groups in accessing employment and other supply chain related opportunities.

The land for the project is mostly comprised of private land, however the details of the same is presently not available. The consultant has been unable to ascertain in detail if any land sellers are from Scheduled Castes or Tribes. However, observations in the AoI and Census 2011 data indicates that these groups are broadly indistinct from the general population and exhibit the same patterns of vulnerability as other households (i.e. female headed households, the elderly and those with disabled members).

Embedded/In Built Control

As part of the Community Development Activities in the local villages, MEIL, will identify specific programmes for SC/ST groups and vulnerable groups in the broader AoI.

Additional Mitigation Measures

In addition to the embedded measures, the following additional mitigation measures are identified:

- preference to be given to vulnerable groups in employment and contracting opportunities
- Undertake a profiling of the various social groups in the study area, to understand the individual needs and concerns of the social groups and identify community development and CSR programmes in accordance to the same
- As part of the stakeholder engagement, ensure adequate representation of the SC/ST groups and vulnerable groups identified, and undertake specific engagement activities with these groups
- Ensure that the grievance management mechanism established is accessible to these groups.

Residual Impact Assessment

The assessment of the residual impacts on the Indigenous Communities and Vulnerable Groups is given below.

Table 8.51 Impact Significance on Indigenous Communities/Vulnerable Groups

Impact	***Labour Rights and Welfare***				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	the SC/ST Community and vulnerable groups may be negatively impacted by the project, in case the economic or developmental opportunities generated by the project are not equally accessible to them in comparison to other social groups.				
Frequency	Project life cycle				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be **Minor**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is considered **Negligible**				

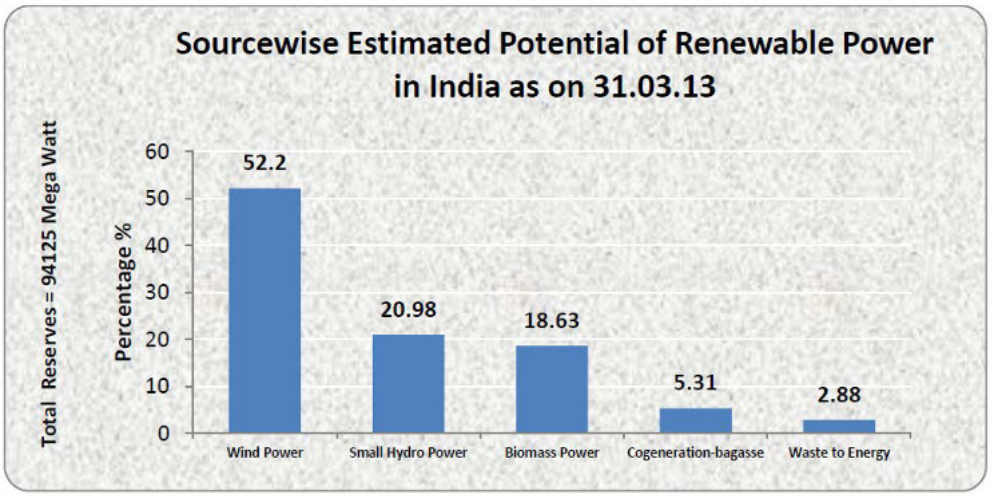
Significance of Residual Impacts

The significance of impact will be reduced to negligible on implementation of mitigation measures.

9.1 THE POWER SCENARIO IN INDIA

India has witnessed unprecedented economic growth over the last decade with real GDP growth of approximately 8.7% in the last five years (7.5% over the last ten years), positioning it amongst the global 'big five' (*Energy Statistics by Central Statistics Office, 2014*). As a consequence of high GDP and the urgency to sustain positive growth, there is surge in energy demand and the need to prospect for new energy reserves and harvest the same. Predictions by the Planning Commission *via* the Twelfth Five Year Plan document indicate that a total of 669.6 million tonnes of oil equivalent (MTOE) will be reached by 2016-17 and 844 MTOE by 2021-22. This will meet around 71 per cent and 69 per cent of expected energy consumption, with the balance to be met from imports, projected to be about 267.8 MTOE by 2016 - 17 and 375.6 MTOE by 2021 - 22. Coal and natural gas (and their imports) will continue to fuel India's growth with a growing need to harvest energy from renewable sources in environmentally responsible and sustainable manner. India generated about 855 BU of electricity in 2012. As of 2012, India had an installed renewable energy capacity about 24.9 GW. During the Eleventh Five Year Plan, nearly 55,000 MW of new generation capacity was created, yet there continued to be an overall energy deficit of 8.7 per cent and peak shortage of 9.0 per cent. Therefore, resources currently allocated to energy supply are not sufficient for narrowing the gap between energy needs and energy availability.

Figure 9.1 Plan wise Growth of Installed Generating Capacity in India



Source: Energy Statistics, 2014

As of 2014, the total potential for renewable power generation in the country as on 31st March, 2013 is estimated at 94125 MW (refer ***Figure 4.1***). This includes wind power potential of 49130 MW (52.2%), SHP (small-hydro power) potential of 19750 MW (20.98%), Biomass power potential of 17,538

MW (18.63%) and 5000 MW (5.31%) from bagasse-based cogeneration in sugar mills.

9.2 ALTERNATIVE SITE LOCATION

Wind energy projects are non -polluting energy generation projects which are site specific and dependent on the availability of wind resource. As per Wind resource mapping and power potential assessment project the option of choosing an alternative area is limited. However as the project is part of a larger 180 MW project being developed by INOX in case of any major issues with a WTG location option for alternative WTG selection can be explored if others are not yet sold.

Alternate Location for WTGs and Associated Facilities

Within the potential area, there is a possibility as well as flexibility of moving the individual WTG locations (micrositing) to avoid any potential environmental and social issue or risks like:

- Total landlessness of a landowner;
- Impact on environmental sensitive receptors like prime agricultural land, vegetation and tree cover, surface water bodies and forests etc.;
- Impacts on nearby residents due to the noise and shadow flickering generated due to the operation of WTGs; and
- Impacts on social sensitive receptors like schools, hospitals, human habitation, individual dwellings, government lands, common property resources etc.

The proposed wind power project site has the following location advantages:

- No ecological sensitive receptor such as national Parks, Wildlife Sanctuary, within 5 km radius; Though forest land exist in the AOI but none of the WTGs and any associated facility are/shall be located within these lands.
- No cultural property of archaeological importance and tribal population is getting impacted;
- No major habitations falling within 500 m of WTG locations.
- Access roads being developed as part of the project can be used by locals.

9.3 ALTERNATE METHODS OF POWER GENERATION

Harnessing wind energy is an eco-friendly process, inexhaustible and possesses a minimal environmental footprint. There are no fuel requirements or large quantities of water for operation of the plant. Wind energy scores over other forms of energy generation as it has a low gestation time: a short lead time is needed to design, install, and start-up (up to a maximum of 2 months after micrositing, approvals and land purchase) a wind farm. ***Table 9.1***

elaborates upon the advantages and disadvantages of various power generation systems.

Table 9.1 Environmental advantages and disadvantages of various power generation systems

Mode	Disadvantage	Advantage
Thermal Power Plant	High fossil fuel consumption. Large quantities of water requirement for cooling High volume of emissions from operation Accumulation of fly ash (in case of coal powered installations) Upstream impact from mining and oil exploration GHG emission estimated as 228gCeq/kWh	Large scale production potential Moderate gestation period Relatively inexpensive Wider distribution potential
Hydropower Plant	Site specific, dependent on reservoir/river etc. Downstream impact on flow Long gestation period Acute and chronic social and ecological impacts	GHG emission estimated as low as 1.1gCeq/kWh for run of river projects
Nuclear Power	Availability of fuel source Hazards associated with radioactive material High cost of project Long gestation period Risk of fallout and meltdown scearios and its impacts on the local populace and environment.	Cheaper power generation GHG emissions as low as 2.5gCeq/kWh
Wind Power	**Land requirement of about 2.0 to 2.5 acres (1 ha approx.) per MW** **Site specific (associated to wind pattern)** **Expensive installation**	**Pollution levels are insignificant** **Inexpensive power generation** **Inexhaustible source** **GHG emissions as low as 2.5gCeq/kWh for the Production Chain**
Solar Power	Large land requirement Site specific to solar insolation Expensive installation Concrete foundation on larger area	Pollution levels are insignificant Inexpensive power generation Inexhaustible source GHG emissions as low as 8.2gCeq/kWh for the Production Chain

Source: International Atomic Energy Agency (IAEA)

9.3.1 Greenhouse Gases (GHG) Emission

As per the estimations of International Atomic Energy Agency (IAEA) the grams of carbon-equivalent (including CO_2, CH_4, N_2O, etc.) per kilowatt-hour of electricity (gCeq/kWh) for wind energy project are low and scores better when compared with other forms of conventional and non-conventional sources of energy. Table 9.2 highlights the advantages and disadvantages along with GHG emissions that each technology possesses.

Considering various factors such as wind resource potential in the project districts; favourable environmental and social settings; low GHG emissions in the project life cycle; land availability, governmental assistance, and local community's acceptance of wind energy projects over the last decade in the region, wind energy based power generation is the most appropriate alternative.

Table 9.2 Green House Emissions from different Electricity Production Chains

Technology	Mean tonnes (CO_2e/GWh)	Low tonnes (CO_2e/GWh)	High tonnes (CO_2e/GWh)
Lignite	1054	790	1372
Coal	888	756	1310
Oil	733	547	935
Natural Gas	499	362	891
Solar PV	85	13	731
Biomass	45	10	101
Nuclear	29	2	130
Hydroelectric	26	2	237
Wind	26	6	124

Source: World Nuclear Association (WNA)

9.3.2 Water Consumption

The water requirements for producing the different primary energy carriers vary; also, there are significant differences between the different types of electricity generation. Several evaluation methods are being employed to assess the footprint of electricity generation through various ways. The methods are often referred to those by the developed regions to compare energy and water uses; where certain measurements and statistics are a common and accepted practice.

Solar and wind power projects have been known to use almost insignificant water, in comparison to nuclear and coal based power projects. Wind farms require small amounts of water are used to clean wind turbine rotor blades in arid climates (where rainfall does not keep the blades clean).

According to the American Wind Energy Association (AWEA), wind therefore uses less than 1/600 as much water per unit of electricity produced as does nuclear, and approximately 1/500 as much as coal. As per AWEA, water consumption (technology gallons/MWh) is as follows: Nuclear – 620; Coal – 490; Oil – 430; Wind – 1; Solar – 30.

9.3.3 Carbon Offsetting

Hydro, solar and wind energy projects help in offsetting CO_2 emissions from conventional power generation. According to National Renewable Energy Laboratory, 1 MW of wind energy results in 2600 tons of CO_2 offsetting. In case of MEIL, 50.4 MW can offset approximately 131000 tons CO_2.

9.3.4 No-Go Alternative

As per the load generation balance report 2015-16 of the Central Electricity Authority, the current power supply scenario and the future forecast indicate a progressive deficit in supply. The ***Table 9.3*** shows the actual power scenario in MP and western region for the year 2014-15 and the ***Table 9.4*** shows the power forecasts for MP for the year 2016-17 and year 2021-2022.

Table 9.3 Actual Power supply scenario in 2014-15 for MP and Western region

State/Region	Requirement (MU)	Availability (MU)	Deficit (MU)	Deficit (%)
Madhya Pradesh	53, 874	53,082	292	0.5
Western Region	317,367	314,923	2,444	0.8

Source: Load generation balance report 2015-16 of the Central Electricity Authority

Table 9.4 Power Forecasts for MP

Parameters	2016-17	2021-22
Electrical Energy Requirement at Power Station Bus Bards (GWh)	70444.570	98986.680
Peak Load (MW)	11772.241	16128.817

Source: Load generation balance report 2013-14 of the Central Electricity Authority

In order to meet the gap in demand and supply, renewable/non-conventional sources of power will be required to supplement the conventional sources. The proposed project being renewable source of power generation will contribute towards bridging the gap between demand and supply.

National Institute of Wind Energy (NIWE) data suggests that at 80 m and 50 m hub-height, an estimated potential of 2,931 MW and 920 MW exists in the state of Madhya Pradesh. The Government of Madhya Pradesh has been encouraging wind power as an additional, alternate source of energy and has notified an investor friendly policy for the development of Wind power projects in the state. Further, the New and Renewable Energy Department has initiated an extensive wind resource assessment program with support from MNRE.

The proposed project presents an opportunity to utilize the potential for wind power generation. A "No Project Scenario" will not address the issue of power shortage. An alternative without the project is undesirable, as it would worsen the power supply-demand scenario, which would be a constraint on economic growth.

9.4 CONCLUSION

Further to the above mentioned reasons, it would be significant to conclude that:

- The Project will be environment friendly with minimal greenhouse gas emissions;
- It is the most feasible and choice of power generation in the state; and
- It will contribute towards the state of Madhya Pradesh attaining self-sufficiency in power supply.
- It is at least at an arieal distance of 16 km from the nearby protected area, however, many wing farm project are at various stages of development awithin 5 km arial distance of the same protected area.
-

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This section presents the Environmental and Social Management Plan (ESMP) for proposed wind farm. The purpose of this ESMP is to specify the standards and controls required to manage and monitor environmental and social impacts during construction and operation phase. To achieve this, the ESMP identifies potential adverse impacts from the planned activities and outlines mitigation measures required to reduce the likely negative effects on the physical, natural and social environment.

10.1 THE COMPANY'S ORGANISATIONAL STRUCTURE

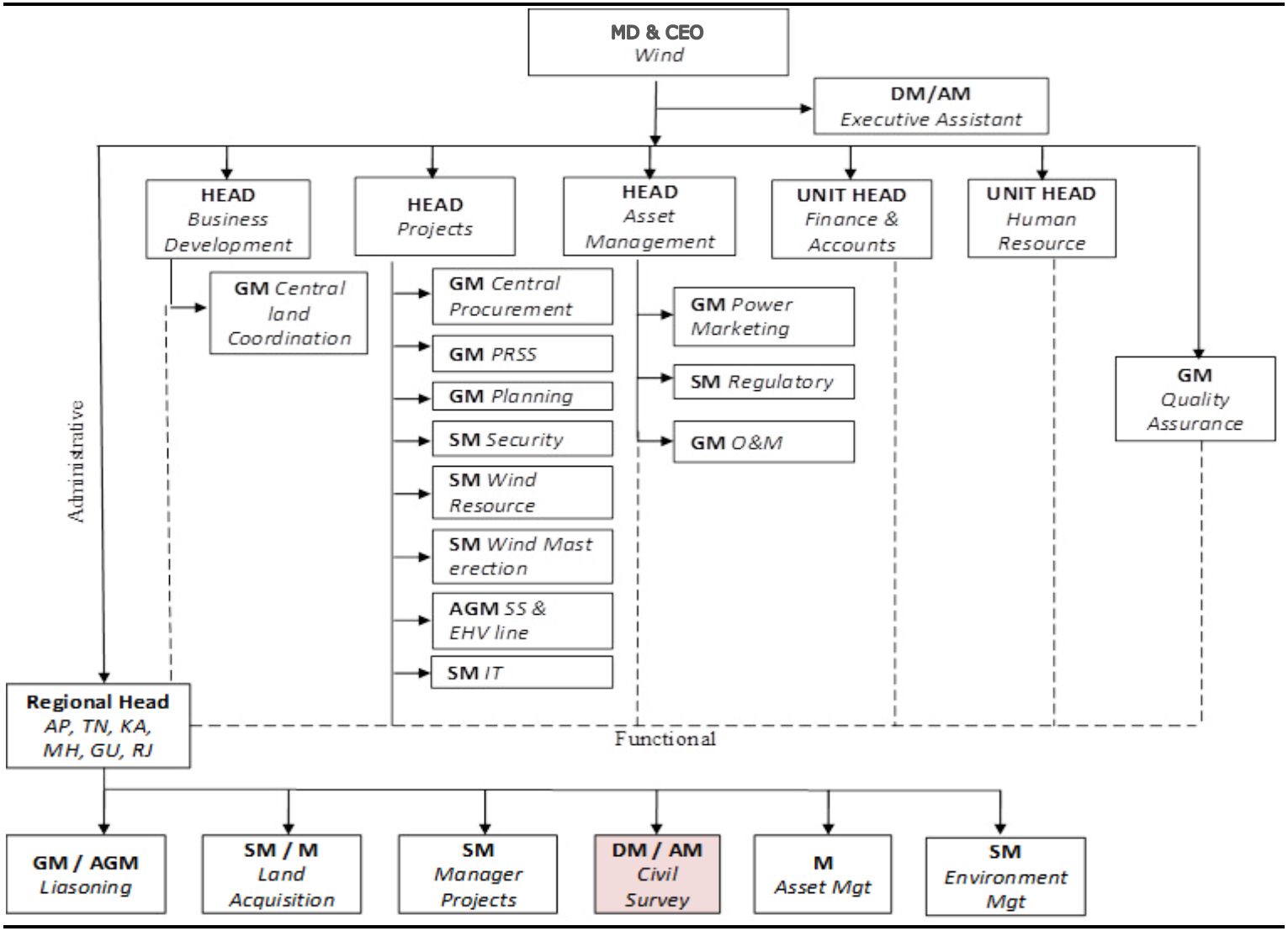
To ensure the efficacy of Environmental and social management plan, certain institutional mechanism with well-defined roles and responsibilities is essential for effective implementation of identified mitigation measures has been put in place for both construction and operation phases.

The organizational structure for environmental management at proposed wind farm is defined below and is subject to change depending on staffing allowance and budgets and will be reviewed on an annual basis to ensure that effective environmental management is accomplished.

10.1.1 Company Structure

The following ***Figure 11.1*** provides a schematic representation of the organizational structure of MEIL at the corporate.

Figure 10.1 Organizational structure of MEIL at Corporate and at Regional level



Source: MEIL

10.1.2 Roles and responsibilities of EHS Department

MEIL will have a corporate EHS Head, who will be responsible for ensuring the implementation of the ESMP.

In addition to the Corporate EHS head, MEIL will have in place regional and project level Engineers looking after EHS along with the respective personnel from EPC. The roles and responsibilities include the implementation of the ESMP, through in-house, EPC sub-contractors and O & M contractor.

The roles and responsibilities of the EHS head and Managers/Project Level Engineers include:

- Develop the training and awareness programme to understand and implement ESMP.
- Monitor processes to ensure that the ESMP accountabilities along with rights and responsibilities of staff and O & M contractors are identified, defined, documented, maintained, understood, and applied.
- Be responsible for ensuring that the inputs consistent with the requirements outlined in the ESMP are provided at project conceptualization, planning, costing, contracting, construction and O&M phases.
- Monitor all internal and external complaints related to EHS and community aspects of MEIL's operations are recorded, acknowledged, and investigated as incidents, the complaints are redressed and feedback provided to aggrieved parties.
- Coordinate effective communication of throughout relevant information on EHS issues and social performance to its own personnel as well as O & M contractor on a regular basis.
- Decision making at all stages to include monitoring corporate and operational site staff and contractors/sub- contractors on ESMP issues.
- Review the systems in place to identify, prioritize, plan, document, and monitor training needs and performance for staff and contractors/ sub-contractors.

10.1.3 Inspection, Monitoring and Audit

Inspection and monitoring of the environmental and social impacts of the project activities will increase the effectiveness of ESMP. Through the process of inspection and auditing, MEIL will ensure that the conditions stipulated in various permits are complied. The inspection and audits will be done by the project identified EHS staff in coordination with O & M contractors and any other external agencies identified. The entire process of inspections and audits should be documented. The inspection and audit findings are to be implemented by the site In-charge (O & M) in coordination with respective departments.

10.1.4 Reporting and Documentation

MEIL will develop and implement a programme of regular reporting through the stages of the project lifecycle involving O & M contractor personnel. The personnel delegated EHS roles shall be required to fully comply with the monitoring programme in terms of timely submissions of reports as per acceptable level of detail. Reporting will be done in form of environmental check list, incident record register, training records, and environmental and social performance reports (weekly, monthly, quarterly, half yearly, yearly etc.).

10.1.5 External Reporting and Communication

The personnel delegated EHS roles shall be responsible for ensuring that the communication with the regulatory agencies and stakeholders is maintained as per the requirement. All complaints and enquiries are to be appropriately dealt with and records be maintained as discussed in ***Section 8***. All communication made to the regulatory agencies shall also be reported to MEIL's regional and corporate EHS head.

10.1.6 Internal Reporting and Communication

Internally, the personnel delegated EHS roles (including O & M) will share inspection and audit findings with their suggested measures regularly to the senior management for their consideration. The same are also to be communicated within the staff working on the project. To maintain an open communication between the staff and management on
EHS and social issues the followings are being used:

- Team Briefings,
- On-site work group meetings;
- Work Specific Instructions;

10.1.7 Documentation

Documentation is an important step in the implementation of the ESMP. MEIL will establish a documentation and record keeping system in keeping with their ESMS, to ensure recording and updating of documents as discussed in the ESMP. Responsibilities have to be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained and that document control is ensured through access by and distribution to, identified personnel in form of the following:

- Master Environment Management System document;
- Legal Register;
- Operation control procedures;
- Work instructions;
- Incident reports;
- Emergency preparedness and response procedures;

- Training records;
- Monitoring reports;
- Auditing reports; and
- Complaints register and issues attended/closed.

MEIL will in coordination with O & M contractor maintain the necessary documentations and assign relevant responsibilities to the contractor.

10.1.8 *ESMP Review and Amendments*

The ESMP acts as an environment and social management tool which needs to be periodically reviewed to address changes in the organization, process or regulatory requirements.

Following a review, Site in charge in coordination with personnel delegated EHS will be responsible for making the amendments in the ESMP and seeking approval from the Regional and Corporate heads. The amended ESMP will be communicated to all the staff on the project and O & M contractors and sub-contractors.

10.2 *TRAINING PROGRAMME AND CAPACITY BUILDING*

Training is needed for effective implementation of ESMP. The training programme will ensure that all concerned members of the team understand the following aspects:

- Purpose of management plan for the project activities;
- Requirements of the management plan and specific Action Plans;
- Understanding of the sensitive environmental and social features within and surrounding the project areas; and
- Aware of the potential risks from the Project activities.

The corporate EHS head through designated personnel will ensure that Environmental health and safety induction training and job specific trainings are identified and given to the concerned personnel for construction activities and during operations of the wind farm. This may also include the O & M contractor and sub-contractors.

Also general environmental awareness will be increased among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. This will help in minimising adverse environmental impacts, compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment will be imparted to the contractors and sub-contractors prior to the commencement of the project.

10.3 *ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN*

This section outlines the potential adverse impacts, mitigation measures, monitoring and management responsibilities during construction and operation phases of the Project.

The purpose of ESMP is to:

- List all suggested mitigation measures and control technologies, safeguards identified through the ESIA process;
- Provide an institutional mechanism with well-defined roles and responsibilities for ensuring that measures identified in ESIA designed to mitigate potentially adverse impacts, are implemented;
- Provide Project monitoring program for effective implementation of the mitigation measures and ascertain efficacy of the environmental management and risk control systems in place; and
- Assist in ensuring compliance with all relevant legislations at local, state and national level for the Project.

In order to minimize adverse impacts during different phases of project lifecycle, mitigation measures, monitoring plan and responsibilities for its implementation are given in ***Table 10.1*** below. The approximate costs of EMP implementation have been estimated to be INR 6 Lakhs and 5 Lakhs for the construction and operation phase respectively by MEIL for Project Nipanya. In case any additional studies are required budget will be allocated accordingly.

Please note the ESMP has mainly focussed on impacts with minor and moderate impacts, for the impacts with negligible significance mitigation measures have already been captured under impacts section and minimal monitoring should be sufficient.

Table 10.1 Proposed Environmental and Social Management Plan for the Nipanya Wind Power Project

S. No,	Environmental/ Social Resource	Activities resulting in Potential impact/ and issues	Mitigation Measure	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase	
										Construction	Operation
1.	**Land Use**										
i.	Land use Change due to	Various construction activities as site clearance,	Construction activities should be restricted to designated area	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.		preperation , setting up pg project facilties as site office, labour accomodation, storage areas, resulting in	Labours should be trained not to disturb flora around the construction site.	MEIL EPC team	• Training Records, • Discussion with EPC, labours • Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iii.		Change in land use	Waste should not be allowed to litter in and around the project area.	MEIL EPC team	Discussion with EPC, Visual inspection for littering	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iv.			On completion of construction activities, land used for temporary facilities shall be restored to the extent possible.	MEIL EPC team / O &M contractor	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☒
v.			The land use in and around the permanent project facilities shall not be disturbed.	MEIL EPC team / O &M contractor	Discussion with EPC/ O & M Visual inspection	Weekly Monitoring	EHS Manager and EPC/ O & M EHS Team	EHS - MEIL	Report from EPC/ O & M to EHS Manager	☒	☒

S. No,	Environmental/ Social Resource	Activities resulting in Potential impact/ and issues	Mitigation Measure	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase	
										Construction	Operation
2.	**Soil and land**										
i.	Soil and land	Establsihment of acess roads, clearing of vegetation, digging of WTG foundations, storage of materials resulting in Soil Erosion	Bunds shall be constructed to prevent soil erosion especially for the construction sites which are near to the water bodies or have slopes.	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.			All excavations should be filled before rainy season	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iii.			The disturbed areas and soil stock piles should be kept moist to the extent possible to avoid wind erosion of soil	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
i.		Heavy vehicular movement, parking, storage resulting in Soil Compaction	Clear demarcation of areas should be done for parking of heavy vehicles/equipment and not allowed to park anywhere	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.			Heavy parts of WTGs should only be transported from the store yard to the WTG locations once it ready to be used.	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iii.			After completion of project activities, in the heavy soil compaction areas, the soil shall be ploughed again to the extent possible to reduce soil compaction.	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐

S. No,	Environmental/ Social Resource	Activities resulting in Potential impact/ and issues	Mitigation Measure	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase	
										Construction	Operation
i.		Impact on land due to improper waste disposal from labour activities, construction activities etc	Municipal domestic waste generated at site to be segregated onsite	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.			Ensure hazardous waste is properly labelled, stored onsite at a location provided with impervious surface, shed and secondary containment system as per in accordance to Hazardous Wastes Rules, 2008	MEIL EPC team /O & M Contractor	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☒
iii.			Ensure routinely disposal of hazardous waste through approved vendors and records are properly documented	MEIL EPC team /O & M Contractor	Discussion with EPC/O & M, Visual inspection	Weekly Monitoring	EHS Manager and EPC/O & M EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☒
iv.			Disposal of hazardous wastes shall be done strictly as per the conditions of authorisation granted by MPPCB	MEIL EPC team /O & M Contractor	Discussion with EPC/O & M, Visual inspection	Weekly Monitoring	EHS Manager and EPC/O & M EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☒
v.			Construction contractor should ensure daily collection and periodic (weekly) disposal of construction waste generated debris, concrete, metal cuttings wastes, waste/used oil etc.	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐

S. No,	Environmental/ Social Resource	Activities resulting in Potential impact/ and issues	Mitigation Measure	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase	
										Construction	Operation
vi.	Soil and land		The municipal waste from the labour camp shall only be routed through proper collection and handover to local municipal body for further disposal. The hazardous wastes shall be temporarily stored in labelled drums on impervious surface at designated area onsite and shall be disposed of through approved vendors in accordance to Hazardous Wastes Rules, 2008. The nearest Common Hazardous Waste transfer Station and Disposal Facility (CHWTSDF) is located at in the same state at Pithampur in Dhar district about 240 km south of project area.	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
i.		Soil Contamination due to Leaks/Spills from vehicles, batching plant, storage yards, loading, unloading, toilets etc	Use of spill control kits to contain and clean small spills and leaks	MEIL EPC team / O & M Contractor	Discussion with EPC/ O & M, Visual inspection	Weekly Monitoring	EHS Manager and EPC/O & M EHS Team	EHS - MEIL	Report from EPC/ O & M to EHS Manager	☒	☒
ii.			The sewage generated onsite will be treated and disposed through septic tanks and soak pits as per specifications given in IS 2470: 1995 (Part I and II)	MEIL EPC team / O & M Contractor	Discussion with EPC/ O & M, Visual inspection	Weekly Monitoring	EHS Manager and EPC/ O & M EHS Team	EHS - MEIL	Report from EPC/ O & M to EHS Manager	☒	☒

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iii.			Transport vehicles and equipment should undergo regular maintenance to avoid any oil leakages	EPC / O & M Contractor	Discussion with EPC/ O & M, Visual inspection	Weekly Monitoring	EHS Manager and EPC/ O & M EHS Team	EHS - MEIL	Report from EPC/ O & M to EHS Manager	☒	☒
iv.			Any unloading and loading protocols should be prepared for diesel, oil and used oil respectively and workers trained to prevent/contain spills and leaks	EPC / O & M Contractor	Discussion with EPC/ O & M, Training Records, Review of Protocols	Weekly Monitoring	EHS Manager and EPC/ O & M EHS Team	EHS - MEIL	Report from EPC/ O & M to EHS Manager	☒	☒
3.	**Water**										
i.	Impact on Water Resources	Impact on water availability due to requirement of water for civil work and requirement for labour	Bunds shall be constructed on the water body side to prevent wash away of sediment load to the water bodies	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.			Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iii.			Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers	MEIL EPC team / O & M Contractor	Discussion with EPC/ O & M, Visual inspection	Weekly Monitoring	EHS Manager and EPC/ O & M EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☒
iv.			Recycling/reusing to the extent possible	MEIL EPC team / O & M Contractor	Discussion with EPC, / O & M Visual inspection	Weekly Monitoring	EHS Manager and EPC/ O & M EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☒

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i.		Impact on Water Quality from improper waste mangemnt, accidental leaks and spills at storage areas etc	Ensure proper cover and stacking of loose construction material at Batching plant site and WTG's site to prevent surface runoff and contamination of receiving water body	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.			Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets. Open defecation and random disposal of sewage will be strictly restricted	MEIL EPC team	Discussion with EPC, Visual inspection, Training Records	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
4.	**Ambient Air Quality**										
i.	Impact on Air Quality	Construction activities, transportation, operation of batching plant, DG sets may have Impact on Air Quality	Burning of any waste material shall be prevented	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.			Labours shall be provided with gas connection to prevent burning of fuel wood for cooking purposes	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iii.			Work shall be ceased or phased down if excess fugitive dust is observed. Source of dust shall be investigated and proper suppression measures ensured	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐

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iv.		Transportation realted actvities	Proper maintenance of engines and use of vehicles with Pollution Under Control (PUC) Certificate shall be ensured	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
5.	**Ambient Noise Levels**										
i.		Operation of DG sets, construction equipment and machinery may have Impact on Ambient Noise Levels	DG set with acoustic enclosures only shall be used	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.			If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components shall be carried out to bring down the noise and placing such machinery far away from the households as possible	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iii.			Machinery and construction equipment that may be in intermittent use should be shut down or throttled down during non-work periods	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iv.			Minimal use of vehicle horns in the area needs to be encouraged	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐

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v.		Operations of WTGs may generate noise	Regular maintenance of WTGs;	O & M Contractor	Discussion with O & M, inspection	Weekly Monitoring	EHS Manager and O & M	EHS - MEIL	Report from O & M to EHS Manager	☐	☒
vi.			Periodic monitoring of noise and consultations near to the sources of generation to ensure compliance with design specification; and check if there are any complaints from residents regarding noise	O & M Contractor	Discussion with O & M, inspection	Weekly Monitoring	EHS Manager and O & M	EHS - MEIL	Report from O & M to EHS Manager	☐	☒
vii.			If the above two monitoring results confirm the impact and its level, then provide solid noise barriers near the receptors based on the impact magnitude.	O & M Contractor	Discussion with O & M, records of monitoring	Weekly Monitoring	EHS Manager and O & M	EHS - MEIL	Report from O & M to EHS Manager	☐	☒
viii.			In case of complaints of higher noise levels and discomfort, received from the inhabitants of nearby settlements, possibility of putting noise barriers near to the receptor need to be considered.	O & M Contractor	Discussion with O & M, complaint book	Weekly Monitoring	EHS Manager and O & M	EHS - MEIL	Report from O & M to EHS Manager	☐	☒
6.	**Shadow Flicker**										

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i.	**Shadow Flicker**	Opeartion of WTGs amy Impact of shadow flicker on nearby residents	Close monitoring of shadow flickering through engagement with residents during the operational phase where there are predicted impacts from shadow flicker. The threshold levels are 30 hrs/year but MEIL can interact with the residents to check if they are facing any disturbance from shadow flickering or not.	O & M Contractor	Discussion with O & M, inspection	Weekly Monitoring	EHS Manager and O & M	EHS - MEIL	Report from O & M to EHS Manager	☐	☒
ii.			Potential for using screening like higher fencing and planting trees if required at problem locations	O & M Contractor with MEIL if required	Discussion with O & M, inspection	If required	EHS Manager and O & M	EHS - MEIL	Report from O & M to EHS Manager	☐	☒
iii.			Identify the exact timings and conditions under which shadow flicker occurs, and a technical solution sought.	EPC/O & M Contractor with MEIL if required	Discussion with EPC/O & M, inspection	If required	EHS Manager and O & M	EHS - MEIL	Report from O & M to EHS Manager	☒	☒
7.	**Ecology**										
i.	Vegetation	Clearance of Vegetation	Vegetation clearance shall be limited to the project activity area	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.			No major vegetation should be removed, alternate route should be planned in case any tree/large shrubs is falling within access road alignment	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐

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iii.			Top soil should be stored separately for restoration of the habitat	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iv.			Strict prohibition on use of fuel wood and shrubs from nearby areas as kitchen fuel	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
v.			Local grass species should be seeded in disturbed areas during monsoon period	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
i.		Construction Activity	It is suggested to start the project in phased manner	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.			Construction activities should be avoided at night (600 pm to 600 am) in areas where several species of wildlife are active	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iii.			Good housekeeping should be followed for construction activities, waste packaging material should be properly disposed	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iv.			Efforts should be made to minimize construction noise	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐

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v.			Labour movement should be restricted between construction camps and construction sites	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
vi.			Camp and kitchen waste should be collected and disposed in a manner that do not attract wild fauna	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
vii.			Temporary barriers/danger ribbons should be installed on excavated areas	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
viii.			General awareness regarding fauna should be enhanced through trainings, posters etc. among the staff and labourers	MEIL EPC team	Discussion with EPC, Visual inspection, Training Records	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ix.			Proper sanitation facilities should be provided at the labour camps	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
x.			Anti -poaching/hunting policy should be strictly enforced	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
i.		Laying of Approach Roads	Construction activities should be planned and undertaken in a phased manner. It is suggested to proceed with sets of WTG together, instead of opening all the areas	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐

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ii.			Project related activities should be avoided during the night time	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iii.			Damage to the natural topography and landscape should be minimized	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iv.			Strict prohibition should be implemented on trapping, hunting or injuring wildlife within the subcontractors and should bring a penalty clause under contractual agreements	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
v.			A minimum possible number of routes should be authorized for use during construction by the labourers and staff	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
vi.			Speed limit of the vehicles plying in these routes should be kept 20-25 km/hr to avoid road kill	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
vii.			Where natural drainage crossing is envisaged at approach roads, culverts should be provided for crossing of herpetofauna species	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
		Bird Mortality due to electrocution and possible collision									

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i.		operation of wind turbines	To reduce collision risk, livestock carcass management is to be undertaken in the wind farm area. All carcasses detected inside the wind farm area are to be removed and dumped at designated livestock dumping locations. This will reduce the probability of vultures occurring in the wind farm area, thereby reducing the risk of collision with operating WTGs.	MEIL EPC team	Discussion with EPC, Visual inspection	Continiuos, as and when information of a carcass is recieved	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☐	☒
ii.			Certain modification is required in the transmission line infrastructure as the same line will be developed by Inox for MEIL and the design is expected to be same as used by Inox for other developers.	MEIL EPC team	Discussion with EPC, Visual inspection	Once after completion of construction phase	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☐	☒
iii.			Herb layer restoration in the WTG area to prevent birds of prey flying in close proximity to the wind farm in search of prey.	MEIL EPC team	Discussion with EPC, Visual inspection	Monitoring during construction and operation phase	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☐	☒

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i.		Avoidance	Bird-safe strain poles require insulating chains at least 60 cm in length should be adopted; uninsulated poles are causing risk of electrocution Use of Line markers on the conductors and insulating power lines with tubing 130 cm in length. The conductors have to be spaced at a distance of at least 140 cm and installation of perch rejectors on cross arms.	MEIL EPC team	Discussion with EPC, Site inspection; Visual assessment and monitoring of actual implementation, budget and responsibility allocation.	Once after completion of construction phase	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☐	☒
ii.			Flash lamps on the WTGs will prevent bird collision at nights	MEIL EPC team	Discussion with EPC, Site inspection; Visual assessment and monitoring of actual implementation, budget and responsibility allocation.	One time monitoring during construction phase	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☐	☒

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iii.			Regular checking of the vacuums or holes in the towers to avoid nesting by any of the birds	MEIL EPC team /O & M Contractor	Discussion with EPC, Site inspection; Visual assessment and monitoring of actual implementation, budget and responsibility allocation.	One time monitoring during construction phase	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☒
iv.			The transmission poles should be raised with suspended insulators to the extent possible in order to reduce the electrocution of bird species	MEIL EPC team /O & M Contractor	Discussion with EPC, Site inspection; Visual assessment and monitoring of actual implementation, budget and responsibility allocation.	One time monitoring during construction phase	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☒
v.			Marking overhead cables using diffractors and avoiding use over areas of high bird concentrations, for species vulnerable to collision	MEIL EPC team /O & M Contractor	Discussion with EPC, Site inspection; Visual assessment and monitoring of actual implementation, budget and responsibility allocation.	One time monitoring during construction phase	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☒

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8.	**Social**										
i.	Community Health and Safety	The construction phase activities such as the erection of the WTGs, construction of the transmission line and substations and movement of material and personnel may result in impacts on the health and safety of the community.	As part of the stakeholder engagement and information disclosure process, the community will be engaged with on a regular basis and will be provided with an understanding of the project activities to be undertaken and the precautions taken for safety	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.			The traffic movement for the project in the area will be regulated to ensure road and pedestrian (including livestock) safety	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iii.			The workers (both regular and contractual) on the project will be provided with trainings on the Health and Safety policy in place, and their role in the same and refresher courses will be provided throughout the life of the project	MEIL EPC team	Discussion with EPC, Visual inspection, Training Records	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐

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iv.			Put in place a grievance mechanism to allow for the workers and community members to report any concern or grievance related to project activities	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
i.	Impacts on Economic Opportunities	The construction phase activities of the project including construction of access road, civil works, foundation activities, site clearance and security will result in creation of economic opportunities	post the completion of land procurement for WTGs, undertake an audit of the land procurement process through a third party to ensure that the land procurement process was undertaken on the basis of willing-buyer willing seller arrangements and that no land owner was severely impacted by the same	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
ii.			The sourcing of local labour wherever possible should be made obligatory for the sub-contractors and in all major procurement activities	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iii.	Occupational Health and Safety	The construction phase activities such as construction of	Preference should be given to the vulnerable population in the AoI	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐

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iv.		WTGs, access roads, transmission lines and other project components and maintenance activities in the operations phase are likely to result in a risk on the health and safety of the workers on the project.	The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labour and resources	MEIL EPC team	Discussion with EPC, records inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
i.			The workers (both regular and contractual) on the project will be provided with trainings on the Health and Safety policy in place, and their role in the same and refresher courses will be provided throughout the life of the project	MEIL EPC team / O & M Contractor	Discussion with EPC/ O & M, Training Records	Weekly Monitoring	EHS Manager and EPC / O & M EHS Team	EHS - MEIL	Report from EPC/ O & M to EHS Manager	☒	☒
ii.			Establish a grievance redressal mechanism in place, to allow for the employees and workers to report any concern or grievance related to work activities	MEIL EPC team / O & M Contractor	Discussion with EPC/ O & M, Training Records	Weekly Monitoring	EHS Manager and EPC / O & M EHS Team	EHS - MEIL	Report from EPC/ O & M to EHS Manager	☒	☒

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iii.	Labour Rights and Welfare	the influx of labour (skilled, semi-skilled and unskilled) may result in impact on labour rights and welfare	Put in place measure to reduce the risk of prevalence of diseases, including screening of workers, undertaking health awareness amongst the workers, implementation of vector control programs, avoiding presence of unsanitary conditions and better facilities in the project site, such as safe drinking water, proper waste collection and disposal etc.	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
i.			The labour camp and accommodation facility for regular employees should be constructed to meet the requirements of the applicable reference framework in terms of space per worker, water and sanitation facilities, first aid, lighting and ventilation etc. and regular monitoring should be undertaken to ensure compliance through the project lifecycle	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐

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ii.			MEIL should ensure a monthly monitoring and regular auditing mechanism for monitoring the sub-contractors and suppliers with respect to compliance to the applicable reference framework, in terms of resources, migrant workers, child labour and forced labour, health and safety, payment of wages etc.	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iii.			Strengthening security personnel around labour camps in order to maintain adequate law and order and avoid any possible tensions between the migrant workforce and host community	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐
iv.			Establish a grievance redressal mechanism in place, to allow for the employees and workers to report any concern or grievance related to work activities	MEIL EPC team / O & M Contractor	Discussion with EPC, / O & M, inspection	Weekly Monitoring	EHS Manager and EPC/ O & M EHS Team	EHS - MEIL	Report from EPC/ O & M to EHS Manager	☒	☒
i.	Impact on Indigenous Communities/	The project activities during construction and operations phase	give to the vulnerable groups identified in the employment and contracting opportunities generated	MEIL EPC team	Discussion with EPC, Visual inspection	Weekly Monitoring	EHS Manager and EPC EHS Team	EHS - MEIL	Report from EPC to EHS Manager	☒	☐

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										Construction	Operation
ii.	Vulnerable Groups	may have disproportionate impact on vulnerable groups	Undertake a profiling of the various social groups in the study area, to understand the individual needs and concerns of the social groups and identify community development and CSR programmes in accordance to the same	MEIL	Study report/CSR report	Weekly Monitoring	CSR team	CSR - MEIL	Report from CSR	☒	☒
iii.			As part of the stakeholder engagement, ensure adequate representation of the SC/ST groups and vulnerable groups identified, and undertake specific engagement activities with these groups	MEIL	Study report/CSR report	Weekly Monitoring	CSR team	CSR - MEIL	Report from CSR	☒	☒
iv.			Ensure that the grievance management mechanism established is accessible to these groups	MEIL	Study report/CSR report	Weekly Monitoring	CSR team	CSR - MEIL	Report from CSR	☒	☒

Note: Decommissioning phase (WEP closure, dismantling of equipment, transportation and site restoration) related environmental and social management plan is not presented in the above. Decommissioning phase may result in environmental and social impacts, however, due to no clarity of the project after expiry of energy purchase agreement and land lease is known at this stage. Though in case of decommissioning, process for the plant decommissioning to be developed prior to the culmination of the MEIL WTGs operational life and adequate decommissioning plan need to be formulated in accordance with the regulatory requirements as well as international guidelines. Environmental and social due diligence before and after decommissioning phase also need to be conducted to ensure no environmental and social liability of MEIL after leaving the site.

11 GRIEVANCE REDRESSAL MECHANISM

Grievance management is an important component of any project's implementation. Over the duration of a project lifecycle, it encounters numerous instances of conflicts, allegations and dissatisfaction within the working and associated human capital and their interactions. Some of the common areas of grievance include timely payment of wages and compensation, failure to fulfil commitments and poor management of construction activities, accidents due to inappropriate planning of vehicle movement. This may have an impact on the nature of the relationship and grievances.

In order to manage these risks, MEIL needs an internal mechanism to allow prior to approaching the formal legal mode of solutions. Presently, MEIL does not have a formal grievance redressal mechanism in place for external stakeholders. Since the project is part of a larger project being developed by INOX, the INOX operations and maintenance team will be required to be a part of the Grievance redressal mechanism put in place. Presently INOX has an employee grievance redressal mechanism in place, which will be applicable to the project. However, Inox does not have a community grievance redressal mechanism in place.

According to the consultations with the local community, it was understood that presently the local community communicated any concern/grievance verbally to the project land team. However, this is an informal process and no records of such communication are maintained. For the remaining project lifecycle, a formal grievance redressal mechanism has been put in place for the project.

11.1 OBJECTIVES OF THE GRIEVANCE REDRESSAL MECHANISM

The primary objective of the mechanism shall be to provide an accessible mechanism to the stakeholders of the project and resolve any social and environmental related grievances. For this purpose, a Grievance Redressal Cell (GRC) shall be established, to resolve non-judicial disputes arising out of various matters related to the implementation of the ESMP, as well as other aspects of the project, as deemed fit to be raised before the GRC.

11.2 COMPOSITION OF THE GRC

The GRC will be driven internally by the INOX and MEIL Project teams and shall representation from the following teams to ensure fair and timely solution to the grievances:

- MEIL Project Manager

- INOX Section Heads and HoD
- INOX Site Manager/Project Manager
- INOX EHS Officer
- INOX HR Department
- Senior representation on behalf of MEIL
- Any other concerned person with decision making authority in relevance to the grievance or aggrieved party

The GRC shall be led by a Grievance Officer, who can either be the site EHS officer or Community Relations Officer. The aggrieved party shall register their grievances with the GRC. The GRC shall be empowered to take a decision which is to be considered final and binding on the Project. However, the decision of the GRC is not binding on the aggrieved person and he or she may take the grievance to the administrative setup in case any grievance channel is available at that level or take a legal course, in case not satisfied with the outcome of GRC decision.

11.3 FUNCTIONING OF THE GRC FOR GRIEVANCE REDRESS

The GRC meetings will be held on a regular basis (atleast monthly) at the Project's site office. The key responsibilities of the GRC shall be as follows:

- Receive, review, consider and resolve grievances related to the social and environmental aspects of the project
- Entertain grievances of indirectly affected persons and/or persons affected during project implementation;
- Resolve grievances within a maximum period of two weeks at the GRC level and communication of the resolution to the aggrieved party;
- The GRC shall not engage in any review of the legal standing of an "awardee" nor shall deal with any matters pending in the court of law;
- Arrive at decisions through consensus, failing which resolution will be based on majority vote. Any decision made by the GRC must be within the purview of Environmental Management Plan, Corporate EHS and Social Policies or any such documents of relevance of that matter;
- In case the grievance relates to environmental monitoring results or engineering matters, the GRC will validate the information available to it, as provided by the INOX's Project management team/ environmental monitoring team. However, GRC will not be in a position to question the validity of the data provided to it.
- If needed, may undertake field visits to verify and review the issues, disputes or other relevant matters

11.4 PROCESS OF RECEIVING AND ADDRESSING GRIEVANCES

The mechanism for grievance redressal will allow for grievances/ complaints to be received in written or verbal form. For this purpose, complaint registers will be maintained at the security gates of the project site office. Complaint

drop boxes will also be established in the community, in consultation with the local stakeholders. In addition to this, the stakeholders will also have access to the GRC contact details and will be able to record their grievances in a verbal manner.

The GRC will open the drop boxes and registers on a weekly basis. On receipt of complaint the GRC shall give an acknowledgment to the complainant with date, time and venue of hearing his/her grievance. The GRC shall prepare a brief note on the grievance for discussion on scheduled date. On the given date, the GRC shall hear the complainant and give its decision. A written copy of decision shall be provided to the complainant. If the complainant is satisfied with the decision, an acknowledgement of same shall be obtained from him on the decision copy and the case shall be closed.

While every effort shall be made to resolve the complaint amicably, if the complainant is not satisfied with the outcome of GRC's decision, he or she can opt for any grievance redress forum available at the administrative level or any other arbitration mechanism with mutual agreement. If these alternative mechanisms of resolution of conflict fails, then the aggrieved person may take legal recource However, every effort shall be made to resolve the case amicably without resorting to legal course of action. While the process continues, a proper documentation of the records shall be maintained by the project company, pertaining to each of the grievance in a proper grievance register or record.

11.5 MONITORING AND EVALUATION

Like the other project components, the GRM shall be regularly monitored to ensure that the stakeholders are having no or limited issues with the project and in case there are concerns, they are being adequately addressed as per the mandate. In order to keep track on the effectiveness of GRM, it is the responsibility of the MEIL's project team to compile and maintain database on grievances for periodic review. The mechanism shall be based on two components, internal monitoring and reporting and external monitoring and reporting which shall run simultaneously. Mostly this shall be aligned with simultaneous process monitoring rather than doing it separately all the time.

11.6 BUDGETING

MEIL shall ensure adequate budgeting and resource allocation for implementing the GRM.

12 CONCLUSION & RECOMMENDATIONS

12.1 INTRODUCTION

This Environmental and Social Impact Assessment has been conducted to evaluate the impacts associated with the proposed MEIL's wind farm project of 50 MW capacity in Nipaniya in Mandsaur district of Madhya Pradesh. The impact assessment has been conducted in compliance with administrative framework identified herein, including relevant national legislative requirement, international conventions and MEIL's corporate requirements.

12.2 IMPACTS REQUIRING DETAILED ASSESSMENT

Following a Scoping exercise, this ESIA was focused on interactions between Project activities and various resources/receptors that could result in significant impacts. The table below presents the outcomes of the comprehensive assessment of identified impacts as a result of the various phases of the proposed Project and summarize the impacts. Based on the impacts significance, the ESMP has been prepared.

Impact Summary

The proposed project is a green energy project comprising of 25WTG to generate 50 MW power through wind energy. Impacts due to wind energy projects are short term, generally limited to construction phase and operation phase have negligible adverse environmental and social impacts.

The Project and its key components such as access road, WTGs, Office building and transmission lines, are likely to have some adverse environmental impacts on baseline parameters such as land use, water quality etc. The social impacts from the project are assessed to be generally beneficial in terms of overall local area development.

Impact Description	Impact nature		
		Significance of Impact	Residual Impact
Construction Phase			
Change in land use	Negative	Moderate	Negligible to Minor
Soil erosion	Negative	Minor	Negligible
Soil compaction	Negative	Minor	Negligible
Impact on land due to Improper waste disposal	Negative	Minor	Negligible
Soil contamination due to Leaks/spills	Negative	Minor	Negligible
Impact on Water availability	Negative	Moderate	Negligible to Minor
Impact on water quality	Negative	Minor	Negligible
Impact on Air quality	Negative	Minor	Negligible
Increased Ambient Noise Levels		Minor	Negligible to Minor

Ecological impacts due to Vegetation Clearance	Negative	Minor	Minor
Impact due to construction of WTG foundation and installation	Negative	Minor	Negligible to minor
Impact due to laying of approach roads	Negative	Minor	Negligible to minor
Community Health and Safety	Negative	Minor	Negligible to minor
Occupational Health and Safety	Negative	Minor	Negligible to Minor
Impacts on Economic Opportunities	Positive		
Labour Rights and Welfare	Negative	Moderate	Minor
Impacts on Indigenous Communities/Vulnerable Groups	Negative	Minor	Negligible
Operations Phase			
Impact on land due to improper waste disposal	Negative	Negligible	-
Soil Contamination due to leaks/spills	Negative	Negligible	-
Impact on water availability	Negative	Minor	Negligible
Impact on Water quality	Negative	Negligible	-
Impact on air quality	Negative	Negligible	
Impact on ambient noise levels (day time)	Negative	Negligible	Negligible
Impact on ambient noise levels (night time)		Negligible to Minor	Negligible
Impact of Shadow Flicker	Negative	Negligible to Minor	Negligible to Minor
Impact on Avifaunal and bat species	Negative	Moderate-Species	Minor
	Negative	Minor-Habitat	Minor
Accidents- Blade Throw and Natural Hazards	Negative	Negligible	-
Decommissioning Phase			
Impact on land and soil	Negative	Minor	Negligible to minor
Impact on air quality	Negative	Negligible	
Impact on ambient noise levels	Negative	Minor to moderate	

The key features of the project in terms of impact include the following:

- Majority of the project area is primarily used for agricultural purposes. The WTGs are to be located on waste land (open scrub) and agricultural fallows.
- There are about 12 receptors located within 500 m of WTG locations. There are also few water bodies and forest area in the Project AOI though none of the WTG locations fall within the forest land. .
- The construction of proposed project may bring local changes in the landuse pattern of the site but there would be no drastic visual impact to the area as other wind energy projects are already operating in the study area;
- The Project will require ~2-4 m^3/day of water during construction and about 2-3 m^3/day of fresh water during operation phase planned to be sourced from tanker water;
- The negligible quantity of sewage will be generated at site office, which will be disposed through septic tanks;

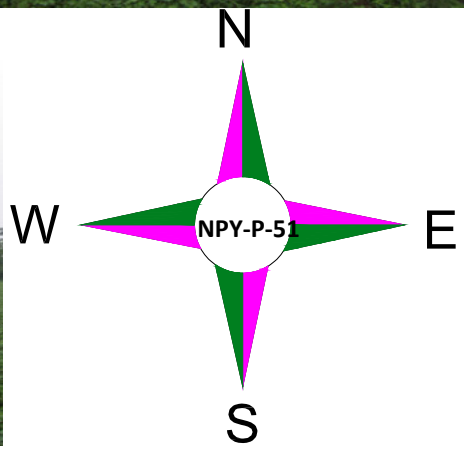
- The project will have negligible to moderate residual impacts varying across receptors and day and night time post implementation of mitigation measures as suggested;
- The project will have minor to moderate impacts due to shadow flicker across receptors. It is suggested either to shift the WTG location (NPY-P-56) near the school and WTG NPY—P-58 (near houses) to avoid or reduce flickering impact or the options suggested needs to be considered.
- The hazardous waste will be disposed of as per authorisation from MPPCB. The storage, handling, transportation and disposal will be strictly as per the requirement of authorisation by MPPCB and Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008. The waste will be stored into closed containers under covered area with concrete flooring and sent for disposal to TSDF through authorized vendors;
- The proposed project will not result in any physical displacement of people.

The Environmental and Social Management Plan (ESMP) describes mitigation measures for impacts specific to project activities and also discuss implementation mechanism.

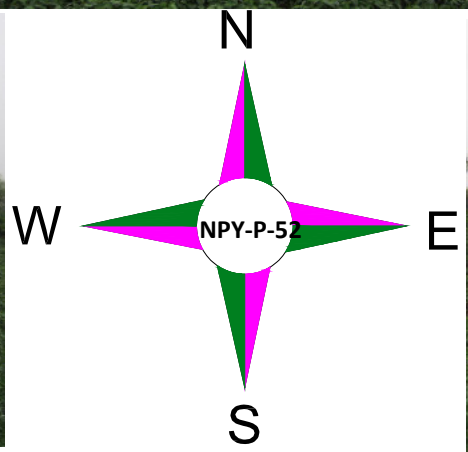
To conclude, the implementation of ESMP will help MEIL in complying with national/ state regulatory framework as well as to meet IFC/ ADB reference framework requirements.

Annex A

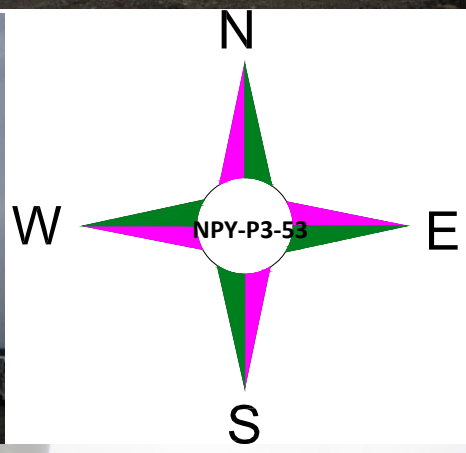
WTG Photo Profile



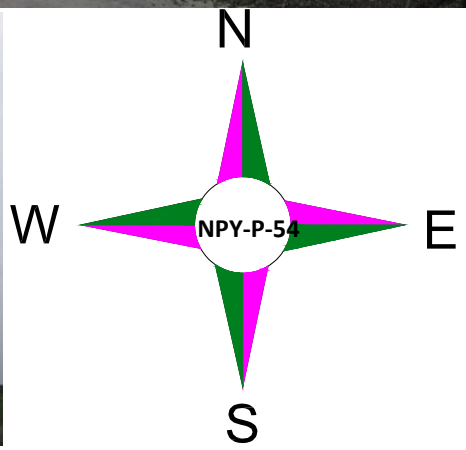
Barkheda Uda Village



Barkheda Uda Village



Takaravad Village



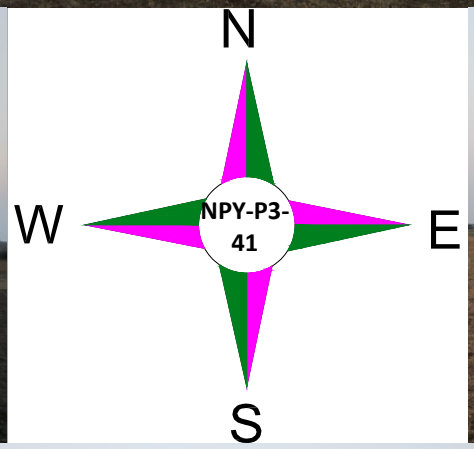
Takaravad Village

N

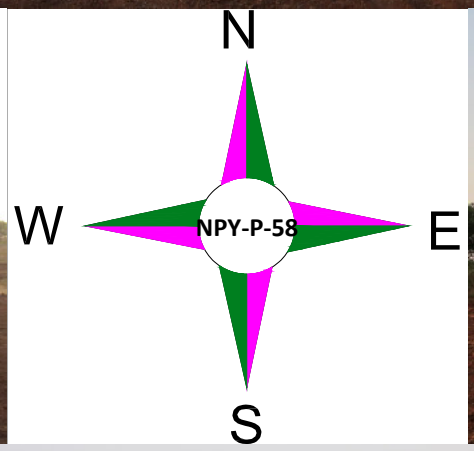
W NPY-P-55 E

S

Chhayan Village



Dhaman Diwan



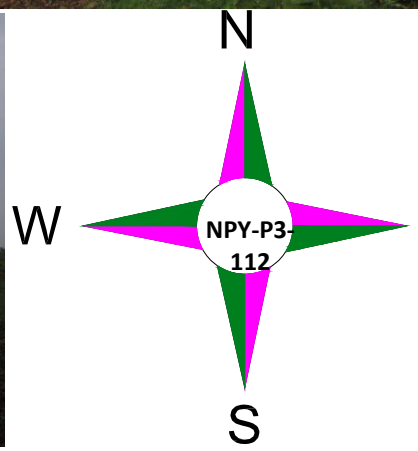
JamuniyaVillage

N

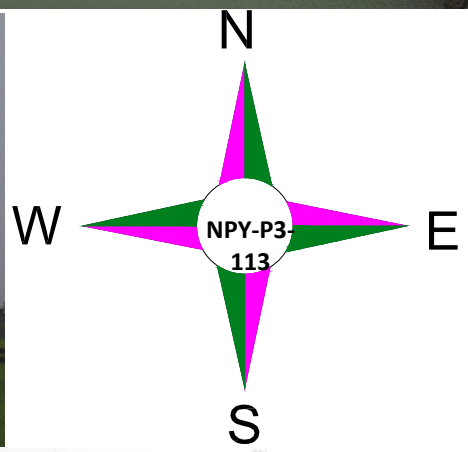
W NPY-P-59 E

S

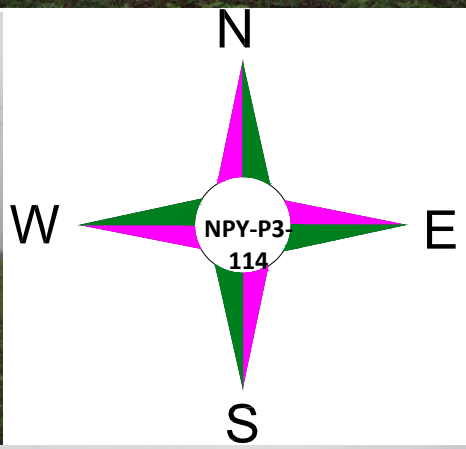
JamuniyaVillage



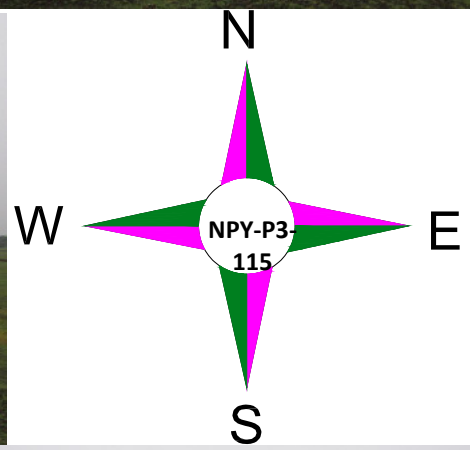
Badariya Amara Village



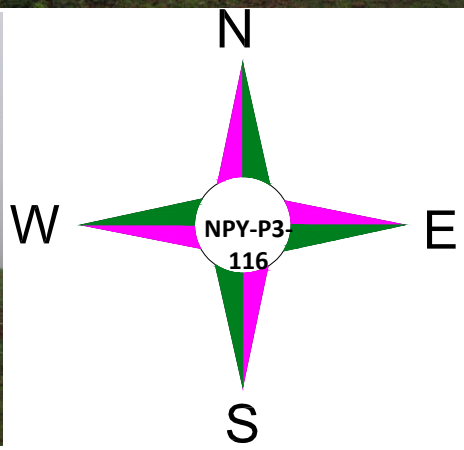
Badariya Amara Village



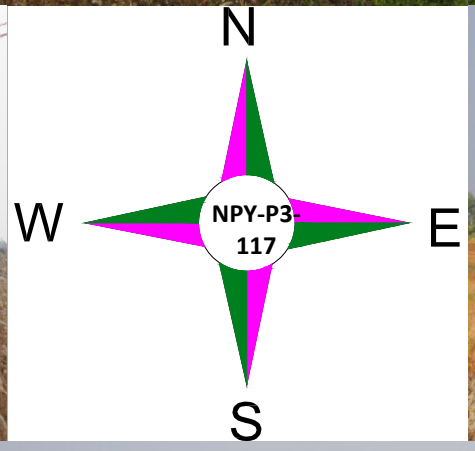
Nariya Buzurg Village



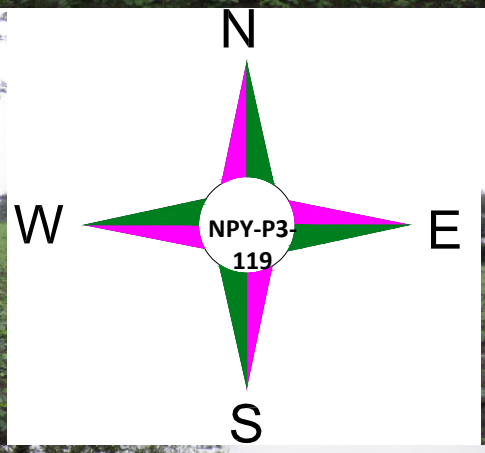
Nariya Buzurg Village



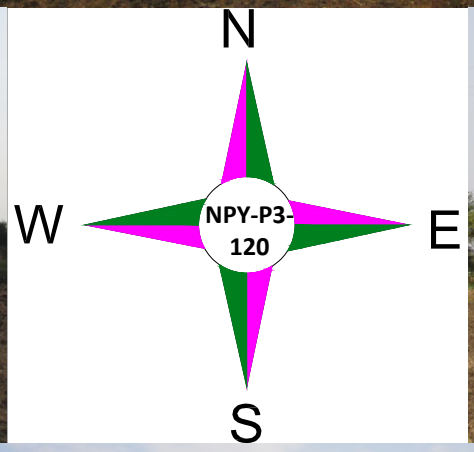
Nariya Buzurg Village



Khankhari Village



Akali Shivdas Village



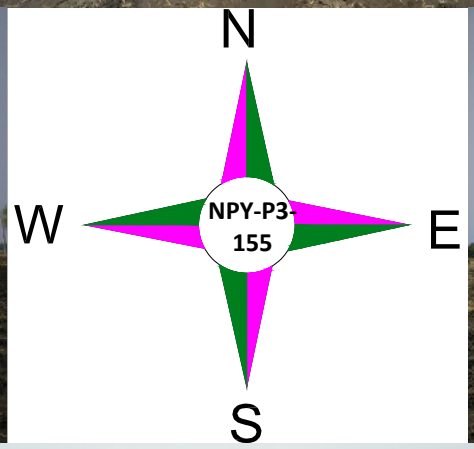
Akali Shivdas Village

N

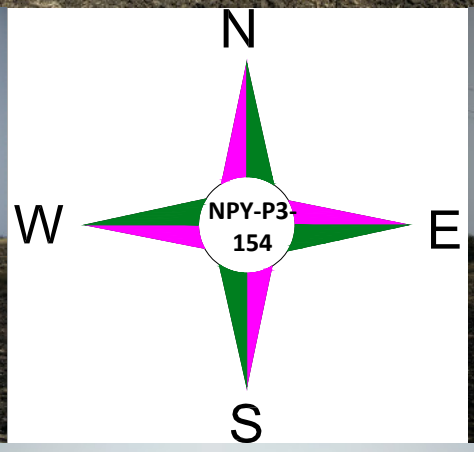
W NPY-P-124 E

S

Sahdey Khedi Village



Guradia Mata



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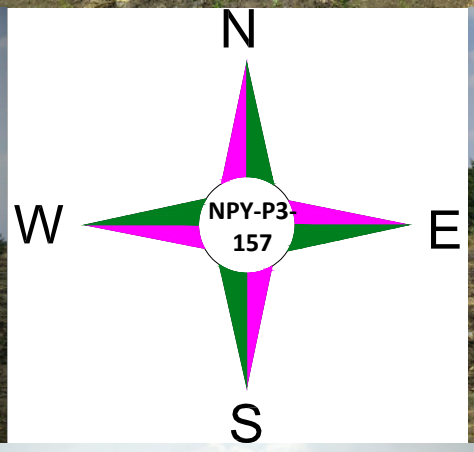


Chandkhedi Village

N

W NPY-P3-156 E

S

Guradia Mata

N

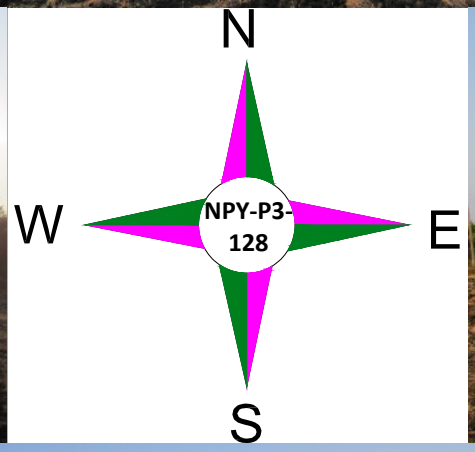
W

NPY-P-127

E

S

Jamuniya Village



Jamuniya Village

N

W E

NPY-P-140

S

Chhayan Village

N

W E

NPY-P-143

S

Annex B

Mandsaur Market Rate

कार्यालय उप पंजीयक शामगढ़ जिला मन्दसौर (म.प्र.)

कृषि भूमि के बाजार मूल्य

वित्तीय वर्ष 01 अप्रेल 2015 से 31 मार्च 2016 तक जिले का नाम– मन्दसौर

प्ररूप 'क'

स0क0	प.ह.नं.	वार्ड/मोहल्ला/कालोनी/सोसायटी/रोड का नाम/गांव का नाम	आवासीय भूखण्ड(रूपये प्रति वर्ग मीटर)	व्यावसायिक भूखण्ड(रूपये प्रति वर्ग मीटर)	औद्योगिक भूखण्ड(रूपये प्रति वर्ग मीटर)	आवासीय भवन आर.सी.सी (रूपये प्रति वर्ग मीटर)	आवासीय भवन आर.बी.सी (रूपये प्रति वर्ग मीटर)	आवासीय भवन टीन शेड (रूपये प्रति वर्ग मीटर)	आवासीय भवन कच्चा कवेलु(रूपये प्रति वर्ग मीटर)	व्यावसायिक भवन –दुकान (रूपये प्रति वर्ग मीटर)	व्यावसायिक भवन –कार्यालय (रूपये प्रति वर्ग मीटर)	व्यावसायिक भवन –गोदाम (रूपये प्रति वर्ग मीटर)	बहुमंजिला भवन आवासिय (रूपये प्रति वर्ग मीटर)	बहुमंजिला भवन व्यावसायिक (रूपये प्रति वर्ग मीटर)	सिंचित कृषि भूमि (रूपये प्रति हेक्टर)	असिंचित कृषि भूमि (रूपये प्रति हेक्टर)	कृषि भूमि के आवासिय भूखण्ड 300 वर्ग मीटर तक(रूपये प्रति वर्ग मीटर)	कृषि भूमि के व्यावसायिक भूखण्ड 300 वर्ग मीटर तक(रूपये प्रति वर्ग मीटर)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1	भडका	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
2	1	पिपल्या	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
3	1	मोलाखेडी खुर्द	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
4	1	मोरडी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
5	2	परासली रोड पर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1700000	850000	800	1200
6	2	परासली अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
7	2	बोरखेडी घाटा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
8	2	बकाना	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
9	3	हतुनिया रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1632000	816000	1100	1650
10	3	हतुनिया अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1480000	740000	900	1350
11	3	मुण्डला	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
12	4	रूपारेल	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
13	4	संकरियाखेडी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
14	4	बोरखेडी रेडका	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
15	5	बर्डिया इस्तमुरार (ऊंचा)	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
16	5	आंक्या	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
17	5	चिडी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
18	6	तौलाखेडी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
19	7	आवरा	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
20	7	किलगारी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
21	8	भटूनी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1440000	720000	800	1200

(DIPALI PASTOR)
Inspector ... Registration

जिला पंजीयक एवं संयोजक
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

कलेक्टर एवं अध्यक्ष
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

कार्यालय उप पंजीयक शामगढ़ जिला मन्दसौर (म.प्र.)

कृषि भूमि के बाजार मूल्य

वित्तीय वर्ष 01 अप्रेल 2015 से 31 मार्च 2016 तक जिले का नाम– मन्दसौर

प्ररूप 'क'

स0क0	प.ह.नं.	वार्ड/मोहल्ला/कालोनी/सोसायटी/रोड का नाम/गांव का नाम	आवासीय भूखण्ड(रूपये प्रति वर्ग मीटर)	व्यावसायिक भूखण्ड(रूपये प्रति वर्ग मीटर)	औद्योगिक भूखण्ड(रूपये प्रति वर्ग मीटर)	आवासीय भवन आर.सी.सी (रूपये प्रति वर्ग मीटर)	आवासीय भवन आर.बी.सी (रूपये प्रति वर्ग मीटर)	आवासीय भवन टीन शेड (रूपये प्रति वर्ग मीटर)	आवासीय भवन कच्चा कवेलु(रूपये प्रति वर्ग मीटर)	व्यावसायिक भवन –दुकान (रूपये प्रति वर्ग मीटर)	व्यावसायिक भवन –कार्यालय (रूपये प्रति वर्ग मीटर)	व्यावसायिक भवन –गोदाम (रूपये प्रति वर्ग मीटर)	बहुमंजिला भवन आवासिय (रूपये प्रति वर्ग मीटर)	बहुमंजिला भवन व्यावसायिक (रूपये प्रति वर्ग मीटर)	सिंचित कृषि भूमि (रूपये प्रति हेक्टर)	असिंचित कृषि भूमि (रूपये प्रति हेक्टर)	कृषि भूमि के आवासिय भूखण्ड 300 वर्ग मीटर तक(रूपये प्रति वर्ग मीटर)	कृषि भूमि के व्यावसायिक भूखण्ड 300 वर्ग मीटर तक(रूपये प्रति वर्ग मीटर)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1	भडका	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
2	1	पिपल्या	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
3	1	मोलाखेडी खुर्द	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
4	1	मोरडी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
5	2	परासली रोड पर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1700000	850000	800	1200
6	2	परासली अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
7	2	बोरखेडी घाटा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
8	2	बकाना	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
9	3	हतुनिया रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1632000	816000	1100	1650
10	3	हतुनिया अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1480000	740000	900	1350
11	3	मुण्डला	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
12	4	रूपारेल	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
13	4	संकरियाखेडी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
14	4	बोरखेडी रेडका	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
15	5	बर्डिया इस्तमुरार (ऊंचा)	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
16	5	आंक्या	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
17	5	चिडी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
18	6	तौलाखेडी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
19	7	आवरा	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
20	7	किलगारी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
21	8	भटूनी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1440000	720000	800	1200

(DIPALI PASTOR)
Inspector ... Registration

जिला पंजीयक एवं संयोजक
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

कलेक्टर एवं अध्यक्ष
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
22	8	घट्या	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
23	9	चंदवासा रोड पर	4000	6000	4700	11000	10000	8000	7000	18000	17000	16000	10200	16800	1900000	950000	4000	6000
24	9	चंदवासा अंदर	3600	5400	4200	10600	9600	7600	6600	17400	16400	15400	9880	16320	1720000	860000	3600	5400
25	10	आगर रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1780000	890000	1000	1500
26	10	आगर अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
27	10	खेरखेडी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
28	11	पण्डेरिया	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1220000	610000	900	1350
29	12	बघुनिया रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1720000	860000	1100	1650
30	12	बघुनिया अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1620000	810000	900	1350
31	12	ऐरी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1420000	710000	900	1350
32	13	भुण्डिया रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1660000	830000	1100	1650
33	13	भुण्डिया अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1440000	720000	900	1350
34	13	रामखेडी रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1660000	830000	1100	1650
35	13	रामेखेडी अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1500000	750000	900	1350
36	14	सालरी रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1760000	880000	1000	1500
37	14	सालरी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
38	14	बरखेडा नायक रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1720000	860000	1100	1650
39	14	बरखेडा नायक अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1600000	800000	900	1350
40	15	पिंछला	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
41	16	लालपुरा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
42	16	असावती रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1720000	860000	1000	1500
43	16	असावती अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
44	16	बावडीखेडा रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1720000	860000	1000	1500
45	16	बावडीखेडी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
46	17	गोपालपूरा रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1720000	860000	1000	1500
47	17	गोपालपूरा अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
48	17	बजारी रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1620000	810000	1000	1500
49	17	बंजारी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
50	18	गरडा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1700000	850000	1000	1500
															1440000	720000	800	1200
															1400000	700000	800	1200

(DIPALI RASTOGI)
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Madhya Pradesh

जिला पंजीयक एवं संयोजक
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

कलेक्टर एवं अध्यक्ष
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
22	8	घट्या	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
23	9	चंदवासा रोड पर	4000	6000	4700	11000	10000	8000	7000	18000	17000	16000	10200	16800	1900000	950000	4000	6000
24	9	चंदवासा अंदर	3600	5400	4200	10600	9600	7600	6600	17400	16400	15400	9880	16320	1720000	860000	3600	5400
25	10	आगर रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1780000	890000	1000	1500
26	10	आगर अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
27	10	खेरखेडी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
28	11	पण्डेरिया	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1220000	610000	900	1350
29	12	बघुनिया रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1720000	860000	1100	1650
30	12	बघुनिया अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1620000	810000	900	1350
31	12	ऐरी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1420000	710000	900	1350
32	13	भुण्डिया रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1660000	830000	1100	1650
33	13	भुण्डिया अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1440000	720000	900	1350
34	13	रामखेडी रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1660000	830000	1100	1650
35	13	रामेखेडी अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1500000	750000	900	1350
36	14	सालरी रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1760000	880000	1000	1500
37	14	सालरी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
38	14	बरखेडा नायक रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1720000	860000	1100	1650
39	14	बरखेडा नायक अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1600000	800000	900	1350
40	15	पिंछला	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
41	16	लालपुरा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
42	16	असावती रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1720000	860000	1000	1500
43	16	असावती अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
44	16	बावडीखेडा रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1720000	860000	1000	1500
45	16	बावडीखेडी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
46	17	गोपालपूरा रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1720000	860000	1000	1500
47	17	गोपालपूरा अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
48	17	बजारी रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1620000	810000	1000	1500
49	17	बंजारी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
50	18	गरडा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1700000	850000	1000	1500
															1440000	720000	800	1200
															1400000	700000	800	1200

(DIPALI RASTOGI)
Inspector General of Registration
Madhya Pradesh

जिला पंजीयक एवं संयोजक
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

कलेक्टर एवं अध्यक्ष
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
51	18	रणायरा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
52	18	वारनी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
53	19	बापच्या	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1460000	730000	900	1350
54	19	आमली	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1460000	730000	900	1350
55	19	गागसी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1460000	730000	900	1350
56	20	बनी	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1780000	890000	1000	1500
57	21	कुरावन रोड पर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1560000	780000	800	1200
58	21	कुरावन अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1500000	750000	900	1350
59	22	देवरी	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1680000	840000	1000	1500
60	22	टकरावद रोड पर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
61	22	टकरावद अंदर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1500000	750000	800	1200
62	22	डोंगरखेडी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1920000	960000	1000	1500
63	23	भागडी रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1400000	700000	800	1200
64	23	भागडी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1600000	800000	1000	1500
65	23	बर्डिया पूना रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	800	1200
66	23	बर्डिया पूना अंदर	4000	6000	4700	11000	10000	8000	7000	18000	17000	16000	10200	16800	2160000	1080000	4000	6000
67	23	निपानिया	3600	5400	4200	10600	9600	7600	6600	17400	16400	15400	9880	16320	1960000	980000	3600	5400
68	24	मेलखेडा रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1600000	800000	1000	1500
69	24	मेलखेडा अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
70	24	सकरियाखेडी रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1460000	730000	900	1350
71	24	सकरियाखेडी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1720000	860000	800	1200
72	25	कुण्डला बुजुर्ग	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1460000	730000	800	1200
73	25	कुण्डला खुर्द रोड पर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1600000	800000	900	1350
74	25	कुण्डला खुर्द अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	900	1350
75	26	मानपुरा रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
76	26	मानपुरा अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1600000	800000	900	1350
77	26	नारिया बुजुर्ग	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
78	27	आकली शिवदास रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
79	27	आकली शिवदास अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1600000	800000	900	1350

(DIPAK BASTOGI)
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मन्दसौर (म. प्र.)

कलैक्टर एवं अध्यक्ष
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
51	18	रणायरा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
52	18	वारनी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
53	19	बापच्या	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1460000	730000	900	1350
54	19	आमली	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1460000	730000	900	1350
55	19	गागसी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1460000	730000	900	1350
56	20	बनी	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1780000	890000	1000	1500
57	21	कुरावन रोड पर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1560000	780000	800	1200
58	21	कुरावन अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1500000	750000	900	1350
59	22	देवरी	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1680000	840000	1000	1500
60	22	टकरावद रोड पर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
61	22	टकरावद अंदर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1500000	750000	800	1200
62	22	डोंगरखेडी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1920000	960000	1000	1500
63	23	भागडी रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1400000	700000	800	1200
64	23	भागडी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1600000	800000	1000	1500
65	23	बर्डिया पूना रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	800	1200
66	23	बर्डिया पूना अंदर	4000	6000	4700	11000	10000	8000	7000	18000	17000	16000	10200	16800	2160000	1080000	4000	6000
67	23	निपानिया	3600	5400	4200	10600	9600	7600	6600	17400	16400	15400	9880	16320	1960000	980000	3600	5400
68	24	मेलखेडा रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1600000	800000	1000	1500
69	24	मेलखेडा अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1460000	730000	800	1200
70	24	सकरियाखेडी रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1460000	730000	900	1350
71	24	सकरियाखेडी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1720000	860000	800	1200
72	25	कुण्डला बुजुर्ग	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1460000	730000	800	1200
73	25	कुण्डला खुर्द रोड पर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1600000	800000	900	1350
74	25	कुण्डला खुर्द अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	900	1350
75	26	मानपुरा रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
76	26	मानपुरा अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1600000	800000	900	1350
77	26	नारिया बुजुर्ग	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
78	27	आकली शिवदास रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
79	27	आकली शिवदास अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1600000	800000	900	1350

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कलैक्टर एवं अध्यक्ष
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
80	27	खांखरी रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1600000	800000	900	1350
81	27	खांखरी अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
82	28	चांदखेडी रोड पर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1720000	860000	800	1200
83	28	चांदखेडी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1440000	720000	800	1200
84	28	सगोरिया रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1820000	910000	900	1350
85	28	सगोरिया अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1640000	820000	800	1200
86	29	जमुनिया रोड पर	3000	4500	3000	9000	8000	6500	6000	14500	13500	12500	8400	13600	1920000	960000	3000	4500
87	29	जमुनिया अंदर	2600	3900	2600	8600	7600	6100	5600	13900	12900	11900	8080	13120	1600000	800000	2600	3900
88	29	भगौरी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
89	30	माकडी चामुण्डा रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1660000	830000	1000	1500
90	30	माकडी चामुण्डा अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
91	30	सेमली हाडा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1660000	830000	800	1200
92	30	बरखेडा उदा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
93	30	छायन	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1560000	780000	800	1200
94	31	शामगढ रोड पर	5000	7500	5000	12000	11000	9000	8000	19500	18500	17500	11000	18000	**5000000**	5000000	5000	7500
95	31	शामगढ अंदर	4500	6750	4500	11500	10500	8500	7500	18750	17750	16750	10600	17400	**4000000**	4000000	4500	6750
96	32	धामनिया दीवान रोड पर	3000	4500	3000	9000	8000	6500	6000	14500	13500	12500	8400	13600	2160000	1080000	3000	4500
97	32	धामनिया दीवान अंदर	2600	3900	2600	8600	7600	6100	5600	13900	12900	11900	8080	13120	1920000	960000	2600	3900
98	33	मकडावन रोड पर	3000	4500	3000	9000	8000	6500	6000	14500	13500	12500	8400	13600	1560000	780000	3000	4500
99	33	मकडावन अंदर	2600	3900	2600	8600	7600	6100	5600	13900	12900	11900	8080	13120	1500000	750000	2600	3900
100	33	जुनापानी धोरन्या रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1720000	860000	1100	1650
101	33	जुनापानी धोरन्या अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1480000	740000	900	1350
102	34	ढाबला गुजर रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1720000	860000	1000	1500
103	34	ढाबला गुजर अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1560000	780000	900	1350
104	37	खजूरीपंथ रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1920000	960000	1000	1500
105	37	खजूरीपंथ अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1680000	840000	900	1350
106	38	बरखेडा राठौर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1560000	780000	900	1350
107	39	आकली दीवान	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1500000	750000	900	1350
108	39	खेजडिया	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1300000	650000	900	1350

(DIPALI RASTOGI)
Inspector General of Registration
Madhya Pradesh

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मन्दसौर (म. प्र.)

कलेक्टर एवं अध्यक्ष
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
80	27	खांखरी रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1600000	800000	900	1350
81	27	खांखरी अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
82	28	चांदखेडी रोड पर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1720000	860000	800	1200
83	28	चांदखेडी अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1440000	720000	800	1200
84	28	सगोरिया रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1820000	910000	900	1350
85	28	सगोरिया अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1640000	820000	800	1200
86	29	जमुनिया रोड पर	3000	4500	3000	9000	8000	6500	6000	14500	13500	12500	8400	13600	1920000	960000	3000	4500
87	29	जमुनिया अंदर	2600	3900	2600	8600	7600	6100	5600	13900	12900	11900	8080	13120	1600000	800000	2600	3900
88	29	भगौरी	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
89	30	माकडी चामुण्डा रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1660000	830000	1000	1500
90	30	माकडी चामुण्डा अंदर	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
91	30	सेमली हाडा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1660000	830000	800	1200
92	30	बरखेडा उदा	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1400000	700000	800	1200
93	30	छायन	800	1200	800	6800	5800	4300	3800	11200	10200	9200	6640	10960	1560000	780000	800	1200
94	31	शामगढ रोड पर	5000	7500	5000	12000	11000	9000	8000	19500	18500	17500	11000	18000	**5000000**	5000000	5000	7500
95	31	शामगढ अंदर	4500	6750	4500	11500	10500	8500	7500	18750	17750	16750	10600	17400	**4000000**	4000000	4500	6750
96	32	धामनिया दीवान रोड पर	3000	4500	3000	9000	8000	6500	6000	14500	13500	12500	8400	13600	2160000	1080000	3000	4500
97	32	धामनिया दीवान अंदर	2600	3900	2600	8600	7600	6100	5600	13900	12900	11900	8080	13120	1920000	960000	2600	3900
98	33	मकडावन रोड पर	3000	4500	3000	9000	8000	6500	6000	14500	13500	12500	8400	13600	1560000	780000	3000	4500
99	33	मकडावन अंदर	2600	3900	2600	8600	7600	6100	5600	13900	12900	11900	8080	13120	1500000	750000	2600	3900
100	33	जुनापानी धोरन्या रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1720000	860000	1100	1650
101	33	जुनापानी धोरन्या अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1480000	740000	900	1350
102	34	ढाबला गुजर रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1720000	860000	1000	1500
103	34	ढाबला गुजर अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1560000	780000	900	1350
104	37	खजूरीपंथ रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1920000	960000	1000	1500
105	37	खजूरीपंथ अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1680000	840000	900	1350
106	38	बरखेडा राठौर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1560000	780000	900	1350
107	39	आकली दीवान	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1500000	750000	900	1350
108	39	खेजडिया	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1300000	650000	900	1350

(DIPALI RASTOGI)
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मन्दसौर (म. प्र.)

कलेक्टर एवं अध्यक्ष
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
109	41	एमदी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1240000	620000	900	1350
110	41	सूरजना	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
111	41	खेरखेडी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1300000	650000	900	1350
112	41	खाईखेडा	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1380000	690000	900	1350
113	42	परासली दीवान रोड पर	2500	3750	2500	8500	7500	6000	5500	13750	12750	11750	8000	13000	1720000	860000	2500	3750
114	42	परासली दीवान अंदर	2100	3150	2100	8100	7100	5600	5100	13150	12150	11150	7680	12520	1400000	700000	2100	3150
115	42	धतुरिया	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1380000	690000	900	1350
116	42	कोटडी अक्खा	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1300000	650000	900	1350
117	43	नारिया खुर्द	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1480000	740000	900	1350
118	43	सेमली शंकर रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1720000	860000	1000	1500
119	43	सेमली शंकर अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1440000	720000	900	1350
120	44	बासखेडी रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1720000	860000	1100	1650
121	44	बासखेडी अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1480000	740000	900	1350
122	44	सालरिया	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1480000	740000	900	1350
123	44	बोरवनी रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1720000	860000	900	1350
124	44	बोरवनी अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1560000	780000	900	1350

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मन्दसौर (म. प्र.)

कलेक्टर एवं अध्यक्ष
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
109	41	एमदी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1240000	620000	900	1350
110	41	सूरजना	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1400000	700000	900	1350
111	41	खेरखेडी	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1300000	650000	900	1350
112	41	खाईखेडा	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1380000	690000	900	1350
113	42	परासली दीवान रोड पर	2500	3750	2500	8500	7500	6000	5500	13750	12750	11750	8000	13000	1720000	860000	2500	3750
114	42	परासली दीवान अंदर	2100	3150	2100	8100	7100	5600	5100	13150	12150	11150	7680	12520	1400000	700000	2100	3150
115	42	धतुरिया	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1380000	690000	900	1350
116	42	कोटडी अक्खा	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1300000	650000	900	1350
117	43	नारिया खुर्द	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1480000	740000	900	1350
118	43	सेमली शंकर रोड पर	1000	1500	1000	7000	6000	4500	4000	11500	10500	9500	6800	11200	1720000	860000	1000	1500
119	43	सेमली शंकर अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1440000	720000	900	1350
120	44	बासखेडी रोड पर	1100	1650	1100	7100	6100	4600	4100	11650	10650	9650	6880	11320	1720000	860000	1100	1650
121	44	बासखेडी अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1480000	740000	900	1350
122	44	सालरिया	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1480000	740000	900	1350
123	44	बोरवनी रोड पर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1720000	860000	900	1350
124	44	बोरवनी अंदर	900	1350	900	6900	5900	4400	3900	11350	10350	9350	6720	11080	1560000	780000	900	1350

(DIPALI RASTOGI)
Inspector General of Registration
Madhya Pradesh.

जिला पंजीयक एवं संयोजक
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

कलेक्टर एवं अध्यक्ष
जिला मूल्यांकन समिति
मन्दसौर (म. प्र.)

Annex C

Applicable Environmental standards

1.1.1 Ambient Air Quality Standards

National Ambient Air Quality Standards (NAAQS)

National Ambient Air Quality Standards (NAAQ Standards), as prescribed by MoEF vide, *Gazette Notification dated 16th November, 2009* are given below in ***Table Error*! No text of specified style in document.**..1**.**

Table.1 National Ambient Air Quality Standards

Pollutant	Time Weighted Avg.	Concentration in Ambient Air	
		Industrial, Residential, Rural & Other Areas	Ecologically Sensitive Areas (notified by Central Government)
Sulphur dioxide (SO_2)	Annual Average*	50	20
µg/m³	24 Hours**	80	80
Oxides of Nitrogen (NO_x)	Annual Average*	40	30
µg/m³	24 Hours**	80	80
Particulate Matter (PM 10)	Annual Average*	60	60
µg/m³	24 Hours**	100	100
Particulate Matter (PM 2.5)	Annual Average*	40	40
µg/m³	24 Hours**	60	60
Ozone (O_3)	8 Hours**	100	100
µg/m³	1 Hour**	180	180
Lead (Pb)	Annual Average*	0.50	0.50
µg/m³	24 Hours**	1.0	1.0
Carbon monoxide (CO)	8 Hours**	02	02
mg/m³	1 Hour**	04	04
Ammonia (NH_3)	Annual*	100	100
µg/m³	24 Hours**	400	400
Benzene (C_6H_6)	Annual*	05	05
µg/m³			
Benzo(α)Pyrene-particulate phase ng/m³	Annual*	01	01
Arsenic (As)	Annual*	06	06
ng/m³			
Nickel (Ni)	Annual*	20	20
ng/m³			

Note: *Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform interval.
** 24 hourly/8 hourly/1 hourly monitored values, as applicable shall be complied with 98% of the time in a year. 2% of the time, it may exceed but not on two consecutive days of monitoring.

As the project is in rural/residential set up, NAAQS for rural/residential area will be applicable for the project.

IFC/WB Air Emissions and Ambient Air Quality Standards

The IFC/WB General EHS guidelines on Air emissions and ambient air quality, specifies that emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence World Health Organization (WHO) Ambient Air Quality guidelines as represented in ***Table Error*! No text of specified style in document.**..2

Table.2 WHO Ambient Air Quality Guidelines

Pollutant	Averaging Period	Guideline Value in μg/m³
Sulphur Dioxide	24-hour	24-hour
	10 minute	10 minute
		125 (Interim target-1)
		50 (Interim target-2)
Nitrogen Oxide	1 year	40 (guideline)
	1 hour	200 (guideline)
Particulate Matter 10	1 year	70 (Interim target-1)
		50 (Interim target-2)
		30 (Interim target-3)
		20 (guideline)
	24 hour	150 (Interim target-1)
		100 (Interim target-2)
		75 (Interim target-3)
		50 (guideline)
Particulate Matter 2.5	1 year	35 (Interim target-1)
		25 (Interim target-2)
		15 (Interim target-3)
		10 (guideline)
	24 hour	75 (Interim target-1)
		50 (Interim target-2)
		37.5 (Interim target-3)
		25 (guideline)
Ozone	8-hour daily Maximum	8-hour daily Maximum

Source: IFC/WB General EHS Guidelines: Air emissions and ambient air quality, 30 April 2007
Interim target means Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

1.1.2 Water Quality Standards

As per the Bureau of Indian Standards, (IS 10500: 2012) drinking water shall comply with the requirements given in ***Table Error*! No text of specified style in document.**..3.

Table.3 Indian Drinking Water Standard (IS 10500: 2012)

S.N	Substance/ Characteristics	Requirement (Acceptable limit)	Permissible limit in absence of alternate source
1.	Colour, Hazen units, max	5	15
2.	Odour	Unobjectionable	-
3.	Taste	Agreeable	-
4.	Turbidity, NTU, max	5	5
5.	pH value	6.5 - 8.5	No Relaxation
6.	Total hardness (as $CaCO_3$) mg/l, max	200	600
7.	Iron (as Fe) mg/l, max	0.3	No relaxation
8.	Chlorides (as Cl) mg/l, max	250	1000
9.	Free residual chlorine, mg/l, min	0.2	1
10.	Dissolved solids mg/l, max	500	2000
11.	Calcium (as Ca) mg/l, max	75	200
12.	Magnesium (as Mg) mg/l, max	30	100
13.	Copper (as Cu) mg/l, max	0.05	1.5
14.	Manganese (as Mn) mg/l, max	0.1	0.3
15.	Sulphate (as SO_4) mg/l, max	200	400
16.	Nitrate (as NO_3) mg/l, max	45	No relaxation
17.	Fluoride (as F) mg/l, max	1.0	1.5

S.N	Substance/ Characteristics	Requirement (Acceptable limit)	Permissible limit in absence of alternate source
18.	Phenolic compounds (as C6H6OH) mg/l, max	0.001	0.002
19.	Mercury (as Hg) mg/l, max	0.001	No relaxation
20.	Cadmium (as Cd) mg/l, max	0.003	No relaxation
21.	Selenium (as Se) mg/l, max	0.01	No relaxation
22.	Arsenic (as As) mg/l, max	0.01	0.05
23.	Cyanide (as CN) mg/l, max	0.05	No relaxation
24.	Lead (as Pb) mg/l, max	0.01	No relaxation
25.	Zinc (as Zn) mg/l, max	5	15
26.	Anionic detergents (as MBAS) mg/l, max	0.2	1.0
27.	Total Chromium (as Cr) mg/l, max	0.05	No relaxation
28.	Polynuclear aromatic hydrocarbons (as PAH) g/l, max	0.0001	No relaxation
29.	Mineral Oil mg/l, max	0.5	No relaxation
30.	Pesticides mg/l, max	Absent	0.001
31.	Radioactive materials: a) Alpha emitters Bq/l, max b) Beta emitters pci/l, max	 0.1 1.0	 No relaxation No relaxation
32.	Total Alkalinity (as CaCO3), mg/l, max	200	600
33.	Aluminium (as Al) mg/l, max	0.03	0.2
34.	Boron, mg/l, max	0.5	1.0
35.	Ammonia (as total ammonia-N). mg/l, max	0.5	No relaxation
36.	Barium (as Ba), mg/l, max	0.7	No relaxation
37.	Chloramines (as Cl_2), mg/l, max	4.0	No relaxation
38.	Silver (as Ag), mg/l, max	0.1	No relaxation
39.	Sulphide (as H2S), mg/l, max	0.05	No relaxation
40.	Molybdenum (as Mo), mg/l, max	0.07	No relaxation
41.	Nickel (as Ni), mg/l, max	0.02	No relaxation
42.	Polychlorinated biphenyls, mg/l, max	0.0005	No relaxation
43.	Trilomethanes: a) Bromoform, mg/l, max b) Dibromochloromethane, mg/l, max c) Bromodichloromethane, mg/l, max d) Chloroform, mg/l, max	 0.1 0.1 0.06 0.2	 No relaxation No relaxation No relaxation No relaxation
	Bacteriological Quality		
1.	All water intended for drinking: a) E. coli or thermotolerant coliform bacteria	Shall not be detectable in any 100 ml sample	-
2.	Treated water entering the distribution system: a) E. coli or thermotolerant coliform bacteria b) Total coliform bacteria	Shall not be detectable in any 100 ml sample; Shall not be detectable in any 100 ml sample.	-
3.	Treated water in the distribution system: a) E. coli or thermotolerant coliform bacteria b) Total coliform bacteria	Shall not be detectable in any 100 ml sample; Shall not be detectable in any 100 ml sample.	-

Source: Central Pollution Control Board

General Standards for discharge

The general standards for discharge are as prescribed under the Environment Protection Rules, 1986 and amendments. The project intends to treat the domestic waste water in septic tanks and soak pits. The general standards for

discharge of environmental pollutants are detailed in ***Table Error*****! No text of specified style in document.**.4**.**

Table.4 *General Standards for Discharge of Environmental Pollutants*

S. N	Parameter	Standards Inland surface water	Public sewers	Land for Irrigation
1.	Colour and odour	Refer to Note 1	-	Refer to Note 1
2	Suspended solids mg/l, max.	100	600	200
3	Particle size of suspended solids	Shall 850 micron IS sieve	-	-
4	PH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5	Temperature	Shall not exceed 5^0 C above the receiving water temperature	-	-
6	Oil and grease, mg/l max,	10	20	10
7	Total residual chlorine, mg/l max	1.0	-	-
8	Ammonical nitrogen (as N), mg/l max.	50	50	-
9	Total Kjeldahl nitrogen (as N); mg/l max	100	-	-
10	Free ammonia (as NH3), mg/l max	5.0	-	-
11	Biochemical oxygen demand (3 days at 27^0 C), mg/l max	30	350	100
12	Chemical oxygen demand, mg/l max	250	-	-
13	Arsenic (as As) mg/l, max	0.2	0.2	0.2
14	Mercury (As Hg) mg/l max.	0.01	0.01	-
15	Lead (as Pb) mg/l, max	0.1	1.0	-
16	Cadmium (as Cd) mg/l, max	2.0	1.0	-
17	Hexavalent chromium (as Cr +6) mg/1 max	0.1	2.0	-
18	Total chromium (as Cr) mg/1 max	2.0	2.0	-
19	Copper (as Cu) mg/1, max	3.0	3.0	-
20	Zinc (as Zn)	5.0	15	-
21	Selenium (as Se)	0.05	0.05	-
22	Nickel (as Ni) mg/1,max	3.0	3.0	-
23	Cyanide (as CN) mg/1,max	0.2	2.0	0.2
24	Fluoride (as F) mg/1,max	2.0	15	-
25	Dissolved phosphates (as P) mg/1,max	5.0	-	-
26	Sulphide (as S) mg/1,max	2.0	-	-
27	Phenolic compounds (as C_6H_5OH) mg/1,max	1.0	5.0	-
28	Radioactive materials: (a) Alpha emitters micro curie mg/1,max (b) Beta emitters micro curie mg/1	10^{-7} 10^{-6}	10^{-7} 10^{-6}	10^{-8} 10^{--7}
29	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
30	Manganese	2 mg/1	2 mg/1	-
31	Iron (as Fe)	3mg/1	3mg/1	-
32	Vanadium (as V)	0.2 mg/1	0.2 mg/1	-
33	Nitrate Nitrogen	10 mg/1	-	-

Source: as per G.S.R 422 (E) dated 19.05.1993 and G.S.R 801 (E) dated 31.12.1993 issued under the provisions of E (P) Act 1986.

Designated Best Use Classification of Surface Water

The designated best use classification as prescribed by CPCB for surface water is as given in ***Table Error*! No text of specified style in document.**..5 below:

Table .5 Primary Water Quality Criteria for Designated-Best-Use-Classes

Designated-Best-Use	Class	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	• Total Coliforms Organism MPN/100ml shall be 50 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 6mg/l or more • Biochemical Oxygen Demand 5 days 20^{o}C 2mg/l or less
Outdoor bathing (Organized)	B	• Total Coliforms Organism MPN/100ml shall be 500 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 5mg/l or more • Biochemical Oxygen Demand 5 days 20^{o}C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	• Total Coliforms Organism MPN/100ml shall be 5000 or less • pH between 6 to 9 • Dissolved Oxygen 4mg/l or more • Biochemical Oxygen Demand 5 days 20^{o}C 3mg/l or less
Propagation of Wild life and Fisheries	D	• pH between 6.5 to 8.5 • Dissolved Oxygen 4mg/l or more • Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	• pH between 6.0 to 8.5 • Electrical Conductivity at 25^{o}C micro mhos/cm Max.2250 • Sodium absorption Ratio Max. 26 • Boron Max. 2mg/l
	Below-E	Not Meeting A, B, C, D & E Criteria

Source: Central Pollution Control Board

IFC/WB Guidelines for Treated Sanitary Sewage Discharge

Indicative values for treated sanitary sewage discharges are given in ***Table Error*! No text of specified style in document.**..6. These are applicable to meet national or local standards or in the absence of national standards for sanitary wastewater discharges and where either a septic system or land is used as part of treatment system.

Table.6 Indicative values for treated sanitary wastewater discharges

Pollutants	Units	Guideline Value
pH	pH	6-9
BOD	mg/l	30
COD	mg/l	125
Total Nitrogen	mg/l	10
Total Phosphorous	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total Coliform bacteria	MPN*/100ml	400

Source: General EHS Guidelines, World Bank Group, April 2007
*MPN = Most Probable Number

1.1.3 Noise Standards

Noise standards specified by the MoEF vide gazette notification dated 14th February, 2000 based on the *A* weighted equivalent noise level (L_{eq}) are as presented in ***Table Error*! No text of specified style in document.**.7.

Table.7 Ambient Noise Standards

Area Code	Category of Area	Limits in dB(A) Leq	
		Day time*	**Night Time**
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone**	50	40

Note:*Day time is from 6 am to 10 pm, Night time is10.00 pm to 6.00 am;**Silence zone is an area comprising not less than 100 meters around premises of hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority. Use of vehicle horns, loud speakers and bursting of crackers are banned in these zones. Source: Noise Pollution (Regulation and control)Rules,2000)

As the project is in rural/residential set up, noise standards for residential area will be applicable for the project.

IFC/WB Noise Standards

As per the IFC/WB, General EHS Guidelines on noise management, noise impacts should not exceed the levels presented in ***Table Error*! No text of specified style in document.**.8 or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table.8 Noise Level Guidelines

Receptor	One Hour LAeq (dBA) Daytime 07:00 - 22:00	 Night time 22:00 - 07:00
Residential; Institutional; Educational	55	45
Industrial; Commercial	70	70

Source: IFC/WB, General EHS Guidelines on noise management, 30 April, 2007

1.1.4 Hazardous Waste Management

The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 were promulgated under Environment (Protection) Act 1986, which was further amended in July 2009, September 2009, March 2010 and August 2010.

The major hazardous wastes to be released due to the proposed project are used or waste/used oil, oil containing rags and jutes. The categories of the wastes as applicable to construction and operation phases of the project and as

covered under Schedule 1 of the Hazardous wastes Rules, 2008 are given in the ***Table Error*! No text of specified style in document.**.9**.**

Table.9 ***List of Hazardous Wastes Generated in the Project: Schedule-1 of HWM Rules, 2008***

Category No.	Processes	Hazardous Wastes
5	Industrial operations using mineral/synthetic oil as lubricant in hydraulic systems or other applications	5.1 Used spent Oil 5.2 Wastes/ residues containing oil

Schedule V (Part A) to these rules provide specifications for Used Oil suitable for reprocessing /recycling as given in ***Table Error*! No text of specified style in document.**.10. If the specifications are exceeded the oil should be incinerated properly.

Table 10 ***Specifications of Used Oil Suitable for Recycling: Schedule V (Part A)***

S.N	Parameter	Limit
1	Polychlorinated biphenyls (PCBs)	< 2ppm maximum
2	Lead	100 ppm maximum
3	Arsenic	5 ppm maximum
4	Cadmium+ Chromium+ Nickel	500 ppm maximum
5	Polyaromatic hydrocarbons (PAH)	6% maximum

The Central Pollution Control Board (CPCB) has stipulated different environmental standards w.r.t. ambient air quality, noise quality, water and waste water for the country as a whole under EP Act, 1986.

Annex D

Project Data overview

Licensed user:
ERM India Private Limited
Building 10, 4th Floor, Tower A, DLF Cyber City
IN-122002 Gurgaon
+91 124 4170300
Naval Chaudhary / naval.chaudhary@erm.com
Calculated:
11/17/2015 5:00 PM/3.0.578

BASIS - Project data overview

Calculation: Project Data Overview
Country: India

Maps

Name	Format	Path
Basemap1	Bitmap map	C:\Users\Naval.Chaudhary\Documents\WindPRO Data\Projects\MEIL - Nipaniya\Basemap1.bmi
Basemap2	Bitmap map	C:\Users\Naval.Chaudhary\Documents\WindPRO Data\Projects\MEIL - Nipaniya\Basemap2.bmi
Basemap	Bitmap map	C:\Users\Naval.Chaudhary\Documents\WindPRO Data\Projects\MEIL - Nipaniya\Basemap.bmi

Site center: UTM (north)-WGS84 Zone: 43 East: 561,889 North: 2,678,492

WTGs

	UTM (north)-WGS84 Zone: 43				WTG type					
	Easting	Northing	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height
			[m]					[kW]	[m]	[m]
NPY-P3-112	563,125	2,684,570	450.1	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-113	563,365	2,684,128	454.6	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-114	563,017	2,683,540	454.4	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-115	562,741	2,682,922	449.2	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-116	562,668	2,682,394	452.7	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-117	562,399	2,681,877	454.7	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-119	562,247	2,680,746	454.1	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-120	562,280	2,680,363	452.4	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-124	560,738	2,679,883	456.6	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-127	561,625	2,678,699	462.1	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-128	561,705	2,678,371	462.0	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-140	561,122	2,675,545	467.6	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-143	560,999	2,673,501	477.0	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-154	565,883	2,680,293	450.4	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-155	566,024	2,679,687	452.0	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-156	566,062	2,679,179	458.7	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-157	565,989	2,678,669	458.6	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P3-41	563,300	2,670,901	478.6	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P-51	561,778	2,671,930	482.5	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P-52	561,589	2,672,797	477.9	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P-53	561,061	2,674,073	476.8	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P-54	560,866	2,674,487	474.8	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P-55	560,642	2,674,883	475.7	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P-58	561,969	2,676,944	469.5	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0
NPY-P-59	561,874	2,677,704	466.0	INOX WT 2000 DF 100 20...	New	No	INOX WT 2000 DF 100-2,000	2,000	100.0	80.0

Shadow receptor

	UTM (north)-WGS84 Zone: 43								
	Easting	Northing	Z	Object name	Orientation	Length	Height	Height a.g.l.	Angle
			[m]		[°]	[m]	[m]	[m]	[°]
A	562,574	2,683,085	446.8	Structure	135.7	1.0	1.0	1.0	90.0
B	562,050	2,677,168	474.9	Structure	202.8	1.0	1.0	1.0	90.0
C	561,907	2,676,713	479.2	Training institute	12.5	1.0	1.0	1.0	90.0
D	561,631	2,676,754	471.0	Warehouse	60.2	1.0	1.0	1.0	90.0
E	561,715	2,676,725	471.6	Structure	38.9	1.0	1.0	1.0	90.0
F	560,724	2,674,122	472.0	Structure	106.5	1.0	1.0	1.0	90.0
G	560,899	2,673,754	471.1	Structure	160.4	1.0	1.0	1.0	90.0
H	560,983	2,673,455	476.3	Shed - Kutcha	10.9	1.0	1.0	1.0	90.0
I	562,126	2,671,944	478.7	Structure	263.3	1.0	1.0	1.0	90.0
J	560,754	2,679,641	462.3	Hut	-3.5	1.0	1.0	1.0	90.0
K	562,215	2,681,815	449.9	Structure 1 (NPY-P3-117)	68.2	1.0	1.0	1.0	90.0
L	562,601	2,682,078	454.1	Structure 2 (NPY-P3-117)	224.9	1.0	1.0	1.0	90.0
M	562,646	2,681,827	452.0	Structure 3 (NPY-P3-117)	-78.0	1.0	1.0	1.0	90.0
N	561,734	2,676,853	479.1	Structure 1 (WTG_NPY-P-58)	66.3	1.0	1.0	1.0	90.0
O	561,990	2,676,573	469.6	Structure 2 (WTG_NPY-P-58)	-4.4	1.0	1.0	1.0	90.0
P	562,082	2,677,123	477.2	Structure 3 (WTG_NPY-P-58)	213.8	1.0	1.0	1.0	90.0
Q	562,068	2,676,492	467.3	Temple (WTG_NPY-P-58)	-20.5	1.0	1.0	1.0	90.0
R	562,103	2,676,624	467.0	Structure 4 (WTG_NPY-P-58)	-27.6	1.0	1.0	1.0	90.0
S	565,491	2,678,485	455.9	Structure 1 (WTG_NPY-P3-157)	52.7	1.0	1.0	1.0	90.0
T	565,607	2,678,414	455.0	Structure 2 (WTG_NPY-P3-157)	52.7	1.0	1.0	1.0	90.0
U	565,736	2,678,357	457.7	Structure 3 (WTG_NPY-P3-157)	31.4	1.0	1.0	1.0	90.0
V	565,853	2,678,331	458.4	Structure 4 (WTG_NPY-P3-157)	28.6	1.0	1.0	1.0	90.0

To be continued on next page...

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BASIS - Project data overview

Calculation: Project Data Overview

...continued from previous page

UTM (north)-WGS84 Zone: 43

	Easting	Northing	Z	Object name	Orientation	Length	Height	Height a.g.l.	Angle
			[m]		[°]	[m]	[m]	[m]	[°]
W	565,976	2,678,310	459.0	Structure 5 (WTG_NPY-P3-157)	0.4	1.0	1.0	1.0	90.0
X	566,076	2,678,308	458.0	Structure 6 (WTG_NPY-P3-157)	-18.5	1.0	1.0	1.0	90.0

Elevation grid

UTM (north)-WGS84 Zone: 43

	Easting	Northing	Z [m]	Object name	File
A	561,881	2,678,492	0.0	Elevation Grid Data Object: Nipaniya_EMDGrid_0.wpg	C:\Users\Naval.Chaudhary\Documents\WindPRO Data\Projects\MEIL - Nipaniya\Nipaniya_EMDGrid_0.wpg

Annex E

Shadow Calendar

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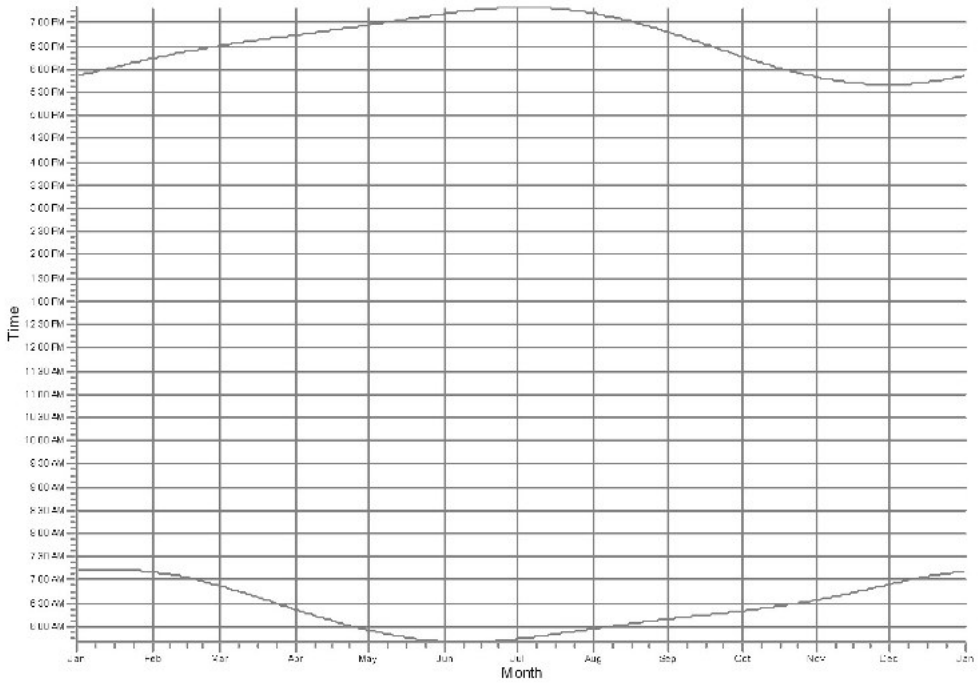
SHADOW - Calendar, graphical

Calculation: Real Case Scenario

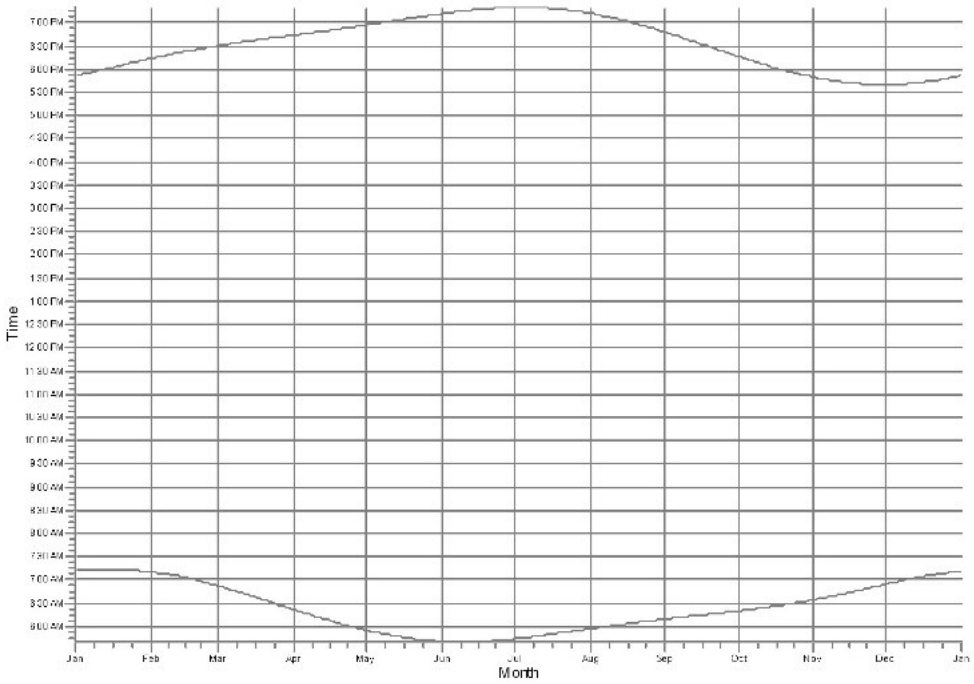
A: Structure

B: Structure

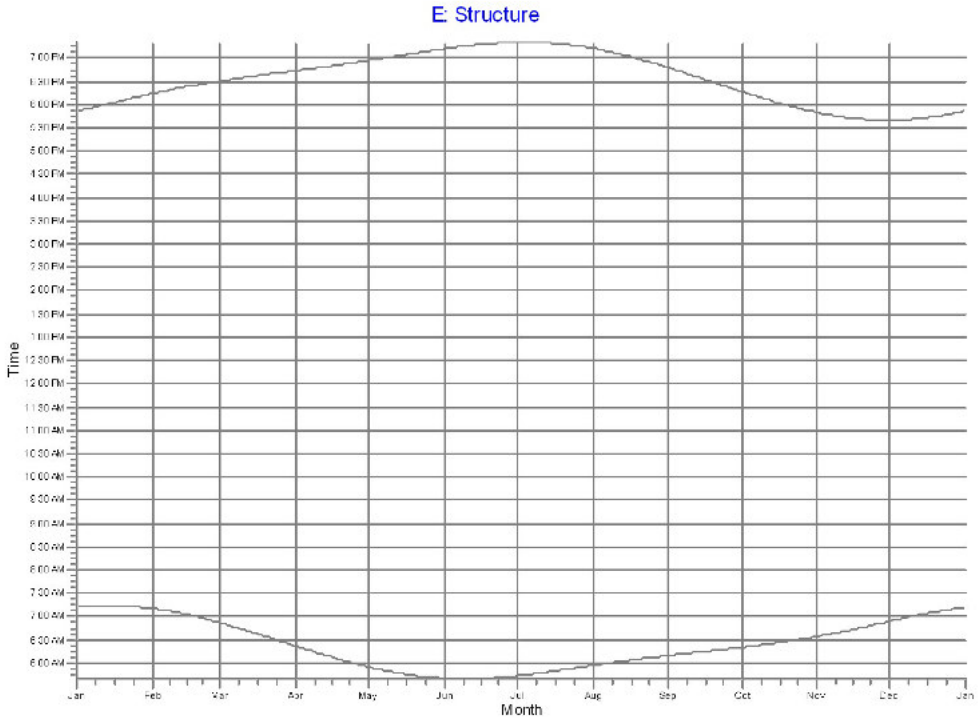
C: Training institute



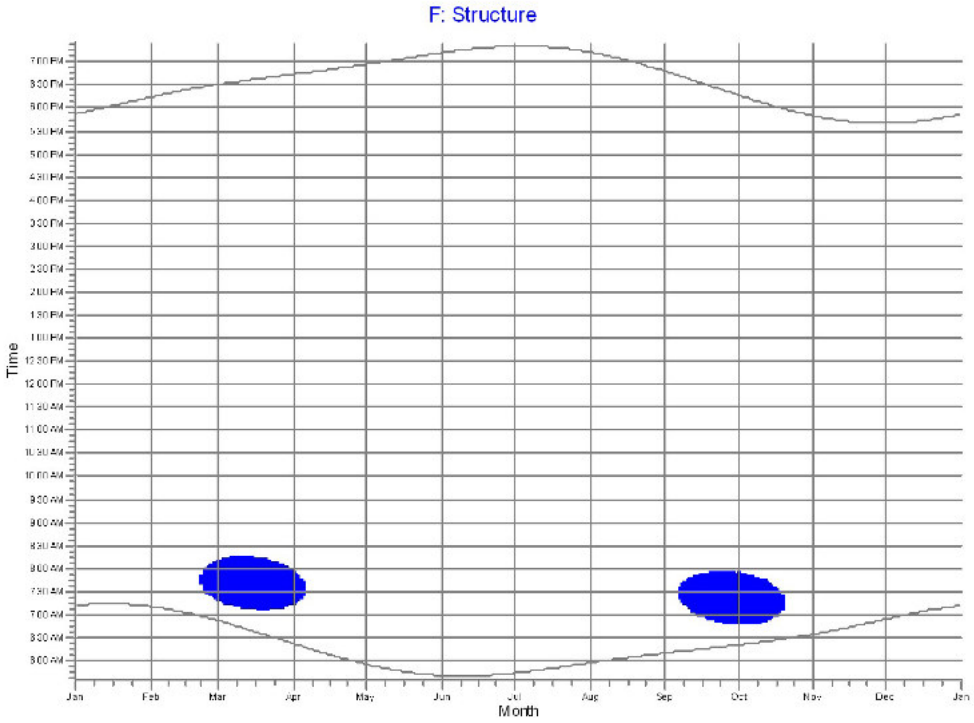
D: Warehouse



E: Structure



F: Structure



WTGs

NPY-P-53: INOX WT 2000 DF 100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (3)

NPY-P3-115: INOX WT 2000 DF 100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (13)

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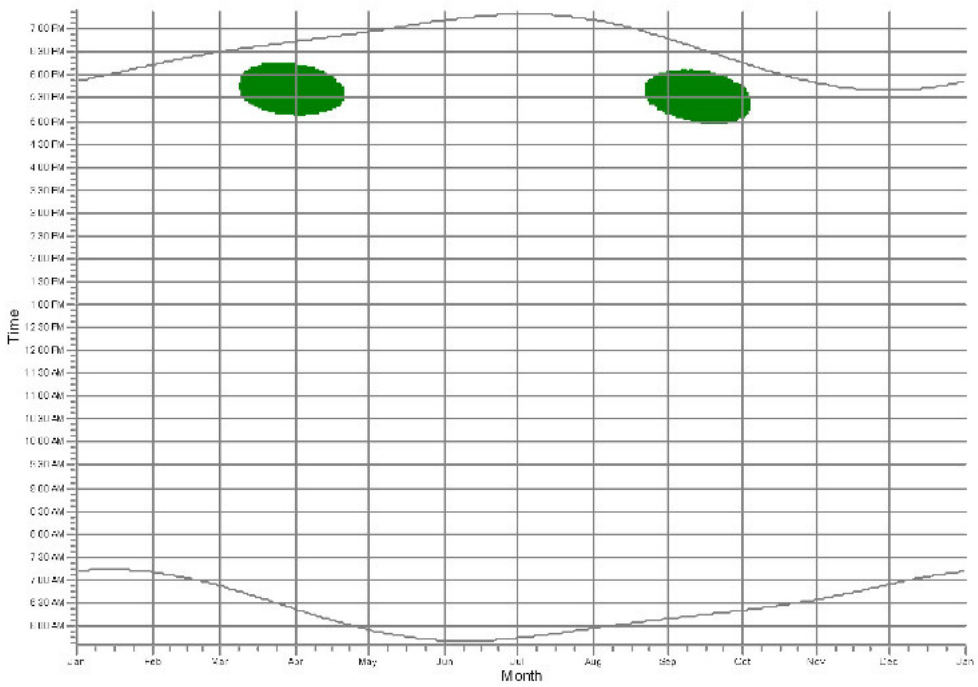
SHADOW - Calendar, graphical

Calculation: Real Case Scenario

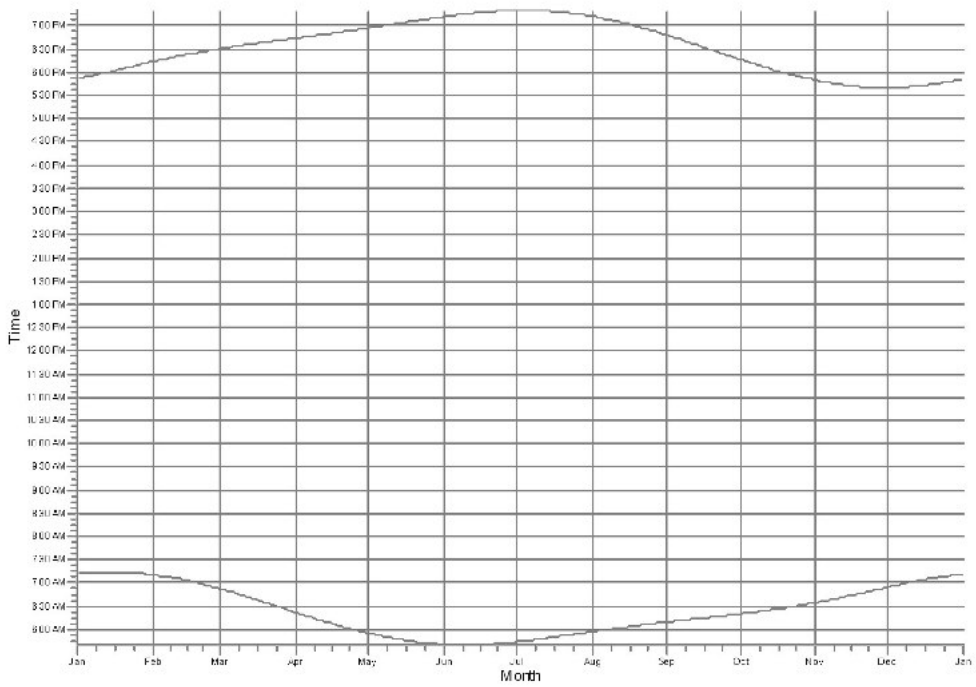
G: Structure

H: Shed - Kutcha

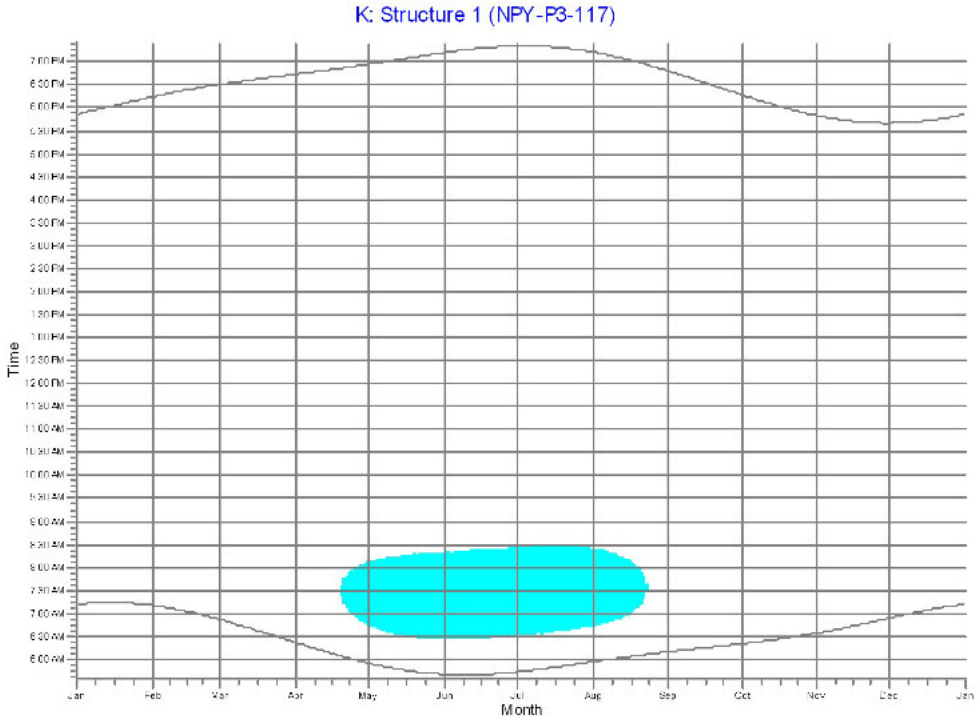
I: Structure



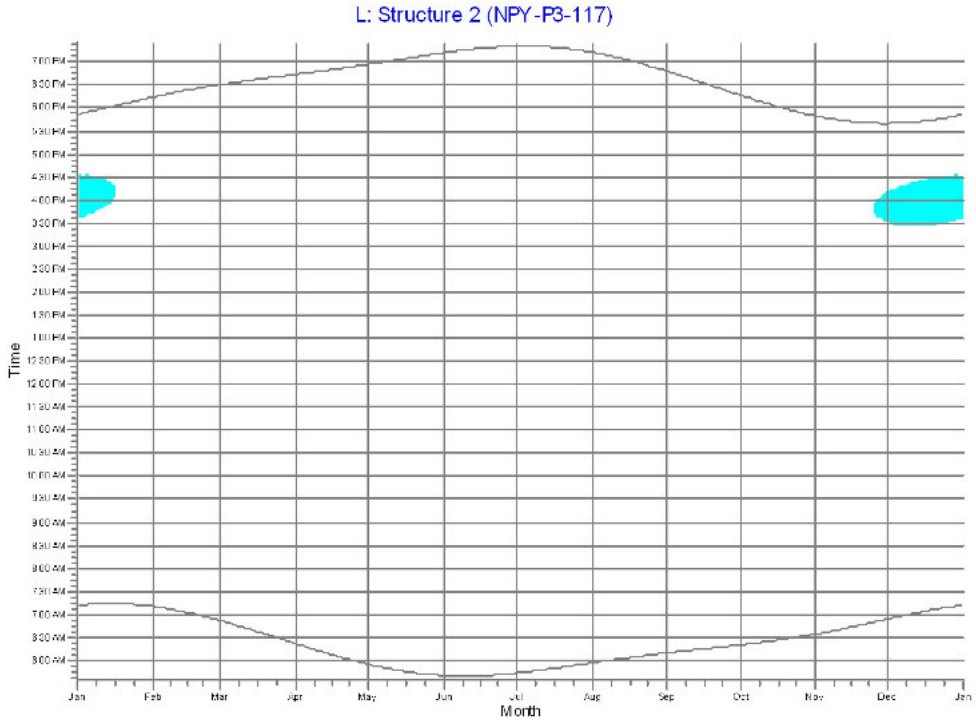
J: Hut



K: Structure 1 (NPY-P3-117)



L: Structure 2 (NPY-P3-117)



WTGs

NPY-P-51: INOX WT 2000 DF 100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (1)

NPY-P3-117: INOX WT 2000 DF 100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (15)

NPY-P3-143: INOX WT 2000 DF 100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (25)

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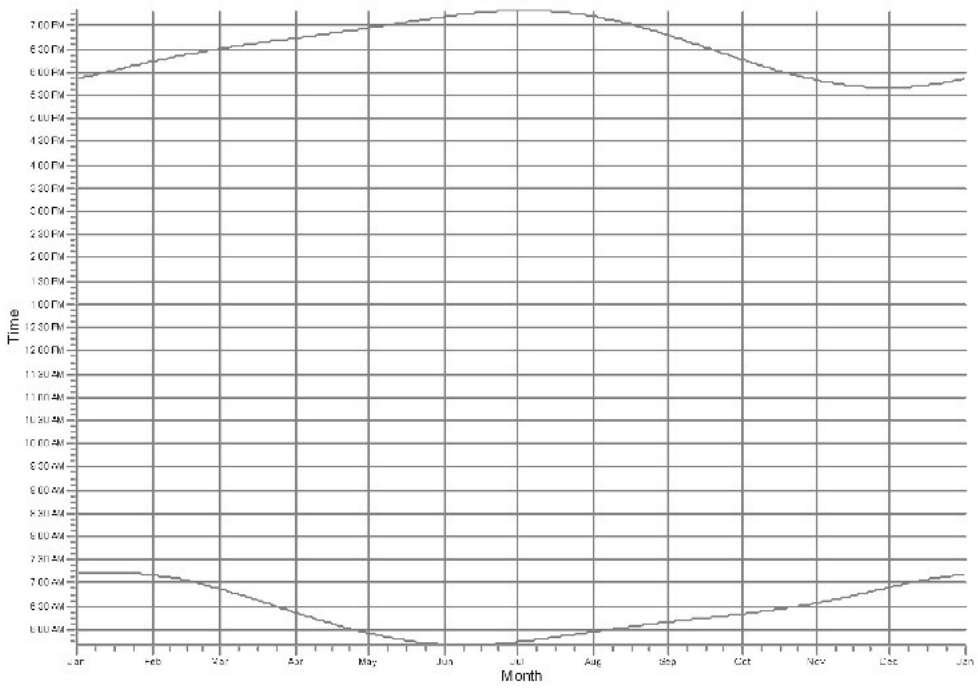
SHADOW - Calendar, graphical

Calculation: Real Case Scenario

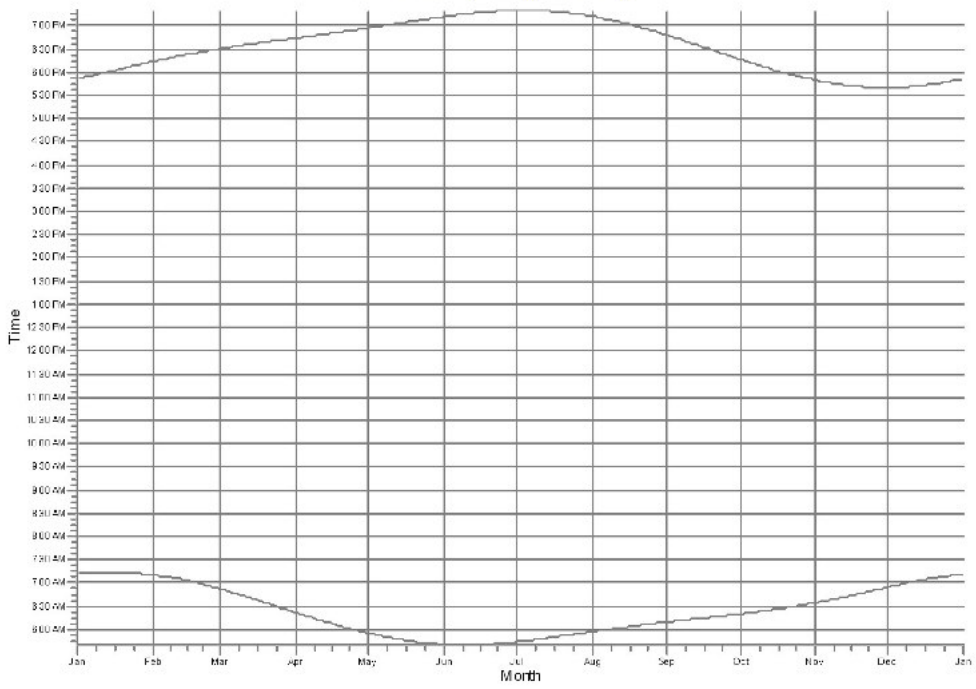
M: Structure 3 (NPY-P3-117)

N: Structure 1 (WTG_NPY-P-58)

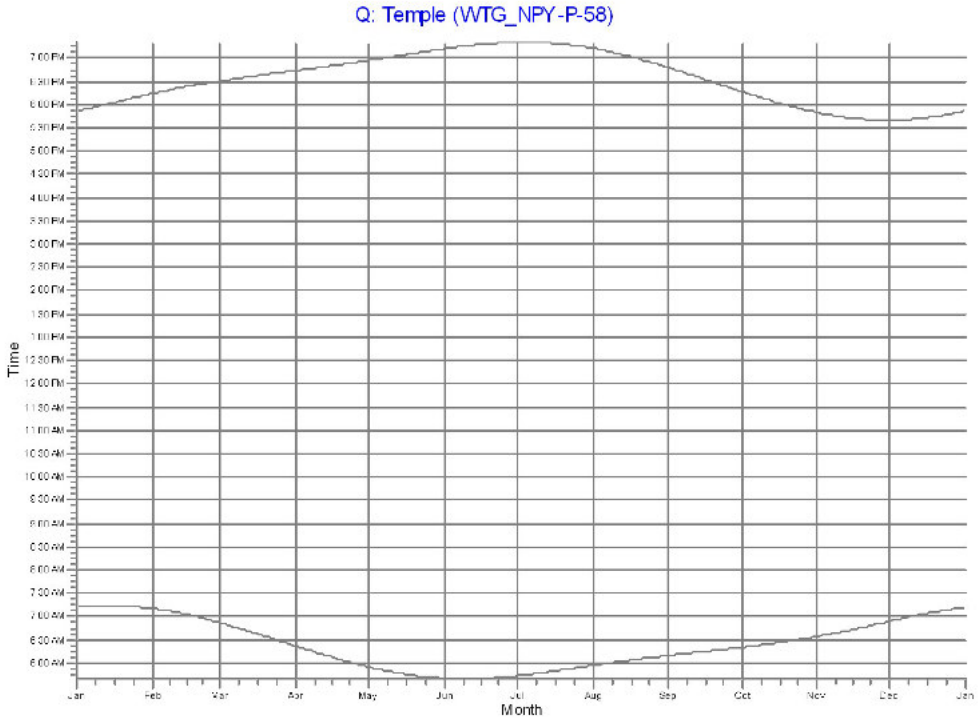
O: Structure 2 (WTG_NPY-P-58)



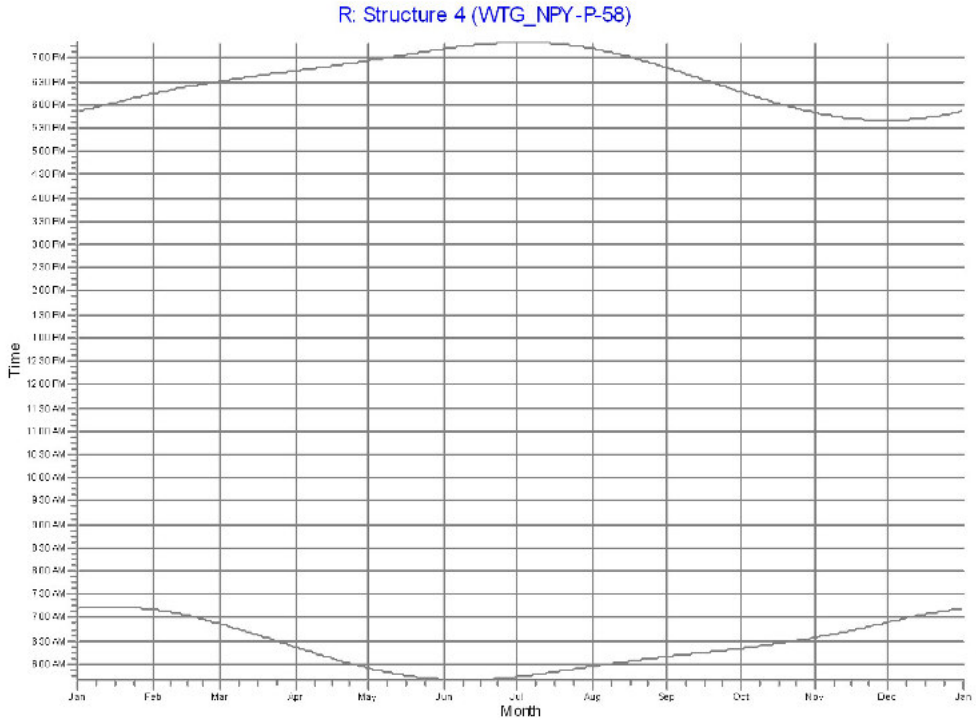
P: Structure 3 (WTG_NPY-P-58)



Q: Temple (WTG_NPY-P-58)



R: Structure 4 (WTG_NPY-P-58)



WTGs

NPY-P-58: INOX WT 2000 DF 100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (8)

NPY-P3-117: INOX WT 2000 DF 100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (15)

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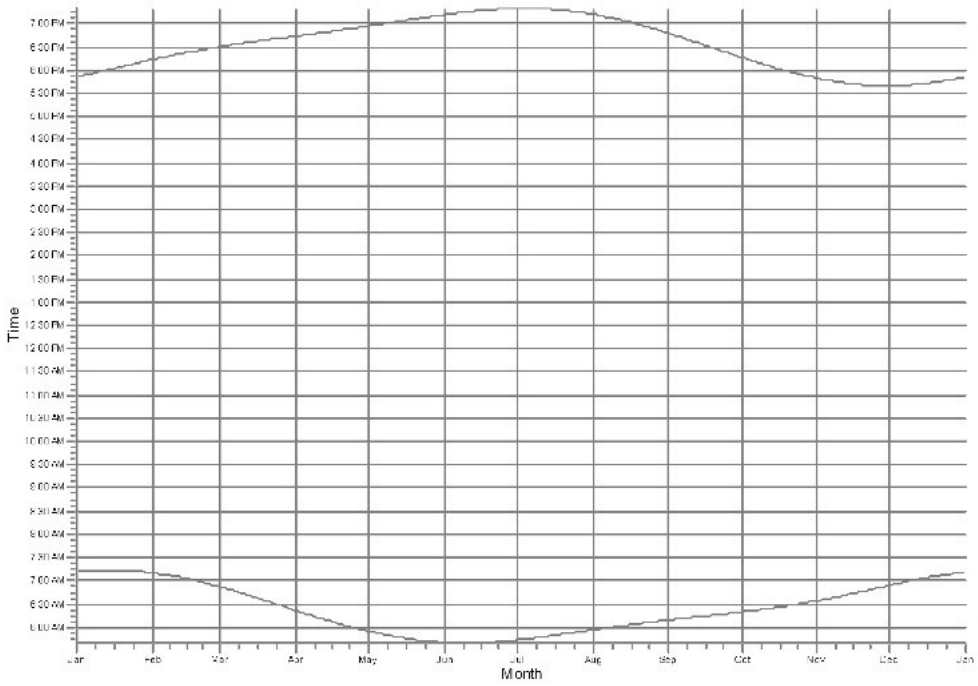
SHADOW - Calendar, graphical

Calculation: Real Case Scenario

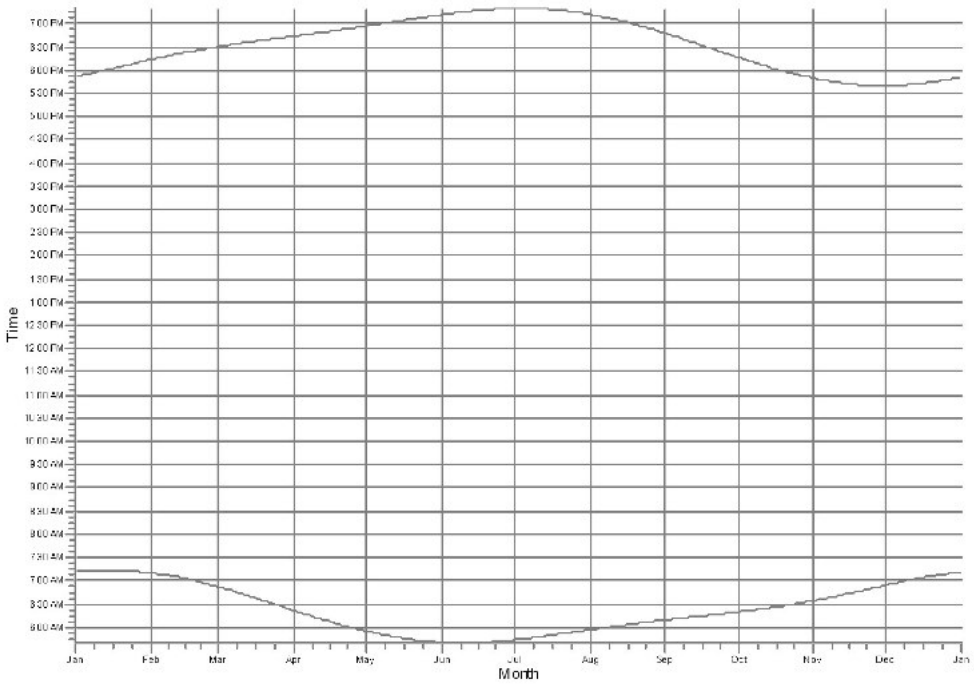
S: Structure 1 (WTG_NPY-P3-157)

T: Structure 2 (WTG_NPY-P3-157)

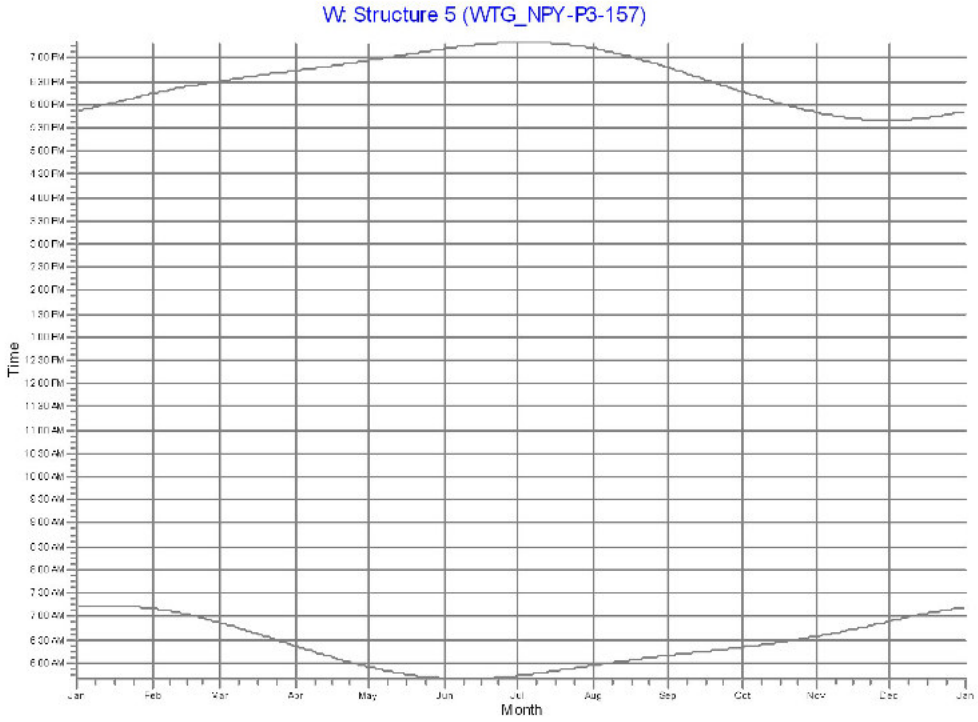
U: Structure 3 (WTG_NPY-P3-157)



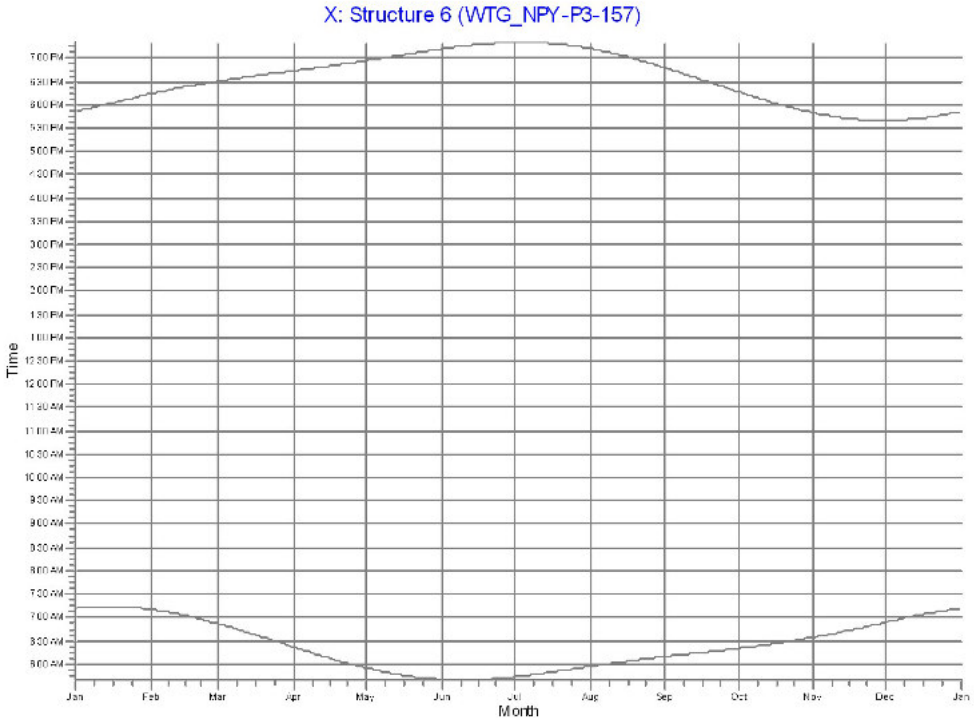
V: Structure 4 (WTG_NPY-P3-157)



W: Structure 5 (WTG_NPY-P3-157)



X: Structure 6 (WTG_NPY-P3-157)



WTGs

NPY-P3-157: INOX WT 2000 DF 100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (29)