Temperature

As per the data recorded at meteorological station, Jaisalmer, the temperature begins to increase from January till May. May and June are the hottest months with highest temperature of 41.6^{0}C recorded in May month. The lowest temperature of 23.7^{0}C was recorded in month of January. The daily mean minimum temperature varies from 7.6^{0}C in January to 27.0^{0}C in June, whereas the daily mean maximum temperature varies from 23.7^{0}C in January to 41.6^{0}C in May.

Rainfall

The total annual rainfall in the region is about 208 mm as per the data from the year 1948-2000. The monsoon sets in June and attains the high intensity in month of August. The monsoon withdraws towards the end of the September. The remaining months of the year also experience the sporadic rains. The maximum rainfall was observed during month of August (75.8 mm) and minimum during the month of November (1.5 mm).

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:

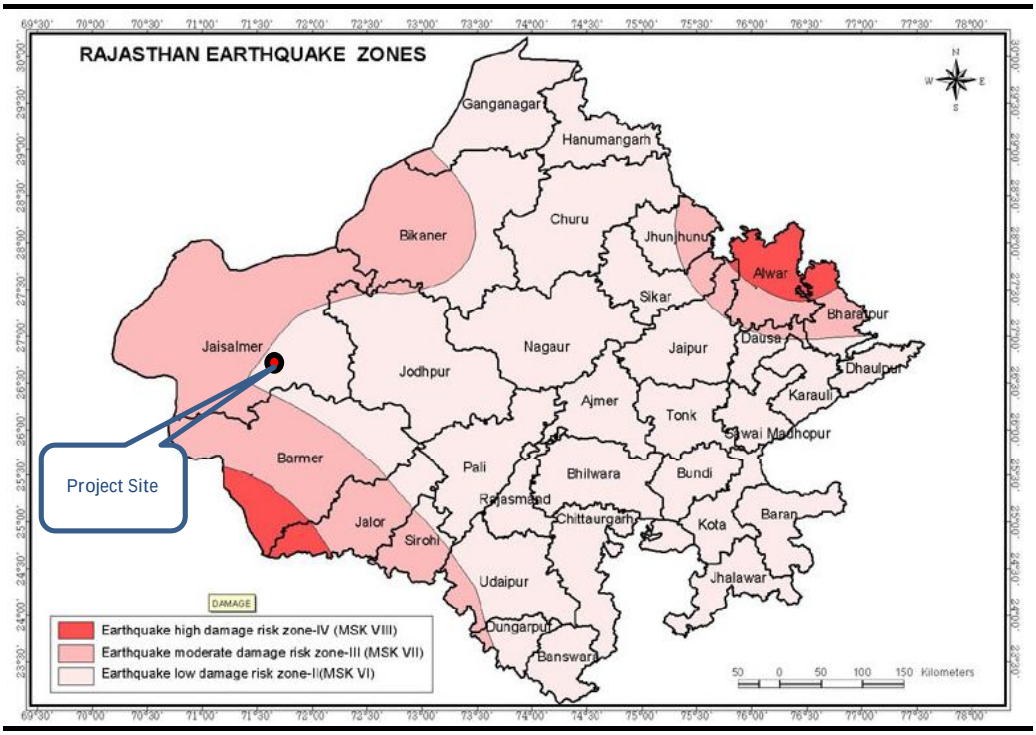
Seismic

The project area falls in Seismic Zone I which is defined as a low damage risk zone and vulnerable to earthquakes of intensity MSK VI[2] (as defined by the BMTPC - ***Figure 6.6***). Most recent seismic activity that occurred in Jaisalmer district was when an earthquake of magnitude Mw=5.1 struck the area on 9 April 2009. According to data available on ASC (Amateur Seismic Centre) website, this moderate earthquake (M 5.0-5.9 termed as moderate) had its epicentre east of Mokal village, which lies approximately 80 km north-west of the wind farm area and was felt in a large part of the region along the India-Pakistan border. No other data on historical earthquakes were available for the region. It indicates that the foundation and structures of the project have to be designed to handle seismic interruptions.

[1] Natural Hazard maps can be found on the BMTPC website here: http://www.bmtpc.org/topics.aspx?mid=56&Mid1=178

[2] MSK – Medvedev-Sponheuer-Karnik Scale is a macroseismic intensity scale used to evaluate the severity of ground shaking on the basis of observed effects in an area of the earthquake occurrence. This scale was first propoed in 1964. The MSK scale has 12 intensity degrees expressed in Roman numerals I (Not perceptible) – XII (very catastrophic). VI indicates strong felt by many indoors and outdoors.

Figure 6.6 Seismic Map of Rajasthan



Source: Disaster Management & Relief Department, Government of Rajasthan website (http://www.dmrelief.rajasthan.gov.in/index.php/citizen-charter/maps-of-rajasthan/earthquake-zones)

Wind

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

Flood

The Wind farm site and AoI do not fall under flood prone areas although news of flash floods in year 2010 was reported in the Jaisalmer districts.

6.4.8 Noise Quality

Noise Level was recorded at six (06) locations in the study area during the monitoring period. Noise levels were recorded in form of sound pressure levels with the help of a digital sound level meter.

Table 6.5 Details of Ambient Noise Monitoring Location

S.N	Location	Geographical Coordinates (UTM)	Distance and direction w.r.t Wind farm site (approx.)
1	NQ01 (Near WTG 058)	744931.74 E, N 2954265.26	12 m; N
2	NQ02 (Near WTG 055)	743069.0 N, 2954730.13 E	10 m; S
3	NQ03 (Near WTG 128 close to Sadrasar village)	748608.09 E, 2954004 N	210 m;
4	NQ04 (Near WTG 342)	760407 E, 2949833.0 N	291 m; SW

S.N	Location	Geographical Coordinates (UTM)	Distance and direction w.r.t Wind farm site (approx.)
5	NQ05 (Near WTG 360)	759715 E, 2951320 N	1750 m; NW
6	NQ06 (Near WTG 056)	744001 E, 2951320 N	930 m; SW

Source: ERM's Site Assessment

Thus, these locations capture the baseline conditions prevailing at nearest settlements to the wind farm site. Two sensitive receptors (a temple and school) were observed at a distance of 250 m from the WTGs 360 and 342 respectively within 500 m radius of the project footprint area.

Methodology

Noise monitoring was carried out for 24 hours (one time) during monitoring period. Noise levels were recorded continuously using a digital logger covering both daytime (0600 to 2200 hrs) and night-time (2200 to 0600 hrs). At each location, day time Leq has been computed from the continuous 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 6.6.***

Table 6.6 Ambient Noise Levels in the Study Area during Monitoring Period

S.No.	Locations	Noise level (dB(A))				Applicable CPCB Standard (dB(A))-Residential Landuse	
		Leq Day	Leq Night	Lmax	Lmin	Day time	Night time
1	Near WTG 058 (NQ-01)	64.4	54.9	67.9	52.0	55	45
2	Near WTG 055 (NQ-02)	76.4	66.4	79.2	60.0	55	45
3	Near WTG 128 (NQ-03) (Sadrasar Village)	52.6	43.6	54.6	39.8	55	45
4	Near WTG 342 (NQ-04)	64.8	53.9	68.8	54.8	55	45
5	Near WTG 360 (NQ 05)	63.3	52.7	66.7	50.1	55	45
6	Near WTG 056 (NQ-06)	62.9	53.1	66.4	50.0	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.

The equivalent ambient noise level for day time (Leq day) and night time (Leq night) at all the monitoring locations were observed to be exceeding the prescribed CPCB limits except at location 3 (near WTG 128) which is below

the prescribed corresponding limits for a residential area. The high noise levels are attributed to high wind speeds during the period, vehicular movement, and presence of other turbines.

6.5 ECOLOGICAL BASELINE

6.5.1 Introduction

An ecological survey was undertaken from 22nd to 25th August, 2015 of the Bhesada wind farm site of Mytrah. The ecological assessment was carried out in a study area which comprised the wind farm (core zone) and surrounding 5 km radius from the boundary of wind farm (buffer zone).The sky was clear and sunny. The temperature ranged between a maximum of 36-32°C and minimum temperature of 27-24°C.

The ecological surveys were conducted with following objectives:

Flora

- Identification of floral species (terrestrial and aquatic), sensitive habitats, endangered species and forest land falling within the study area (including within the core zone);
- Enumeration of tree species present in the core zone) and the buffer zone
- Field surveys to identify any endangered, protected or endemic floral species prevailing in the study area;
- 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 2015 v2.0, or according to the schedules of the Indian Wildlife Protection Act 1972 and amendments);
- Identification of areas which are important or vulnerable for breeding, nesting, foraging, resting or 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 core and buffer areas include vegetation on sand dunes, 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 carried out along the hedges of all the aquatic habitats and open wells located in the study area were checked to identify and list 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 area.

Avifauna

Avifaunal species were enumerated by habitat surveys at the sample plots. Avian identification was carried out with standard field guides [(3)].

Mammals

Habitat survey for mammals was conducted. Identification was carried out using standard literature. [(4)(5)]

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 was assessed using the IUCN Red data list 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 study area (core and buffer zone) as shown in ***Figure 6.7*** is through the Jaisalmer-Barmer Highway NH-15 Road. The study area is part of

(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.

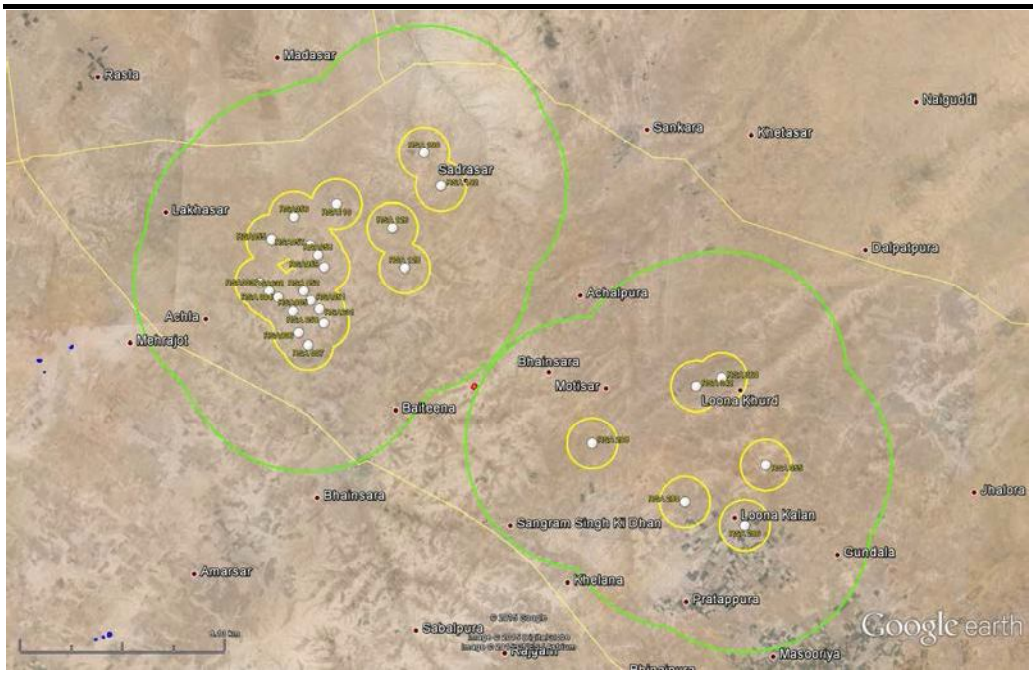
(3) Birds of India, Srilanka, Pakistan, Nepal, Bhutan, Bangladesh and Maldives. 2000. Krys Kazmeierczak and Ber Van `Perlo. Om Field Guides

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

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

larger wind farm of Suzlon however in the buffer area, other wind farms of Inox and Enercon (Wind World) have been erected.

Figure 6.7 Map showing the Study area



Source: Google Earth Satellite Imagery dtd.: 1st January 2014

Core Area

The core area has agricultural fields, open scrub vegetation, community plantation areas and some man made water bodies (mostly dried). Construction activities have been started at the site for WTG erection, approach roads and transmission lines.

The other anthropogenic activity in the area is agriculture and livestock rearing which is the main source of livelihoods. Rainwater is the main source for irrigation and drinking water in the region. The vegetation classification of the area is given in the ***Table 6.7.***

Table 6.7 Vegetation Classification of the Region

Area Type	Classification
Plant Diversity Centers of India[1]	3. Desert
Biogeographic Province of India[1]	3A. Desert-Thar
Phyto-geographical regions of India[2]	Semi Arid and Arid Region
Agro Ecological Sub Region (Indian Council of Agricultural Research) [3]	Western Plain, Katchch And Part Of Kathiawar Peninsula, Hot Arid Eco-Region (2.1)
Agro-Climatic Region (Planning Commission)[3]	Western Dry Region- (XIV)
Agro Climatic Zone (National Agricultural Research Project)[3]	Arid Western Zone (RJ-1)

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-Jaisalmer, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India

Following habitats are found within the core and buffer zone as discussed below

6.5.4 *Habitats in the study area with representative vegetation*

Open Land and Grasslands

The study area is predominantly open land with sparse grassland habitat. . These grasslands are represented by species such as *Panicum antidotale, Cenchrus bifloris, Cenchrus ciliaris, Dactyloctenium sindicum, Aristida funiculate, Tragus racemosa, Cyperus bulbosus, Cymbopogon jwarancusa, Aristida mutabilis* and *Panicum turgidum*.

Beside grasses, isolated tree species, predominantly *Prosopis cineraria*, with *Acacia nilotica, Acacia catechu*, *Acacia senegal* and shrubs of *Salvadora oleoides, Capparis decidua* are also present. Smaller shrubs of *Salvadora oleoides, Euphorbia nerifolia, Calatropis procera,* "Bui" *(Aerva tomentora),* "Kair" *(Capparis decidua),* Phog *(Calligonum polygonoides), Tecomella undulata, Salvadora persica and Zizyphus nummularia* and "Kheep" *(Leptadenia pyrotechnica)* are commonly found in the area.

Figure 6.8 Habitats in Study Area

Isolated trees in Agriculture Lands

Scrub vegetation (*Calatropis*) in fallow land

Agricultural Land

Grassland

Wheat cultivation

Water Bodies

Source: Site and surrounding areas survey by ERM during 22nd to 25th August, 2015

Sand dunes and Interdunal Plains

Sand dunes are vegetated for stabilization with tree species predominantly of *Prosopis cineraria*, *Acacia nilotica,Acacia catechu*, *Acacia senegal* and shrubs of *Salvadora oleoides, Capparis decidua* which are present on the fringes. Occasional presence of *Calotropis gigantea* and *Lasiurus sindicus* is also observed. Interdunal plain is majorly a grassland habitat with species of *Cenchrus bifloris, Cenchrus ciliaris, Dactyloctenium sindicum, Aristida funiculate, Tragus racemosa, Cyperus bulbosus* and *Cymbopogon jwarancusa.*

Agricultural Land

Agriculture in the study area is mainly undertaken during the post monsoon season (July-September). Rainfall is the only source of irrigation. Some parcels of land are also been irrigated by tube wells and crops such as cumin (*Cuminum cyminum*), Cluster bean (*Cyamopsis tetragonoloba*), Ground Nut (*Arachis hypogaea*)were observed during the survey. Watermelon (*Citrullus lanatus*) is also grown during monsoon season. In the agricultural land *Prosopis cineraria* is the most dominant tree. Species of *Ziziphus nummularia* (Ber), *Ziziphus mauritiana*, *Clerodendrum phlomoidis* (Irna), *Balanites aegiptium* (Hingota), *Calotropis procera* (Aak) shrubs are also sparsely present in the agricultural land not utilized for last 4-5 years. Among under-shrubs and herbs, *Crotalaria burhia* and *Tephrosia purpurea* (bewna) are the common species. *Acacia tortilis* is a common species planted under roadside plantation and for the rehabilitation of Gauchar (Grazing Land) lands of the region.

Waterbodies

The water bodies in the study area are seasonal and accumulate the runoff water during rainfall. During the survey most of them were dried up.

Plantation Areas

Isolated plantations were raised by the forest department to check soil erosion and habitat restoration along with providing forage to mammal species such as Indian Gazelle (*Gazella bennettii*) and Nilgai (*Boselaphus tragocamelus*). The common tree species associated with these plantation areas are *Prosopis juliflora*, *Prosopis cineraria, Acacia Senegal*, *Salvadora oleoides* and *Salvadora persica.* Shrubs are represented by species of *Capparis decidua*, *Ziziphus nummularia*, *Leptadenia pyrotechnica* and *Balanites aegiptiaca*. Grasses are mainly *Aristida adsensionis*, *Cenchrus ciliaris*, *Cenchrus biflorus*, *Panicum turgidum*, and *Lasiurus sindicus*.

Economic values of Plant species from the Study area

The economic values of some plant species from the area are given in ***Table 6.8***

Table 6.8 Economic Values of some plant species from the area

SN	Local Name	Botanical Name	Economic Uses
Common Tree Species			
1	Khejri	*Prosopis cineraria*	Fuel wood, Young shoots used as Fodder
2	Rohida	*Tecomella undulata*	Timber, Fuel wood & Medicinal uses
3	Bordi	*Ziziphus mauritiana*	Fruits edible, Timber & Medicinal uses
4	Neem	*Azadirachta indica*	Medicinal uses
5	Kumat	*Acacía senegal*	Forage, Fodder & source of Gum
6	Babool	*Acacia nilotica*	Forage, Fodder & Medicinal
7	Faras	*Tamarix aphylla*	Commonly used as windbreak
8	Gonda	*Cordia myxa*	Multiple uses
9	Ker	*Capparís decidua*	Landscaping and Slope stablization
10	Hingota	*Balanites ægyptiaca*	Fruits are edible, Medicinal uses
11	Jal(Khara)	*Salvadora persica*	Medicinal
12	Keekar	*Prosopis juliflora*	Fuel wood
13	Giri	*Choloroxylon swietenia*	Furniture Building
14	Kheenp	*Leptadenia reticulata*	Medicinal
15	Bar	*Ziziphus zizyphus*	Fruits edible
Common Bushes			
1	Gugal	*Conmiiphora wiglatii*	Medicinal
2	Thar Beri	*Ziziphus nummularia*	Forage & Fodder
3	Kheemp	*Leptadenia pyrotechnica*	Sand dune fixation
4	Phog	*Calligonum polygonoides*	Forage & Fodder, Flower edible
5	Banwali	*Acacia jacquemontii*	Medicinal
6	Vajradanti	*Barleria prionitis*	Medicinal
7	Alai	*Mimosa hamata*	Forage & Fodder, Soil Binder
8	Murali	*Lycium barbarum*	Medicinal
9	Senia	*Crotalaria burhia*	Hut making, Medicinal & Forage
10	Lana	*Haloxylon salicornicum*	Medicinal
11	Bui	*Aerva persica*	Medicinal
12	Beyani	*Tephrosia purpurea*	Medicinal
13	Sonamukhi	*Cassia auriculiformis*	Medicinal
Common Grasses			
1	Sewan	*Lasiurus sindicus*	Forage & Fodder
2	Murat	*Panicum antidotale*	Forage & Fodder in tender stage
3	Bhurat	*Cenchrus bifloris*	Edible
4	Dhaman	*Cenchrus ciliaris*	Soil erosion control
6	Gandhiya	*Dactyloctenium sindicum*	Sand dune stabilization, shelterbelts and afforestation in dry zones
7	Lamp	*Aristida funiculata*	Forage & Fodder in tender stage
8	Hiran Chugi	*Tragus racemosa*	Forage & Fodder in tender stage
9	Moth	*Cyperus bulbosus*	Edible
10	Bura	*Cymbopogon jwarancusa*	Essential Oil
11	Lampra	*Aristida mutabilis*	Grazing
12	Murat	*Panicum turgidum*	Soil Stabilization and restoration

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 communities. During consultation with communities, pictorial representations of species were used from field guides and other literature of the faunal species of India. The species occurring within the study area are discussed in the following sections:

Herpetofauna

Amphibians

The only amphibian species observed in the study area was the Skittering Frog (*Euphlyctis cyanophlyctis*). It is a common dicroglossid frog found in South Asia. It is categorized as Least Concern as per IUCN (2015 v 2.0) and not listed in the Indian Wildlife Protection Act, 1972.

Reptiles

A total of seven (7) species belonging 4 families were observed from the study area. Monitor Lizard (*Varanus bengalensis*) has been listed in Sch.I and Spiny Tailed Lizard (*Saara hardwickii*) has been listed in Sch. II of Wildlife Protection Act and has conservational significance. The spiny tailed lizard is traded for its medical importance and is also listed in Appendix II of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) the details of reptiles are given in ***Table 6.9*** and ***Figure 6.9***

Table 6.9 Reptiles observed from the Study Area

Sn.	English / Popular Name	Scientific Name	Family	Occurrence	WPA Schedule / IUCN Status
1	Russell's Viper	*Daboia russelii*	Viperidae	Frequent	IV / LC
2	Saw-scaled viper	*Echis carinata*	Viperidae	Frequent	IV / LC
3	Brilliant Ground Agama	*Trapelus agilis*	Agamidae	Common	- / -
4	Laungwala Long-headed Lizard	*Bufoniceps laungwalaensis*	Agamidae	Rare	- / -
5	Indian fringe-fingered lizard	*Acanthodactylus cantoris*	Lacertidae	Common	- / -
6	Spiny Tailed Lizard	*Saara hardwickii*	Agamidae	Common	II / -
7	Monitor Lizard	*Varanus bengalensis*	Varanidae	Common	I / LC

Note: Migratory-M, Resident-R, LC-Least Concern, NT-Near Threatened, VU-Vulnerable, EN- Endangered, CR-Critically Endangered, IUCN-International Union for Conservation of Nature, WPA-Wildlife Protection Act ,1972, *Species listed in Appendix I & ** Species listed in Appendix II of Convention of Migratory Species.

Figure 6.9 Herpetofaunal Species observed within the Study Area

Indian fringe-fingered lizard

Spiny Tailed Lizard

Source: Site and surrounding areas survey by ERM during 22nd to 25th August, 2015

Avifauna

A total of seventy six (76) species were observed from the study area. White rumped vulture (*Gyps bengalensis*) is Critically endangered, Egyptian Vulture (*Neophron percnopterus)* is Endangered, Imperial Eagle (*Aquila heliaca*) is Vulnerable and Eurasian Roller (*Coracias garrulous*) Cinereous vulture (*Aegypius monachus*), Eurasian Spoonbill(*Platalea leucorodia*), Eurasian Griffon (*Gyps fulvus*) are Near Threatened as per IUCN Red data list (2014).

Shikra (*Accipiter badius),* White Eyed Buzzard (*Butastur teesa*), Black Shouldered Kite (*Elanus caeruleus*), Short Toed Snake Eagle (*Circaetus gallicus*), White Eyed Buzzard (*Butastur teesa*), Egyptian Vulture (*Neophron percnopterus*), Imperial Eagle (*Aquila heliaca*), and Indian peafowl (*Pavo cristatus*), Steppe Eagle (*Aquila nipalensis*), Short-toed Snake eagle (*Circaetus gallicus),* Tawny Eagle (*Aquila rapax*) are listed as Schedule I species in the Wildlife Protection Act, 1972.

Twenty five (25) species were observed as migratory of which one species Imperial Eagle (*Aquila heliaca*) is listed in Appendix I and one species Demoiselle Crane (*Anthropoides virgo*) is listed as Appendix II of Convention of Migratory Species (CMS) and are protected under the CMS to which India is a signatory.

The details of species are given in ***Table 6.10*** and photographs are provided in ***Figure 6.10*****.**

Figure 6.10 Avifaunal Species observed within the Study Area

Blue Rock Pigeon

White Eyed Buzzard

Hume's Wheatear

Paddy field Pipit

Grey Francolin

White eared Bulbul

Eurasian Collared Dove

Ashy crowned Sparrow Lark

Purple Sunbird

Rosy Pastor

House Sparrow

Little Grebe

Indian Silverbill

Chestnut Shouldered Petronia

Grey Heron

Eurasian Spoonbills

Egyptian Vulture

Source: Site and surrounding areas survey by ERM during 22nd to 25th August, 2015

Table 6.10 Avifaunal Species Observed in the Study Area

Sn	Common Name	Scientific Name	Family	Migratory Status	Conservation Status	
					IUCN	WPA,72
1	Rosy Pastor	*Pastor roseus*	Sturnidae	M	LC	IV
2	Grey Francolin	*Francolinus pondicerianus*	Phasianidae	R	LC	IV
3	Large Grey Babbler	*Turdoides malcolmi*	Leiothrichidae	R	LC	IV
4	Chestnut bellied Sandgrouse	*Pterocles exustus*	Pteroclididae	R	LC	IV
5	Southern Grey Shrike	*Lanius meridionalis*	Laniidae	R	LC	IV
6	Demoiselle Crane	*Anthropoides virgo***	Gruidae	M	LC	IV
7	Common Myna	*Acridotheres tristis*	Sturnidae	R	LC	IV

Sn	Common Name	Scientific Name	Family	Migratory Status	Conservation Status	
					IUCN	WPA,72
8	Long tailed Shrike	*Lanius schach*	Laniidae	R	LC	IV
9	Small Green Bee-eater	*Merops orientalis*	Meropidae	R	LC	IV
10	Blue-cheeked Bee-eater	*Merops persicus*	Meropidae	R	LC	IV
11	House Sparrow	*Passer domesticus*	Passeridae	R	LC	IV
12	House Crow	*Corvus splendens*	Corvidae	R	LC	IV
13	Shikra	*Accipiter badius*	Accipitridae	R	LC	I
14	White Eyed Buzzard	*Butastur teesa*	Accipitridae	R	LC	I
15	Black Shouldered Kite	*Elanus caeruleus*	Accipitridae	R	LC	I
16	Short Toed Snake Eagle	*Circaetus gallicus*	Accipitridae	R	LC	I
17	Egyptian Vulture	*Neophron percnopterus*	Accipitridae	R	EN	I
18	Imperial Eagle	*Aquila heliacal**	Accipitridae	M	VU	I
19	Indian peafowl	*Pavo cristatus*	Phasianidae	R	LC	I
20	Eurasian collared Dove	*Streptopelia decaocto*	Columbidae	R	LC	IV
21	Laughing Dove	*Spilopelia senegalensis*	Columbidae	R	LC	IV
22	Asian Palm Swift	*Cypsiurus balasiensis*	Apodidae	R	LC	IV
23	House Swift	*Apus nipalensis*	Apodidae	R	LC	IV
24	Blue Rock Pigeon	*Columba livia*	Columbidae	R	LC	IV
25	Common Hoopee	*Upupa epops*	Upupidae	R	LC	IV
26	Crested Lark	*Galerida cristata*	Alaudidae	R	LC	IV
27	Indian Bush Lark	*Mirafra erythroptera*	Alaudidae	R	LC	IV
28	Rufous Tailed Lark	*Ammomanes phoenicura*	Alaudidae	R	LC	IV
29	Ashy crowned Sparrow Lark	*Eremopterix griseus*	Alaudidae	R	LC	IV
30	Black Drongo	*Dicrurus macrocercus*	Dicruridae	R	LC	IV
31	Red vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	R	LC	IV
32	White-eared Bulbul	*Pycnonotus leucotis*	Pycnonotidae	R	LC	IV
33	Indian Robin	*Saxicoloides fulicatus*	Muscicapidae	R	LC	IV
34	Pied Bush Chat	*Saxicola caprata*	Muscicapidae	R	LC	IV
35	Indian Hoopee	*Upupa epops*	Upupidae	R	LC	IV
36	Indian Silver bill	*Lonchura malabarica*	Estrildidae	R	LC	IV
37	Greater Hoopoe-Lark	*Alaemon alaudipes*	Alaudidae	R	LC	IV
38	White eared Bulbul	*Pycnonotus leucotis*	Pycnonotidae	R	LC	IV
39	Cattle Egret	*Bulbulcus ibis*	Ardeidae	R	LC	IV
40	Red naped Ibis	*Pseudibis papillosa*	Threskiornithidae	R	LC	IV
41	Indian Courser	*Cursorius coromandelicus*	Glareolidae	R	LC	IV
42	Humes Wheatear	*Oenanthe albonigra*	Muscicapidae	R	LC	IV
43	Eurasian Roller	*Coracias garrulus*	Coraciidae	M	NT	IV
44	Common ringed Plover	*Charadrius hiaticula*	Charadriidae	M	LC	IV
45	Black Winged Stilt	*Himantopus himantopus*	Recurvirostridae	R	LC	IV
46	Green Sandpiper	*Tringa ochropus*	Scolopacidae	M	LC	IV

Sn	Common Name	Scientific Name	Family	Migratory Status	Conservation Status	
					IUCN	WPA,72
47	Cinereous vulture	*Aegypius monachus*	Accipitridae	M	NT	IV
48	White rumped vulture	*Gyps bengalensis*	Accipitridae	R	CR	IV
49	Little Grebe	*Tachybaptus ruficollis*	Anatidae	R	LC	IV
50	Common Coot	*Fulica atra*	Rallidae	M	LC	IV
51	Common Teal	*Anus crecca*	Anatidae	M	LC	IV
52	Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	M	NT	I
53	Northern Pintail	*Anus acuta*	Anatidae	M	LC	IV
54	Northern Shoveler	*Anus clypeata*	Anatidae	M	LC	IV
55	Great Egret	*Casmerodious albus*	Anatidae	R	LC	IV
56	Indian Pond Heron	*Ardeola grayii*	Anatidae	R	LC	IV
57	Lesser Whistling Duck	*Dendrocygna javanica*	Anatidae	M	LC	IV
58	Lesser Whitethroat	*Sylvia curruca*	Sylviidae	M	LC	IV
59	Purple Heron	*Ardea purpurea*	Ardeidae	R	LC	IV
60	Indian Silverbill	*Lonchura malabarica*	Estrildinae	R	LC	IV
61	Grey Heron	*Ardea cinerea*	Ardeidae	R	LC	IV
62	Purple Heron	*Ardea purpurea*	Ardeidae	R	LC	IV
63	Purple Sunbird	*Nectarinia asiatica*	Nectariniidae	R	LC	IV
64	Indian Bushlark	*Mirafra erythroptera*	Alaudidae	R	LC	IV
65	Desert Wheatear	*Oenanthe deserti*	Turdinae	M	LC	IV
66	Spotted Sandgrouse	*Pterocles senegallus*	Pteroclidae	M	LC	IV
67	Steppe Eagle	*Aquila nipalensis*	Accipitridae	M	LC	I
68	Short-toed Snake eagle	*Circaetus gallicus*	Accipitridae	M	LC	I
69	Tawny Eagle	*Aquila rapax*	Accipitridae	R	LC	I
70	Common Kestral	*Falco tinnunculus*	Falconidae	M	LC	IV
71	Eurasian Griffon	*Gyps fulvus*	Accipitridae	M	NT	IV
72	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	M	LC	IV
73	Black Redstart	*Phoenicurus ochruros*	Turdidae	M	LC	IV
`74	Common Stonechat	*Saxicola torquatus*	Muscicapidae	M	LC	IV
75	Desert Wheatear	*Oenanthe deserti*	Muscicapidae	M	LC	IV
76	Chestnut Shouldered Petronia	*Petronia xanthocollis*	Passeridae	R	LC	IV

Note: Migratory-M, Resident-R, LC-Least Concern, NT-Near Threatened, VU-Vulnerable, EN- Endangered, CR-Critically Endangered, IUCN-International Union for Conservation of Nature, WPA-Wildlife Protection Act ,1972, *Species listed in Appendix I & ** Species listed in Appendix II of Convention of Migratory Species.

Mammals

A total of 16 species of 13 genera belonging to 12 families were observed / reported from the study area. None of the species is threatened as per the IUCN red-list (2014). Indian Gazelle (*Gazella bennettii*), Caracal (*Caracal caracal*) and Asiatic Wild Cat (*Felis sylvestris*) are listed as Sch. I, as per the Wildlife

Protection Act, 1972. A list of species observed / reported from the study area are given in ***Table 6.11*** and represented in ***Figure 6.11***.

Table 6.11 Details of Mammals observed/ reported from the Study area

Sn.	English Name	Scientific Name	Family	Occurrence	WPA Schedule / IUCN Status	O/R
1	Indian Gazelle	*Gazella bennettii*	Bovidae	Common	Sch.I / LC	O
2	Nilgai	*Boselaphus tragocamelus*	Bovidae	Common	Sch.III / LC	O
3	Golden Jackal	*Canis aurens*	Canidae	Common	Sch.II / LC	O
4	Indian Fox	*Vulpes benghalensis*	Canidae	Occasional	Sch.II / LC	O
5	Desert Fox	*Vulpes vulpes*	Canidae	Occasional	Sch.II / LC	R
6	Grey Mongoose	*Herpestes edwardsii*	Herpestidae	Common	Sch.II / LC	O
7	Caracal	*Caracal caracal*	Felidae	Rare	Sch.I. / LC	R
8	Asiatic Wild Cat	*Felis sylvestris*	Felidae	Rare	Sch.I. / LC	R
9	Small Indian Civet	*Viverricula indica*	Viverridae	Uncommon	Sch.II / LC	R
10	Indian Hare	*Lepus nigricollis*	Leporidae	Common	Sch.IV / LC	O
11	Indian hedgehog	*Paraechinus micropus*	Erinaceidae	Uncommon	IV / LC	R
12	Asian house shrew	*Suncus murinus*	Soricidae	Common	Not Listed / LC	O
13	Greater Mouse-tailed Bat	*Rhinopoma microphyllum*	Rhinopomatidae	Uncommon	Sch.V / LC	R
14	Lesser Mouse-tailed Bat	*Rhinopoma hardwickii*	Rhinopomatidae	Uncommon	Sch.V / LC	R
15	Naked-rumped Tomb Bat	*Taphozous nudiventris*	Emballonuridae	Uncommon	Sch.V / LC	R
16	Indian Flying Fox	*Pteropus giganteus giganteus*	Pteropodidae	Uncommon	Sch.V / LC	R

Notes: IUCN-International Union for Conservation of Nature, WPA-Wildlife Protection Act ,1972, LC-Least Concern Occurance, O-Observed, R-Reported,

Figure 6.11 Mammalian Species observed within the Study Area

Indian Gazelle / Chinkara

Indian Gerbil

Desert Fox

Source: Site and surrounding areas survey by ERM during 22nd to 25th August, 2015

6.5.6 Protected Area-Desert National Park

There are no protected areas within 5 km radius. The nearest protected area is Desert National Park at a distance of 70 km approximately.

6.5.7 Interpretation and Conclusion

Construction of approach roads and erection of WTGs will require clearance of the grassland vegetation. The grasslands in the core zone area harbors

mammal species such as Indian Gazzelle (*Gazella bennettii),* Indian Fox *(Vulpes benghalensis),* Desert Fox *(Vulpes vulpes)* and other mammals and reptiles as observed and reported from the study area. Clearance of vegetation may lead to habitat disturbance and habitat loss to these species during construction phase.

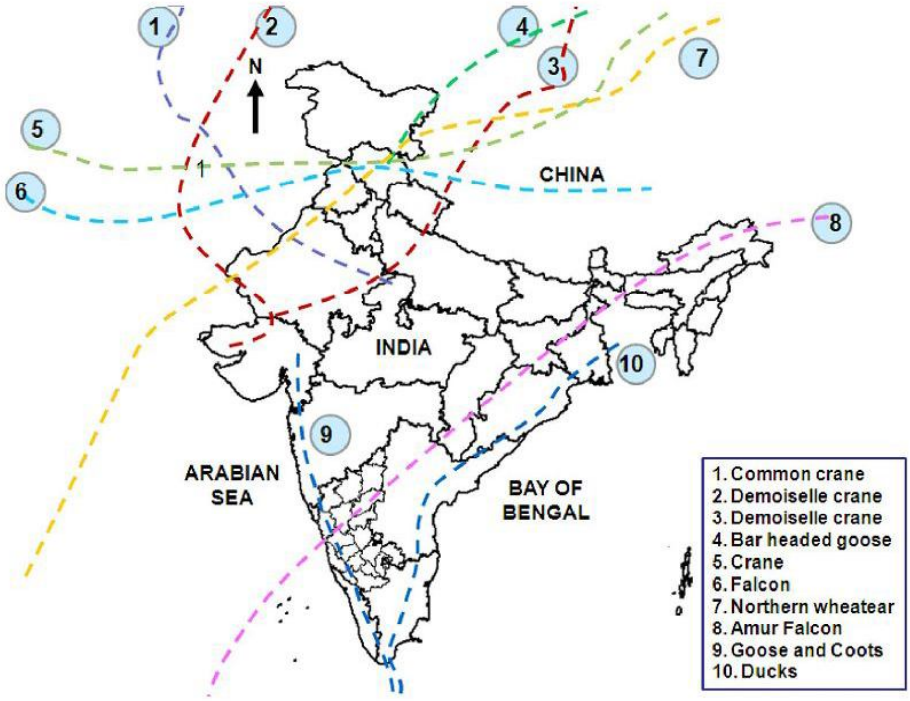
The thirteen (13) raptor and scavenger species observed and reported from the study area may face risk of collision with WTG's. These species are of conservation significance as per IUCN red-list 2015 v2.0 and Indian Wildlife Protection Act, 1972.

To understand the actual impact on these species a long term monitoring for the aerial use of these species needs to be considered. It is to be further noted that the area is surrounded by other wind farms.

6.5.8 Migratory routes

The available migratory routes passing through India is provided in ***Figure 6.12.*** The figure confirms the migratory passage of Demoiselle Crane and Northern Wheatear from the wind farm area.

Figure 6.12 Avifaunal Migratory routes through 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 SOCIO-ECONOMIC BASELINE

This section provides an understanding of the administrative set up of the district, the demographic profile of the villages in the project area, the social groups present, the land use patterns 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. The purpose of this section is to allow for an increased understanding of the key issues identified as well as identify areas of intervention in future scenarios.

As discussed above in S***ection 6.2*** of this chapter, the AoI for this baseline is understood as the area within a 5 km radius. The methodology adopted for the social assessment is as follows.

6.6.1 *Social Baseline Data Collection Methodology*

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. 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 AoI, a review of the secondary information available in the public domain was undertaken. The list of secondary sources of information used is as follows:

- Census of India 2011 data
- Maps of India
- Panchayati Raj Website of Rajasthan
- Official Website of Jaisalmer, managed by Government of Rajasthan
- Agricultural Contingency Plan, 2012, Jaisalmer District
- http://www.indianrajputs.com/history/
- http://meghhistory.blogspot.in/2010/08/meghwal-samaj.html
- http://manganiar.com/music.html
- http://www.gurjarsutharsocialgroup.com/whoarethesuthars.html
- http://joshuaproject.net/people_groups/16711/IN
- http://www.ncpcr.gov.in/view_file.php?fid=120\

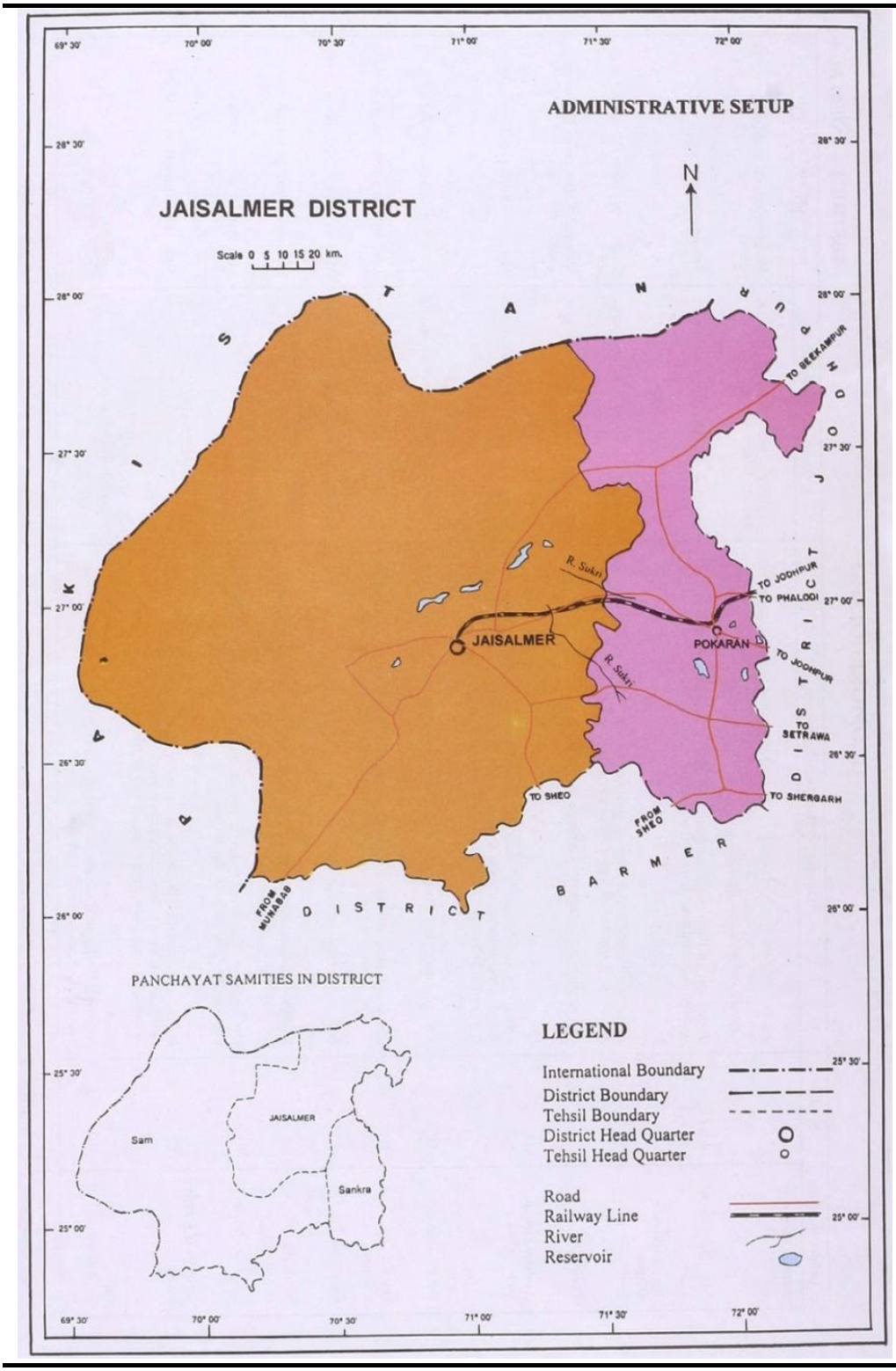
6.7 LOCATION AND ADMINISTRATIVE SETTING

The proposed project (50.4 MW) is being developed as a part of a larger wind (300MW) farm by Suzlon Energy Ltd., in Fatehgarh and Pokaran *tehsils* of Jaisalmer district of Rajasthan. It is the western most and largest (in terms of

geographical area) district in the Rajasthan state and has a 471 km long international boundary with Pakistan along its north and west. Neighbouring districts of Jaisalmer on north-east, east and south are Bikaner, Barmer and Jodhpur respectively.

The Project lies in and around four (04) villages lying in Fatehgarh *tehsil* and 14 villages of Pokaran *tehsil*. The locations of the WTGs have been finalised and no national park, Reserve forest, wildlife sanctuaries, biosphere reserves, notified historical or cultural sites etc. are located within 5 km from the project.

Figure 6.13 Administrative Set-up of Jaisalmer



Source: CGWB District Groundwater Atlas of Rajasthan

6.8 AREA OF INFLUENCE

The Area of Influence for a project is identified for the establishment of baseline and to carry out Impact Assessment. The following sub section

provides an understanding of the AoI thus identified and the underlying reasons for the same.

6.8.1 Study Area

The study area considered for ESIA includes an area within 5 km radius, farthest from WTGs. The study area of 5 km has been selected based on the location of Wind farm 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 is likely to be affected by various project activities, spread out in different phases. 24 WTGs of Project Bhesada is located across government land of four villages, out of which total 383.005 Ha revenue land has been allotted to MEIL. These four villages are Naya Loonakalan, Motisar, Khoda and Naya Achla village. Physically, there is no demarcation or fencing for the Wind farm site boundary and hence it is contiguous with the rest of the area.

The footprint for project includes land used for the erection of WTGs, Pooling sub-station, 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:

Social and Cultural: The project footprint is spread across 18 villages, in which the impact of the project activities is envisaged. These villages lie within a distance of 5 km from the WTGs and are further categorised as lying in the "Core" and the "Buffer" zone, depending on their proximity from the project.

Core and Buffer Zone

The Core area demarcation is based on the understanding that majority of the impacts from the project (during the mobilization, construction, operations and decommissioning phase) would be contained within 1 km radius from the Project in terms of spread and intensity. The buffer zone, lying in a range between 1 km and 5 km is likely to have lesser interaction with the project activities. For the project, 4 villages lie within a distance of 1 km from the project, in the Core zone and 14 villages lie in a range between 1 km and 5 km, in the buffer zone.

6.9 SOCIO-ECONOMIC BASELINE

This section helps in understanding the background of the area in which the project is being setup, in terms of administrative structure, population distribution, demographic profile, land use pattern in the area, sources of livelihoods, state of agriculture in the area and the status of the physical and social infrastructure, which is critical for development of the village community.

The Study Area for the baseline is considered to be within 5 km radius from the project. The methodology adopted for the social assessment is as follows.

6.9.1 Social Baseline Data Collection Methodology

The social baseline for the project has been established with the help of secondary information from Census 2011 which has been corroborated with information gathered through primary stakeholder consultations in the villages in and around the wind farm area. 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 AoI, a review of the secondary information available in the public domain was undertaken. The list of secondary sources of information used is as follows:

- Census of India 2011 data
- Maps of India
- Panchayati Raj Website of Rajasthan
- Official Website of Jaisalmer, managed by Government of Rajasthan
- Agricultural Contingency Plan, 2012, Jaisalmer District
- http://meghhistory.blogspot.in/2010/08/meghwal-samaj.html,
- http://www.gurjarsutharsocialgroup.com/whoarethesuthars.html,
- http://www.peoplegroupsindia.com/profiles/nai/
- http://www.peoplegroupsindia.com/profiles/teli/
- http://www.peoplegroupsindia.com/profiles/kumhar/

Stakeholder Identification and Analysis

The stakeholders are a group of individuals or institutions which are likely to be impacted by the project or may have significant influence on the project. Therefore, as a necessary step, the concerns and expectations of the stakeholders were assessed as a part of the stakeholder analysis. This exercise is helpful in understanding the effect of project activities on the relevant stakeholders and subsequently designing mitigation measures to ensure smooth functioning of the project. Furthermore, stakeholder mapping was undertaken which helped in:

- Identification of stakeholder groups;
- Understanding of their profile and the nature of the stakes;
- Understanding each group's specific issues, concerns as well as expectations from the project;
- Gauge their influence on the Project.

On the basis of this understanding, the stakeholder were categorised into High Influence / Priority, Medium Influence / Priority and Low Influence / Priority on the basis of their influence / power as well as interest in the project.

Site Survey and Stakeholder Consultations

As part of the baseline data collection process, consultations were undertaken with the local stakeholders identified for the project.

Figure 6.14 Stakeholder Consultations Undertaken

Source: ERM Site Visit, August 2015

The following ***Table 6.12*** provides a list of the consultations undertaken, as part of the site visit.

Table 6.12 Consultations undertaken for the Project

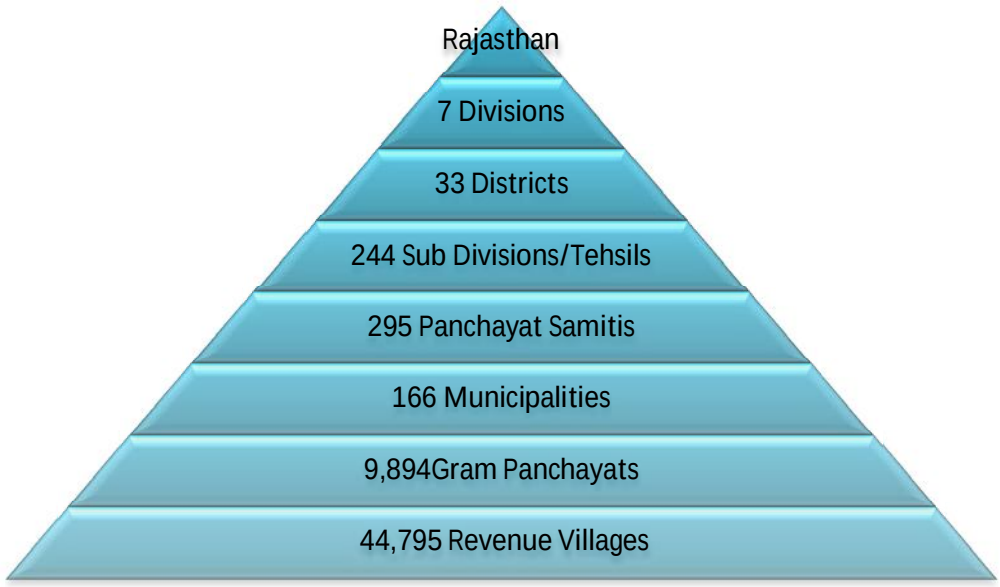
Date	Stakeholder Details
22-08-2015	FGD with Men's group (Wateadon ki Dhani- New Achla)
23-08-2015	Discussion with Men's group in Loona Khurd
24-08-2015	FGD with Men's group in Khuhra village
24-08-2015	FGD with Men's group in New Achla village
25-07-2015	Discussion with Suzlon Land and CSR team

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

6.9.2 State Profile: Rajasthan

Rajasthan is situated in the north western part of India and is the largest state (in terms of geographical area), constituting 10.41% of the country's total area. The state is administratively divided into 7 divisions, 33 districts and 44,795 revenue villages, as per Census of India, 2011.

Figure 6.15 Administrative Structure of Rajasthan



Source: Panchayati Raj Website of Rajasthan

The state supports a population of 68,548,437 individuals which constitutes 5.66% of India's total population. The population growth rate in the past decade (2001 to 2011) is 21.44% for Rajasthan, which is higher than the country's decadal population growth rate of 17.64%. There is discernible dominance of rural population, with a contribution of 75.13% to the total population of the state and the rural literacy rate of 61.44% points towards lacunae in the awareness of the rural population vis-à-vis urban population, with literacy rate of 79.68%.

Table 6.13 Rajasthan Demographic Profile

Attribute	Number	% of India
Area (ha)	34,223,900	10.41
Total population	68,548,437	5.66
Males	3,55,50,997	5.71
Females	3,29,97,440	5.62
Decadal Population Growth Rate (2001-2011)	21.44%	NA
Sex ratio	928	NA
Percentage of rural Population	75.13	NA

Attribute	Number	% of India
Percentage of urban population	24.87	NA
Population density	200	NA
Percentage of SC population	17.83	NA
Percentage of ST population	13.48	NA
Total Literacy rate	66.11	NA
Male Literacy rate	79.19	NA
Female Literacy Rate	52.12	NA
Urban Literacy Rate	79.68	NA
Rural Literacy	61.44	NA

Source: Census of India, 2011 data

The state has a patriarchal society, which is reflected by the sex ratio of 928 females per 1000 males, which is very low as compared to the country's sex ratio of 940 females per thousand males. The stark difference in the male literacy rate (79.19%) and female literacy rate (52.12%) also underscores the difference in the state of exposure and awareness of both the sexes in the area. The population density of the state at 200 persons per sq. km is lower in the state as compared to the country (382 persons per sq. km in Census 2011)

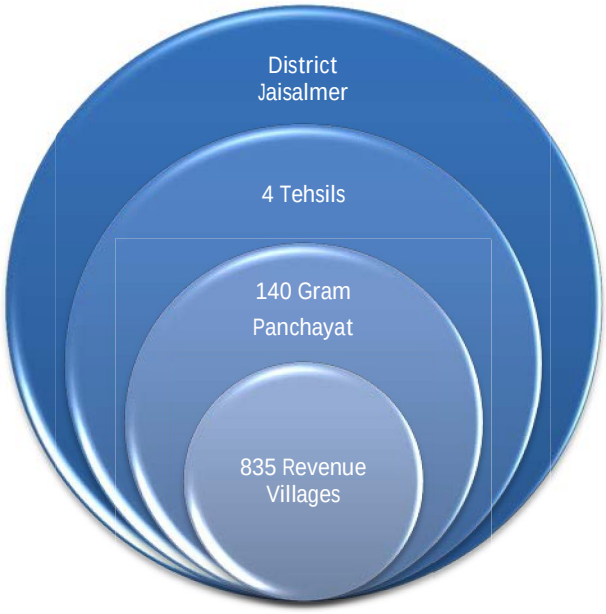
The population of Scheduled Caste in the state is 17.83% and Scheduled Tribe population is 13.48%. The state has 34 recognized Scheduled Caste groups which include Bairwa, Balmiki, Chamar, Kalbelia, Bargi etc., and 12 recognized Scheduled Tribe groups including Bhil, Bhil Mina, Koli, Mina, Sahariya etc.

6.9.3 District Profile: Jaisalmer

Jaisalmer district is situated in the westernmost corner of the country, with a 471km long International border with Pakistan on its left and the districts of Bikaner, Barmer and on north-east, east and south. It is the largest district in Rajasthan and third largest district in the country with a geographical area of 38,40,100 Ha.

For administrative purposes, the district is divided into four sub-divisions viz. Jaisalmer, Pokaran, Fatehgarh and Bhaniyana and four tehsils, i.e. Jaisalmer, Pokaran, Fatehgarh and Bhaniyana. The developmental activities of the district are being looked after by three Panchayat Samities, i.e. Jaisalmer, Sam and Sankra. There are total 835 revenue villages and 140 Gram panchayats in the district.

Figure 6.16 Administrative Structure of Jaisalmer



Source: Official Website of Jaisalmer, managed by Government of Rajasthan

The population of Jaisalmer district is 6,69,919 individuals which forms 0.97% of the total population of Rajasthan. Jaisalmer district has a predominantly rural population, comprising 86.71% of total population in the district. The total percentage decadal growth rate of Jaisalmer district is 32% which is relatively higher than the decadal growth rate of Rajasthan (21.31%). A significant growth has been witnessed by the rural areas with almost 35% as opposed to the urban areas with a growth rate of 17%.

Table 6.14 Jaisalmer district Demographic Profile vis-à-vis Rajasthan

Attribute	Rajasthan	Jaisalmer District
Population	68,548,437	6,69,919
Population Density	200	17
% of SC population	18	15
% of ST population	13	6
Sex Ratio	928	852
% total literacy rate	66	57
% female literacy rate	52	40
% rural population	75.13	86.71

Source: Census of India, 2011 data

The data released by Census of India 2011, shows that density of Jaisalmer district for 2011 is 17 people per sq. km., which is has risen from the density of 13 people per sq. km in 2001. However, the density is still very low compared to the state average of 200. The sex ratio is also highly skewed in the district, with only 852 females per 1000 males.

The literacy profile of the district suggests huge gap from the national literacy rates, with the female literacy rate of 40% being significantly lower than the female literacy rates of the state (52%) and the country (65.46%).

The majority of inhabitants of Jaisalmer are Rajputs. Other castes present in the area are Brahmins, (belonging to the General category) and Meghwals, Dholi and Manganiyars (all belonging to Scheduled Caste) and Suthars, Jogis etc. belonging to Other Backward Classes (OBC). Muslim population is also present in the area, which, according to social consultations, resides in Muslim dominated settlements.

Jaisalmer district is not notified as Schedule V area (Section 244) as it is not dominated by a majority of tribals unlike districts such as Dungarpur, Banswara and Pratapgarh (select blocks). However, nearly 6% of the population at the District level comprises of ST population and about 15% of the population is comprised of SC population.

6.9.4 Fatehgarh and Pokaran Tehsils

The *tehsils* collectively comprise of 60% population of Jaisalmer district and the proportion of SC and SC population in the two tehsils and the district are nearly equal as shown in ***Table 6.15***.

Table 6.15 Demographic Profile of Fatehgarh and Pokaran Tehsil

Attribute	Jaisalmer District	Fatehgarh *tehsil*	Pokaran *tehsil*
Population	6,69,919	1,01,020	3,03,662
% of SC population	15	16	14
% of ST population	6	6	6
Sex Ratio	852	836	878
% total literacy rate	57	55	56
% female literacy rate	40	35	38

Source: Census of India, 2011 data

The sex ratio is higher in Pokaran *tehsil* at 878 females per 1000 males as compared to Fatehgarh (836 females per 1000 males) and Jaisalmer district (852 females per 1000 males). The status of total Literacy in the *tehsils* and the district is also equivalent however the district figure of Female Literacy is a little higher than the two *tehsils*.

6.9.5 Area of Influence Profile

The project is being developed as a part of a larger Wind farm being developed by Suzlon Energy Ltd. located in the villages of Fatehgarh and Pokaran *tehsils* of Jaisalmer district. There are 18 villages in the AoI out of which 4 lie in the Core zone and 14 in the Buffer zone.

Demographic Profile

Table 6.16 Demographic Profile of AoI

Name	No of HH	Total Population	Sex Ratio	Child Sex Ratio	% SC	% ST	% Lit	% F Lit

Name	No of HH	Total Population	Sex Ratio	Child Sex Ratio	% SC	% ST	% Lit	% F Lit
Core Villages								
Loona Kalan	69	351	877	854	2.0%	0.0%	48.0%	27.9%
Loona Khurd	134	845	825	974	41.4%	0.0%	57.3%	32.4%
Naya Loonakalan	79	454	900	1250	53.5%	0.0%	62.8%	45.0%
Sadrasar	101	720	989	1012	6.0%	21.1%	36.4%	16.2%
Core Total	***383***	***2,370***	***894***	***1016***	***27.1%***	***6.4%***	***50.9%***	***29.0%***
Buffer Villages								
Achla	65	462	848	723	0.0%	0.0%	45.4%	18.5%
Betina	185	947	850	833	19.2%	0.0%	62.9%	43.1%
Bhesada	377	2063	854	985	10.4%	0.8%	61.7%	36.6%
Gundala	217	1134	871	817	12.5%	4.7%	30.0%	14.7%
Khelana	107	588	776	594	5.1%	0.0%	50.2%	36.1%
Khuhra	230	1431	842	723	3.4%	28.7%	35.1%	11.9%
Lakhasar	67	285	748	500	0.0%	0.0%	68.3%	44.9%
Mehrajot	105	572	882	1052	0.0%	0.0%	51.0%	21.3%
Motisar	118	700	862	926	22.9%	0.0%	69.3%	52.6%
Naya Achala	86	492	751	980	0.0%	0.0%	43.8%	19.1%
Naya Rasala	63	358	904	652	40.2%	0.0%	74.5%	65.7%
Pratappura	64	397	890	1027	0.0%	0.0%	50.0%	29.5%
Rasla	182	1047	932	961	32.2%	0.0%	61.5%	46.2%
Sangram Singh Ki Dhani	62	352	751	600	0.0%	0.0%	57.5%	30.6%
Buffer Total	***1,928***	***10,828***	***850***	***840***	***11.6%***	***4.4%***	***52.9%***	***32.0%***
AoI Total	**2,311**	**13,198**	**858**	**870**	**14.4%**	**4.8%**	**52.5%**	**31.5%**

Source: Census of India, 2011 data

As per the 2011 Census records, the AoI has 2,311 households supporting a population of 6,418 individuals. The entire population in the AoI falls in the rural category. The sex ratio, both adult and child, is higher in the core area at 894 females per 1000 males and 1016 girls per 1000 boys respectively, as compared to the buffer area figures of 855 females per 1000 males and 840 girls per 1000 boys. The sex ratio in the AoI is strongly skewed towards males (a general pattern in the state and the district as well); however the child sex ratio in core area (Naya Loonakalan and Sadrasar villages) shows signs of improvement of the female presence in the generation to come. he buffer area villages of Lakhasar, Khelana, Sangram Singh ki DhanTi and Naya Rasla register significantly negative child sex ratios which also accounts for lower child Sex Ratio (and 840 girls per 1000 boys) than adult Sex ratio (850 females per 1000 males) in the buffer area.

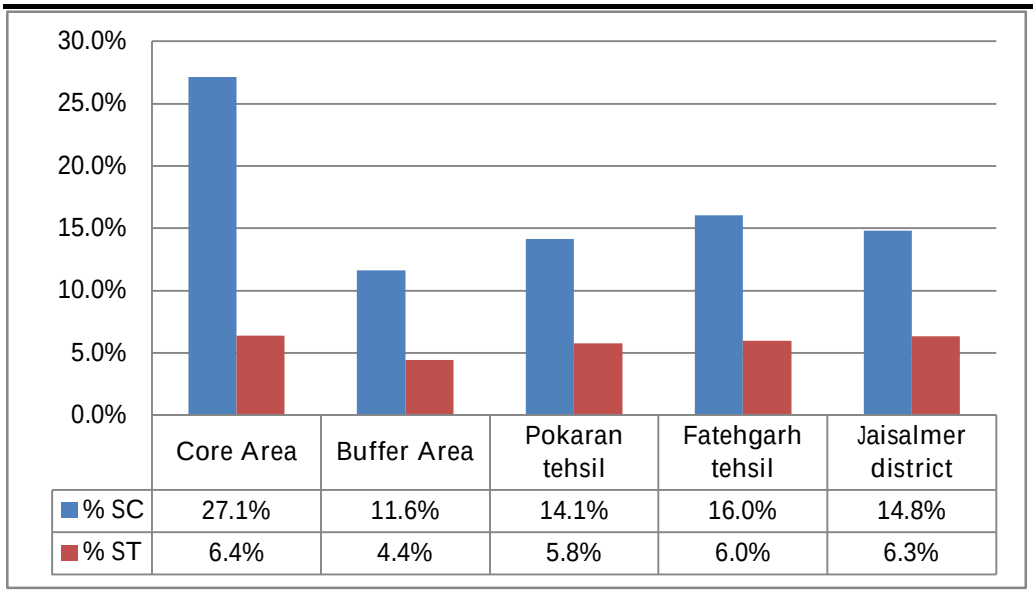
There is a considerable presence of Scheduled Caste population in both core and the buffer areas, with 27.1% and 11.6% contribution. In the buffer area, 6 villages out of 14 (Achla, Lakhasar, Mehrajot, Naya Achla and Pratappura and Sangram Singh ki Dhani) do not have any SC population. In terms of ST population, only Sadrasar houses 21.1% ST population in the core area, while only 3 villages (out of 14) register the presence of ST population in the buffer zone.

In terms of literacy, both the core and the buffer areas exhibit equivalent Total Literacy rate of nearly 51% in Core zone and 53% in Buffer zone, while the female literacy rate is slightly higher in the buffer zone at 32% as compared to core zone figure of 29%. But the literacy levels in the AoI are challenging both for the male and the female population. The status of female literacy is even less promising in the villages of Khuhra, Gundala and Sadrasar with 12%, 14% and 16% literacy amongst the female residents of the village.

Social Stratification

The entire population in the AoI falls in the rural category and the proportion of SC varies across the core and buffer zone of AoI, *tehsils* and the district. The village consultations highlighted the presence of Rajputs in majority, followed by Brahmins, both of which belong to General Category. Meghwals, belonging to Scheduled Caste, form the second most dominant caste group in the region. In addition there are caste groups belonging to Other Backward Classes (OBC), viz., Suthar, Nai, Teli, Kumhar, etc.

Figure 6.17 Proportion of SC/ST Population in the AoI vis-a-vis the Tehsil and District



	Core Area	Buffer Area	Pokaran tehsil	Fatehgarh tehsil	Jaisalmer district
% SC	27.1%	11.6%	14.1%	16.0%	14.8%
% ST	6.4%	4.4%	5.8%	6.0%	6.3%

Source: Census of India, 2011 data

The proportion of SC and ST population is the highest in the core area, with 27.1% and 6.4% respectively. Thereafter, Fatehgarh *tehsil* exhibits the highest presence of SC population of nearly 16%which is higher than the district's SC population. The village consultation highlighted that the Rajputs enjoy a higher socio-economic status, driven by their huge concentration in the area and financial well-being. The consultations also revealed that there is a strong caste-driven affinity in the area which is sometimes exhibited in terms of access to limited resources, like water.

Box 6.1 Main Social groups in the AoI

- **Rajput**: The Rajputs have been traditionally known as the warrior clan and have enjoyed a higher social status in the Indian Caste system. Rajputs (meaning, son of a King) have governed the majority of princely states in Rajasthan and Saurashtra.
- **Meghwal:** The Meghwals are primarily found in the north-western parts of India and belong to the Scheduled Caste. Traditionally, they have been a part of the weaver community in India.1
- **Suthar:** The Suthar or Sutar is a Hindu caste within the Vishwakarma community of India. They are also found in the province of Sindh in Pakistan. Their traditional occupation is that of carpentry and they are classified as a Scheduled Caste.
- **Nai:** The Nai are barbers. The name, Nai, is a corrupt form of the Sanskrit word napika, or 'one who cleans nails'. The traditional occupation of the Nai is cutting hair, beard and nail and, shaving,. They also perform some important rituals in connection with marriage, matchmaking and celebrations.
- **Teli:** Traditionally, the Teli are an occupational caste of oil-pressers. They are a large group numbering around 17.5 million and are distributed in one hundred and twenty-one districts throughout India and spread across fifteen states.
- **Kumhar:** The name Kumhar denotes a maker of pots and pitchers or someone who creates. One of the largest castes, they are reportedly spread across 212 districts of India, predominantly in the states of Punjab, Haryana, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Gujarat, Maharashtra, parts of Karnataka and Andhra Pradesh. They are known by different names in each state.

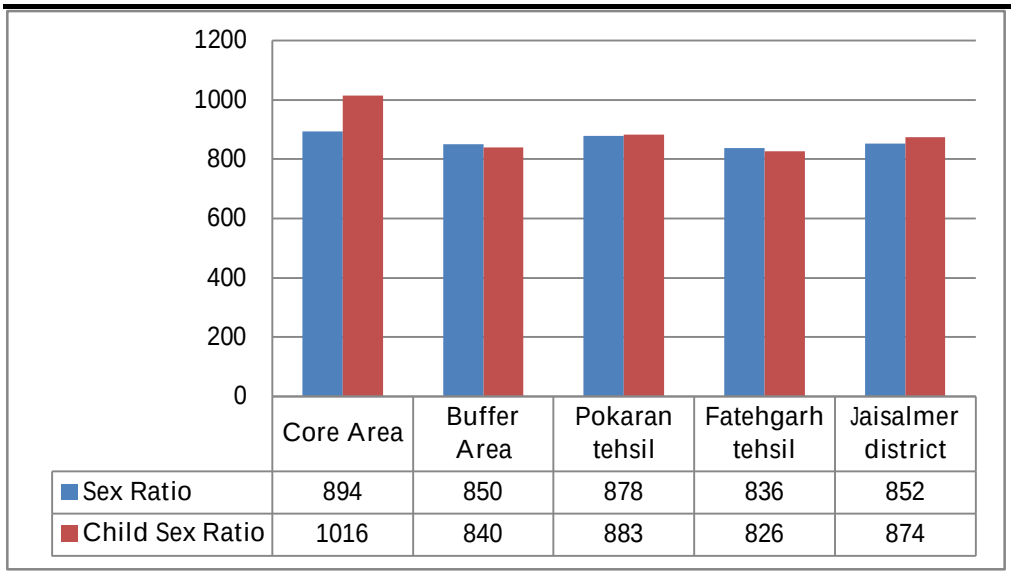
Source: http://meghhistory.blogspot.in/2010/08/meghwal-samaj.html,

- http://www.gurjarsutharsocialgroup.com/whoarethesuthars.html, [1]
- http://www.peoplegroupsindia.com/profiles/nai/
- http://www.peoplegroupsindia.com/profiles/teli/
- http://www.peoplegroupsindia.com/profiles/kumhar/

Gender: Role in Society

The AoI, keeping up with the trend set by the state and the district, is characterised by a patriarchal society, with economic, political and social decision making power residing with the male population. Core area has the highest adult sex ratio of 894 females per 1000 males across all levels followed by the Pokaran *tehsil*, with a sex ratio of 878 females per 1000 males. The core area also shows a positive child sex ratio of 1016 girls per 1000 boys.

Figure 6.18 Comparison of Adult and Child Sex Ratios across AoI, Tehsils and District



	Core Area	Buffer Area	Pokaran tehsil	Fatehgarh tehsil	Jaisalmer district
Sex Ratio	894	850	878	836	852
Child Sex Ratio	1016	840	883	826	874

Source: Census of India, 2011 data

Women continue to be rooted in traditional norms of social behaviour which include *Purdaah* system, minimal participation in household or economic decision making, lesser economic freedom and limited opportunity to socialize with other females in the village, etc. Early marriages also continue to happen in select caste groups. The market relations, trade or sale aspects are mostly managed by the male members of the family. It was brought to light during social consultations that none of the villages in the AoI had any formal women's groups.

The productive roles of women however vary across caste and religious groups in the AoI. The women of Rajput families are generally confined to their houses and carry out household chores like cooking, animal husbandry (does not include grazing) and working on their own agricultural fields, at the most. However, the women belonging to the lower social strata take up jobs as construction and agricultural labourers in nearby areas, driven by their weak economic status. It was reported during community consultations, that women are paid lesser wages than their male counterparts for the same nature, amount and duration of work. The common reason reported for the disparity was the perceived lesser efficiency of women by the contractors.

Land use pattern

At the village level land resources are essential assets which provide for the fulfilment of the needs in terms of food crops, fuel wood requirement and fodder for livestock and other everyday resources. The table for land use helps in understanding the dependence of population on farm based and non-farm based sources of livelihoods.

Table 6.17 Land use break up in the District and in the AoI

Village Name	Total Geographical Area (in Hectares)	**Net Sown Area** (in Hectares)	Culturable Waste Land Area (in Hectares)	Barren and uncultivable land in Hectares)	Current Fallows in Hectares)
Core Villages					
Loona Kalan	1561.69	669	18.7	188	24
Loona Khurd	3685	2356	1176	6	18
Naya Loonakalan	2868.8	1037	325	882	226
Sadrasar	2295	1111	414	28	222
Core Total	***10,410.49***	***5,173***	***1,933.7***	***1,104***	***490***
Buffer Villages					
Achla	1215.31	510.57	375.59	19.51	0
Betina	1335.8	618.98	105.99	103.2	32.89
Bhesada	6180.52	2129.2	0	937.79	94.99
Gundala	3365	1734	911	92	88
Khelana	3156.69	755.2	253.17	603.82	156.7
Khuhra	3192	1481	530	11	278
Lakhasar	2056	545	468	4	240
Mehrajot	2267.67	1236.39	918.17	2.85	0
Motisar	2488	1271	312	564	89
Naya Achala	2312.67	699.8	1567.86	0	0
Naya Rasala	758.69	229.4	185.04	0	0
Pratappura	1788.19	796.9	453.89	219.9	226.53
Rasla	6235.68	1537.8	3569.77	2.75	0
Sangram Singh Ki Dhani	657.26	249.79	109.98	196.7	0
Buffer Total	***37,009.48***	***13,795.03***	***9,760.46***	***2,757.52***	***1,206.11***
AoI Total	**47,419.97**	**18,968.03**	**11,694.16**	**3,861.92**	**1,696.11**

Source: Village Directory Jaisalmer, 2011 data

The ***Table 6.17*** denotes that nearly 40% of the total area is under Net Sown area[1] which is largely unirrigated. Culturable waste land denotes land available for cultivation but not taken up and includes permanent pastures and other grazing land and land under miscellaneous trees, crops and groves. The culturable waste land in the AoI is nearly 25% while in the Jaisalmer district its proportion is as high as 64%. Nearly 8% of the land in the AoI is termed as Barren Land and 3.5% land is classified as Current Fallows.

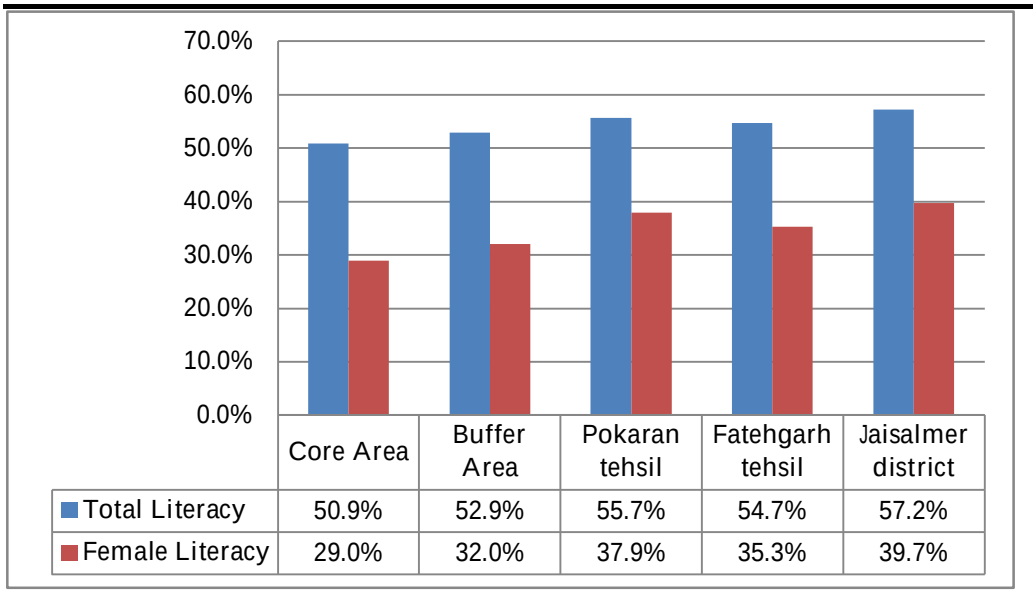
There is no land categorised as Forest Area in the AoI, however; the community consultations suggest that there has been an attempt by the Forest Department to bring additional areas under plantations or *orans*. However, unlike the patterns at the District level, there is a considerable proportion of land in the study area which is under cultivation.

[1] Net area sown : Total area sown with crops and orchards counting area sown more than once source: http://agcensus.nic.in/document/agcensus9596/definition.pdf

Literacy Profile

The villages in the AoI exhibit relatively lower literacy rates (both for males and females), compared to the *tehsil* and the district level literacy rates. The total literacy in the core and buffer zone is 50.9% and 52.9% respectively, which are lesser than the district figure of 57%.

Figure 6.19 Comparative Overview of the Literacy Rate across AoI, Tehsils and District



	Core Area	Buffer Area	Pokaran tehsil	Fatehgarh tehsil	Jaisalmer district
Total Literacy	50.9%	52.9%	55.7%	54.7%	57.2%
Female Literacy	29.0%	32.0%	37.9%	35.3%	39.7%

Source: Census of India, 2011 data

It was highlighted during social consultations that the girls in the AoI start dropping out of schools after 5th class. The primary reasons behind the practice are child marriages, absence of all-girls schools in and around the villages and absence of female teachers in the schools.

The social consultations also revealed that the boys attain education till 12th class, but only few go for higher education (university and above) because of limited financial means as the facilities are situated away from the village. Some boys usually take up jobs as labourers in the nearby areas and support their families financially, while many are rendered unemployed, because of limited jobs in the area.

Livelihood Profile

The AoI has a Work Participation Ratio (WPR)[1] of 44.4, which means nearly 44.4% population in the area is engaged in income generating activities. Simultaneously, nearly 56% of the population comes under dependent population, which includes children, old aged people as well as unemployed youth. The Work Participation Ratio is highest at 68.9 in New Achla, which

[1] A measure of the active portion of an economy's labor force. The participation rate refers to the number of people who are either employed or are actively looking for work. The number of people who are no longer actively searching for work would not be included in the participation rate.

incidentally also happens to be closest to the Construction Site office and the Stockyard for the project.

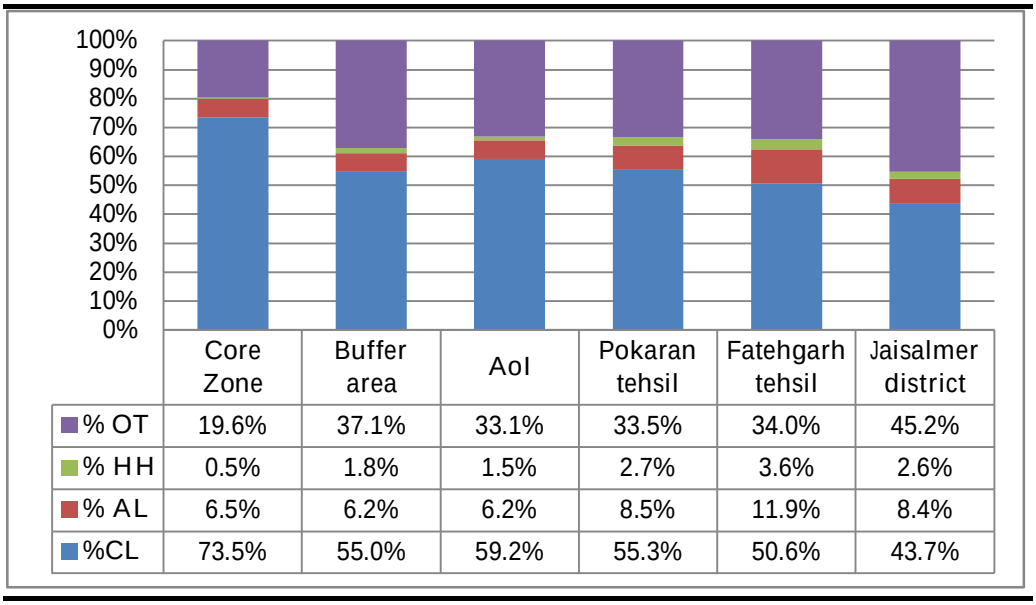
Table 6.18 Proportion and break-up of working population in the AoI

Name	WPR	% Main	% Marg	% Non Work
Core Villages				
Loona Kalan	50.1	83.0%	17.0%	49.9%
Loona Khurd	43.7	39.3%	60.7%	56.3%
Naya Loonakalan	53.7	55.3%	44.7%	46.3%
Sadrasar	32.6	88.5%	11.5%	67.4%
Core Total	***43.2***	***61.9%***	***38.1%***	***56.8%***
Buffer Villages				
Achla	48.1	45.5%	54.5%	51.9%
Betina	24.4	99.1%	0.9%	75.6%
Bhesada	44.6	29.3%	70.7%	55.4%
Gundala	50.1	11.1%	88.9%	49.9%
Khelana	46.1	100.0%	0.0%	53.9%
Khuhra	44.8	50.2%	49.8%	55.2%
Lakhasar	52.3	69.8%	30.2%	47.7%
Mehrajot	44.9	94.9%	5.1%	55.1%
Motisar	55.3	3.6%	96.4%	44.7%
Naya Achala	68.9	77.9%	22.1%	31.1%
Naya Rasala	22.3	30.0%	70.0%	77.7%
Pratappura	55.9	5.4%	94.6%	44.1%
Rasla	41.8	31.7%	68.3%	58.2%
Sangram Singh Ki Dhani	33.0	86.2%	13.8%	67.0%
Buffer Total	***44.7***	***44.6%***	***55.4%***	***55.3%***
AoI Total	**44.4**	**47.6%**	**52.4%**	**55.6%**

Source: Census of India, 2011 data

Out of the total working population in the AoI, the majority is classified as Marginal workers, i.e., they are unemployed for more than six months in a year. Cultivators form the major proportion (59%) of both Main as well as Marginal population. In the Main Working population, nearly 34% people are classified as Other Workers, which are usually the construction labourers and people engaged in other full time jobs.

Figure 6.20 Distribution of Main Working Population in the AoI

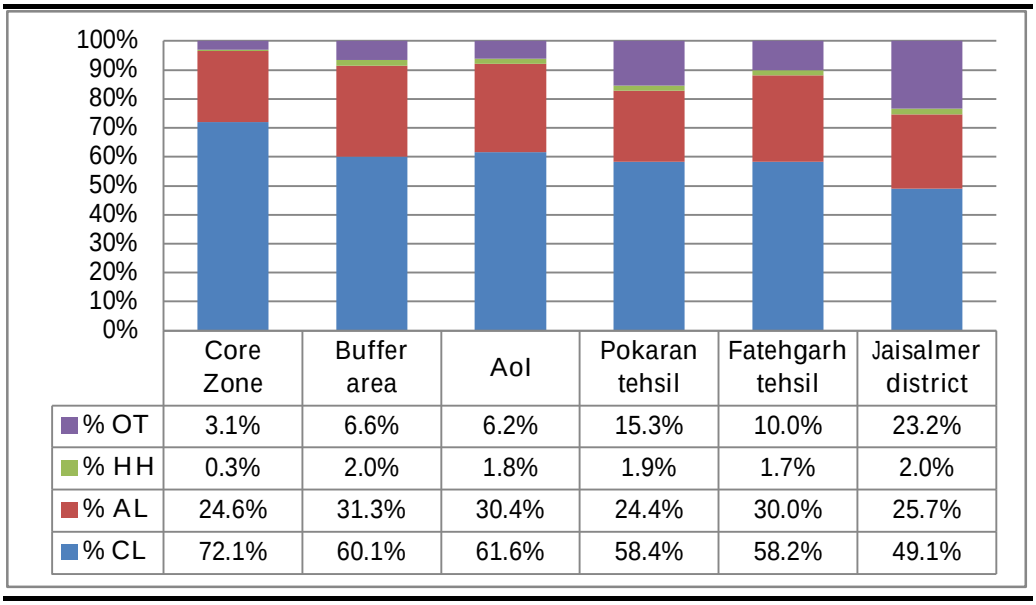


	Core Zone	Buffer area	AoI	Pokaran tehsil	Fatehgarh tehsil	Jaisalmer district
% OT	19.6%	37.1%	33.1%	33.5%	34.0%	45.2%
% HH	0.5%	1.8%	1.5%	2.7%	3.6%	2.6%
% AL	6.5%	6.2%	6.2%	8.5%	11.9%	8.4%
%CL	73.5%	55.0%	59.2%	55.3%	50.6%	43.7%

Source: Census of India, 2011 data

In the Marginal Workers' population, the Agricultural Labourers form the next significant working group after Cultivators, with 30% proportion. The agriculture in the area is mostly rain fed and hence the people usually grow a single crop during the year, which can be ascribed to one of the reasons of a high proportion of Marginal Workers in the area.

Figure 6.21 Distribution of Marginal Working Population in the AoI



	Core Zone	Buffer area	AoI	Pokaran tehsil	Fatehgarh tehsil	Jaisalmer district
% OT	3.1%	6.6%	6.2%	15.3%	10.0%	23.2%
% HH	0.3%	2.0%	1.8%	1.9%	1.7%	2.0%
% AL	24.6%	31.3%	30.4%	24.4%	30.0%	25.7%
% CL	72.1%	60.1%	61.6%	58.4%	58.2%	49.1%

Source: Census of India, 2011 data

Jaisalmer lies in the Western Dry region of the Agro-Climatic zone [1] and hence receives rainfall only during monsoons. Subsistence agriculture is practiced in

[1] http://agricoop.nic.in/Agriculture%20contingency%20Plan/Rajasthan/RAJ14-Jaiselmer-9.3.2012.pdf

the region to a large extent as area is characterised by rain fed agriculture and hence the practice of single crop cultivation during a year is rampant. The dependence on monsoons for agriculture is high and is resultant from the lack of irrigation canals in the region, low water retention of the soil, hard quality and greater depth of ground water. Thus agriculture solely does not satiate the needs of the household and people take up additional income generating activities.

As can be seen from ***Figure 6.20***, approximately 65% of the main working population in the AoI is dependent upon farm based activities for their livelihood. The farm based activities primarily comprise of agriculture, agricultural labour and livestock rearing.

The main crops in the region comprise of pearl millet, cluster bean (guar) and Watermelon amongst Kharif crops. Certain pockets of land are irrigated, where people also take up cultivation of Mothbean, *Jeera* (Cumin) and Groundnut, however such cases are rare. After harvest, Millets are retained for self-consumption by the cultivators or a part is given to Agricultural Labourers, while cluster bean is sold in the nearby markets at a price of Rs. 3,000-4,000 per quintal

In addition, 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 Cattle, Goats and Sheep. A large number of households are reported to be involved into sale of livestock (mostly sheep and goats), which generally happens within the village as traders keep visiting the villages regularly. The sale of wool from the sheep also takes place in the region where raw wool is sold at a price of Rs. 50-60 per kg. While there are no reported household maintaining livestock holdings for sale of milk for commercial purposes, sale of livestock forms a significant source of their income. The general rates for a sheep or goat ranges between Rs. 3,000 to 4,500 depending on the age and health of the animal.

Figure 6.22 Livestock Grazing in the AoI

Source: ERM Site Visit, August 2015

Furthermore, 35% of the Main Workers and 10% of Marginal workers also engage in non-farm based jobs, which include casual labour in construction

sites of houses in nearby villages and Jaisalmer. Wind farm sites are also providing jobs to many people from the villages as unskilled labourers and Security guards. Furthermore, the people migrate to nearby cities during lean agricultural seasons to work as labourers.

Social and Physical Infrastructure

Water Supply

The villages in the AoI draw water from a host of sources ranging from untreated tap water, uncovered wells, pond, hand pumps and tube wells in some cases. However, all these sources put together, fail to suffice the water needs of the people year round. People store rain water in underground tanks, which lasts only till the end of October. Thereafter, majority of the villagers have to resort to buying water from external sources and pay Rs. 300-800 (depending upon the distance) for a Water tanker.

Figure 6.23 Water Tanks in villages for storing Rain Water

Source: ERM Site Visit, August 2015

Education

The AoI is characterised by the presence of co-educational primary schools in all the villages, however, as pointed out during community consultations, there is a dearth of teachers in the schools and a dire need of all-girls schools to boost education of girls in the area.

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]

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

There are no Government Pre-primary schools in the AoI, nor was the need of Pre-primary schools, cited during community consultations. Only four villages in the core area and 6 villages in Buffer areas have Government Primary Schools.

Table 6.19 Availability of Schools in the AoI

Village Name	Govt Primary School (Numbers)	Govt Middle School (Numbers)	Govt Secondary School (Numbers)	Govt Senior Secondary School (Numbers)
Core Villages				
Loona Kalan	0	0	0	0
Loona Khurd	1	0	0	0
Naya Loonakalan	0	0	0	0
Sadrasar	1	0	0	0
Core Total	**2**	**0**	**0**	**0**
Buffer Villages				
Achla	0	0	0	0
Betina	1	0	0	0
Bhesada	2	1	1	1
Gundala	1	0	0	0
Khelana	1	0	0	0
Khuhra	2	2	0	0
Lakhasar	0	0	0	0
Mehrajot	1	0	0	0
Motisar	1	0	0	0
Naya Achala	0	0	0	0
Naya Rasala	0	0	0	0
Pratappura	0	0	0	0
Rasla	1	1	1	0
Sangram Singh Ki Dhani	0	0	0	0
Buffer Total	**10**	**4**	**2**	**1**

Source: Census of India, 2011 data

While none of the Core area villages had any Middle, Secondary or Senior Secondary school, there are four Middle Schools, 2 Secondary and 1 Senior Secondary schools in the buffer area.

Electricity

The access to electricity in the area is reported to be usually good and reportedly the power outages occur rarely, that too in case of faults.

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 (Indoor 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 of 1 lakh plus, and also provides emergency services. The CHCs in turn report to the public hospitals at the district level.

According to Census of India 2011 data, there are no PHCs and CHCs in the AoI, however there are 5 Primary Health Sub Centres in the buffer area villages of Betina, Bhesada, Khelana, Naya Rasla and Rasla.

The people generally suffer from Common fever, Joint pains, Malaria, Jaundice and Typhoid and the people travel to the city of Jodhpur or Pokaran in case of serious ailments. There is a provision for ambulance in case of deliveries; however, people have to arrange for vehicles on their own in case of other illnesses.

Markets and Banks

The people of the AoI villages are frequent visitors of Pokhran and Jaisalmer cities and are well connected to banks, with most of them having bank accounts. In terms of buying provision for daily purposes, the shops in 3-4 km radius of the villages serve the purpose; however, for trading purposes, one of the main markets is Jaisalmer.

7 STAKEHOLDER ENGAGEMENT AND INFORMATION DISCLOSURE

This section provides an outline of the engagement with the stakeholder groups undertaken as part of the assessment process and the key issues identified from the same.

"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

This section profiles the key stakeholders for the Project and assesses their potential concerns and levels of influence. The project proponents have developed a mechanism by which most of the key stakeholders (internal and external) are informed about the project development and its status.

7.2 STAKEHOLDER CONSULTATION AND DISCLOSURE REQUIREMENT FOR THE PROJECT

The disclosure of project information and consultations with stakeholders has been increasingly emphasized by project finance institutions and government regulatory bodies. A brief overview of the requirements of public disclosure and stakeholder consultation applicable to this project is provided below.

Table 7.1 Overview of Disclosure and Stakeholder Consultation Requirement

Institution/ Regulatory Body	Reference Regulation/ Standard	Requirements
PS-1: Assessment and Management of Environmental and Social Risks and Impacts		
IFC	PS-1	• Community engagement is to be undertaken with the affected communities and must be free of external manipulation, interference, or coercion, and intimidation. • Furthermore, in situations where an affected community may be subject to risks or adverse impacts from a project, the proponent must undertake a process of consultation so as to provide the affected communities with an opportunity to express their views on the project risks, impacts, and mitigation measures, as well as allow the proponents to consider and respond to them. • *Informed participation:* For projects with significant adverse impacts on affected communities, the consultation process must ensure that free, prior and informed consultation with affected communities occurs and that processes exist to facilitate participation by those affected. • Apart from such a consultation process, the project proponents are also to establish a Grievance Redressal Mechanism, which will allow the affected communities' concerns and grievances about the project proponent's environmental and social performance to be received and allow for steps to be taken to resolve the same • *Broader stakeholder engagement:* The proponent must identify and engage with stakeholders that are not directly affected by the Project but those that have established relationships with local communities and / or interest in the Project – local government, civil society organizations, etc. – and establish a dialogue.
PS-2: Labour and Working Conditions		
IFC	PS-2	• Client will consult with workers, their organization, the government, and comply with collective bargaining agreements if they exist.
PS-4: Community Health, Safety and Security		
IFC	PS-4	The community engagement requirements of Performance Standard 4 can be met through implementation of the community engagement process described in paragraphs 22 through 25 of Performance Standard 1, including the informed consultation and participation process of Affected Communities, in the case of projects with potential significant adverse impacts on them.
IFC	PS-4	Emergency plans should be developed in close collaboration and consultation with potentially Affected Communities and other stakeholders and should include detailed preparation to safeguard the health and safety of workers and the communities in the event of an emergency.
PS-5: Land Acquisition and Involuntary Resettlement		

Institution/ Regulatory Body	Reference Regulation/ Standard	Requirements
IFC	PS-5	Client will engage displaced families along with the affected communities as per PS-1. Additional consultations with Indigenous Peoples will be concurrently done if applicable.
IFC	PS-5	The client will establish a grievance mechanism consistent with Performance Standard 1 as early as possible in the project development phase.

7.3 STAKEHOLDER MAPPING AND ANALYSIS

"A stakeholder is defined as 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 are categorized in terms of the degree of interest, influence and control they have over the Project."

Identification of stakeholders and their inclusion in the decision making process is essential in prioritizing, analyzing and addressing issues; and increasing management systems and strategies to address their concerns / expectations.

Stakeholder mapping for the purpose of the project has been conducted to:

- Identify each stakeholder group;
- Study their profile and characteristics and the nature of stakes they have;
- Gauge their influence on the Project; and
- Understand the specific issues, concerns as well as expectations from the project that each group retains.

Table 7.2 Stakeholder Group Categorization

Category	Primary Stakeholder	Secondary Stakeholder
Community	• Local Community • Vulnerable Groups • Opinion Makers and Community Leaders	
Institutional Stakeholders	• Local Gram Panchayats	• Village Institutions
Government Bodies	• Regulatory Authorities • District Administration	• State Administration
Other Groups	• Local Labourers	• Civil Societies / NGOs

This stakeholder engagement will enable to assess the socio-political environment in which they are to operate and in particular to:

- Identify conflict of interests between stakeholders in order to help manage such relationships during the course of the project;
- Identify relations between stakeholders that may enable "coalitions" of project sponsorship, ownership and co-operation;

- Generate information critical to planning, implementation and monitoring of the project; and
- Develop the framework of participatory planning and implementation.

The table below provides the profile of the key stakeholders who might have certain direct or indirect impact. These stakeholders have also been classified in accordance with the level of influence they might have over the project as well as their priority to the project proponent in terms of importance. The influence and priority have both been primarily rated as:

- ***High Influence:*** This implies a high degree of influence of the stakeholder on the project in terms of participation and decision making or high priority to engage with the stakeholder;
- ***Medium Influence:*** Which implies a moderate level of influence and participation of the stakeholder in the project as well as a priority level to engage the stakeholder which is neither highly critical nor are insignificant in terms of influence.
- ***Low Influence:*** This implies a low degree of influence of the stakeholder on the project in terms of participation and decision making or low priority to engage that stakeholder.

The intermediary categories of low to medium or medium to high primarily imply that their influence and important could vary in that particular range subject to context specific conditions or also based on the responses of the project towards the community.

The coverage of stakeholders as stated above includes any person, group, institution or organization that is likely to be impacted (directly or indirectly) or may have interest / influence over project. Keeping this wide scope of inclusion in stakeholder category and the long life of project, it is difficult to identify all potential stakeholders and gauge their level of influence over project at the outset of the project. Therefore project proponent is advised to consider this stakeholder mapping as a live document which should be revised in a timely manner so as to make it comprehensive for any given period of time.

Table 7.3 Stakeholder Analysis

Relevant Stakeholders	Profile	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Primary Stakeholders					
Local Community	This stakeholder group is comprised of the local community living in the study area, in 18 villages of Fatehgarh and Pokhran. The local community is characterised by a population of 6418 individuals across 2311 households. The population is characterised by a dominance of Hindu population, with a small proportion of SC and ST groups. The main caste groups in the local community are Rajputs, Meghwals, Suthars, Teli, Nai, etc., with Rajputs being in majority.	• Though a 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	• The stakeholders may exert a strong influence over the project especially during the pre-construction and construction phases if the livelihoods are getting impacted or there are changes in the socio-economic dynamics at the wind farm site. • To a large extent, there has been cooperation extended by the local community and provision of local labour, vehicles etc. has been ensured by them.	• Key concern is minimal impact on livelihood and primary expectation is of additional employment generation at the local level for the project affected families. • The key expectation would be of targeted and consistent CSR support pertaining to education, health and water, among others.	Influence of Stakeholder: High 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 the women population, women headed households in the village, landless families, and the families below the poverty line.	• The project proponent may be required togive priority on providing employment opportunities to the vulnerable community members;	• The stakeholder group will have a limited or negligible impact on the project.	• Key concerns and expectations would range from targeted support to vulnerable families, involving them in the ambit of beneficiaries through community development activities.	Influence of Stakeholder: Low Influence of Project: High
Opinion Makers and Community Leaders	This stakeholder group comprises of those individuals of the local community who hold traditional and rational power. These stakeholder group members include the elders,	The expectations and concerns of this group from the project: • Receiving benefits from the project in terms of employment and development of infrastructure and	• This group may play a critical role in the opinion formation towards the project and the achievement of a 'social	• Though a number of other wind power projects already exist in the area, the project can play a critical role in the	Influence of Stakeholder: High Influence of

Relevant Stakeholders	Profile	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	community and political leaders in the village and play a critical role in the decision making in the local community	the 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	license to operate' • In the past, the local community has been reported to create road blockades and disrupt other project activities in cases where the local community was not given preference in economic opportunities • The stakeholder may also an important role in the implementation of the development and CSR activities planned and the implementation of the management plans such as stakeholder engagement and grievance management	development of the community through economic opportunities and CSR projects • 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	Project: Medium
Gram Panchayats	• The Panchayat is the lowest levels of local governance and consists of one or more revenue villages. This body of local governance was accorded with a number of responsibilities and powers as part of the 73rdAmendment to the Constitution. • As part of this, most of the rural development schemes and funds for central schemes are channelled through this body of governance. • Also, it is the Panchayat who are bestowed with the decision making authority for economic	• The project is expected to have a positive impact over this stakeholder group through extending support in community development activities and by strengthening their role in this entire process of facilitation;	• GPs play an important role in overall mobilization and shaping the perception and opinions of the people in the project area. • They play a role even in demanding community development works for social welfare purpose. • Consultation with GP has also been made for permissions regarding traffic flow, road diversions, if any etc.	• Key concern is of the nature of minimal livelihood impacts, if any, due to the project purpose. • Key expectation will include: local employment generation and support through adequate CSR activities.	Influence of Stakeholder: High Influence of Project: Medium

Relevant Stakeholders	Profile	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	development and social justice. Thus in order for the smooth and proper functioning of the project, the Consent of the Panchayat is imperative.				
Regulatory Authorities	• The primary authorities for renewable energy (wind power) are RRPNVL and RRECL. • The office of District Industries Commissioner regulates the Industrialization at the District Level. • Rajasthan Power Trans Corp. Ltd. for power evacuation/ grid connectivity etc.	• The project has ensured compliance with the relevant guidelines and policy recommendations as per the State Govt. • The project needs permission and coordination with the DC for local infrastructure and other supports required for smooth industrial operation	• The failure of the project to comply with the various rules and regulations applicable is instrumental for the timely implementation of the project	• The key expectations of the regulatory authorities is ensuring that the project proponent meets all the statutory compliances and that the project operations are undertaken as per the conditions put forth by the authorities and after having obtained all the necessary permits;	Influence of Stakeholder: High Influence of Project: Low
District Administration	• The project area is administered by government bodies at three levels: at the district level, at the block/ tehsil level and at the Panchayat level in each village/or cluster of villages. • The local administration in this regard refers to the district and block level administration comprising of the offices of the Tehsildaar, District Collectors, and Revenue officer etc. The revenue department (sub registrar) is responsible for registration of land sale, mutation, updating and records and transfer of land. • The revenue department (sub registrar) is responsible for	• The project is expected to have a positive influence over the local administration by extending support through these authorities or by collaborating to undertake any community development activities.	• The construction phase requires a number of permissions and support from the local administration. • The procedural complication can cause significant project delay. • The land-matters can give rise to unnecessary litigations (especially pertaining to lack of records or encroachment issues in case of access roads etc.).	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	Influence of Stakeholder: High Influence of Project: Low

Relevant Stakeholders	Profile	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	registration of land sale, mutation, updating and records and transfer of land.				
Local Labourers	• Local area has adequate workforce in unskilled category as mostly working population of the local area are cultivators/agriculture labourers; • There are very few industries in the surrounding area and hence there is also immediate availability of unskilled youth for labour purpose; • The local availability of wage earners is however linked to the agricultural season.	• The proportion of locals being employed will only be limited to the construction phases solely. The local wage earners have high expectation of employment from the project; • There might be an overall positive perception associated with local employment generation by the project. • The employment of local labourers might positively influence the project operations, in strengthening project relations with the local community and building a positive rapport.	• The stakeholder group will play an important role during the project construction phase • Aspects such as timely payments for work undertaken, other support for conducive work conditions etc. will lead to either a positive or negative impact on the project	• The primary concerns for these stakeholders pertain to the timely payment of wages and dues for the work completed, continued employment for the local labourers and an emphasis on the health and safety aspects of the work conditions on site.	Influence of Stakeholder: Medium Influence of Project: Medium
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
State Administration	The state administration is comprised of the state level agencies of the various departments/authorities such	The main expectations and concerns of the stakeholder group from the project include:	State Administration	The state administration is comprised of the state level agencies of the various	The main expectations and concerns of

Relevant Stakeholders	Profile	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	as industries department, revenue department, labour department and land department etc.			departments/authorities such as industries department, revenue department, labour department and land department etc.	the stakeholder group from the project include:
Civil Society/Local NGOs	• Suzlon conducts its CSR activities in partnership with NGO GRAVIS through which various activities like Youth skill training, Health care services, Tree plantation, etc.; • There are other NGOs based in Jaisalmer focused on improving the livelihood of the rural communities by supporting the various facets of their social life;	• The project might directly collaborate or indirectly extend support to any of the ongoing activities being carried out or initiate newer ones in the study area.	• The stakeholder group often plays a significant role in representing the interests of the vulnerable sections and related socio-economic issues. • On the other hand, the same group may also build community confidence through highlighting the positive impact of the project and the targeted support extended to the community through CSR activities.	• The opinion of this stakeholder group may vary depending on whether the project operations have had any negative or positive impact over the community. • The expectations of this group will be similar to that of the local community and vulnerable sections of the population.	Influence of Stakeholder: Low Influence of Project: Low

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

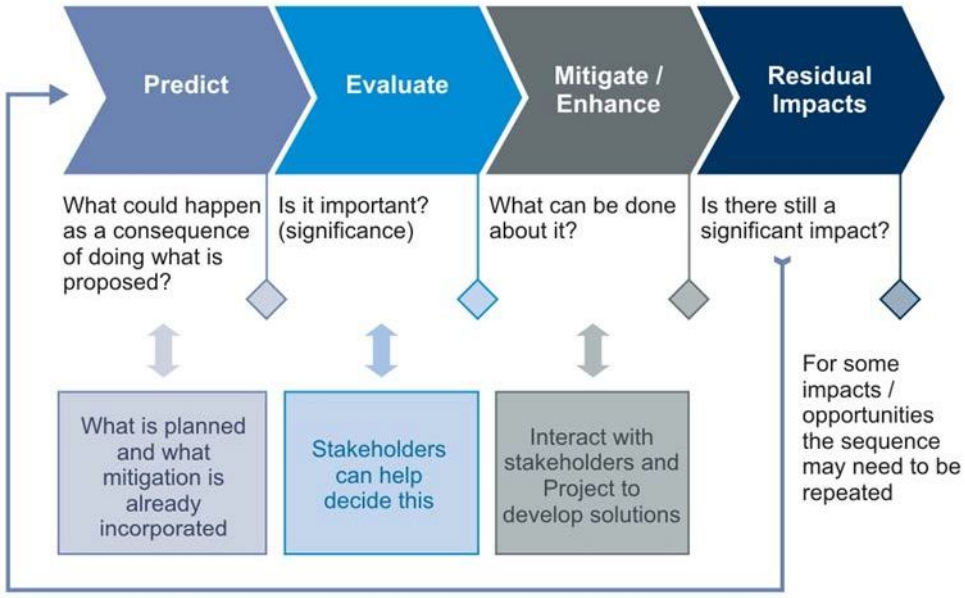
The scope of the assessment captures the understanding on the envisaged risks and impacts assessed during the scoping exercise of this impact assessment study as well as the risks identified during subsequent physical baseline assessment and impact evaluation process. The key environmental and social 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, ERM 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;
- Shadow Flicker;

8.4.2 Key Ecological risks

- Impact on habitat of disturbance to flora and fauna e.g., for reptiles, herpetofaunal species, resident avifaunal species and mammals during construction stage;
- Mortality of Avifaunal and bat species due to collision risk during operational stage;

8.4.3 Key Social risks

- Occupational health and safety of workers;
- Community health and safety impacts; and
- Potential impact on land procurement, labour welfare and working conditions and economic opportunities;

Drawing on the outcomes of scoping, the following *Sections 7.5* to *7.7* present the detailed assessment of the key potential environmental and social impacts associated with the proposed wind farm.

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, the entire wind farm area is primarily agriculture land (nearly 77%), followed by fallow land (21%). WTGs (RSA 005, RSA 006, RSA 192, RSA 208) near Naya Achla, Khuhra, Motisar, Naya Loona Kalan villages on the north, south and north-western edge of the proposed project had some agricultural activities (Though as reported by site representative, the land was government land and any improvement on the land observed, was primarily an encroachment, which was used only in case of rains for cultivation, while the land plot changes every time). The agriculture in this part is heavily rain dependent and there is only one cropping season in the year.

The project would result in change of the land use where the WTGs, substation and internal roads are proposed. About 1.62 hectare land per WTG

and further land would be required for internal access and installation of transmission towers. Additional land will be required for labor camp, storage yards, batching plants, site office that would temporarily alter the land use.

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, transmission towers with transmission lines	Permanent

The land use change will be primarily for the batching plant, site office and labour camps. The existing pooling sub-station at Betina will be used for the project, therefore no land is required for the same. The construction of internal transmission lines is expected to create disturbance in agricultural activity for a short period. The diversion of land for erection of WTGs will lead to a permanent change in land use as the procured land will be utilised for maintenance, safety and security of the WTGs during the operation stage. Agricultural areas are avoided for siting of temporary facilities such as labor camp and batching plant.

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. As a result impact assessment of land use change has not 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 Engineering, Procurement and Construction (EPC) contractors will be instructed to avoid any unnecessary disturbance to nearby surrounding features or land parcels. Further, construction activities ad 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 fallow land, the land resource sensitivity is low. As a result, the impact significance is assessed to be **minor.**

Additional Mitigation Measures

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

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

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

Impact	Change in Land use during construction, erection of WTGs and associated facilities				
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 **minor.**				
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 quality provides use (agricultural use etc.) 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	• The soil quality has little or no role in provisioning of services as agricultural uses for the local

Sensitivity Criteria	Contributing Criteria	
	population of low quality.	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 i.e. 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- -Wind farm 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- Wind farm 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	No

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.

As the project is located in dry sandy land and during the visit the surface water bodies were observed to be dry, which, reportedly is the case during most of the year due to scanty rainfall, indirect impacts of soil erosion on waterways are not expected; though it would contribute 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

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 effects of the impact, no mitigation measures are deemed essential.

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 **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**.

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. 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 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. However it should be noted that soil in this area (only in flat area) is used for agriculture which is a secondary occupation and rain dependent.

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

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 effects of the impact, no mitigation measures are deemed essential.

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 **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 impact will be **negligible**.

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 will be done strictly as per the conditions of authorisation granted by RSPCB.
- 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 will only be routed through proper collection and handover to local municipal body for further disposal. The hazardous wastes will be temporarily stored in labelled drums on impervious surface at designated area onsite and will 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 Balotra (Kher Village) in Barmer District of Rajasthan.

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 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	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, 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 less in 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 CHWTSDF located at Balotra (Kher Village) in Barmer District of Rajasthan. 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**.

Soil Contamination due to Leaks/Spills

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 Leaks/Spills during operation phase

Impact	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 whole 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 consumption 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*

Sensitivity Criteria	Contributing Criteria	
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 (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

Sensitivity Criteria	Contributing Criteria
	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 season flow) or no consumption of surface water by the Project at any time	The Project will consume surface water, but the 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)	The Project will consume surface water, and the 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)	The Project will consume surface water, and the 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	Repeated breaches of statutory discharge limits

Magnitude Criteria	Negligible	Small	Medium	Large
			(limited periods) expected	(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 effects on groundwater quality which is likely to return to equilibrium conditions within a short (months) timeframe.	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.

Construction Phase

Impact on water availability

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 consumption 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 8.20*** and ***Table 8.21*** respectively have been used.

Table 8.20 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 (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

Sensitivity Criteria	Contributing Criteria
	a regional or national level for water supply or contribution to groundwater dependent ecosystems (e.g. transboundary rivers).

Table 8.21 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 season flow) or no consumption of surface water by the Project at any time	The Project will consume surface water, but the 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)	The Project will consume surface water, and the 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)	The Project will consume surface water, and the 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	Groundwater quality be within ambient levels or allowable	Groundwater quality exceeds ambient levels or allowable	Groundwater quality exceeds ambient levels or allowable

Magnitude Criteria	Negligible	Small	Medium	Large
	aquifer(s) are unlikely to cause water quality issues.	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 effects on groundwater quality which is likely to return to equilibrium conditions within a short (months) timeframe.	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.	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.

Construction Phase

Impact on water availability

Context

Water will be required for civil works during the construction of the foundation for all WTGs estimating 200 m^3 of water for each WTG foundation. This water demand will be met through procurement of water tankers sourcing water from Jaisalmer either from ground or surface. Additionally, 3 m^3 per day and 1 m^3 per day respectively of water is required for domestic and potable water services.

Although there are no natural perennial water bodies in the Project area, however, water is supplied from vendors either from canal or using ground water.

Embedded/in-built control

- Water tankers should be utilised to fulfil supply required for all purposes, including construction work, use in labour camp and site office and local surface water bodies like ponds should not be utilised for these purposes.

Impact Significance

The sensitivity of water resource in the area is considered as medium due to the fact that the project area is generally a dry area with very little rainfall, hardly any surface water bodies and experiences shortage of water. It is categorized as Over Exploited category of CGWB. However, the direct

negative impact on water resources due to construction activities will be short term and limited mainly to construction phase of the project. Also the requirement will be in a phased manner and procured mostly from Jaisalmer city. 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:

- 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.
- Blending of low quality water with fresh water for construction uses.
- Recycling / reusing to the extent possible.

Table 8.22 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 **moderate.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible to minor.**				

Residual Impact Significance

The significance of impact will be **negligible to** minor 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 at wind farm site office or other accidental spills / leaks at the storage areas.

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;
- 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;
- Use of licensed contractors for management and disposal of waste and sludge;
- 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;
- Spill / leakage clearance plan to be adopted for immediate cleaning of spills and leakages.

Impact Significance

There are no surface water bodies in vicinity of the foot print area which could be directly impacted from project activities. Groundwater levels are very deep due to deep aquifers[1] and chances of contamination from project activities is considered low. Based on the above the impact is assessed to be **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

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

[1] http://www.aquiferindia.org/About_AQUIM_Parts_of_Thar_Rajasthan4.aspx show that aquifers are encountered in the depth range of 45 to 70 m and 125 to 160 m. Depth to ground water levels vary from 15 to 110 m.

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.**				

Residual significance of impacts during construction phase will be **negligible**.

Operation Phase

Impact on Water Availability

Context

Around 3 m^3/month water is required to meet domestic requirements of O&M staff and about 5.6 m^3 per month of utility water is required for use in the SCADA building and sub-station complex

Embedded/in-built control

- Domestic water demand will be met through tankers and 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 8.24 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 CMS building and this will also be of negligible quantity. The estimated sewage generation from wind farm site will be about 3 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/ CMS 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 8.25 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 8.26*** and ***Table 8.27*** respectively have been used.
The standards considered for assessment of potential impacts to air quality, are *Schedule 11 ECR, 1997 of the GOB* (***Table 2.7***). 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 8.26 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

[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.

Sensitivity Criteria	Contributing Criteria	
		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 8.27 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 (e.g. sand); and / or No emissions / dust generation due to Project across all phases	• Soil type with large grain size (eg sand); and / or • Limited emissions / du st generations for short duration	• Moderately dusty soil type (e.g. silt); and / or • Dust generation and emissions from Projects for long duration	• Potentially dusty soil type (e.g. clay, which will be 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 required during construction activity.

Receptors

There are few receptors falling within 500 m of any of the WTGs (near RSA 006, RSA007, RSA 051, RSA 126, RSA 128, RSA 190, RSA 342, RSA 360, RSA 631) as well as near access roads / dirt tracks to be used for the project.

Embedded/in-built control

- 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;
- Cease or phase down work if excess fugitive dust is observed. Investigate the source of dust and ensure proper suppression measures;
- Proper maintenance of engines and use of vehicles with Pollution Under Control (PUC) Certificate; and
- Idling of vehicles and equipment will be prevented

Impact Significance

The impact on air quality will be local and short-term, restricted to the construction period. The overall impacts are assessed to be **negligible.**

Residual Impact Significance

Table 8.28 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 **negligible.**				
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**.

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 **negligible.**

Additional Mitigation Measures

The embedded measures need to be implemented.

Residual Impact Significance

Table 8.29 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**.

8.5.5 Impact on Ambient Noise Levels

Sources of Wind Turbine Sound

The sources of noise emitted from operating wind turbines can be divided into two categories: (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; and
- 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 be having 24 WTGs[1] of Suzlon S97 with hub height of 120 m. The noise generation from the Suzlon S97 turbines have been taken into consideration during strong wind conditions (with wind velocity ≥ 10 m/s at 10 m height), moderate wind conditions (with wind velocity = 8 m/s at 10 m height) and normal wind conditions (with wind velocity = 6 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 8.30***).

Table 8.30 Noise Generation from WTGs

Wind Condition	Wind Velocity at 10 m height (m/s)	Noise Generation [dB(A)] at Hub Height
Strong	≥ 10	105.9
Moderate	8	105.6
Normal	6	103.9

Source: EMD, WindPro Noise Database (Based on document Sound level guideline S97DFIG_2100kW_Nov 2011)

Receptors

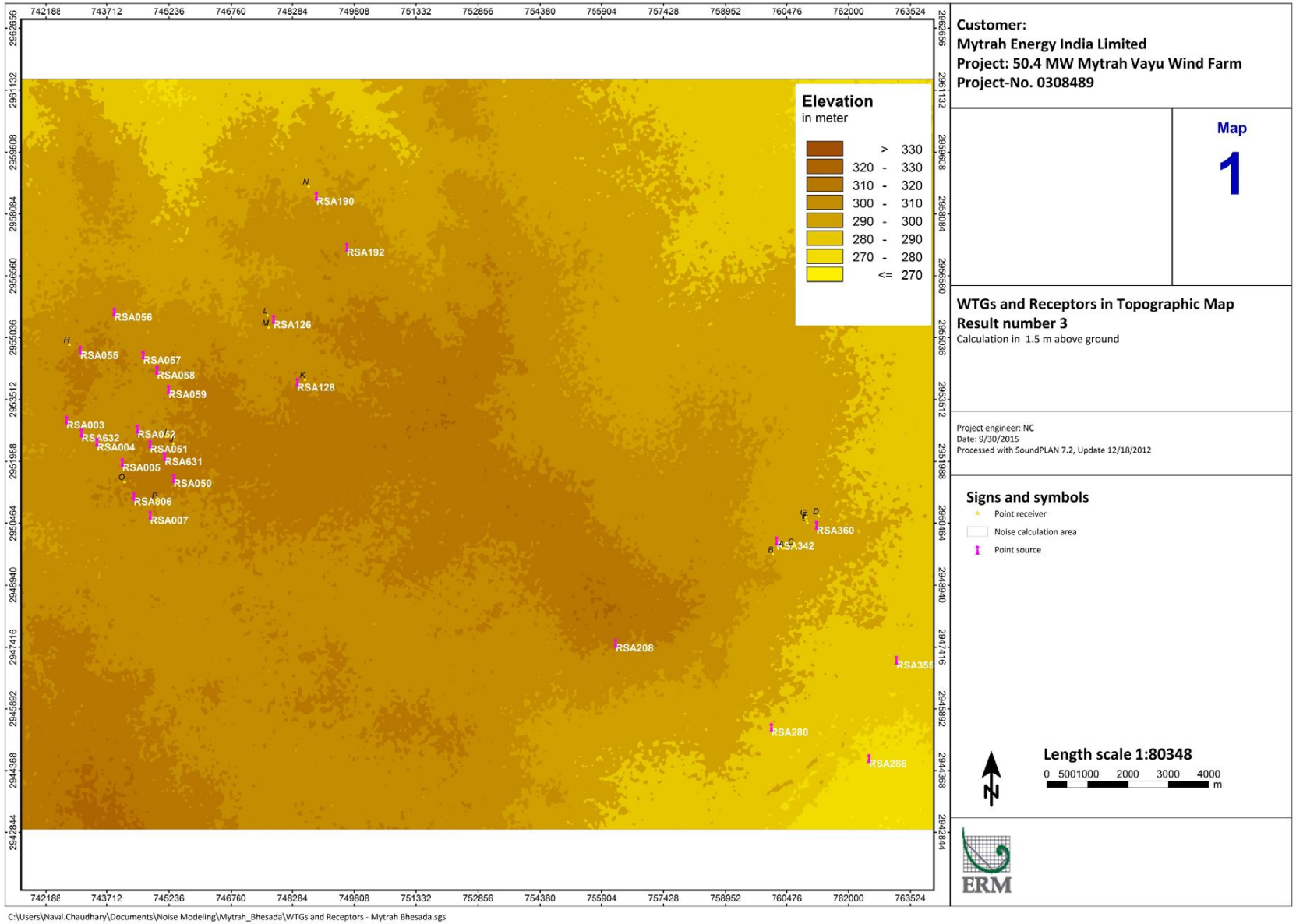
It has been noted during the site reconnaissance that 16 receptors[2] (12 residential structures, 2 storage sheds, 1 temple and 1 school) are present within 500 m from the project WTGs location and the nearest major settlement

[1] Suzlon has provided a total of 25 wind turbine locations to Mytrah, out of which Mytrah will take 24 wind turbines. However, the same was not finalized at the time of assessment. Therefore, the assessment is based on all 25 WTGs.

[2] Where any settlement was noticed within the study area, only 1 or 2 receptors close to the WTGs were considered as noise receptors. The vacant hutments around the WTGs were not being taken into consideration in this study.

Motisar is located at about 3.5 – 4.5 km distance from the WTG RSA 342 and RSA 360 respectively. A total of 16 noise sensitive receptors have been marked for the study and their locations with respect to the WTGs have been presented in ***Figure 8.3***.

Figure 8.3 ***Project Wind Turbines and Noise Sensitive Receptors***



Criteria

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 8.31***), which are similar to the noise emission criteria specified in the WB / IFC EHS Guidelines, as presented in ***Table 8.32***, 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 8.32***, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. Furthermore, for the assessment of ambient noise, the sensitivity and magnitude criteria outlined in ***Table 8.33*** and ***Table 8.34***, respectively have been used.

Table 8.31 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 8.32 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.

Table 8.33 Sensitivity Assessment Criteria for Ambient Noise Impacts

Sensitivity Criteria	Contributing Criteria	
Ambient Noise	Human receptor	Ecological Receptor
Low	Industrial Use	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 8.34 Magnitude Assessment Criteria for Ambient Noise Impacts

Magnitude Criteria	Negligible	Small	medium	Large
Noise	• Predicted noise levels are at or less than 3 dB (A) above the relevant limits / thresholds*. • Short term exposure (Few hours in a day and not continuous)	• Predicted noise levels are 3 to less than 5 dB (A) above the relevant limits / thresholds*. • Short term exposure (< 1 month)	• Predicted noise levels are between 5 and 10 dB (A) above the relevant limits / thresholds*. • Medium Term Exposure (1 to 6 months)	• Predicted noise levels are more than 10 dB (A) above the relevant limits / thresholds*. • Long term exposure (> 6 months)

*Note: reference to Indian Noise Standard (Table 8.31) and the IFC EHS Guidelines (Table 8.32).

Significance of Impact

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 ≥ 10 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 120 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 8 m/s and 6 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 (refer to ***Table 8.30***) are presented in ***Figure 8.4, Figure 8.5*** and ***Figure 8.6***, respectively. Predicted noise levels at 16 receptors within the study domain have been presented in ***Table 8.35***.

Table 8.35 Predicted Noise Levels at Noise Receptors during Operation Phase of Project with Strong, Moderate and Normal Wind Conditions

Noise Receptor	Receptor Type	Nearest WTG	Distance from WTG (m)	Strong Wind Condition		Moderate Wind Condition		Normal Wind Condition		WB/IFC Guidelines[2] and MoEFCC Standard[3]	
				Predicted Leq day [dB(A)][1]	Predicted Leq night[dB(A)][1]	Predicted Leq day [dB(A)][1]	Predicted Leq night[dB(A)][1]	Predicted Leq day [dB(A)][1]	Predicted Leq night[dB(A)][1]	Day	Night
A	Residential	RSA342	250	47.5	47.5	47.2	47.2	45.3	45.3	55	45
B	School	RSA342	330	44.9	44.9	44.6	44.6	42.7	42.7	55	45
C	Residential	RSA342	440	43.3	43.3	43	43	41.1	41.1	55	45
D	Temple	RSA360	220	49	49	48.7	48.7	46.8	46.8	55	45
E	Residential	RSA360	230	48.9	48.9	48.6	48.6	46.7	46.7	55	45
F	Storage	RSA360	260	47.7	47.7	47.4	47.4	45.5	45.5	55	45
G	Residential	RSA360	310	46.3	46.3	46	46	44.1	44.1	55	45
H	Storage	RSA055	290	47	47	46.7	46.7	44.8	44.8	55	45
I	Residential	RSA051	420	46.5	46.5	46.2	46.2	44.3	44.3	55	45
J	Residential	RSA631	370	46.5	46.5	46.2	46.2	44.3	44.3	55	45
K	Residential	RSA128	200	49.6	49.6	49.3	49.3	47.4	47.4	55	45
L	Residential	RSA126	170	50.8	50.8	50.5	50.5	48.6	48.6	55	45
M	Residential	RSA126	240	48.1	48.1	47.8	47.8	45.9	45.9	55	45
N	Residential	RSA190	290	46.8	46.8	46.5	46.5	44.6	44.6	55	45
O	Residential	RSA006	400	46.3	46.3	46	46	44.1	44.1	55	45
P	Residential	RSA007	370	46.3	46.3	46	46	44.1	44.1	55	45

(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 MoEFCC 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

It is evident from ***Table 8.35*** that ambient noise levels due to operation of the 25 WTGs in all wind conditions will be well within the MoEFCC and WB/IFC guideline values for daytime at all the noise sensitive receptors during daytime. The night time noise levels during all the wind conditions will be exceeding at the residential receptor located at about 250 m from the nearby WTGs. Noise levels at school were observed well within the applicable standard. Therefore, the impact magnitude during daytime will be **negligible,** whereas during night time, it will be **minor** to **moderate** depending upon wind conditions.

Table 8.36 Noise quality during operation phase (Daytime)

Impact	Noise generation from operation of the WTGs – Day time				
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.**				

Table 8.37 Noise quality during operation phase (Night time)

Impact	Noise generation from operation of the WTGs – Night time				
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 460 m of WTGs.				
Frequency	Entire Operation phase of Project				
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 **minor to moderate depending upon the wind conditions.**				

It has been noted based on the long term wind assessment at the site; the long term mean wind speed at hub height (i.e. at 120 m) will be of the order of 6.8 to 6.9 m/s. Therefore, the assessment with normal wind conditions will be more relevant in this case. This will result into daytime noise impact significance as ***negligible***, and night-time noise impact significance as ***minor***.

Mitigation Measures

To mitigate operational noise impacts following measures are proposed:

- Ensure regular maintenance of WTGs;
- Periodic monitoring of noise near to the sources of generation to ensure compliance with design specification;
- 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 exceedence 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.

Figure 8.4 Predicted Operation Phase Noise Levels of Project with Strong Wind Conditions during Daytime (Leq $_d$)

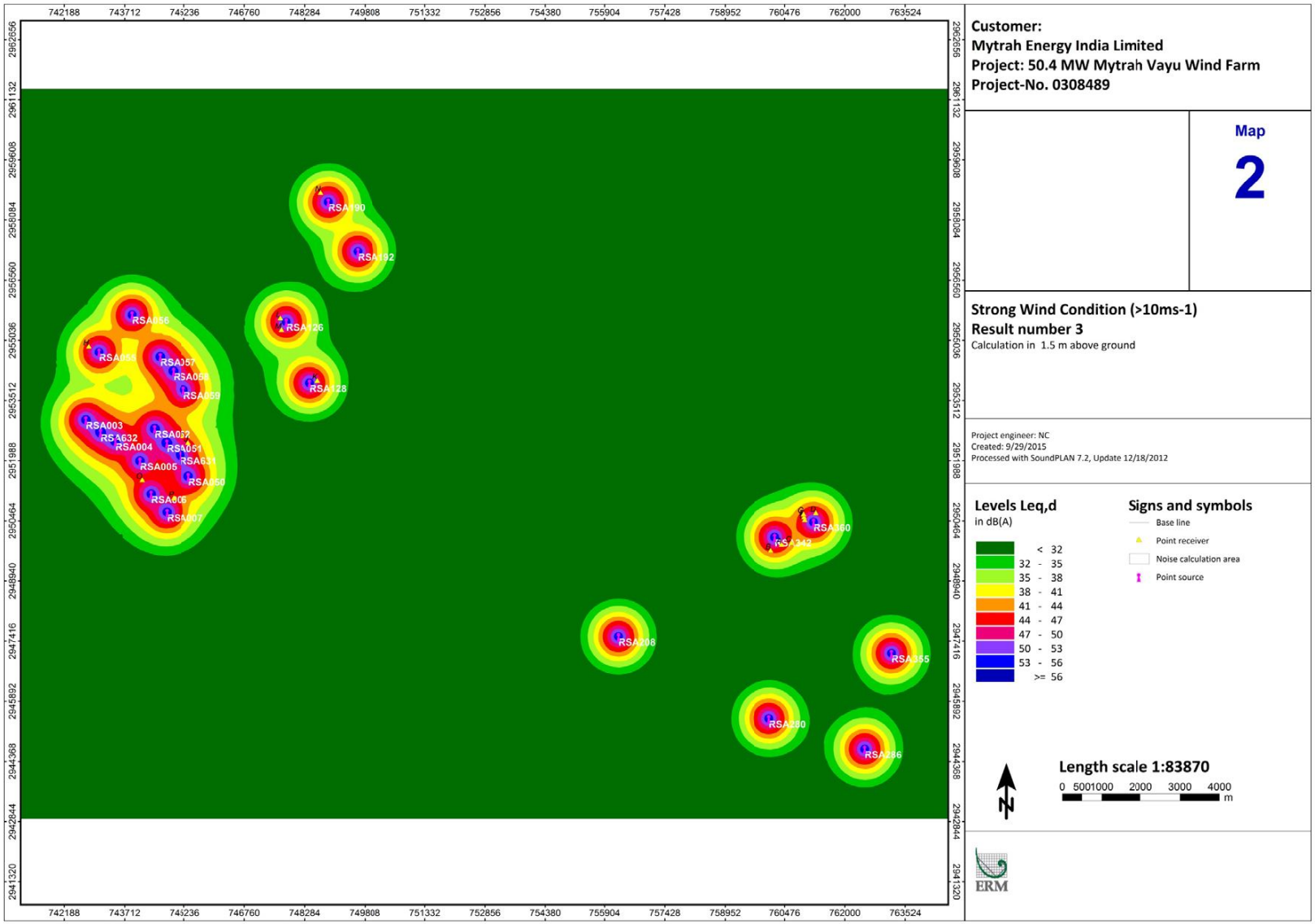


Figure 8.5 ***Predicted Operation Phase Noise Levels of Project with Moderate Wind Conditions during Daytime (Leq $_d$)***

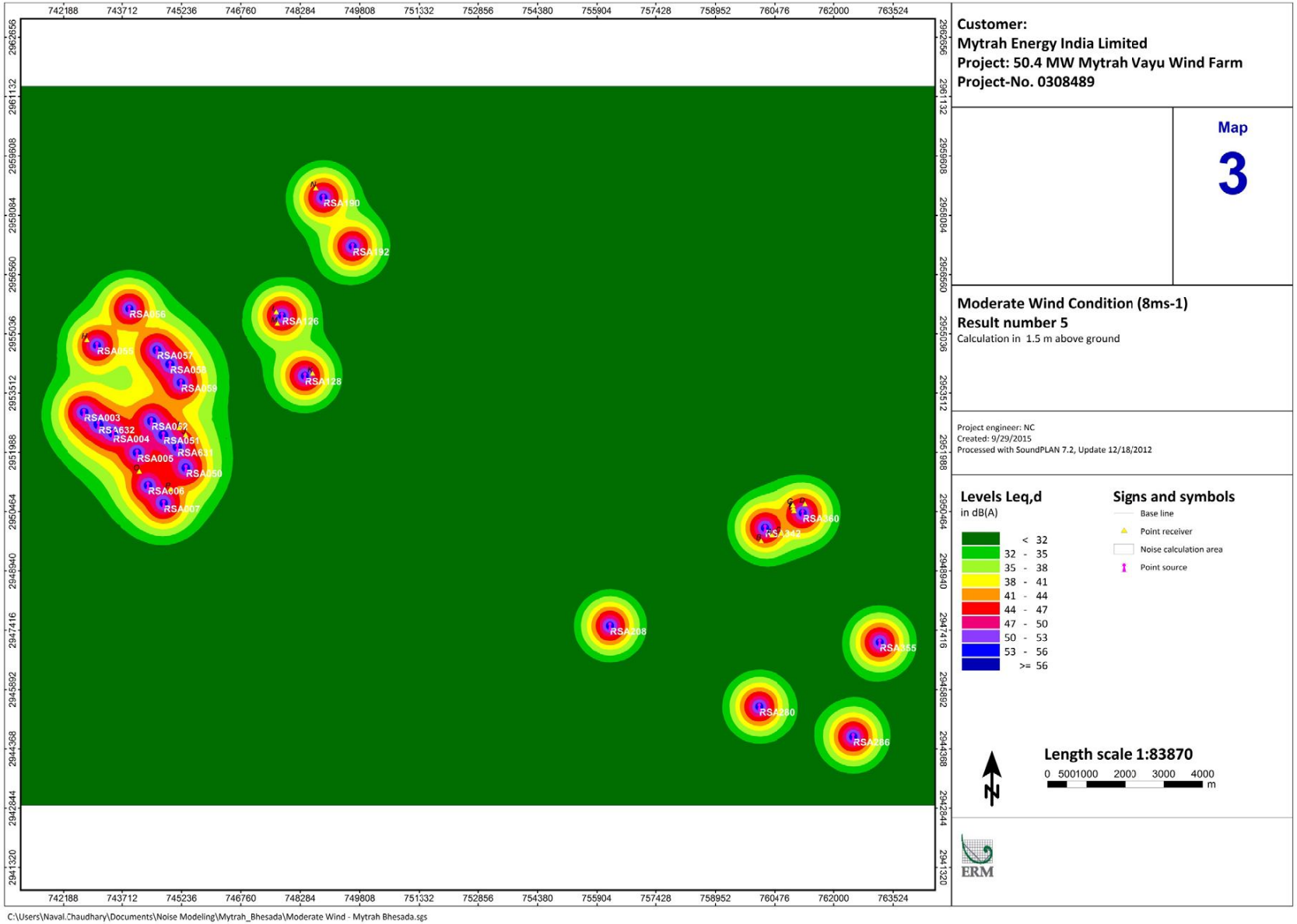
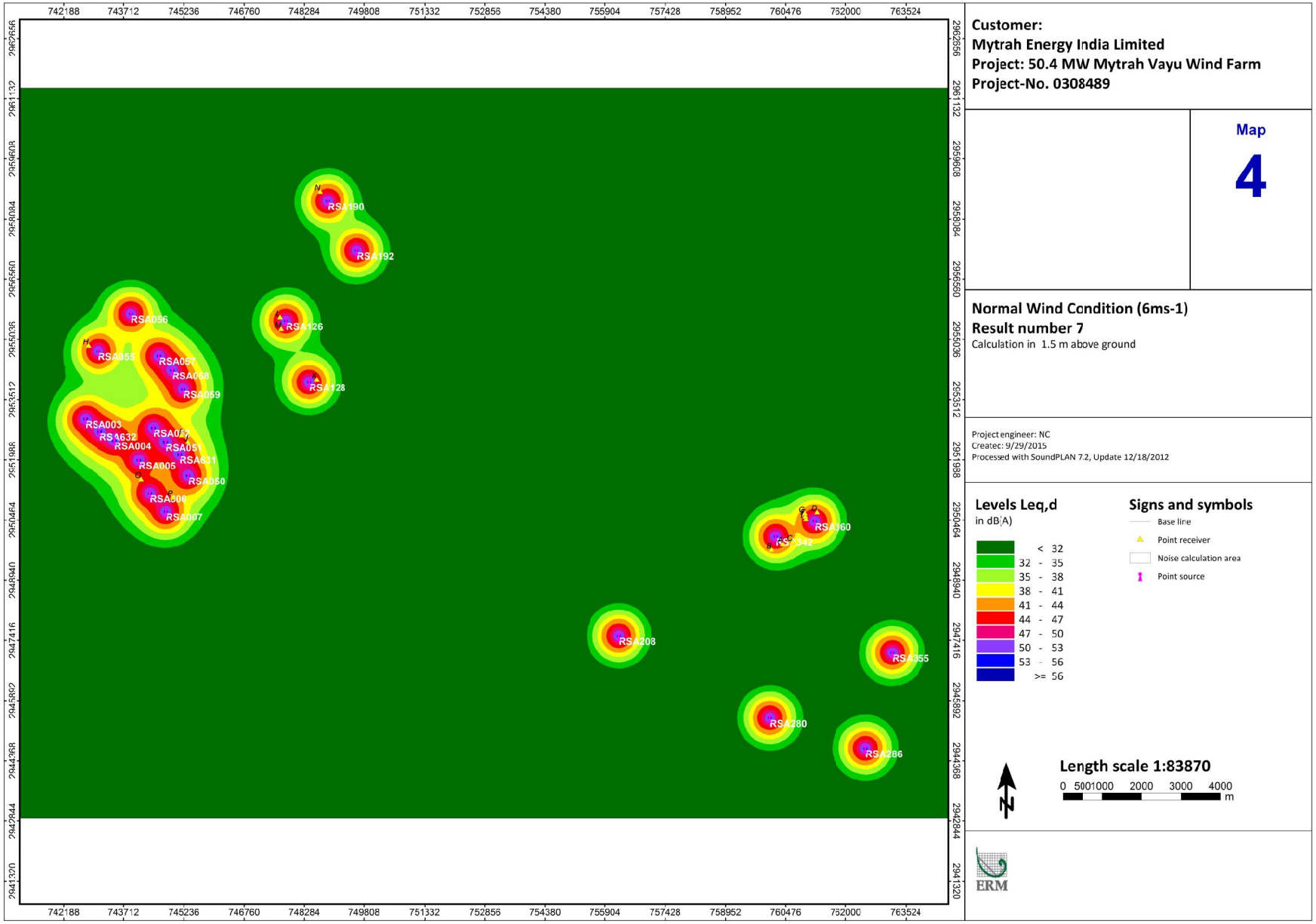


Figure 8.6 ***Predicted Operation Phase Noise Levels of Project with Normal Wind Conditions during Daytime (Leq $_d$)***



C:\Users\Naval.Chaudhary\Documents\Noise Modeling\Mytrah_Bhesada\Normal Wind - Mytrah Bhesada.sgs

8.5.6 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

[1] These are found in "Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergianlagen" (WEA-Shattenwurf-Hinweise).

(2) Draft EIA Guidelines Wind Power Sector, prepared by Centre for Science and Environment, New Delhi

can be theoretically calculated from the geometry of the wind turbines, their 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 and Forests (MoEF) 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).
- 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 4 m/s and 25 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 1Hz for modern turbines, seizures caused by shadow flicker are considered to be extremely unlikely. The Suzlon S97 turbines (proposed to be used in this project) being considered operate at a frequency outside the range where negative health effects may result (2). 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 (3). 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 or 30 minutes (0.5 hours) per day. 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 Jodhpur covering the data period (1969 – 1993)[4];

(1) It is acknowledged by this assessment however that India is at a lower latitude than the European countries and therefore angles of shadow flicker may be narrower.
(2) 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.'
(3) www.windpower.org
(1) [4] Available in WindPro database of climatological data

- the wind turbines have been considered operational with wind speed more than 4 m/s and for the same wind mast data has been considered, which indicates that about 92% 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 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);
- straw huts as well as concrete structures within settlements are considered as shadow receptors[1].

The following data inputs were used in this study:

- a digital elevation model of the site (National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) Data at 90 m resolution);
- latitude and longitude at centre of the site used to calculate the position of the sun (calculated in GIS using WGS84);
- mean monthly sun-shine hours recorded over a period of 25 years at a nearby IMD solar radiation station (Jodhpur);
- wind mast data at site for wind class and frequency distribution;
- turbine locations – coordinates (identified in GIS);
- turbine rotor diameter for Suzlon S97 turbines is 97 m;
- height to bottom of Turbine hub for Suzlon turbines is 120 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 97 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.

(1) [1] It is likely that some of these straw huts are also used as shaded structure for cattle and storage areas.

Figure 8.7 shows the study area of the assessment (within 1000 m) of each of the proposed wind turbine location[1] and the surrounding nearby settlements. A total of 16 structures[2] have been identified as being within the study area of the wind farm (See ***Figure 8.7***). It has been noted that no village settlement is located within the study envelope. All the shadow receptors considered in this study are scattered hutments located within 500 m from any of the WTG location. Project data overview has been presented in ***Annex A*** which provides the details of WTGs in the study area as well as location details of the shadow receptors considered 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)

[1] Suzlon has provided a total of 25 wind turbine locations to Mytrah, out of which Mytrah will take 24 wind turbines. However, the same was not finalized at the time of assessment. Therefore, the assessment is based on all 25 WTGs.

[2] Where any settlement was noticed within the study area, only 1 or 2 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.