Environmental and Social Impact Assessment Report

24 MW Wind Power Project, Babaleshwar, Karnataka

Hero Future Energies Pvt. Ltd.

January 2019

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Revision History

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Table of Contents

Figures

Tables

1. Introduction

1.1 Preface

M/s Clean Wind Power (Babaleshwar) Pvt. Ltd. (hereinafter referred as “CWPPL”), a Special Purpose Vehicle (SPV) of Hero Future Energies Pvt. Ltd. (hereinafter referred as “HFE”) is developing a 24 MW Wind Energy Project (hereinafter referred as “project”) spread across Bijapur taluka of Vijayapura District of the state of Karnataka, India. The project is expected to install 12 Wind Turbine Generators (WTGs).

1.2 Background

AECOM India Pvt. Ltd. (hereinafter referred as “AECOM”) understands that HFE intends to invest in the wind farm project with financial assistance from international lenders / multilaterals. In this context, the project requires evaluation of Environmental and Social risks associated with its operations. Evaluating such risks will help determining mitigation measures to avoid adverse impacts identified as part of the study.

As HFE is seeking project finance from international lenders, it is required to comply with the applicable International Finance Corporation (IFC) guidelines relating to Environment, Social issues and Occupational Health and Safety matters, in addition to regional and national laws and regulations.

AECOM India Pvt. Ltd. (hereinafter referred as “AECOM”) has been commissioned by HFE to undertake an Environment and Social Impact Assessment (ESIA)[1] in order to meet requirements of the following reference framework:

- Applicable national, state and local regulatory requirements;
- IFC Performance Standards (2012);
- IFC/World Bank EHS Guidelines for Wind Energy Projects (2015); and
- IFC/World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007).

1.3 Project Proponent

HFE is an Independent Power Producer, was established in 2012, and is a fully owned subsidiary of the Hero Group. HFE has established projects in ten states of India with a power generation capacity totalling 360 MW across wind, solar PV (grid connected) and rooftop projects. The company has a pipeline of ~1100 MW of wind projects till 2018-19 and is estimated to secure over 500 MW of solar projects through state and central bidding process 2015-16.

HFE has established several renewable energy initiatives through gird connected solar, rooftop solar and wind power projects. The list of wind projects initiated by HFE has been presented in **Table 1-1**.

The following are the wind farm projects undertaken by HFE as of December 2016:

Table 1-1: List of HFE Wind Projects across India

S. No.	Project Location	Capacity
1	Ratlam, Madhya Pradesh	100 MW (50 x 2 MW)
2	Bableshwar, Karnataka	50 MW (25 x 2 MW)
3	Anantapur, Andhra Pradesh	120 MW (60 x 2 MW)
4	Zaheerabad, Telangana	Upto 100 MW; Phase I : 31.5 MW (15 x 2.1 MW)
5	Manvi, Karnataka	50 MW (25 x 2 MW)
6	Gunga, Rajasthan	40 MW (20 x 2 MW)
7	Dangri, Rajasthan	40 MW (20 x 2 MW)

[1] *Note: Wind projects in India are not required to obtain and Environmental clearance from the Ministry of Environment Forests and Climate Change (MoEF&CC). This ESIA is intended to be used for internal Environmental and Social management and is not applicable for fulfilling regulatory purposes (if any).*

S. No.	Project Location	Capacity
8	Satara, Maharashtra	32 MW (16 x 2 MW)
9	Pratapgarh, Rajasthan	37.5 MW (25 x 1.5 MW)

Source: HFE Corporate Office, December 2016

The current project at Babaleshwar is being developed by Gamesa Renewable Pvt. Ltd. (hereinafter referred as "Gamesa" or "EPC") who is the Engineering Procurement Construction (EPC) contractor for the project. The Operations and Management of the project is expected to be extended to Gamesa as well. Gamesa Renewable Pvt. Ltd. is part of Gamesa Corp., which is an ISO 9001: 2008 certified company with headquarters in Zamudio, Spain. It is an India-based company, engaged in wind turbine manufacturing and provides wind energy solutions and services. The Company has established a Blade manufacturing plant in Gujarat and a nacelle assembly plant in Kanchipuram, Tamil Nadu. The WTGs will be transported from both these units.

1.4 Project Overview

The project comprises of 12 WTGs, each with a power rating of 2.0 MW (with total capacity of 24 MW) to be evacuated at proposed 220/33 KV Pooling Substation in Karjol village, Bijapur. **Table 1-2** provides key details pertaining to the project:

Table 1-2: Key Components of the project

Project Component	Description	Current status
Wind farm project with 12 WTGs	Wind project spread over Bijapur Taluka in Vijayapura District of the state of Karnataka	Micro-sitting has been completed for the wind project. A total of 12 WTG locations have been confirmed. As on date of site visit (17th through 18th October 2016), excavation was completed for four (4) WTGs, erection work was in progress for two (2) WTG and foundation was completed for 1 WTG. The land procurement for 24 Acres and 0.5 Guntas was completed (a total of 17 acres and 0.5 Guntas area is expected to be procured for the project).
Access roads	Existing panchayat roads are repaired and widened. New By-Pass road has been developed to reduce vehicular movement through village roads (Karjol)	The land (100% private land) procurement process for the same was in progress as on the date of site visit. The land procurement for the access roads has been initiated by a land aggregator (M/s Sai Associates)
Substation	80% of the construction work Pooling Substation With 2 X 100MVA has been completed.	Private land of 6 acres has already been procured through land developer at Karjol. The procuring process has been completed and development of the substation has been subcontracted to Streling Willson
Transmission line	The project will consist of approximately 22 km of 220KM High Voltage (HV) Line	Private land for the transmission line has been procured through HV line contractor engaged by Gamesa

Source: HFE Corporate Office, December 2016

1.5 Objective and Scope of work

The scope of work for the ESIA broadly includes the following:

1.5.1 Defining the Project/Project Description

The project information includes project description with focus on understanding the environmental and social setting and sensitivities for the wind power project. This also includes any related facilities that may be required (e.g., access roads, transmission lines, water supply arrangements, housing, raw material etc.). Also description of the larger setting in which the project is located.

1.5.2 Outlining Policy, legal, and administrative framework

Discussing the policy, legal, and administrative framework within which the assessment is carried out, including host country regulations, obligations under relevant international social and environmental treaties, agreements, and conventions, IFC Performance Standards and subsequently reviewing the social and environmental compliance requirements against afore mentioned requirements.

1.5.3 Generating Baseline Data

Collecting and generating relevant baseline social and environmental data (primary & secondary) relevant to decisions about project location, design, operation, or mitigation measures. The baseline data generation is specifically focused on issues around a) noise including cumulative impact assessment on noise quality due to operation of existing and proposed wind turbines, b) traffic, c) water- its quality, availability and adequacy vis-à-vis the requirements during different phases of the project life cycle, d) land and land use e) ecology/ biodiversity including baseline conditions and impact on birds and bats) f) physical or cultural heritage (if any), g) other environmental sensitivities like wetlands, forests etc. Review of the land take/lease process to assess any legacy or current/existing issues (like informal settlers, livelihood dependence, other usage etc.) on the purchased/leased land is also assessed.

1.5.4 Consultation

Consultation with local community, stakeholders, household surveys is carried out to review land procurement and compensation process and assess compliance to IFC PS 5 standards.

1.5.5 Assessing Social and Environmental Impacts and Mitigation Measures

Evaluating potential Environment and Social impacts of the Project and its components (including associated facilities like, transmission line, access roads etc. as per the details available) and developing mitigation measures and plans to maximize project benefits in consultation with affected communities including, potential assessment of cumulative impacts (linked to development or other wind projects), if relevant and as appropriate. The impact assessment will identify mitigation measures for any residual negative impacts that may not be mitigated and also evaluate impacts and risks from associated facilities and other third party activities. Sensitive receptors information includes collecting information on the positioning of households/settlements with respect to the proposed WTGs for shadow flicker assessment and subsequently assessing impact of shadow flicker on the community using appropriate software.

1.5.6 Analysing Alternatives

Comparing reasonable alternatives against proposed project site, technology, design, and operation in terms of their potential social and environmental impacts is to be undertaken. The feasibility of mitigating these impacts, capital and recurrent costs, suitability under local conditions, and institutional, training, and monitoring requirements also has been considered. The resultant alternative will state the basis for selecting a particular site and project design by justifying recommended approaches to pollution prevention and abatement.

1.6 Limitations

The Environment and Social Impact Assessment study of the project is limited to project information made available by the client, discussion with Gamesa and other contractor staff, primary monitoring, secondary data collected, consultation with local community and observations made during site visit. Professional judgement and interpretation of facts has been applied for presenting inference from the collected information.

Note: A total of 12 WTGs (2 MW each) are proposed to be installed for the 24 MW project. However, out of 12 WTG locations only 7 are confirmed locations and the rest are pending as on date of issue of this report (please refer to Table 3-1 for more details). Impacts identified in this report are limited to these identified locations only.

1.7 Report structure

The report structure is outlined in the following manner:

- Chapter 2 – outlines Project Description
- Chapter 3 – outlines Environmental and Social Regulatory Framework
- Chapter 4 – outlines Environmental and Social Baseline
- Chapter 4 – Outlines Stakeholder Engagement and Public Consultation conducted for the Study
- Chapter 6 – describes Impacts associated with the Project
- Chapter 7 – outlines Alternatives that may be considered for the Project
- Chapter 8 – presents Environmental and Social Management Plan for the Project
- Chapter 9 – provides Conclusion and Recommendations

2. Project Description

2.1 Overview

This section provides an overview of project and describes the project in terms of its location, associated infrastructure, equipment required and activities to be performed during the construction, operation and decommissioning stages of the project.

The project once complete will have 12 WTGs with total capacity of 24 MW. The details about this development have been summarised in subsequent sections.

2.1.1 Project Status

Micro-sitting exercise for the project was carried out, based on this study; location of the proposed 12 WTGs has been confirmed. As on date of site visit (18th through 19th December 2016), excavation work was completed for four (4) WTGs, erection work was in progress for two (2) WTGs and foundation was completed for 1 WTG. The land procurement for approximately 25 acres was completed (a total of 60 acres area is expected to be procured for the project) while procurement for external transmission lines (22 km length) connecting to pooling substation was completes and compensation was given to the farmers.

About 80% of the construction work at the pooling substation in Karjol village was completed at the time of site survey conducted in December 2016. Nearly 5km of existing village panchayat road is extended for internal connectivity of the project. The same is presently being acquired during the acquisition of land for WTG.

2.2 Project Setting

2.2.1 EPC Contractor and Subcontractors

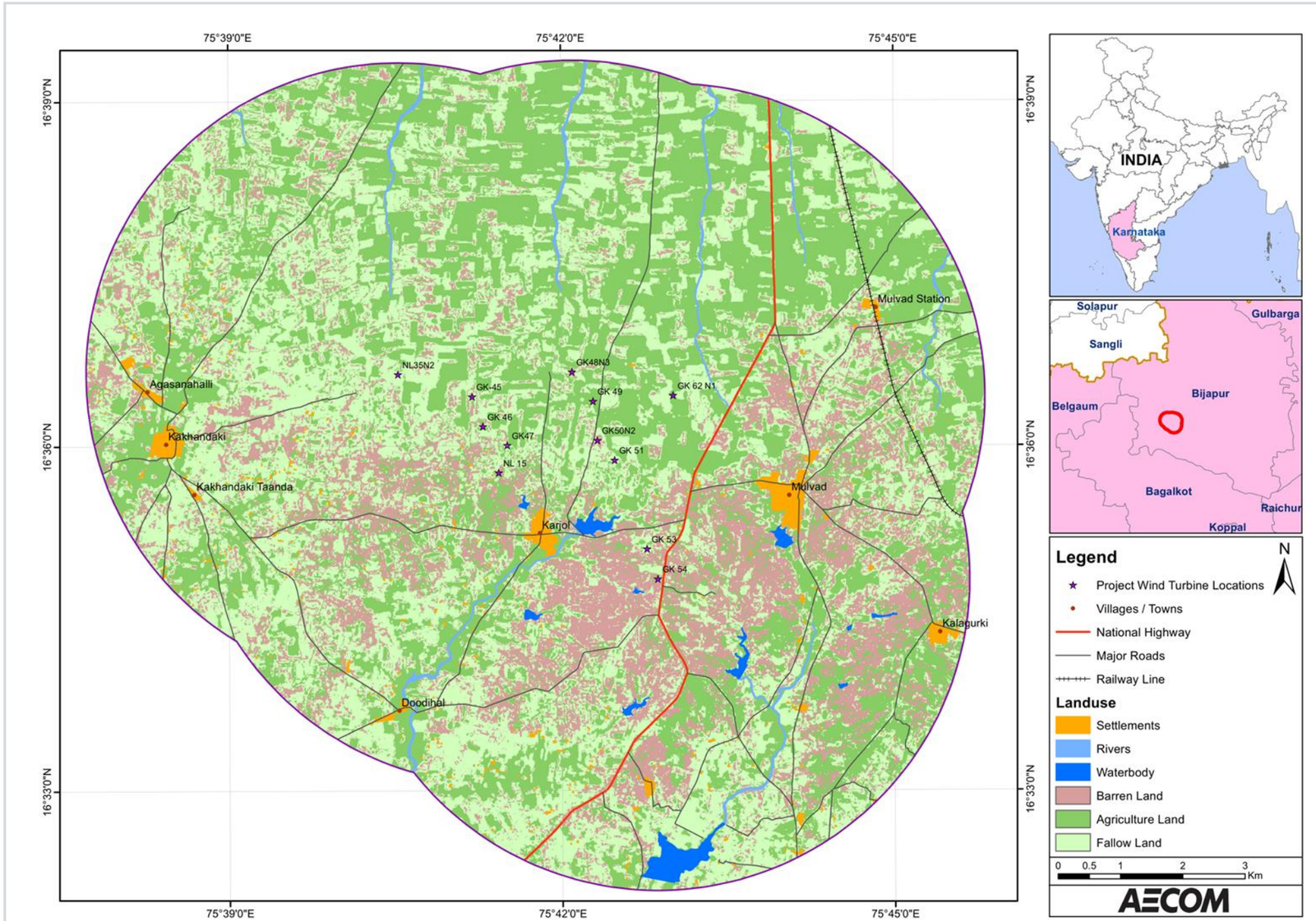
As per the agreement between CWPPL and Gamesa, the latter has been extended the responsibility for overall implementation and supervision of wind turbine supply, transportation of wind turbines, civil infrastructure related work, electrical infrastructure related work, foundation work, and installation of WTGs through use of cranes, and site commissioning and testing. To meet the requirements, Gamesa has appointed subcontractors for various civil, mechanical and other labour related works. The responsibility of Operations and Maintenance for the project has also been extended to Gamesa.

2.2.2 Site setting

The proposed project site is located approximately 70 km east of Vijayapura town via state highway SH-34. The project area is characterised by rural setup. The site is located at an elevation of 550-600 m above mean sea level (amsl) having a flat terrain with scattered low vegetation. The project area is characterised by red soils, which are sandy in nature derived from granites, gneisses.

A water body was observed close to WTG no. GK 53 near Karjol village in the project area. Few individual households were observed to be located near the proposed turbines and the noise and flickering impact on these structures are assessed in **Chapter 6**.

Table 2-1 presents the site surroundings of each WTG location for which primary data was collected during site survey. Map showing location of WTGs and land-use of the study area (5km radius of the project area) is presented as **Figure 2-1** below.



Source: AECOM India Pvt. Limited

Figure 2-1: Map showing location of WTGs and Land Use of the Study Area

Table 2-1: WTG Specific surrounding features

WTG no.	Name of Village	Coordinates (UTM) (43Q)		Surrounding Land-use				Topographic profile			
		Easting	Northing	North	South	East	West	North	South	East	West
NL35N2	KHAKANKI	572040	1836579	Agricultural	Agricultural	Agricultural	Partly Agricultural	Flat	Flat	Flat	Flat
GK45	TONASYAL	573229	1836226	Agricultural	Slight vegetation	Agricultural	Agricultural	Flat	Flat	Flat	Flat
GK46	KARAJOL	573403	1835745	Partly Agricultural	Agricultural	Agricultural	Agricultural	Flat	Flat	Flat	Flat
GK47	KARAJOL	573795	1835445	Agricultural	Agricultural	Agricultural	Agricultural	Flat	Flat	Flat	Flat
NL 15	TONASYAL	573659	1835005	Agricultural	Agricultural	Agricultural	Agricultural	Undulated	Undulated	Undulated	Undulated
GK48N3	TONASYAL	574830	1836623	Agricultural	Partly Agricultural	Partly Agricultural	Agricultural	Flat	Flat	Flat	Flat
GK 49	KARAJOL	575168	1836154	Partly Agricultural	Agricultural	Agricultural	Agricultural	Flat	Flat	Flat	Flat
GK50N2	KARAJOL	575239	1835528	Agricultural	Agricultural	Agricultural	Agricultural	Undulated	Undulated	Undulated	Undulated
GK 51	KARAJOL	575515	1835209	Agricultural	Agricultural	Agricultural	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Undulated
GK 53	KARAJOL	576036	1833786	Slight vegetation	Slight vegetation	Partly Agricultural	Partly Agricultural	Flat	Flat	Flat	Flat
GK 54	KARAJOL	576211	1833305	Agricultural	Agricultural	Slight vegetation	Agricultural	Flat	Flat	Flat	Flat
GK 62 N1	KARAJOL	576453	1836249	Agricultural	Agricultural	Agricultural	Agricultural	Flat	Flat	Flat	Flat

Source: Primary data collated by AECOM, December 2016

2.3 Project Components

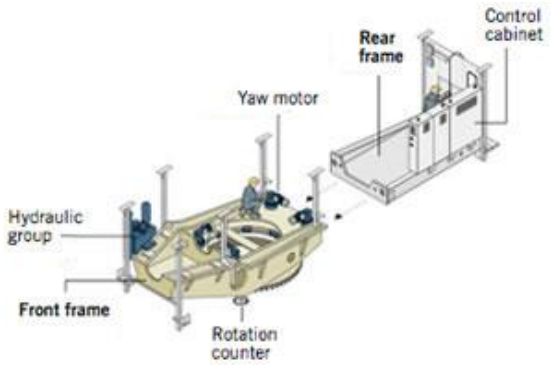
2.3.1 Wind Turbines

The project will comprise of 12 WTGs of the Gamesa 114 model, each of 2.0 MW aggregating to 24 MW. Each WTG will have a hub height of 106 metres with a rotor diameter of 114 metres and a tubular steel tower structure. The rotor speed will vary in between 7.8 to 14.8 rpm. A brief technical specification of Gamesa 114 wind turbine has been presented in **Table 2-2** and **Figure 2-2.**

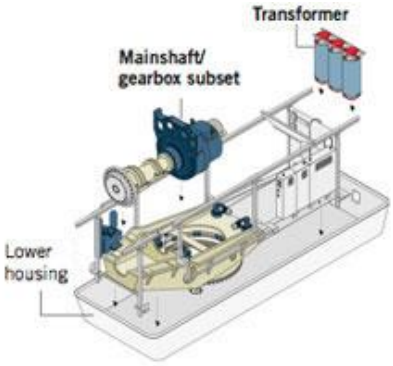
Table 2-2: Technical Specifications of Gamesa

Components	Specifications
Rotor	
Diameter	114 metres
Swept area	10,207 m^2
Rotational Speed	7.8 - 14.8 rpm
Speed control	Blade pitches in such a way that RPM is maintained
Over speed control	Blade pitches in such a way that RPM is maintained
Blades	
Number of blades	Three (3)
Length	56 metres
Airfoils	Gamesa
Material	Fiberglass reinforced with epoxy or polyester resin
Total weight of the blade	Approx. 11.5 Tonnes
Tower	
Type	Conical barrel tube
Height	106 metres
Gear box	
Type	1 planetary stage / 2 parallel stages
Ratio	1:128.5 (50 Hz), 1:102.5 (60 Hz)
Generator	
Type	Doubly-fed machine
Rated power	2.0 MW
Voltage	690 V AC
Frequency	50 Hz / 60 Hz
Protection class	IP 54
Cooling system	Passive air cooling
Power factor	0.95 CAP-0.95 IND throughout the power range

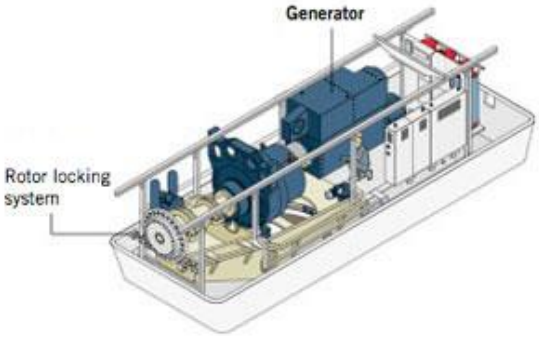
Source: Gamesa Platform Catalogue, August 2016



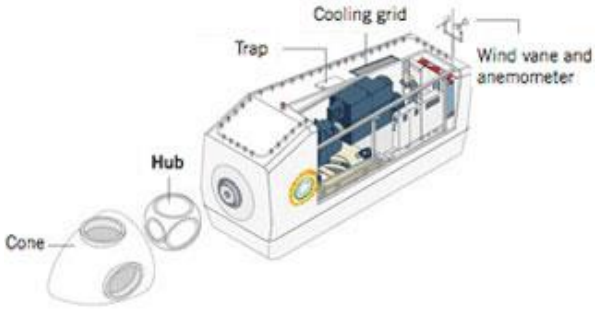
Frame diagram



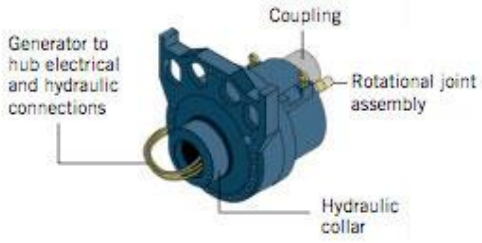
Gearbox assembly and lower housing



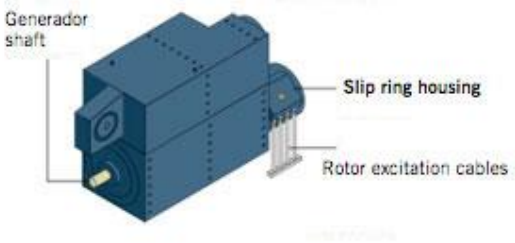
Generator



Upper housing



Gearbox diagram



Generator diagram

Source: http://www.gamesacorp.com/en/

Figure 2-2: Typical diagram of Gamesa Turbine

2.3.2 Access roads

Establishment of access to the site will be one of the preliminary activities that have to be undertaken as part of construction process. A bypass road has been constructed connecting the Zero point and Kakhandaki to avoid intervention into the village. The existing panchayat roads are being developed. The project related traffic is not expected to flow through the Kakhandaki village but will utilize the existing road and bypass to reach WTG locations in and around Kakhandaki village.

The strength of the road will be designed to carry the cranes and heavy trailers. In order to assess the exact depth of cutting required for the slope, profile survey will be carried out by CWPPL and length of the road would be increased if required to reduce the depth of cutting.

2.3.3 Substation and Transmission Line

As per technical specifications reported by the site management, works for development of 33 / 220 kV pooling substation has been contracted out to M/s PVR Constructions. An area of 8 acre has been procured for this purpose and 80% of the construction work was observed to be completed.

Power generated from the project will be evacuated through 33 kV internal transmission lines (approximately 22 km in length) connecting the proposed pooling substation at Karjol and WTG locations. Two transformers will be installed at the pooling substation at Karjol to step up power from 33 kV to 220 kV. Karjol substation was under construction during site survey and is expected to be completed prior to commissioning.

2.4 Project schedule and activities

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

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

These phases are outlined in the sections below. The Project is currently in the construction phase.

2.4.1 Planning and Preconstruction Phase

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

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

The micro-siting has been completed for the project and a Wind Resource Assessment report has been prepared.

2.4.2 Construction Phase

The Construction activities for the wind farm development include:

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

2.4.3 Operations and Maintenance Phase

A dedicated Operation and Maintenance (O&M) facility for storing equipment and supplies required during operation shall be maintained. There shall be a workshop facility available at site to take care of regular maintenance requirement of the Wind Turbines. A tool room with sufficient stock of tools and spares as well as critical components will be maintained at the site.

Pooling substation at Karjol will be equipped with supervisory control and data acquisition (SCADA) system and central monitoring system (CMS). This system provides two-way communication with each wind turbine. A SCADA system allows a central computer system to monitor and control each turbine's operation.

An O&M agreement will be signed with Gamesa to entrust them with responsibility of operation, maintenance and/or in accordance with accepted industry practices.

2.4.4 Routine Operational Services

Routine activities during operation phase include cleaning and upkeep of the equipment such as:

- Torqueing;
- Nacelle and Tower head torqueing and cleaning;
- Frequency Converter Panel and Low-Tension Panel Maintenance;
- Site Maintenance; and
- Security.

2.4.5 Preventive Maintenance

Preventive maintenance involves use of materials and consumables such as lubricants and oils, electrical and mechanical parts etc., for preventive maintenance and upkeep of the equipment including transformer yard, greasing of main bearings, Yaw Bearing and Blade Bearings; topping up of hydraulic and transformer oil; painting of equipment; brake pads for main brakes and yaw brakes; oil and dry filters; batteries; carbon brushes; coolant; cleaning detergents and solvents; pitch Capacitors; all electrical panels.

2.4.6 Breakdown Maintenance

The breakdown repair work uses sub-assemblies/equipment, components, spares and consumables in the event of any breakdown or suspected breakdown due to any reasons. Major breakdown maintenance anticipated for wind farms include repairs/replacement of Generator and Motors, Nacelle, Rotor Unit, Hub, Transformers, yard, equipment, Blades, Frequency Converter Panels and Control Panels, Tower Components and Electricals; and servicing of Anemometer, Wind vanes, wind sensors and other sensors, Limit switches, etc.

2.4.7 Monitoring and Reporting

The following records will be maintained during operational phase:

- Data logging records for power generation, wind speeds, grid availability, machine availability, machine breakdown, etc.;
- Daily and Monthly performance reports;
- Monthly meter reading for State Electricity Board;
- Visual observation record of wind farm and its components;
- Record of visitors;
- Record of accidents/incidents;
- Record of work permits and tool box talks; and
- Records pertaining to Lock-out Tag-out of turbines under maintenance.

2.4.8 Decommissioning Phase

The project, if it reaches a stage where no upgradation / expansion are expected, then the WTGs will be decommissioned and dismantled. Activities during this stage would primarily include, disembarking / dismantling and transport of WTGs and decommissioning of PSS.

2.5 Required Resources

2.5.1 Manpower

During construction phase, the labour requirement will range from 40-50 (both skilled and unskilled included) during normal operations and approximately 280 workers (Casting, Reinforcement works and Civil works - 100, Mechanical works -80, Electrical works -100) for peak construction activities (assuming construction work at 4 WTGs simultaneously).

The labour requirement varies during the construction phase from the initial phase to the commissioning phase. As reported by CWPPL site management, approximately 280 workers (both skilled and unskilled included) will be employed depending on requirement. Labourers will be employed at the local level from the surrounding villages, as well as from other states. However, no labour camp is expected to be constructed as arrangements have been made in the nearby villages of the project area for rented accommodations for migrant workers.

CWPPL/Gamesa has ensured that villagers will be employed for unskilled works, while contract labour (hired for skilled work) will be provided accommodation in nearby villages with adequate facilities for drinking water, toilets will be set up. Although no significant influx of migrant population is expected, 30-35 skilled workers for mechanical works will be hired from outside.

2.5.2 Water Requirements

During construction phase, water will be required for domestic purposes as well as for construction activities. The water requirements will be primarily met through supply of water from tankers and additional water if required will be sourced from existing bore well located at the store yard. The water requirements during the construction phase have been presented in **Table 2-3**. Total water requirement for the project during construction phase is estimated to be approximately 1608KL.

Table 2-3: Estimated water requirement during construction phase

Type of work	Water required
For erection works	2000 ltrs / location
For WTG specific civil works and casting	42000 ltrs / location
For curing works	90000 ltrs / location
Total water requirement during construction phase	134000 ltrs / location

Source: CWPPL, December 2016

CWPPL site management reported that approximately 3 to 5 m^3 / month of potable water and utility water is expected to be used during Operations and Maintenance phase. Local contractors are expected to provide water through tankers.

2.5.3 Key Material Supplies and Transportation Routes

2.5.3.1 Construction Phase

The construction material along with wind turbines includes cement, aggregates, steel, paints, solvents etc. Besides these, other supplies required for the project are fuels and oils, drilling requirements, spare parts for construction machinery and food and supplies for construction workforce. Most supplies are expected to be procured locally.

2.5.3.2 Operation Phase

Supplies such as WTG spare parts and other operational requirements will be transported from Gamesa manufacturing unit in Chennai. Additional supplies such as fuel requirements and supplies for the site staff will be sourced locally.

2.5.4 Fuel Supplies and Storage

2.5.4.1 Construction Phase

Onsite fuel requirement during construction phase is dependent on fuel requirement. Separate storage for fuel is therefore not expected. Required fuel will be sourced from local vendor and used on "Just in time" basis.

2.5.4.2 Operation Phase

The project is expected to allocate area for above ground storage facility for storage of lubricating oil. The oils will be unloaded in designated areas and stored in drums in dedicated stores. Details of the same have not yet been confirmed.

2.6 Land Requirement

2.6.1 Overview

CWPPL is in the process of procuring private land on willing seller/ and willing buyer basis for the proposed project. Total land requirement for installation of WTGs will be around 60 acres (of which 25 acres have been acquired). Pooling substation at Karajol village is under construction on private land. The entire project area comprises of private agricultural land. The component wise break-up of the land required for the project is provided in the following **Table 2-4**:

Table 2-4: Component breakup of land area required for the Project

Project Facilities	Land Area (in acres)	Land Use Classification			Mode of Procurement
		Forest	Government	Private	
Wind Turbine	42	-	-	✓	Willing Buyer/ Willing Seller
Access Roads	10 to 12	-	-	✓	Willing Buyer/ Willing Seller
Substation/Switchyard/ Administration Building	8	-	-	✓	Willing Buyer/ Willing Seller
External Transmission Lines up to Grid Substation from PSS (22 KM OF 220KM EHV LINE)	ROW requirement yet to be estimated by CWPPL	-	-	✓	Willing Buyer/ Willing Seller

Source: CWPPL, December 2016

Land procurement for the project is being undertaken by land aggregators, M/s Sai Associates. It is understood that private land procurement for substation was undertaken by Gamesa. The procurement was done on a willing seller willing buyer basis and no impact on sole land owner for their loss of land has been envisaged. Moreover, the substation is being built for the entire 200 MW wind farm in the area, proposed to be executed in phases and will be a shared facility by other customers of Gamesa.

2.6.2 Land Procurement / Rental Process

- Approximately 60 acres of private agriculture land is required for the project from nearby 3 villages for development of the WTGs, pooling substation, transmission lines and access roads;
- Land procurement process is in progress on willing seller willing buyer basis (During the site visit in discussion with the land owners it was informed that the transaction took place with their informed consent and they were provided with fair compensation based on prevailing market rates (at the time of land procurement).
- It was reported by HFE management that, during planning stage, four (4) of the potential WTG (NL35N2, GK48N3, GK50N2 & GK62N1) locations had to be changed/shifted due to any incongruity between land owners and aggregator during the procurement process. It was confirmed by HFE and site representatives that currently the land is free from any legal encumbrances and litigations.
- For the land procurement and other approvals, Gamesa has engaged M/s Sai Associates as the land aggregator for the project.

The following steps entail land procurement process.

- M/s Sai Associate undertook community consultations and individual negotiations with the land owners.
- An Agreement to Sale (ATS) based on negotiations was arrived at and all aspects for purchase were discussed with land owners.
- M/s Sai Associate initiated the process to obtain all the required permissions/approvals from government.
- General Power of Attorney (POA) has been given by land owners to Land Aggregator,
- Compensation was made to the land owners
- Application for 11 E[2] sketch
- Based on the 11E sketch, mutation process initiated
- Application was made to obtain change of land use from agriculture land to non-agriculture (NA) land.

Sale deeds were in process at the time of site visit.

Details of land procured for the project are presented in **Table 2-5** below.

Table 2-5: Details of Land Procured for the Project

Location No.	Serial No. (Survey No.)	Land Procured (acre & gunta)	Village, Mandal	Sale Deed Date	Mutation	Land Conversion	Name of the Land Owner
Sub Station	132	8	Karajol	July, 2016	In progress	In progress	-
NL35N2	363/1& 363/2	3.5	Kakhandaki	Sale in progress	In progress	In progress	-
GK45	257	3.5	Tonasyal	12-Dec-16	In progress	In progress	Sri.Sitaram Tulaju Lamani Jadav
GK46	55&56	3.5	Karajol	23-Dec-16	In progress	In progress	Sri.Umesh Gundurao Deshapande
GK47	60	3.5	Karajol	Sale in progress	In progress	In progress	Sri.Thakaru Manu Jadhav
NL 15	98	3.5	Karajol	08-Dec-16	In progress	In progress	Sri.Thakaru Manu Jadhav
GK48N3	85/2	3.5	Karajol	27-Dec-16	In progress	In progress	Smt.Shakuntala Chandrashekhar Rabakavai
GK 49	810	3.5	Karajol	Sale in progress	In progress	In progress	-
GK50N2	808	3.3	Karajol	Sale in progress	In progress	In progress	-
GK 51	813	3.5	Karajol	Sale in progress	In progress	In progress	-
GK 53	815	3.5	Karajol	Sale in progress	In progress	In progress	-
GK 54	820	3.5	Karajol	Sale in progress	In progress	In progress	-
G K 62 N1	677	3.5	Karajol	Sale in progress	In progress	In progress	-

Source: CWPPL, December 2016

[2] ***11E sketch*** *refers to the exact marking, identification and fixing of boundaries by licensed surveyors in the presence of both the buyer and the seller and is done before mutation is initiated.*

3. Environmental and Social Regulatory Framework

3.1 Introduction

This section highlights the environmental and social regulations applicable to the proposed Wind Power project. The section broadly focuses on the institutional framework, applicable environment, health and safety and social legislative requirements and IFC Performance Standards relevant to the proposed Project.

3.2 National and Regional authorities

All the permissions and approvals have to be taken from the concerned ministries, line departments and the local civic bodies for any upcoming project in India. The environmental and social governance approach in the country consists of –

- Regulatory and implementing entities;
- Legal framework including policies, acts and laws; and
- Permitting system

In India, Ministry of New and Renewable Energy (MNRE) is the nodal agency to manage wind power projects and the environmental aspects are governed by Ministry of Environment, Forests and Climate Change (MoEFCC), Central Pollution Control Board (CPCB,) Central Electricity Authority (CEA), Central Electricity Regulatory Commission (CERC) and National Institute of Wind Energy (NIWE). The social governance aspects at the micro level are addressed by institutions like panchayats and municipal bodies.

A brief description of the relevant enforcement agencies with respect to the institutional framework is described in the following sub-sections.

3.2.1 Ministry of Environment, Forests and Climate Change (MoEFCC)

The Ministry of Environment, Forests and Climate Change (MoEFCC) is the nodal agency in the administrative structure of the Central Government for the planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes.

The primary concerns of the Ministry are implementation of policies and programmes relating to conservation of the country's natural resources including its lakes and rivers, its biodiversity, forests and wildlife, ensuring the welfare of animals, and the prevention and abatement of pollution. While implementing these policies and programmes, the Ministry is guided by the principle of sustainable development and enhancement of human well-being.

The specific functions of MoEFCC are as follows:

- Environmental policy planning;
- Effective implementation of legislation;
- Monitoring and control of pollution;
- Environmental Clearances for industrial and development projects covered under EIA notification;
- Promotion of environmental education, training and awareness; and
- Forest conservation, development, and wildlife protection.

3.2.2 Central Pollution Control Board (CPCB)

The Central Pollution Control Board (CPCB) was established in September 1974, for the purpose of implementing provisions of the Water (Prevention and Control of Pollution) Act, 1974. The executive responsibilities for the industrial pollution prevention and control are primarily executed by the CPCB at the Central level, which is a statutory body, attached to the MoEFCC. CPCB works towards control of water, air and noise pollution, land degradation and hazardous substances and waste management. The specific functions of CPCB are as follows:

- Prevent pollution of streams and wells;
- Advise the Central Government on matters concerning prevention, control and abatement of water and air pollution;
- Co-ordinate the activities of SPCB's and provide them with technical and research assistance;
- Establish and keep under review quality standards for surface and groundwater and for air quality;
- Planning and execution of national programme for the prevention, control and abatement of pollution through the Water and Air Acts; and
- The CPCB is responsible for the overall implementation and monitoring of air and water pollution control under the Water Act, 1974, and the Air Act, 1981.

3.2.3 Karnataka State Pollution Control Board (KSPCB)

Karnataka State Pollution Control Board (KSPCB) is a statutory authority entrusted to implement environmental laws and rules within the jurisdiction of the State of Karnataka, India. The Board ensures proper implementation of the statutes, judicial and legislative pronouncements related to environmental protection within the State. The KSPCB was constituted in September 1974 after the enactment of the first major environmental legislation of the country, the Water (Prevention and Control of Water Pollution) Act, 1974.

The Board functions through its Head Office at Bengaluru, five Zonal Offices headed by five Joint Chief Environmental Engineers and nineteen Regional Offices headed by nineteen Environmental Engineers. The important functions of board comprise of planning and execution of annual action plans to implement the provisions of various rules and Acts; consent management; environmental awareness; ensure legal actions defaulters; waste management and deals with public grievances.

Intimation to KSPCB is required before the start of the project

3.2.4 Department of Ecology & Environment, Karnataka

The Department is under the Administrative Control of Minister of Cabinet rank for Forest, Ecology & Environment. The Department is headed by The Principal Secretary, Forest, Ecology and Environment and Secretary (Ecology & Environment). Its mandate is to preserve and enhance the quality of the natural environment, including water, air and soil quality; conserve and protect flora, fauna and other natural resources; enforce environmental Acts and Rules made by the Central Government and Government of Karnataka and coordinate various environmental policies and programs.

The Department primarily deals with:

- Implementation of Air (Prevention and Control of Pollution) Act, 1981,
- Water (Prevention and Control of Pollution) Act, 1974
- Environment Protection Act, 1986 and notifications issued under the Environment Protection Act.
- Implementation of National River Conservation Plan and National Lake Conservation Plan
- To accord Environmental Clearances in respect of certain categories of industries
- To take up activities for the protection of Bio-diversity in the State
- To oversee the activities / functioning of Karnataka State Pollution Control Board
- To oversee Coastal Zone Management of Karnataka

3.2.5 Petroleum and Explosives Safety Organization (PESO)

The PESO is under the Department of Industrial Policy & Promotion, Ministry of Commerce and Industry, Government of India. The Chief Controller of Explosives is responsible to deal with provisions of

- The Petroleum Act 1934 and the Rules 2002,
- The Static and Mobile pressure vessels {Unfired} Rules, 1981 and amendment 2000, 2004;

- Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 and amendment 2000.

3.2.6 Director Industrial Safety and Health

The main objective of the Director, Industrial Safety and Health is to ensure safety, health, welfare and working conditions of workers working in factories and in construction works by effectively enforcing the provisions of the Factories Act, the Building & Other Construction Workers Act and others labour legislations. It is also to ensure the protection of rights of workers and to redress their grievances.

3.2.7 Ministry of New & Renewable Energy (MNRE)

The MNRE is the nodal ministry of Government of India for all matters related to new and renewable energy. The broad aim is to develop and deploy new and renewable energy for supplementing the energy requirements of the country as stated on its website. The role of MNRE has been assuming importance in recent times with growing concerns of energy security. Energy self-sufficiency was identified as the major driver for new and renewable energy in the wake of the two oil shocks of 1970.

3.2.8 Karnataka Renewable Energy Development Limited (KREDL)

The Karnataka Renewable Energy Development Limited (KREDL) is an organization working under the purview of Energy Department, Government of Karnataka. The objectives of the KREDL are to promote renewable energy in the State and to initiate all necessary actions for Energy Conservation in the State. The KREDL works through various Governmental Agencies, Private Organizations, NGO's and Accredited Energy Auditors.

The Karnataka Renewable Energy Development Ltd. (KREDL) is an organization devoted entirely to the promotion of non-conventional energy sources in Karnataka. Its aim is to promote projects for harnessing energy from wind, small-hydro, biomass, solar energy and energy recovery from wastes through private investment. The company advises the Government of Karnataka on policies to be adopted for ensuring a systematic and balanced growth of projects for harnessing renewable energy sources.

KREDL create synergies between industry, finance, government, and technical experts to evaluate challenges and opportunities arising from law and policy; make politically feasible recommendations to promote clean energy. KREDL also catalogues "best practices" in renewable energy regulation at national and regional levels. Disseminate findings through renewable energy networks and global partnerships, targeted events, and at international negotiating fora; and Act as a catalyst for change to promote policy and legal instruments that will enhance the market position for renewable energy.

CWPPL should obtain an approval for project implementation and Certificate of Commissioning from KREDL after commissioning of the project. Project should also be registered under the State Nodal Agency.

3.2.9 National Institute of Wind Energy (NIWE)

National Institute of Wind Energy (NIWE) has been established in Chennai in the year 1998, as an autonomous R&D institution by the Ministry of New and Renewable Energy (MNRE), Government of India. It functions with the following structure.

- **Research & Development Unit:** Its main focus towards novelty in developments of components as well as in sub-systems of wind turbines.
- **Wind Resource Assessment Unit:** The unit identifies resource rich regions in the country by conducting wind resource micro survey and offers its services to the wind farm developers.
- **Standards and Certification Unit:** The unit carries out Provisional Type Certification of Wind Turbines as per the Indian Certification Scheme for Wind Turbines viz. Type Approval - Provisional Scheme - TAPS – 2000 (amended). Standards on Wind Energy are being developed by the unit.
- **Information, Training & Commercial Service Unit**: To establish and update the data bank and serve as finest information centre in wind energy by collecting, collating and analysing the related information.

Gamesa G-114 2.0 MW WTGs proposed to be utilized in the project is NIWE certified as per NIWE notification dated 10.06.2016 with Ref No. NIWE/S&C/RLMM/2016-17/27 on "Revised List of Models and Manufacturers of Wind Turbines – Consolidated "ADDENDUM –II List" to "Main List dated 28.09.2015"

3.2.10 Central Electricity Authority (CEA)

Central Electricity Authority (CEA) is a Statutory Body constituted under the erstwhile Electricity (Supply) Act, 1948, hereinafter replaced by the Electricity Act 2003; where similar provisions exist, the office of the CEA is an "Attached Office" of the Ministry of Power. The CEA is responsible for the technical coordination and supervision of programmes and is also entrusted with a number of statutory functions.

3.2.11 Central Electricity Regulatory Commission

The Commission intends to promote competition, efficiency and economy in bulk power markets, improve the quality of supply, promote investments and advise government on the removal of institutional barriers to bridge the demand supply gap and thus foster the interests of consumers. In pursuit of these objectives the Commission aims to –

- Improve the operations and management of the regional transmission systems through Indian Electricity Grid Code (IEGC), Availability Based Tariff (ABT), etc.;
- Formulate an efficient tariff setting mechanism, which ensures speedy and time bound disposal of tariff petitions, promotes competition, economy and efficiency in the pricing of bulk power and transmission services and ensures least cost investments; facilitate open access in inter-state transmission;
- Facilitate inter-state trading;
- Promote development of power market; and
- Improve access to information for all stakeholders.

3.2.12 Gram Panchayat

Gram Sabha or the Panchayats are the local bodies which have been bodies defined by the 73rd Constitutional Amendment Act, 1992. Panchayats have to be consulted before making the acquisition of land in the Scheduled Areas for development projects and before re-settling or rehabilitating persons affected by such projects in the Scheduled Areas. The responsibilities that have been entrusted upon Panchayats comprises of the preparation of plans for economic development and social justice and the implementation of such schemes for economic development and social justice, as may be assigned to them.

A No Objection Certificate (NOC) has to be obtained for the project from the Gram Panchayat of all the project villages for installation of the WTGs. CWPPL is yet to obtain the same.

3.2.13 Karnataka Power Transmission Corporation Limited (KPTCL)

Karnataka Power Transmission Corporation Limited is a registered company under the Companies Act, 1956 was incorporated on 28th July 1999 and is a company wholly owned by the Government of Karnataka. KPTCL was formed on 1st August 1999 by carving out the Transmission and Distribution functions of the erstwhile Karnataka Electricity Board. KPTCL is mainly vested with the functions of Transmission of power in the entire State of Karnataka and also Construction of Stations & Transmission Lines and maintenance of 400/220/110/66 KV Sub-Stations. Many new lines and Sub-Stations were added & existing stations were modified in the Transmission network. It operates under a license issued by Karnataka Electricity Regulatory Commission.

3.3 Applicable Legislations

The relevant Acts and Rules pertaining to the project have been summarised in the following **Table 3-1**. Some of the policies (including sector specific) have been discussed briefly in the subsequent sections.

3.3.1 National Environmental Policy 2006

Government of India released the National Environment Policy in 2006. The present national policies for environmental management are contained in the National Forest Policy, 1988, the National Conservation Strategy and Policy Statement on Environment and Development, 1992; and the Policy Statement on Abatement of Pollution, 1992. Some sector policies such as the National Agriculture Policy, 2000; National Population Policy, 2000; and National Water Policy, 2002; have also

contributed towards environmental management. All of these policies have recognized the need for sustainable development in their specific contexts and formulated necessary strategies to give effect to such recognition.

The dominant theme of this policy is that while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of conservation, than from degradation of the resource.

CWPPL shall ensure compliance to the requirements of this policy.

3.3.2 National Electricity Policy 2005

The National Electricity Policy 2005 states that environmental concerns would be suitably addressed through appropriate advance action by way of comprehensive Environmental Impact Assessment and implementation of Environment Action Plan (EAP). As per the policy, adequate safeguards for environmental protection with suitable mechanism for monitoring of implementation of Environmental Action Plan and R&R Schemes should be put in place. Open access in transmission has been introduced to promote competition amongst the generating companies who can now sell to different distribution licensees across the country. This should lead to availability of cheaper power.

3.3.3 Karnataka Renewable Energy Policy 2009-14

Karnataka Renewable Energy Policy was formulated by Government of Karnataka to Harness Green, Clean Renewable Energy Sources for Environmental benefits & Energy Security under the leadership of Karnataka Renewable Energy Development Limited (KREDL). KREDL is promoting renewable energy projects through participation of the private sector in wind, mini hydro, bio-mass, co-gen respectively. The Renewable Energy Policy aims at systematic and faster development of Renewable Energy sources.

CWPPL shall ensure compliance to the requirements of Karnataka Renewable Energy Policy 2009-2014 till draft Renewable Energy Policy 2014-2020 is finalised.

Table 3-1: Applicable Environmental and Social Laws, Regulations and Policies

S.N.	Applicable Legislation/Policy	Agency Responsible	Applicable Permits and Requirement
Overview of Applicable Legislations of Government of India			
1.	**The Environment (Protection) Act 1986**, as amended in April 2003*;* **EPA Rules 1986**, as amended in 2002.	KSPCB MoEFCC CPCB	*CWPPL shall ensure compliance under these Rules in order to maintain stipulated standards and environmental management through various supporting rules promulgated under the EP Act.*
2.	**EIA Notification 2006 as amended till 2009** The EIA Notification specifies undertaking Environmental Impact Assessment (EIA) study and obtaining Environmental Clearance (EC) from Ministry of Environment Forests and Climate Change (MoEFCC) or State Environment Impact Assessment Authority (SEIAA). The Schedule of the notification provides criteria for categorising projects into A and B categories based on the magnitude and scale of the impacts associated with the project and provides for incorporating environmental safeguards in the project planning phase.	MoEFCC (for Category A Project) SEIAA (for Category B Project)	Wind power projects are not covered under the 2006 EIA notification and are, therefore, exempt from the EIA process. *The EIA Notification is not applicable to the proposed project.*
3.	**The Water (Prevention and Control of Pollution) Act, 1974**, amended in 1988 (hereafter referred as Water Act)	KSPCB	As per the re-categorisation of Industries by MoEFCC dated 5th March 2016 and CPCB's direction to SPCB/ PPCs dated 7th March, wind power projects have been categorised as White Category Industries. As per the CPCB's direction to SPCB/PPCs, "there shall be no necessity of obtaining Consent to Operate for White Category of industries and intimation to the concerned SPCB/PPC shall suffice." *It is recommended to send intimation to KSPCB as per the recent notification regarding operation of the wind farm*.
4.	**Water Cess Collection** (a tax on water use and water pollution caused)	KSPCB	The project will have water requirement for both the phases and will also lead to generation of wastewater. In this regard, CWPPL is required to file monthly returns as per prescribed format (Form I under The Water (Prevention and Control of Pollution) Cess Rules 1978, as amended through 16th July 1992 and Water (Prevention and Control of Pollution) Cess Act 1977, as amended through 6th May 2003). CWPPL/ Gamesa to ensure Compliance under the Act.
5.	**The Noise (Regulation & Control) Rules, 2000** as amended in October 2002 As per the Environment (Protection) Act (EPA) 1986, the ambient noise levels are to be maintained as stipulated by the Central Pollution Control Board (CPCB) for different categories of areas like, commercial, residential and silence zones etc.	KSPCB	There will be generation of noise during construction activities and during operation of wind energy generators. The Rules require activity/processes generating noise to ensure that the ambient noise standards are within the prescribed Standards. *The project is required to maintain the noise limits prescribed for residential (55 dB (A) for daytime and 45 dB (A) for night-time) areas.*

S.N.	Applicable Legislation/Policy	Agency Responsible	Applicable Permits and Requirement
			CWPPL, construction contractor and O&M contractor (Gamesa) shall ensure compliance under these rules to maintain stipulated standards.
6.	**Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.**	KSPCB	Wind power projects use different types of fluids for the smooth operation of the turbines. Primarily, three main types of fluid are used: i. Generator cooling fluid is used as coolant (a mixture of glycol and water, similar to what is used in automobile radiators); ii. Lubricating oil is used in the gearbox (synthetic oil); ii. Hydraulic oil for operating the blade pitch system, yaw mechanism and rakes. To protect transformer from heating, mineral oil (transformer oil) is used as coolant. According to Section 3 (36) of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 "**Used oil**" means any oil derived from crude oil or mixture containing synthetic oil including used engine oil, gear oil , hydraulic oil, turbine oil, compressor oil, industrial gear oil, heat transfer oil, transformer oil, spent oil and their tank bottom sludge. It clearly indicates that the used lubricating oil, hydraulic oil and transformer oil falls in hazardous waste category as per definition of "Used oil" under Section 3 (36). *CWPPL to make an application in **Form 1** and submit to the KSPCB to obtain an authorization of handling, packaging, storing and management of hazardous waste such as used oil, oily cotton rags that would be generated during the operation of the project*. After **authorization is granted**, the management shall maintain the record of hazardous wastes handled in **Form 3** and prepare and submit to the State Pollution Control Board, an annual return containing the details specified in **Form 4** on or before the 30th day of June following to the financial year. All the hazardous waste generated due to the project shall be stored and disposed as per the requirements of the *Hazardous Waste Rules* i.e., on a paved surface in a designated area with adequate secondary containment, with adequate labelling and before it is disposed to an **KSPCB approved vendor.**
7.	**Ozone Depleting Substances (Regulation) Rules, 2000** as amended in 2005	MoEFCC	The proposed project will involve use of insulating material for wiring and electrical units. Some of the insulating materials may comprise of ozone depleting substances. *CWPPL shall ensure that all the insulation material used for wiring and electrical units for the proposed project are free of ozone depleting substances.*
8.	**The Electricity Act, 2003** including Rules 1956 and 2005 The Rules specify the general safety requirements for construction, installation, protection, operation and maintenance of electricity	KPTCL	The Electricity Act, 2003 allows private sector projects to obtain distribution Licences from the State Electricity Regulation Committee and to have open access to the transmission lines. The license requires power generating companies to comply with

S.N.	Applicable Legislation/Policy	Agency Responsible	Applicable Permits and Requirement
	supply lines and apparatus.		the standards of performance specified in the Act. *CWPPL shall obtain license as mandated under provisions of the Electricity Act and ensure that the health and safety requirements specified under the Rules are complied with.*
9.	**The Petroleum Act 1934,** as amended in August 1976 The Petroleum Rules 1976, as amended in March 2002	PESO (Chief Controller of Explosives)	There will be storage of Diesel at site for operation of generators during construction phase. *The site will store a small quantity of fuel at site. However, in case fuel storage exceeds the limit as stipulated in the Act, CWPPL/ Gamesa is required to obtain a license from PESO*.
10.	**The Motor Vehicles Act 1988**, as amended by Motor Vehicles (Amendment) Act 2000, dated 14th August 2000 The **Central Motor Vehicles Rules 1989**, as amended through 29th June 2012	Transport Department, Karnataka	Every motor vehicle other than motor cycles of engine capacity not exceeding 70 cc, manufactured prior to the first day of March 1990, shall be maintained in such condition and shall be so driven so as to comply with the standards prescribed in these rules. *CWPPL shall ensure compliance of stipulated emission standards under Rule 115. It shall be ensured that all the project vehicles are in possession of valid Pollution Under Control (PUC) Certificate issued by authorised agencies.*
11.	**The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013**	Department of Land Resources, Ministry of Rural Development	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act is applicable only when land acquisition involving rehabilitation and resettlement and compensation is carried out by Government for its own use, hold and control including for Public Sector Undertakings for public purpose and for public private partnership projects. *The land procured for the project is private agricultural land. The land has been procured on a 'willing buyer/willing seller' basis wherein the project proponent has individually negotiated directly with the land seller and land prices have been determined above the prevailing market value.* *As no Government bodies have been involved in the land procurement process and the project does not come under the purview of public private partnership, the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act does not get triggered.*
12.	**The Contract Labour (Regulation and Abolition) Act,** 1970	Chief Labour Commissioner	Any contractors or third parties to be involved in the construction works for the proposed project, if required, will also be engaged only subject to availability of valid license. *CWPPL shall ensure that the EPC contractor has a valid license under the Contract Labour (Regulation and Abolition) Act, 1970 for executing any work through contracted labour*.

S.N.	Applicable Legislation/Policy	Agency Responsible	Applicable Permits and Requirement
			CWPPL shall also ensure that conditions like hours of work, fixation of wages and other essential amenities in respect of contract labour are provided and are in compliance with the standards.
13.	**The Trade Union Act, 1926** **Karnataka Trade Union Regulation, 1938**	Registrar of Trade Union, Karnataka	Provides procedures for formation and registration of Trade Unions and lists their rights and liabilities. It encompasses any combination, permanent or temporary, that gets formed to regulate relationship between workmen and their employers. *CWPPL shall ensure that there is no policy restricting association of workers union*.
14.	**The Child Labour (Prohibition and Regulation) Act, 1986** as amended in 2016	Deputy Commission of the District	The Act prohibits employment of children in certain occupation and processes. The Act also specifies conditions of work for children, if permitted to work. *CWPPL shall ensure that no child labour is engaged at site for construction or operation works either directly or by the sub-contractors. CWPPL shall include a clause in the subcontractor agreements prohibiting employment of child labour for the proposed project.*
15.	**Bonded Labour (Abolition) Act 1976**	District Commissioner of Vijayapura District	The Act states that all forms of bonded labour stand abolished and every bonded labourer stands freed and discharged from any obligations to render any bonded labour. *CWPPL shall ensure no bonded labour is engaged at site for construction or operation works.*
16.	**Minimum Wages Act, 1948**	Commissioner, Department of Labour	This Act requires the Government to fix minimum rates of wages and reviews this at an interval of not more than 5 years. Every employer shall be responsible for the payment of minimum wages to persons employed by him. *CWPPL shall ensure payment of minimum wages as fixed by the government without any gender bias.*
17.	**Equal Remuneration Act, 1976**	Commissioner, Department of Labour	It is the duty of an employer to pay equal remuneration to men and women workers for same work or work of a similar nature. *CWPPL shall ensure compliance to the requirements of the Act.*
18.	**Workmen's Compensation Act, 1923**	Commissioner, Department of Labour	The Act requires if personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer shall be liable to pay compensation in accordance with the provisions of this Act. *CWPPL shall ensure compliance to the requirements of the Act.*
19.	**Maternity Benefit Act, 1961** No employer shall knowingly employ a woman in any establishment during the six weeks immediately following the day of her delivery or her miscarriage. No pregnant woman shall, on a request being made by her in this behalf, be required by her employer to do during the	Inspectors & Officers of Labour Department	*CWPPL shall ensure compliance with the requirements of the act.*

S.N.	Applicable Legislation/Policy	Agency Responsible	Applicable Permits and Requirement
	period any work which is of an arduous nature or which involves long hours of standing, or which in any way is likely to interfere with her pregnancy or the normal development of the foetus, or is likely to cause her miscarriage or otherwise to adversely affect her health.		
Overview of Applicable Policies of Government of India			
20.	**National Environmental Policy 2006**	KSPCB	The dominant theme of this policy is that while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of conservation, than from degradation of the resource. *CWPPL shall ensure compliance to the requirements of this policy.*
21.	**Karnataka Renewable Energy Policy 2009-2014** **Draft Karnataka Renewable Energy Policy 2014-2020**	KREDL	Karnataka Renewable Energy Policy was formulated by Government of Karnataka to harness green, clean renewable energy sources for environmental benefits & energy security under the leadership of Karnataka Renewable Energy Development Limited (KREDL). KREDL is promoting RE projects through participation of the private sector in wind, mini hydro, bio-mass, co-gen respectively. The Renewable Energy Policy aims at systematic and faster development of Renewable Energy sources. *CWPPL shall ensure compliance to the requirements of Karnataka Renewable Energy Policy 2009-2014 till draft Renewable Energy Policy 2014-2020 is finalised.*

3.4 International Standards

3.4.1 IFC Performance Standards

The IFC Performance Standards stipulates that any proposed project shall meet the following requirements throughout the life of an investment by IFC or other relevant financial institution:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Resource Efficiency and Pollution Prevention;
- Performance Standard 4: Community Health, Safety, and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Performance Standard 7: Indigenous Peoples; and
- Performance Standard 8: Cultural Heritage.

These performance standards and guidelines provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts.

3.4.1.1 Performance Standard 1

PS 1 establishes the importance of:

- Integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects;
- Effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and
- The project proponent's management of environmental and social performance throughout the life of the project.

Applicability

The PS 1 is applicable to projects with environment and/or social risks and/or impacts. The proposed project will have environmental and social impacts such as generation of noise and small quantities of hazardous wastes (operation of DG sets etc.). PS 1 is therefore applicable for the project and thus requires an Environmental and Social Impact Assessment (ESIA) study to be conducted before commencement of the project. CWPPL also needs to develop and implement a project specific Environmental and Social Management System to monitor and manage the risks associated with project's operations.

3.4.1.2 Performance Standard 2

PS 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. The objectives of the PS 2 are:

- To promote the fair treatment, non-discrimination, and equal opportunity of workers;
- To establish, maintain and improve the worker-management relationship;
- To promote compliance with national employment and labour laws;
- To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain;
- To promote safe and healthy working conditions and the health of workers; and
- To avoid the use of forced labour.

Applicability

The applicability of PS 2 will be more important during the construction phase as operation phase will only have limited number of staff. It not only covers the main plant employees, but all employees/workers, even those working through contractors. Migrant workers will not be engaged for the project therefore standards pertaining to campsites will not be applicable. CWPPL shall provide adequate provisions such as access to clean water, sanitary facilities and other necessary facilities at the construction sites.

CWPPL / Gamesa shall take measures to prevent child labour, forced labour and discrimination at site. Freedom of association and collective bargaining shall be provided. Wages, work hours and other benefits shall be as per the national labour and employment laws. CWPPL / Gamesa will provide a grievance mechanism for workers (and their organizations, where they exist) to raise workplace concerns. In providing a grievance mechanism through which workers may raise workplace concerns, CWPPL should ensure that matters are brought to management's attention and addressed expeditiously. CWPPL / Gamesa shall document all grievances and follow up on any corrective actions.

CWPPL / Gamesa will extend a safe and healthy work environment to contracted workers and to any other workers who provide project-related work and services and should ensure that training is provided to all workers on relevant aspects of OHS associated with their daily work, including emergency arrangements and OHS briefing for visitors and other third parties accessing the premises. All occupational injuries, illnesses and fatalities are to be documented.

CWPPL should develop and implement procedures to manage and monitor performance of third parties. These procedures should be integrated in the day-to-day operations of the company and requirements should be clearly communicated to third parties, and if possible to workers engaged by these third parties.

3.4.1.3 Performance Standard 3

The PS 3 outlines approach to pollution prevention and abatement in line with internationally disseminated technologies and practices with the following objectives:

- Avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from activities; and
- Promote the reduction of emissions that contribute to climate change.

Applicability

The proposed project is a clean energy project and does not have major pollution sources associated with it. The construction works for the development of project will entail generation of wastes like wastewater, waste oil and construction debris .The operation phase will result in generation of minor quantities of waste such as used or spent oil and wastes or residues containing oil. Storage and disposal of hazardous wastes generated to be done as prescribed in Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. CWPPL should monitor emissions to ensure that the requirements of PS 3 are being met.

3.4.1.4 Performance Standard 4

PS 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. Its main stress is to ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected Communities.

Applicability

The applicability of this PS shall be established during the ESIA process, resulting in preparation of an Action Plan to be disclosed to the community. The Applicability will be limited to construction period with movement of heavy machinery / vehicles. Noise levels and shadow flicker impacts at adjoining villages to be kept within the acceptable norms and IFC guidelines. Labour and security staff to be engaged from local community.

The Action Plan and any other relevant project-related information is to enable the influenced communities and relevant government agencies to understand these risks and impacts, and will engage the influenced communities and agencies on an on-going basis consistent with the requirements of PS 1.

3.4.1.5 Performance Standard 5

PS 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Its main aim is to anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by providing compensation for loss of assets at replacement cost and ensuring that resettlement activities are implemented with appropriate disclosure of Information, consultation, and the informed participation of affected persons and community.

Applicability

The PS 5 is applicable when there is physical and/or economic displacement because of the project.

The land for the proposed project comprises of private agricultural land which has been purchased through 'willing buyer/willing seller' basis. The conditions of the 'willing buyer/willing seller' has been followed by the project proponent and associated land aggregators in terms of directly negotiating with the land sellers, providing compensation based on the prevailing market value and providing opportunities to the land sellers for productive investment of sales income.

As no physical and /or economic displacement has taken place due to the land transaction process for the project, PS 5 is therefore NOT applicable for the project.

3.4.1.6 Performance Standard 6

PS 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. This standard is aimed to promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

Applicability

The proposed project does not involve any diversion of forest land. The project activities are not likely to have any significant impact on the ecology. However, the proposed project will involve additional traffic movement which may impact the higher fauna.

For the protection and conservation of biodiversity, the mitigation hierarchy includes biodiversity offsets, which may be considered only after appropriate avoidance, minimization, and restoration measures. Baseline studies for ecological aspects have been described in ***Section 4. 3*** *of this report. The study has been gathered through site survey, literature review and initial desktop analysis. The extent of the literature review will depend on the sensitivity of the biodiversity attributes associated with the project's area of influence and the ecosystem services that may be impacted.*

With respect to impacts on priority ecosystem services of relevance to Affected Communities and where the client has direct management control or significant influence over such ecosystem services, adverse impacts should be avoided.

3.4.1.7 Performance Standard 7

PS 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development.

Applicability

The project area or its surroundings is not native to any indigenous people. No material degradation or adverse impact is expected on land resources on which people are dependent. Hence, PS7 is not applicable for this project.

3.4.1.8 Performance Standard 8

PS 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.

Applicability

This PS is applicable when tangible forms of cultural heritage, unique natural features or tangible objects that embody cultural values and certain instances of intangible forms of culture are impacted or are proposed to be used for commercial purposes. Religious structures (temples) were observed around the project area, however, the access to these structures will not get restricted as a result of the project activities. Hence, PS8 is not applicable for this project.

3.4.2 IFC Categorization of Projects

As part of its review of a project's expected social and environmental impacts, IFC uses a system of social and environmental categorization. This categorization is used to reflect the size of impacts understood as a result of the client's social and environmental assessment and to specify IFC's institutional requirements. The following categories are used by the IFC:

- ***Category A Projects***: Projects with potential significant adverse social or environmental impacts that are diverse, irreversible or unprecedented;
- ***Category B Projects***: Projects with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures;
- ***Category C Projects***: Projects with minimal or no adverse social or environmental impacts, including certain financial intermediary (FI) projects with minimal or no adverse risks;
- ***Category FI Projects***: All FI projects excluding those that are Category C projects.

IFC therefore categorizes projects primarily according to the significance and nature of impacts. IFC defines the project's area of influence as the primary project site(s) and related facilities that the client (including its contractors) develops or controls; associated facilities that are not funded as part of the project (funding may be provided separately by a client or a third party including the government), and whose viability and existence depend exclusively on the project and whose goods or services are essential for the successful operation of the project; areas potentially impacted by cumulative impacts from further planned development of the project; and areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that would occur without the project or independently of the project.

3.5 World Bank EHS Guidelines

The Equator Principle 3 requires follow up of the environmental, health and safety requirements as per the following guidelines released by IFC on 30th April 2007:

- Environmental, Health, and Safety General Guidelines
- Environmental, Health, and Safety Guidelines for Wind Energy issued on 7th August 2015.

The key requirements stated in the EHS guidelines have been discussed in **Table 3-2**.

Table 3-2: Key Requirements as per EHS Guidelines of IFC

S. No.	Relevant Requirements as stated in EHS and Wind Energy Guidelines
1.	***Landscape and visual impacts***
	Consideration should be given to turbine layout, size, and scale in relation to the surrounding landscape and seascape character and surrounding visual receptors
	Consideration should also be given to the proximity of turbines to settlements, residential areas, and other visual receptors to minimize visual impacts and impacts on residential amenity, where possible
	Maintain a uniform size and design of turbines (e.g., type of turbine and tower, as well as height)
	Minimize presence of ancillary structures on the site by minimizing site infrastructure
	Erosion measures should be implemented and cleared land should be promptly re-vegetated with local seed stock of native species
2.	***Noise***
	Modelling should take account of the cumulative noise from all wind energy facilities in the vicinity having the potential to increase noise levels
3.	***Bio-Diversity***
	Baseline biodiversity surveys, where required, should occur as early as possible
	Consider adjustments of cut-in wind speeds to reduce potential bat collisions
	Eliminate “free-wheeling” (free spinning of rotors under low wind conditions when turbines are not generating power)
	Install bird flight diverters on transmission lines and guy wires from meteorological masts to reduce bird collisions
4.	***Shadow Flicker***
	Modelling should be carried out in order to identify the distance to which potential shadow flicker effects may extend
	Wind turbines can be programmed to shut down at times when shadow flicker limits are exceeded
	Site wind turbines appropriately to avoid shadow flicker being experienced or to meet limits placed on the duration of shadow flicker occurrence
5.	***Wastewater Discharges***
	Water use efficiency to reduce the amount of wastewater generation
	Compliance with national or local standards for sanitary wastewater discharges
6.	***Occupational Health and Safety***
a.	***Over-exertion***
	Training of workers in lifting and materials handling techniques including the placement of weight limits
	Planning work site layout to minimize the need for manual transfer of heavy loads
	Implementing administrative controls into work processes, such as job rotations and rest or stretch breaks
	Slips and Falls
	Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths
	Cleaning up excessive waste debris and liquid spills regularly
b.	***Work in Heights***
	Training and use of temporary fall prevention devices
	Training and use of personal fall arrest systems
c.	***Stuck by Objects***
	Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap

S. No.	Relevant Requirements as stated in EHS and Wind Energy Guidelines
	Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes
d.	***Moving Machinery***
	Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic
	Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations
e.	***Dust***
	Implementation of Dust suppression techniques such as applying water
	Community Health and Safety
f.	***Disease Prevention***
	Providing surveillance and active screening and treatment of workers
g.	***Traffic Safety***
	Adoption of safety measures those are protective of project workers and of road users, including those who are most vulnerable to road traffic accidents
	Regular maintenance of vehicles and use of manufacturer approved parts
h.	***Community Health & Safety***
	Turbines must be sited at an acceptable distance ("setback") between wind turbines and adjacent sensitive receptors to maintain public safety in the event of blade failure
	Minimize the probability of a blade failure by selecting wind turbines that have been subject to independent design verification/certification (e.g., IEC 61400-1), and surveillance of manufacturing quality
	Ensure that lightning protection systems are properly installed and maintained
	Equip wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary
i.	***Public Access***
	Provide fencing of an appropriate standard around the substation with anti-climb paint and warning signs
	Prevent access to turbine tower ladders
	Post information boards about public safety hazards and emergency contact information
7.	***Occupational Health and Safety Monitoring***
	Recording all incidents that occur over the course of project implementation
	Recording near-miss (also known as near-hit) data during a project in order to identify trends and implement improvements
	Carrying out workplace and worker auditing to assess the effectiveness of risk management systems and workplace safety culture
	Conducting worker consultation and feedback via questionnaires or periodic safety meetings

3.6 Applicable standards

3.6.1 Ambient Air Quality

As per the IFC EHS guidelines (December 2008), “the ambient air quality standards are ambient air quality levels established and published through national legislative and regulatory processes and ambient quality guidelines refer to ambient quality levels primarily developed through clinical, toxicological, and epidemiological evidence (such as those published by the World Health Organization)”. National Ambient Air Quality (NAAQ), as notified under Environment (Protection) Rules 1986 and revised through Environment (Protection) Seventh Amendment Rules, 2009 are given **Table 3-3.**

Table 3-3: National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Government)

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur Dioxide (SO_2), µg/m^3	Annual*	50	20
	24 Hours**	80	80
Nitrogen Dioxide (NO_2), µg/m^3	Annual*	40	30
	24 Hours**	80	80
Particulate Matter (size less than 10 µm) or PM_{10}, µg/m^3	Annual*	60	60
	24 Hours**	100	100
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$, µg/m^3	Annual*	40	40
	24 Hours**	60	60
Ozone (O_3), µg/m^3	8 Hours**	100	100
	1 Hour**	180	180
Lead (Pb), µg/m^3	Annual*	0.5	0.5
	24 Hours**	1	1
Carbon Monoxide (CO) , mg/m^3	8 Hours	2	2
	1 Hour**	4	4
Ammonia (NH_3), µg/m^3	Annual*	100	100
	24 Hours**	400	400
Benzene (C_6H_6), µg/m^3	Annual*	5	5
Benzo (O) Pyrene (BaP), particulate phase only, ng/m^3	Annual*	1	1
Arsenic (As), ng/m^3	Annual*	6	6
Nickel (Ni), ng/m^3	Annual*	20	20

** Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly at uniform interval*

*** 24 hourly or 8 hourly or 01 hourly values as applicable shall be complied with 98% of the time in a year. 2% of the time they may exceed, but not on 2 consecutive days. Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.*

3.6.2 Ambient Noise Standards

As per the EHS guidelines of IFC, for residential, institutional and educational area, the one hourly equivalent noise level (L_{eq} hourly) for day time is **55 dB (A)** while the L_{eq} hourly for night time is prescribed as **45 dB (A).** Noise standards notified by the MoEF vide gazette notification dated 14 February 2000 based on the *A- weighted* equivalent noise level (L_{eq}) are as presented in **Table 3-4.**

Table 3-4: Ambient Noise Standards

Area Code	Category of Area	Limits in dB(A) Leq	
		Day time*	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone**	50	40

Note: **Day time is from 6 am to 10 pm, Night time is 10 pm to 6.00 am;*

*** Silence zone is defined as area up to 100 m around premises of hospitals, educational institutions and courts. Use of vehicle horns, loud speakers and bursting of crackers are banned in these zones.*

3.6.3 Noise Standards for Occupational Exposure

Noise standards in the work environment are specified by Occupational Safety and Health Administration (OSHA-USA) which in turn are being enforced by Government of India through model rules framed under the Factories Act.

Table 3-5: Standards for Occupational Noise Exposure

Total Time of Exposure per Day in Hours (Continuous or Short-term Exposure)	Sound Pressure Level in dB(A)
8	90
6	92
4	95
3	97
2	100
3/2	102
1	105
¾	107
½	110
¼	115
Never	>115

- *No exposure in excess of 115 dB (A) is to be permitted.*
- *For any period of exposure falling in between any figure and the next higher or lower figure as indicated in column (1), the permissible level is to be determined by extrapolation on a proportionate scale.*

3.6.4 Water Quality Standards

The designated best use classification as prescribed by CPCB for surface water is as given in **Table 3-6.**

Table 3-6: Primary Water Quality Criteria for Designated Best Use Classes

Designated-Best-Use	Class	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand 5 days 20^{o}C 2mg/l or less
Outdoor bathing (Organised)	B	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more Biochemical Oxygen Demand 5 days 20^{o}C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand 5 days 20^{o}C 3mg/l or less
Propagation of Wild life and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25oC micro mhos/cm Max.2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/l
	Below-E	Not Meeting A, B, C, D & E Criteria

Source: Central Pollution Control Board

As per the IFC EHS guidelines, the treated sewage discharge is required to meet the following guidelines.

Table 3-7: Treated sewage discharge guidelines IFC

S. No.	Parameter	Guideline Value
1	pH	6-9
2	BOD	30mg/l,
3	COD	125mg/l,
4	Total Nitrogen	125 mg/l,
5	Oil and Grease	10 mg/l,
6	Total Suspended Solids	50 mg/l and
7	Total coliform bacteria	400 MPN/100 ml

3.7 Applicable International Conventions

Environmental problems which migrate beyond the jurisdiction (Trans-boundary) require power to control such issues through international co-operation by either becoming a Contracting Party (CP) i.e. ratifying treaties or as a Signatory by officially signing the treaties and agreeing to carry out provisions of various treaties on environment and social safeguards. The relevant international conventions are as provided in the **Table 3-8** below:

Table 3-8: Relevant International Conventions applicable to the project

S. No.	International Conventions	Salient Features
1	Montreal Protocol on Substances That Deplete the Ozone Layer (and subsequent Amendments)	India signed the Montreal Protocol along with its London Amendment on 17-9-1992 and also ratified the Copenhagen, Montreal and Beijing Amendments on 3rd March 2003.
2	UN (Rio) Convention on Biological Diversity	India is a party since: 1994-02-18 by: Ratification; Protocol - Party since: 2003-09-11
3	Conventions on the Conservation of Migratory species of wild animals and migratory species	India is contracting party to the convention on conservation of migratory species of wild animals and migratory species.
4	Kyoto Protocol	The Kyoto protocol was signed by India in August 2002 and ratified in February 2005. The convention pertains to the United Nations framework on Climate Change. The 3rd Conference of the Parties to the Framework Convention on Climate Change (FCCC) in Kyoto in December 1997 introduced the Clean Development Mechanism (CDM) as a new concept for voluntary greenhouse-gas emission reduction agreements between industrialized and developing countries on the project level.
5	The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure	The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals & Pesticides in international Trade was adopted by India at the Conference of Plenipotentiaries at Rotterdam in 1998
6	International Labour Organization conventions	India has also ratified many of the International Labour Organization conventions that are relevant to the Project including: C1 Hours of Work (Industry) Convention, 1919 (14:07:1921, ratified); C5 Minimum Age (Industry) Convention, 1919 (09:09:1955, ratified): C11 Right of Association (Agriculture) Convention, 1921 (11:05:1923, ratified): C14 Weekly Rest (Industry) Convention, 1921 (11:05:1923, ratified); C29 Forced Labour Convention, 1930 (30:11:1954, ratified) & C105 Abolition of Forced Labour Convention, 1957 (18:05:2000, ratified); C100 Equal Remuneration Convention, 1951 (25:09:1958, ratified); C107 Indigenous and Tribal Populations Convention, 1957 C111 discrimination (Employment and Occupation) Convention, 1958 (03:06:1960, ratified)

4. Environmental and Socio-Economic Baseline

This section of the report provides the description of the project area along with the associated facilities, its environment baseline settings, geographic details, demographic detailing inclusive of the facilities available. It provides an overall detailed description of the Project Area.

The Project comprises of 12 WTGs of Gamesa make, G-114 of 106 m hub height with rated capacity of 2.0 MW each, spread across three (03) villages falling within Vijayapura District of Karnataka State. The proposed project site is located approximately 25 km south of Bijapur city and is accessible by National Highway No. 218 (NH-218). The proposed pooling substation for the project is located in Karjol village which falls under Bijapur taluka of Vijayapura District.

4.1 Project Area of Influence (AOI)

4.1.1 Project Area

Project area lies in the Vijayapura District of Karnataka. It is spread in three Villages of Bijapur Taluka, namely Tonsyal, Kakhandaki and Karjol. These villages are located approx. 20-25 kms from the Vijayapura city, and the project site is located at a distance of 24 km from the city. The project area covers a distance of 12.71 km, with 12 wind turbines of Gamesa make of which 4 WTG are located in Tonsyal Village, 7 WTG in Karjol Village and 1 WTG in Kakhandaki.

Table 4-1: Village wise WTG details of the Project Area

S. No	State	District	Taluka	Village	Proposed Number of WTG
1	Karnataka	Vijayapura	Bijapur	Tonsyal	4
2	Karnataka	Vijayapura	Bijapur	Karjol	7
3	Karnataka	Vijayapura	Bijapur	Kakhandaki	1

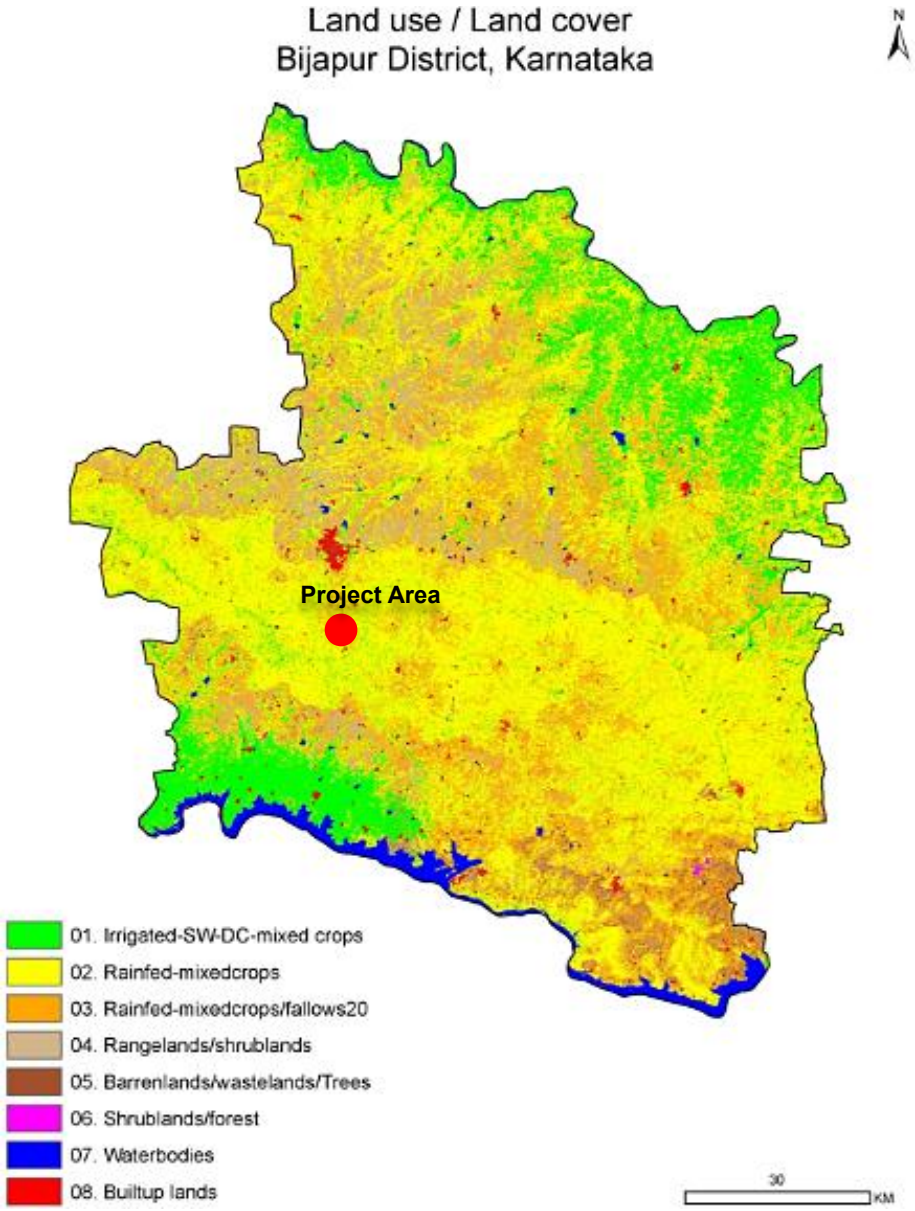
4.2 Environmental Baseline

4.2.1 Land Use and Land Cover (LULC)

The total land resource of Vijayapura District is 26, 03,183.5 acre. It has been utilized for various purposes. The district consists of five taluk's viz., B-Bagewadi, Bijapur, Indi, Muddebihal and Sindagi. The Bijapur Taluka represents 25.22 percent of total geographical area of the district and is recognized as largest taluka in terms of area, while Muddebhihal taluka with 14.21 percent of the total area is smallest taluka. Indi represent 21.11 percent and Sindagi 20.65 percent and Basavan-Bagewadi taluka 18.78 percent of total geographical area of the district[3].

The total area of the district has been put under many types of uses. The dominant land use types in Vijayapura District include forest area, non-agricultural area, barren land, cultivable waste land, permanent pasture land, area under trees and grooves, fallow land, net sown area and others. The area under others category includes the area put to roads, railways, urban and rural settlements, quarrying and industrial etc. Land use/ land cover map of Vijayapura district showing proposed project site is presented as **Figure 4-1** below.

[3] N.B.S.S. and LUP, R. C. Bangalore



Source: N.B.S.S. and LUP, R. C. Bangalore

Figure 4-1: Land Use Classification

4.2.1.1 Description of land use classes

The total land area of the taluka is 6567.3 acre of which 59.925% is the net sown area with 4.46% being sown more than once and 3.04% of the land is uncultivable land which accounts to 199.85acre. 20.6acre of the land is under forest cover which comprises of the 0.31% of the total geographical area of the taluka and 490.50acre which is 7.47% which is the waste land in the taluka. The details are given in **Table 4-2** below.

Table 4-2: Land Use Pattern in Bijapur Taluka

Land Use Classification		Total Area (acre)	% Area
Total Geographical Area		**6567.3**	**100**
Net area sown	Net Sown Area	3935.05	59.92
	Area Sown more than once	293.01	4.46
Area under Forest		20.6	0.31

Land Use Classification	Total Area (acre)	% Area
Waste Land	490.50	7.47
Uncultivable land	199.85	3.04

Source: GROUND WATER INFORMATION BOOKLET VIJAYAPURA DISTRICT, KARNATAKA

Canals, tanks, wells, bore wells and lift irrigation are the important sources for irrigation in the Taluka. Ground water contributes nearly 68% of the total irrigation.

Ground water is being developed through dug wells, bore wells, and the taluk wise ground water development in Vijayapura District is given in **Table 4-3**. Within the weathered and fractured formations, phreatic aquifers are encountered at a shallow depth range of 0 to 20 mbgl and are tapped mainly by dug wells.

Table 4-3: Area Irrigated by different sources in Bijapur Taluka

Irrigation Category	Area (acre)
Irrigation Structures	59962.6
Dug wells	27690.6
Bore wells	4601.1
Piped WS Schemes	333.5
MW schemes	14381.5

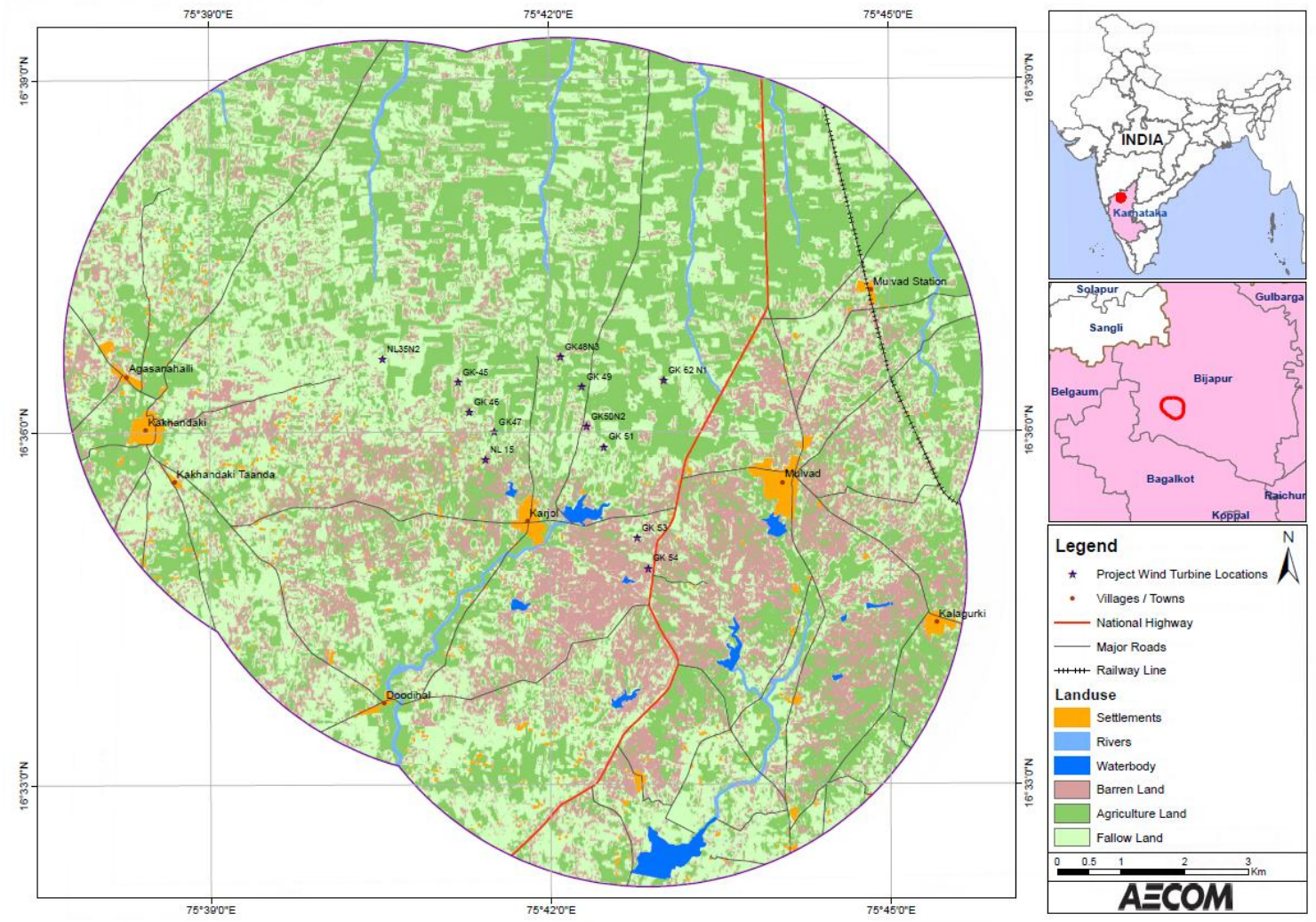
Source: Ground water information booklet, Vijayapura District, Karnataka

Study Area

The study area is characterized by almost flat land with an average elevation of 600m to 640m above mean sea level (amsl) and comprises predominantly of private agricultural land. Proposed site is located in rural set up and land use pattern of the surrounding area comprises of agricultural land followed by fallow land (rain-fed agricultural land). Fallow land is being used for grazing by locals. The land use pattern of the study area is presented in **Table 4-4** and **Figure 4-2**. The land use analysis depicts that the major land use of the study area is fallow land (40.53%) followed by agricultural land (38.7%). Barren land constitutes 18.46% and settlements constitute 1.10% of the total area. River and water bodies constitutes 0.62% and 0.55% respectively.

Table 4-4: Land Use Pattern in the Study Area

S. No	Type of Land Use	Area (acre)	Percentage (%)
1	Settlements	405.25	1.10
2	River	227.3	0.62
3	Waterbody	202.62	0.55
4	Barren Land	6805.2	18.46
5	Fallow Land	14940	40.53
6	Agriculture Land	14280.22	38.74
	Total	**36860.59**	**100.00**



Source : AECOM India Pvt. Ltd.

Figure 4-2: Land Use/Land Cover of the Study Area within 3 km

4.2.2 Geology

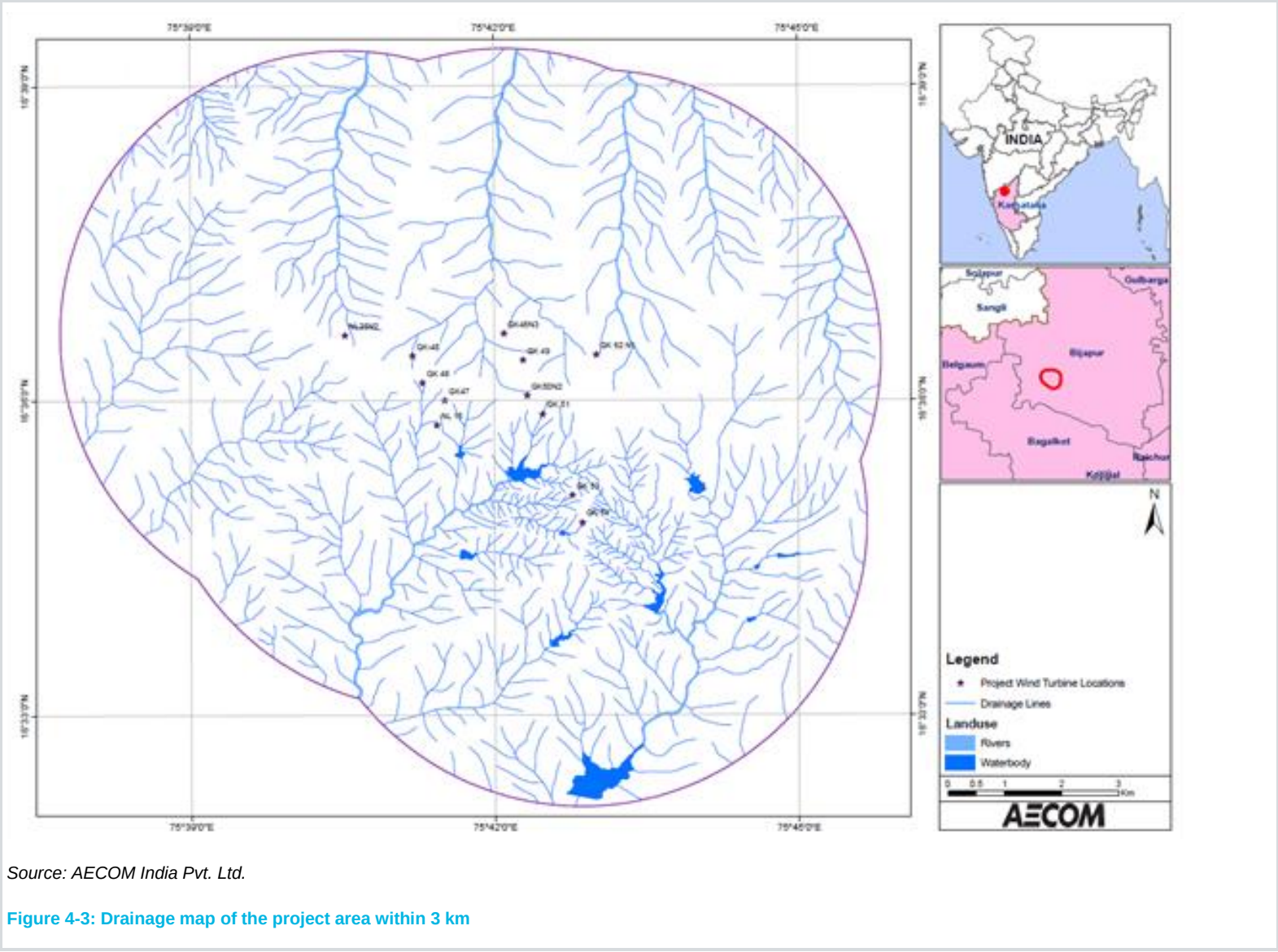
The major part of the Vijayapura District is occupied by the basaltic flows of Deccan traps, which constitutes the main rock formation in the north and central part of the district. These basaltic flows belong to the sequence of Middle Deccan Traps of Upper Cretaceous to Lower Eocene Age. The formations of Granites and Gneisses of Penisular Gneissic Complex and Bhima Series cover a small portion in south and south eastern part of the district. The Granites and Gneisses of Penisular Gneissic Complex cover south and south eastern part of Muddebial taluk, which forms the oldest formations in the district. They are seen as big, rounded, massive boulders and isolated hills. The granitic rocks are pink in colour, coarse grained with well-developed joints and are intruded by pegmatites, quartz veins and basic dolerite dykes. The depth of weathering in the district varies from1.00 to 15.0 m.

The basalts of Deccan Traps are either horizontal or gently sloping towards southeast. The basalts are generally dark grey to black in colour, fine grained, highly vesicular and zeolitic in nature. At some places closed spaced joints, the columnar jointing and spheroidal weathering are commonly observed. The amygdaloidal basalts on weathering results in light grey to purple coloured decomposed material with shining secondary minerals similar to Blue dust. The inter-flow horizons are marked by the presence of red bole beds.

Weathered layer forms an important zone for infiltration of water and as its thickness increases, the holding capacity of formation increases. The extent of weathering depends on several factors like, topography, texture, mineralogical composition and extent of fracturing and jointing. Thick weathered zones with porous residual material forms in topographic lows, act as potential groundwater reservoirs. The thickness of weathered zone varies from place to place because of varied litho logical character of flows, slope, intensity of weathering and prevailing climate. Thick weathered zone favoured for storage of more water since the layer has more porosity and permeability than compact rock. Length of casing lowered indirectly indicates the thickness of weathered zone.

4.2.3 Drainage

Southern part of Vijayapura District forms a catchment area of the Krishna while northern part forms catchment area of Bhima. Bhima River is an important tributary of the Krishna River. Don River is the tributary of the Krishna and flows for about 160 kms in a meandering course from west to east in the central part of the district. The water of this river is generally brackish; it becomes saline at several places during dry months of the year, resulting salt encrustations on the banks of dry beds. During the rainy seasons the river is subjected to flash floods.



Source: AECOM India Pvt. Ltd.

Figure 4-3: Drainage map of the project area within 3 km

4.2.4 Ground Water Resource

According to Dynamic Ground Water Resources of India (as on 31st March 2011) by Central Ground Water Board, Ministry of Water Resources, River Development & Ganga Rejuvenation, Government of India; stage of ground water development of Vijayapura District is 75% as presented in Table below. All the talukas of Vijayapura District which include the project taluka/ Bijapur falls under semi critical category.

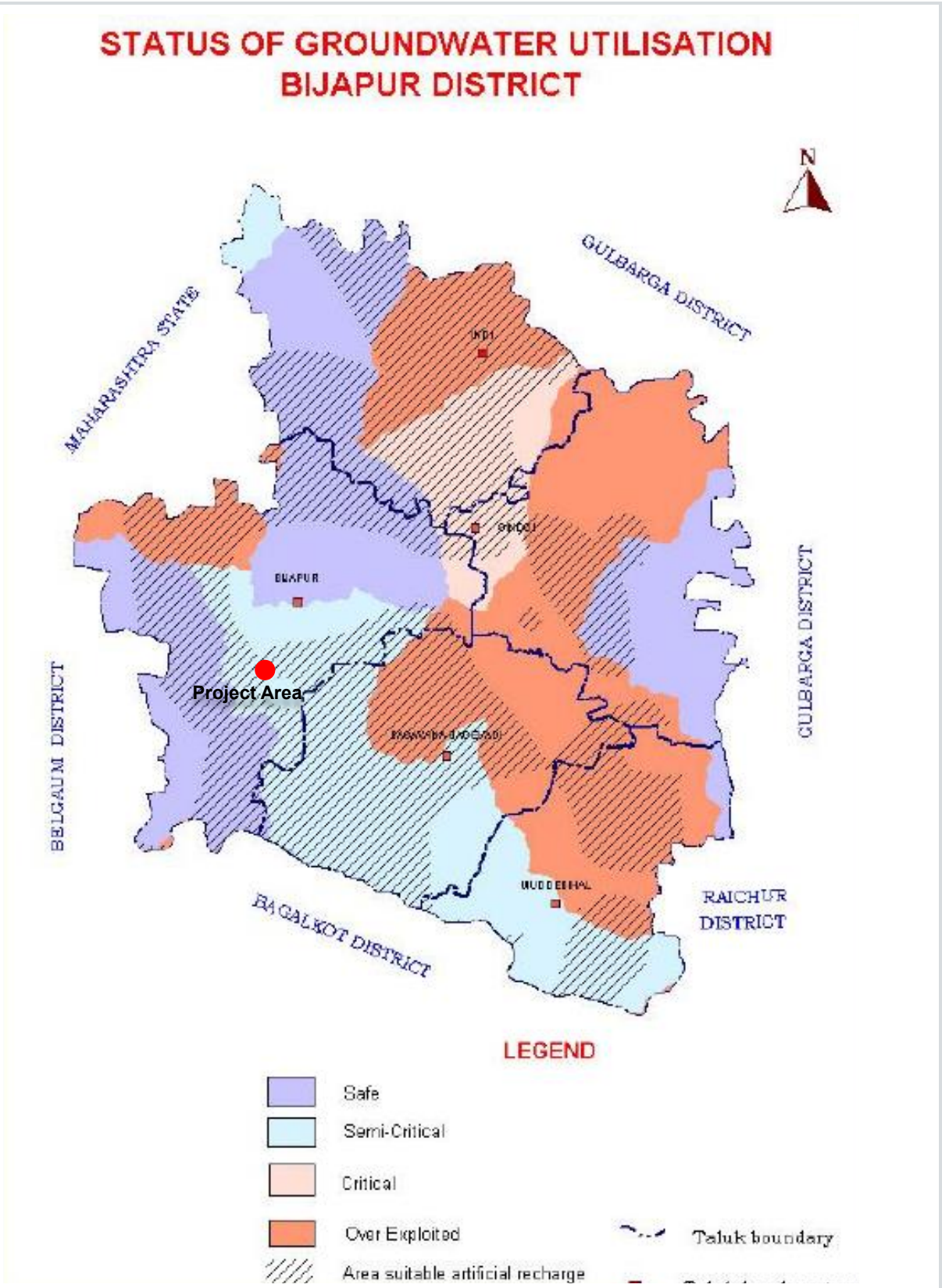
Table 4-5: Ground Water Resource Availability, Utilization and Stage of Development of Vijayapura District

District	Total Annual Replenishable Ground Water Resource	Natural discharge during non-monsoon period	Net Ground Water Availability	Total Annual Ground Water Draft	Projected demand for industrial and domestic uses up to 2025	Net ground water availability for future irrigation use	Stage of ground water developme nt
Bijapur	51446	4036	47410	35640	6070	16071	75

Source: Dynamic Ground Water Resource of India – 2011

Table 4-6: Categorization of talukas in Karnataka

Sl No	Districts	Semi-critical	Critical	Over-Exploited	Saline
1	Bagalkot	1 Bilgi (NC)		1 Badami (C + NC)	
		2 Jamkhandi (NC)		2 Bagalkote (C + NC)	
				3 Hungund (NC)	
				4 Mudhol (NC)	
2	Bangalore Rural			1 Devenhalli (NC)	
				2 Dodaballapur (NC)	
				3 Hoskote (NC)	
				4 Nelamangala (NC)	
3	Bangalore Urban			1 Anekal (NC)	
				2 Bangalore East (NC)	
				3 Bangalore North (NC)	
				4 Bangalore South (NC)	
4	Belgaum	1 Athani (C)	1 Bailahongal (C)	1 Athani (NC)	
		2 Bailahongal (NC)		2 Chikodi (NC)	
		3 Saundatti (C)		3 Gokak (NC)	
				4 Hukkeri (NC)	
				5 Ramdurg (C + NC)	
				6 Raybag (NC)	
				7 Saundatti (NC)	
5	Bellary	1 Kudligi (NC)	1 Bellary (NC)	1 H.B.Halli (NC)	
			2 Hadagalli (NC)		
6	Bidar	1 Bhalki (NC)			
7	Bijapur	1 Basavana Bagevadi (C + NC)	Indi (NC)		
		2 Bijapur (NC)			
		3 Indi (C)			
		4 Muddebihal (NC)			
		5 Sindgi (NC)			
8	Chamrajnagara	1 Kollegal (NC)	1 Chamrajnagara (NC)	1 Gundlupet (NC)	
		2 Yelandur (C + NC)			
9	Chikballapur		1 Bagepalli (NC)	1 Chikballapur (NC)	
				2 Chintamani (NC)	
				3 Gauribidalur (NC)	
				4 Gudibanda (NC)	
				5 Sidlaghata (NC)	
10	Chikmagalur	1 Tarikere (NC)		1 Kadur (NC)	
11	Chitradurga		1 Hosadurga (NC)	1 Challakere (NC)	
				2 Chitradurga (NC)	
				3 Hiriyur (NC)	
				4 Holalkere (NC)	
12	Dakshin Kannada		1 Puttur (NC)		
13	Davangere	1 Channagiri (C)	1 Harihar (NC)	1 Channagiri (NC)	
		2 Honnalli (NC)		2 Davangere (NC)	
				3 Harpanahalli (NC)	
				4 Jagalur (NC)	
14	Dharwad	1 Navalgund (NC)			
15	Gadag	1 Gadag (C)		1 Gadag (NC)	
		2 Mundargi (NC)		2 Ron (NC)	
		3 Nargund (C)			
		4 Ron (C)			
16	Hassan		1 Hassan (NC)	1 Arsikere (NC)	
				2 C R Patna (NC)	
				3 Holenarsipur (NC)	
17	Haveri	1 Haveri (NC)	1 Byadgi (NC)		
		2 Hirekerur (NC)	2 Ranibennur (NC)		
18	Kolar			1 Bangarpet (NC)	
				2 Kolar (NC)	
				3 Malur (NC)	
				4 Mulbagal (NC)	
				5 Srinivaspur (NC)	
19	Koppal		1 Yelbarga (NC)	1 Gangawati (NC)	
				2 Koppal (NC)	
20	Mandya	1 Nagamangala (NC)	1 Maddur (NC)	1 Krishnarajpet (NC)	
				2 Malavalli (NC)	
				3 Mandya (NC)	
				4 Pandavapura (NC)	
21	Mysore	1 Mysore (NC)	1 Nanjangud (NC)	1 Krishnrajanagara (NC)	
			2 Tirumakudal narsipur (NC)		
22	Raichur	1 Lingsugur (NC)			
		2 Raichur (NC)			
23	Ramanagaram		1 Channapatana (NC)	1 Kanakapura (NC)	
			2 Magadi (NC)	2 Ranmanagaram (NC)	
24	Shimoga	1 Bhadravati (NC)			



Source: CGWB, Ground Water Information Booklet, Bijapur 2011

Figure 4-4: Status of Ground Water Utilization of the District.

4.2.5 Soil types

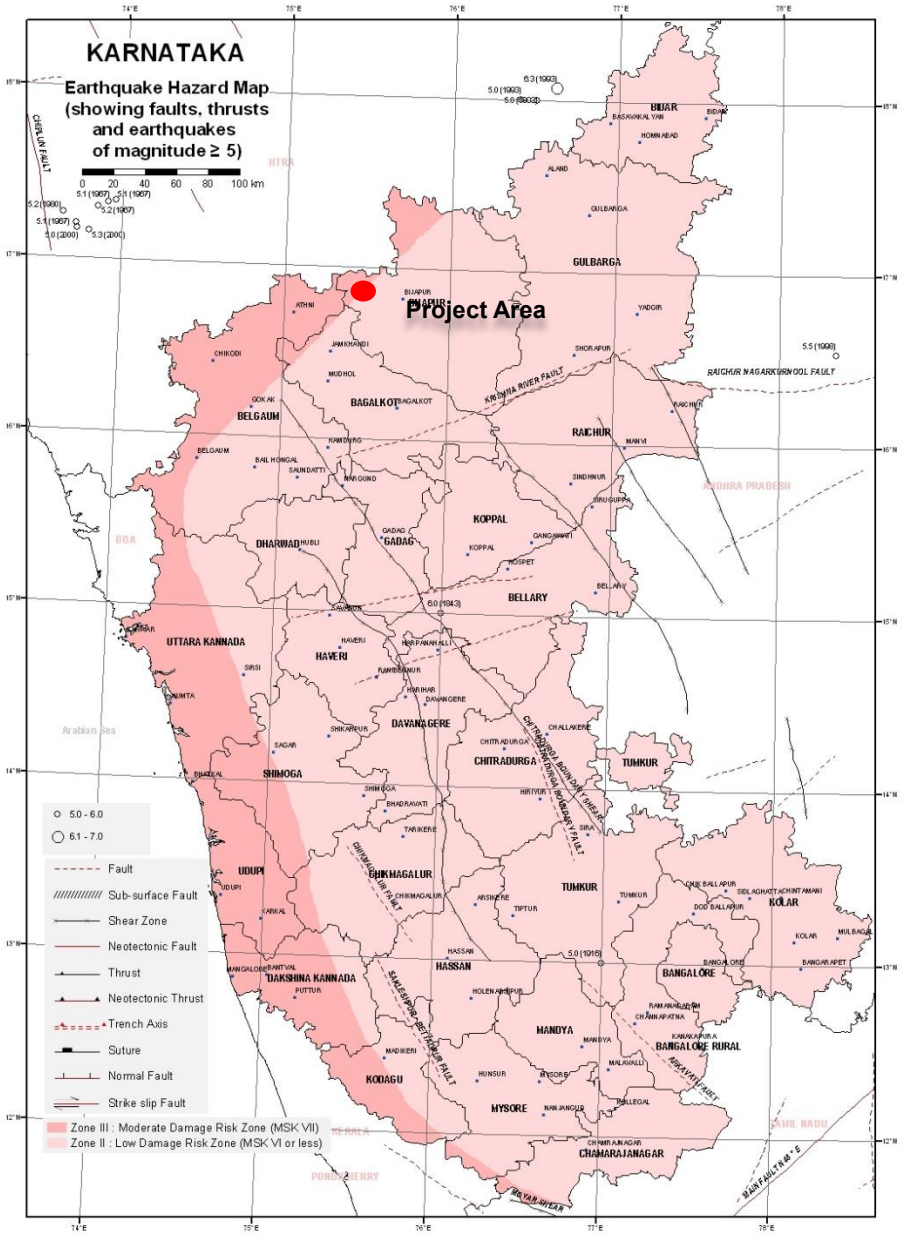
The district of Vijayapura is occupied by three types of soils viz. Black soils, Red sandy soils and mixed soils. Formation of various types of soils is a complex function of chemical weathering of bedrocks, vegetative decay and circulation of precipitated water. Soils are mostly in-situ in nature.

Black soils derived from basaltic bedrock. These soils in upland areas are shallower and are deeper in valley portions. The Don River valley has plains and consisting of rich tracks of deep black cotton soils stretching from west to east in the central part of the district. The infiltration characteristics are poor to moderate. The constant rate of infiltration in these soils varies from 0.75 to 2.5 cm/hr. These soils are alkaline in nature, low in potassium and nitrogen. Black cotton soils with high clay and humus content in low-lying areas. They have high moisture holding capacity and on drying up these soils develop open cracks.

Red soils, which are sandy in nature derived from granites, gneisses and sandstones, are found in southern part of Muddebial taluk of the district. The infiltration rates of these soils range from 2.6 to 3.8 cm/hr. Site for the project site is Black clayey soil.

4.2.6 Earthquake Hazard

As per the Revised Earthquake Hazard Mapping, 22.13% of the total geographical area of the district is under Moderate earthquake damage risk zone & remaining area of the state is under low damage risk zone. The state of Karnataka has reported more than 500 earthquake tremors in the last three decades with most of them having low magnitude. It is found that the weak zones around the northern Karnataka bordering Maharashtra could cause heavy damages in future. The areas of southern part of Karnataka are also not free from frequent tremors. The Karnataka state is categorized as moderate to low seismic risk zone. The following Districts are falling in Zone III (Moderate Damage Risk Zone (MSK VII); Bidar, Gulbarga, Bijapur, Bagalkot, Belgaum, Dharwad, Uttar kannada, Shimoga, Udupi, Dakshina Kannada, Kodagu. All other Districts are falling under Zone II (Low Damage Risk zone MSK VI). Project Area falls in Zone III (Moderate Damage Risk Zone (MSK VII). Earthquake zone map of Karnataka showing project site is presented as **Figure 4-5** below.



Source: Vulnerability Atlas, GOI

Figure 4-5: Earthquake Hazard Map of Karnataka

4.2.7 Climate and Meteorology

Karnataka is located on the western coast, gets most of the precipitation form the southwest monsoon. The State enjoys three distinct climates varying with the seasons. The winter season from January to February is followed by summer season from March to May. The period from October to December forms the post-monsoon season. The period from October to March, covering the post-Monsoon and winter seasons, is generally pleasant over the entire State except during a few spells of rain associated with north-east monsoon which affects the south-eastern 4 parts of the State during October to December. The months April and May are hot, very dry and generally uncomfortable. Weather tends to be oppressive during June due to high humidity and temperature. The next three months (July, August and September) are somewhat comfortable due to reduced day temperature although the humidity's continue to be very high.

The climate of Vijayapura District is generally dry and healthy. In summer, especially in April and May it is too hot; at that time the temperature lays between 40°C to 42°C. In winter season, from November to January the

temperature is between 15°C to 20°C. Usually the district has dry weather, so the humidity varies from 10% to 30%.

4.2.7.1 Temperature

The climate for Vijayapura District is semi-arid with generally extremely hot summers and chilly winters, but the weather is dry altogether with variation on humidity between 10-30%. In summer, especially in April and May it is too hot; at that time the temperature lays between 40°C to 42°C. In winter season, from November to January the temperature is between 15°C to 28°C. Usually the district has dry weather, so the humidity varies from 30%-85%. The temperature begins to rise by the end of February, till the month of May, which is the hottest month. Coldest months are December and January. The year is divided in to summer season from March to May, monsoon season from June to September, post-monsoon season from October to November.

Climate data published by Indian Meteorological Department (IMD), for nearest met station at Vijayapur, for the period of 1981 to 2010 is given below.

Table 4-7: Meteorological Data based on observation from 1981 to 2010 for Vijayapura

Month	Mean Temperature		Humidity (%)	Rainfall (mm) (Monthly Total)	Mean Wind Speed (kmph)
	Daily Max (°C)	Daily Min (°C)			
January I	18.8	15.3	67	4	3.9
II	28.3	18.7	38		
February I	21	15.6	56	0.6	4.4
II	31.4	19.6	31		
March I	24.7	18.1	51	5.7	5.1
II	34.4	21	28		
April I	27.2	20.6	54	20.6	5.9
II	36.3	22.7	30		
May I	27.1	22.3	66	39.8	8.6
II	36.1	23.4	34		
June I	25.1	22.5	80	108	10.9
II	30.4	23.4	56		
July I	24.1	22.1	84	66.9	11.9
II	28.1	23	65		
August I	23.6	21.8	84	92.3	11.1
II	27.8	22.8	65		
September I	23.5	21.7	84	156.9	7.5
II	28.5	22.9	62		
October I	23.5	20.7	77	119.7	4.2
II	28.6	21.7	54		
November I	21.3	18	72	25	3.4
II	27.6	19.9	49		
December I	18.7	15.6	71	7.7	3.5
II	26.9	18.5	43		
Total Annual Mean I	23.3	19.6	71	647.1	6.7
Mean II	30.4	21.4	47		
No. of Years	29	29	29	29	27

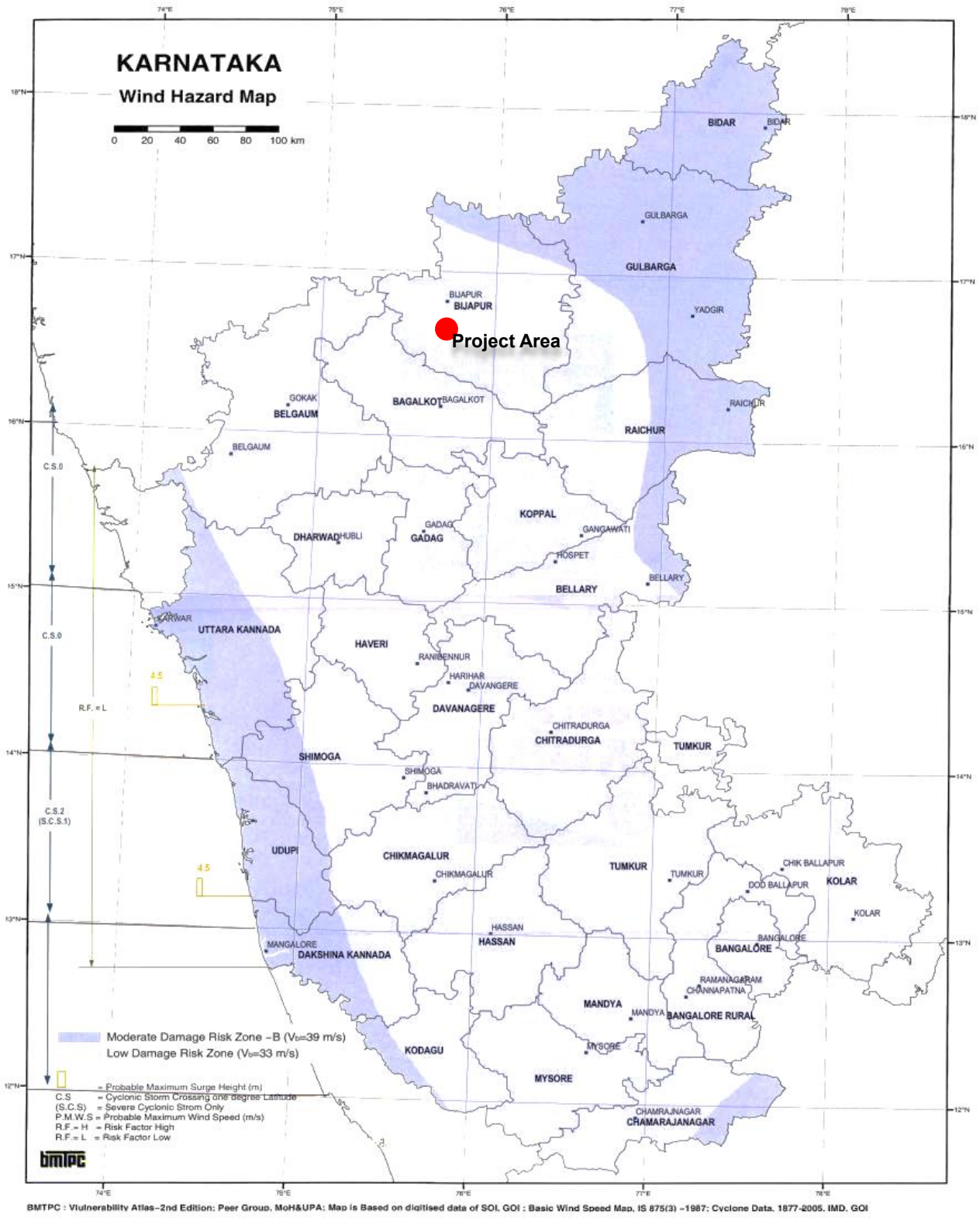
Source: IMD

Note:

- *I: Observation at 0300 UTC (0830 IST)*
- *II: Observation at 1200 UTC (1730 IST)*

4.2.7.2 Wind Speed

As per the **Table 4-7** winds in project area are generally light in winter and moderate to strong in the monsoon. The annual mean wind speed during 1981 and 2010 was measured to be 6.7 (Kmph). The most prominent wind direction is north-east during the months of October to December. The predominant wind direction is west from the month of April to September. During January the wind direction is south-east, during February it is north-west and during March it is north. As per the wind hazard map of Karnataka state, project site falls in low damage risk zone. Wind hazard map of Karnataka showing project site is presented in **Figure 4-6**.



Source : http://nidm.gov.in/pdf/dp/Karnataka.pdf

Figure 4-6: Wind Hazard Map of Karnataka

4.2.7.3 Rainfall

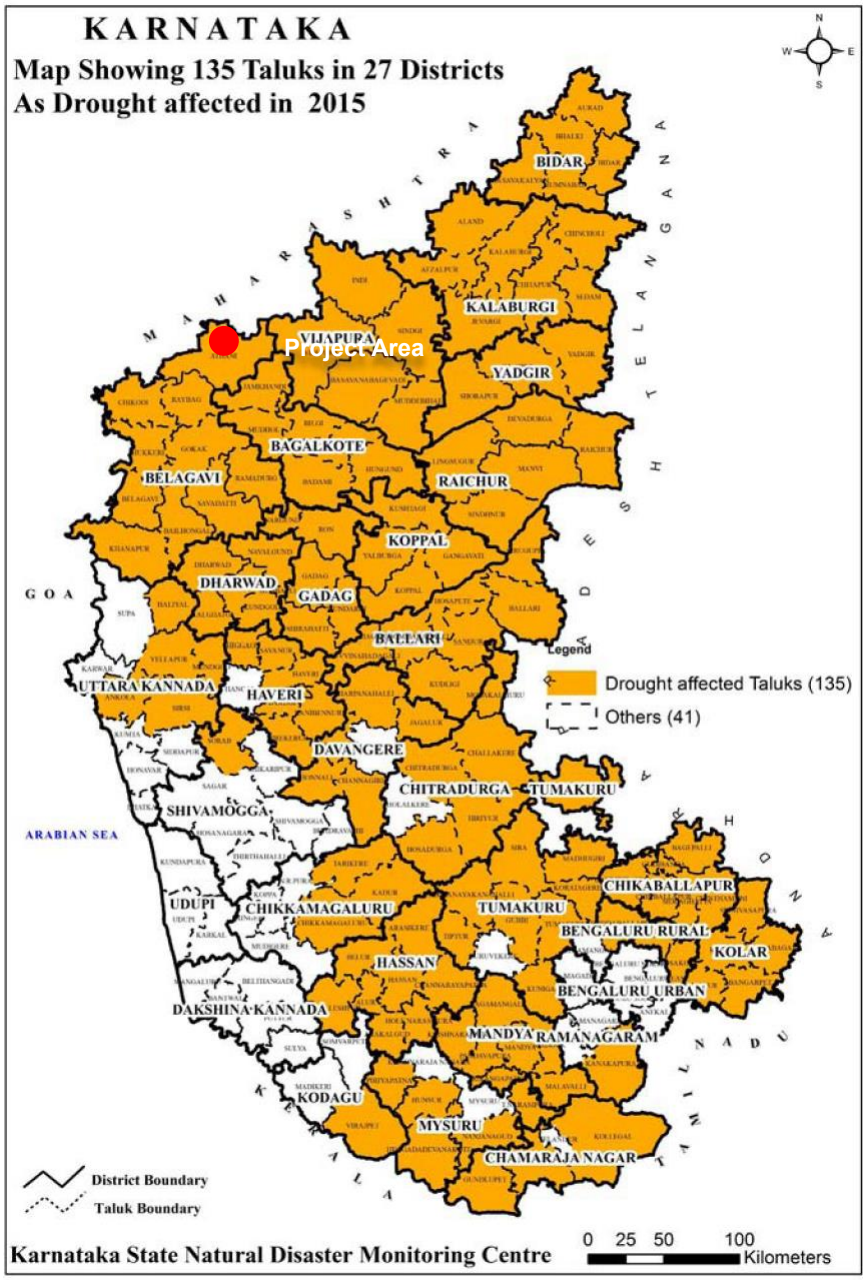
The normal rainfall of the Vijayapura District is 632 mm. The highest rainfall recorded for the district is 882 mm in 2014, which is above the normal rainfall, whereas for 5 years (2012-2016) except for 2014 the rainfall was deficit from the normal and created a drought situation in the district. Rainfall for the project district is presented in **Table 4-8** below:

Table 4-8 : Rainfall Data for Bijapur

District	Normal (mm)	Actual Average (mm)					
		1981-2010	2012	2013	2014	2015	2016
Bijapur	632	647.1	440	564	882	398	451

Source: IMD & Directorate of Economics and Statistics

The Govt. of Karnataka has declared 135 of the 176 talukas as affected by the drought. The Map showing 135 drought affected talukas as in 2015 is presented below as **Figure 4-7**. As is observed in the map, site for the proposed project falls in drought affected talukas.



Source : http://nidm.gov.in/pdf/dp/Karnataka.pdf

Figure 4-7: Drought Vulnerability Map of Karnataka State showing proposed project site

4.2.8 Ambient Air Quality

The project area is located in Bijapur Taluka of Vijayapur district. The area is primarily rural residential area and does not comprise of any industrial activities. No other sources of air pollution were identified in the project area. Therefore, the project operations will not have significant impacts on air quality of the area. Construction activities will have short term impacts on the air quality that will be mitigated through mitigation measures and hence the project will not lead to any major change in the air quality of the area. Hence primary air quality sampling was not considered to be essential for the project.

4.2.9 Noise Environment

Ambient noise levels were monitored at four locations within the project site, identified during the primary baseline survey. Noise monitoring locations were selected so as to obtain representative baseline noise values across the study area. Generally, noise monitoring is conducted at noise sensitive areas such as hospitals, places of worship and schools to document existing baseline conditions with an intention of predicting impacts due to proposed project and recommend mitigation measures to limit such changes.

The details of noise monitoring locations are provided in **Table 4-9** and **Figure 4-9** below.

Table 4-9: Noise Monitoring Locations

S. No	Location ID	Description
1	NQ-1	Near kuthurraichammal High. Sec. School, Karjol Cross Road
2	NQ-2	Near Substation, West of Project boundary
3	NQ-3	Near Govt. Middle School, Karjol village

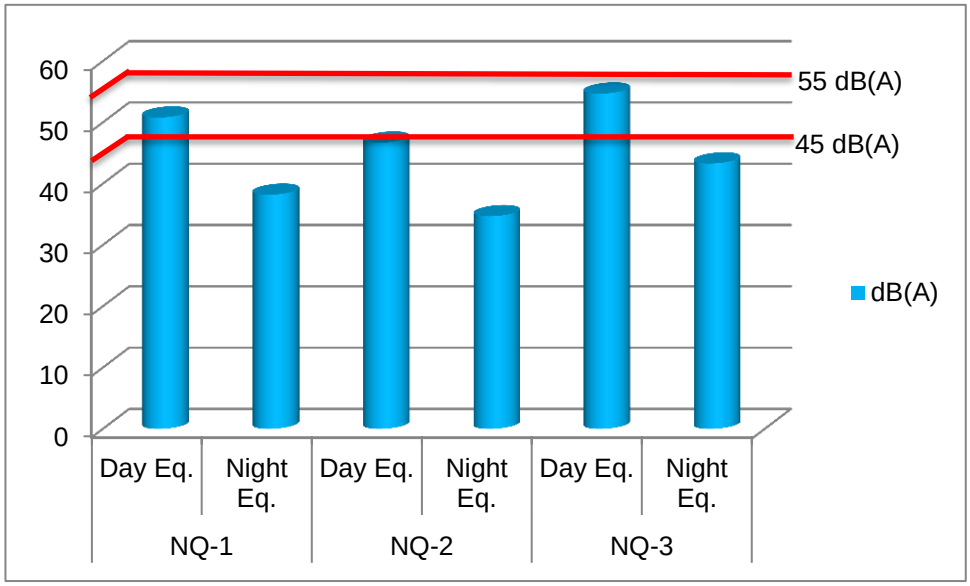
The observations of noise monitoring were calculated as Leq Day and Leq Night. The results are presented in the **Table 4-10** below.

Table 4-10: Results of Noise Monitoring

Monitoring Location	Monitoring Duration	Noise Level in dB (A) Leq	CPCB Standards
NQ-1	Day Equivalent	50.8	55
	Night Equivalent	38.2	45
NQ-2	Day Equivalent	46.7	55
	Night Equivalent	34.7	45
NQ-3	Day Equivalent	54.7	55
	Night Equivalent	43.3	45

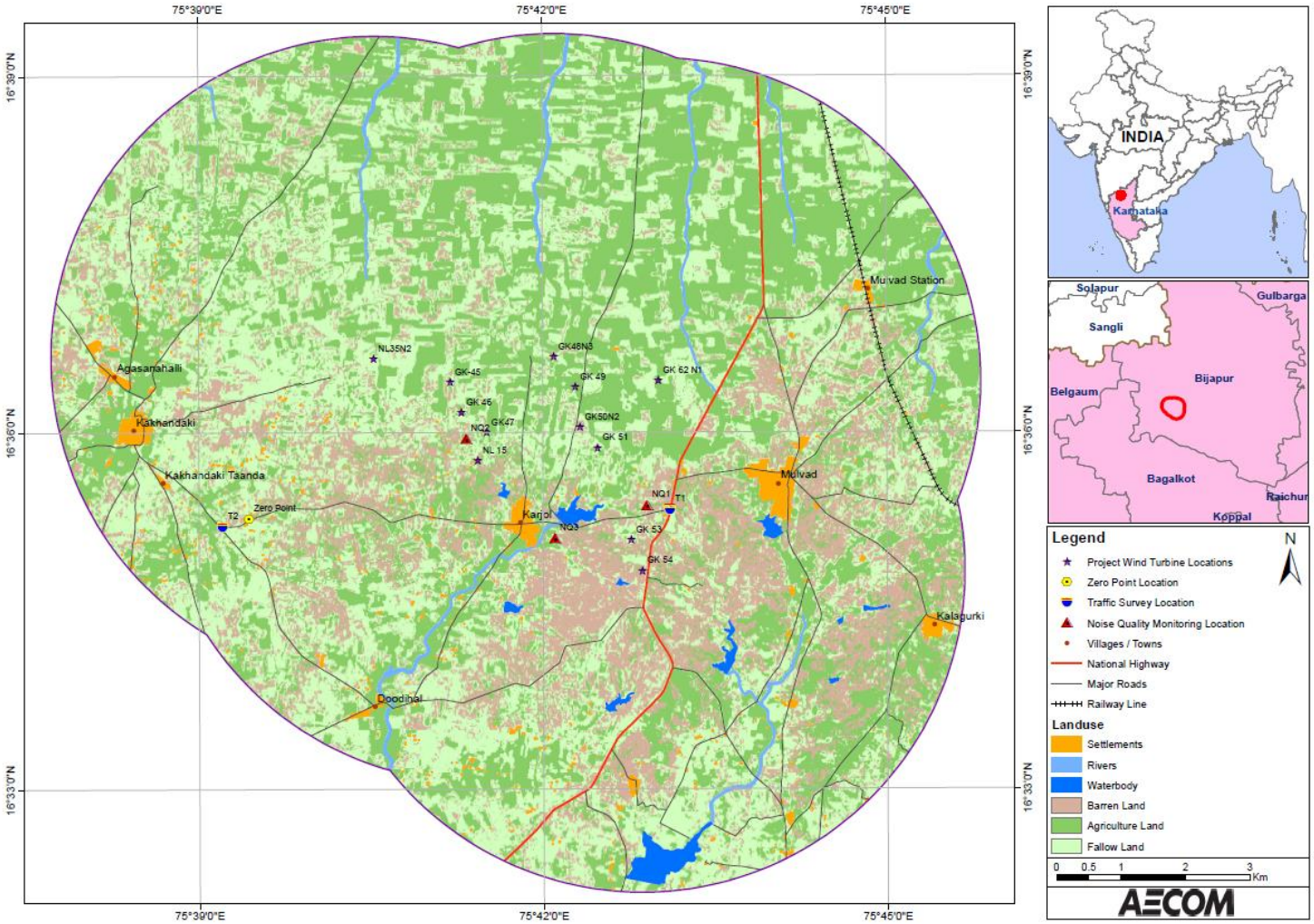
Source: Eco services, India Laboratory

The noise at the monitoring locations are well within the limits of 45 dB (A) during the night time and 55 dB (A) during the day time. The day and night time noise levels are graphically represented in **Figure 4-8**.



Source : AECOM India Pvt. Ltd.

Figure 4-8: Noise Levels Monitored in the Study Area



Source: AECOM India Pvt. ltd.

Figure 4-9: Noise Monitoring Location Map

4.2.10 Water Environment

The major rivers in the Vijayapura District are Krishna River, Bhima River and Doni River. Krishna River is the most important River of Vijayapura. Northern area of Vijayapura is drained by Bhima River and it stretches about 20 miles. During the rainy season, Bhima River overflows and spreads over a wide area which is thereby rendered extremely fertile. The center portion of Vijayapura is drained by Doni River. The water in Doni River is slightly salty, thus is not useful for agriculture.

The depth to water levels observed during the pre-monsoon period (May 2006) by Central Ground Water Board for Vijayapura District varied from 1.75 mbgl (Almatti) to 24.15 mbgl (Bijapur). The deepest was recorded at Vijayapura because of elevated area. The depth to water levels during post monsoon period (November 206) varied from 0.75 mbgl at Almatti to 18.87 mbgl at Bijapur.

The analysis of ground water samples of the district revealed that the ground water quality when compared with standards prescribed by BIS was found to be potable. It is also suitable for irrigation purposes in the major parts of the district.[4]

As per “Groundwater Quality Scenario of Karnataka State”, Electrical Conductivity (EC) value of Bijapur Taluka ranges from 110 to 17900mmhos/cm. The range of pH value recorded in Bijapur ranges from 6.2 to 10.35. Range of chemical characters in Project Taluka is presented in **Table 4-11** below.

Table 4-11: Range of Chemical Characteristics of Project Taluka

S. No	Parameter	Unit	Bijapur
1	Total Dissolved Solids (TDS)	Ppm	2010 - 11400
2	Total Hardness (TH)	Ppm	612- 4332
3	Calcium Hardness	Ppm	202 - 1603
4	Chloride (Cl)	Ppm	1010-5894
5	Sulphate (SO_4)	Ppm	402-1900
6	Fluoride (F)	ppm	1.57 - 4.5
7	Nitrate (NO_3)	ppm	-
8	Alkalinity	Ppm	624-992
9	Iron (Fe)	ppm	1.1 – 4.4S
10	Bacteria (E. Coli)		Present

Source: Groundwater Quality Scenario of Karnataka State

Water of Bijapur Taluka has reflected the presence of Total Hardness, Total Dissolved Solids, Calcium Hardness, Sulphate, Iron and Bacteria. In order to establish the baseline status of water quality in the project, water quality monitoring was undertaken by collection of 2 ground water samples in the study area. In the study area, source of drinking water is groundwater and piped supply by panchayat. The Type of sample and the sampling Locations are given in the **Table 4-12**.

Table 4-12: Details of the Water Quality Sampling Location

S. No	Sampling Location	Type of Sample	Sample Code
1	Karjol Village	Surface Water (Lake)	E-3238
2	Near Mallikarjun High.Pri. School, Karjol Village	Bore Well Water	E-3237

Source: Eco services, India Laboratory

4 Ground Water Information Booklet, Vijayapura District, Karnataka

The water sample was analysed for parameters as per IS: 10500 standards and the analysis was undertaken as per IS 3025 and relevant APHA (American Public Health Association) standard methods. The results of the analysis are presented in Table 4-13. The summary of results is presented in the following sub sections.

Table 4-13: Water Quality Monitoring Results

S.No	Parameters (Characteristic)	Units	IS 10500* specification for Drinking water (Desirable limit/ Permissible limit)	E-3238	E-3237
1	Colour	Hazen Units	5 (15)	BDL (DL:5.0)	BDL (DL : 5.0)
2	Turbidity	NTU	1 (5)	0.3	1.0
3	Temperature	^{o}C	---	23.9	26.1
4	pH @ 25^{o}C	Unit	6.5-8.5 (No relaxation)	7.95	6.99
5	Electrical Conductivity @ 25^{o}C	µmhos/cm	---	453	942
6	Total Dissolved Solids	mg/l	500 (2000)	266	553
7	Total Hardness as $CaCO_3$	mg/l	200 (600)	138	189
8	Calcium as Ca	mg/l	75 (200)	31	54
9	Magnesium as Mg	mg/l	30 (100)	14	13
10	Chloride as Cl	mg/l	250 (1000)	44	124
11	Sulphate as SO_4	mg/l	200 (400)	37	35
12	Iron as Fe	mg/l	0.3 (No relaxation)	BDL (DL : 0.1)	BDL (0.1)
13	Dissolved Oxygen	mg/l	---	8.2	NA
14	Chemical Oxygen Demand	mg/l	---	6.0	NA
15	Bio Chemical Oxygen Demand	mg/l	---	2.0	NA
16	Oil & Grease	mg/l	---	BDL(DL:2)	BDL(DL:2)
17	Fluoride	mg/l	1.0 (1.5)	1.62	1.82
18	Chromium as Cr^{6+}	mg/l	0.05 (No relaxation)	BDL(DL:0.03)	BDL(DL:0.03)
19	Manganese	mg/l	---	BDL(DL:0.01)	BDL(DL:0.01)
20	Nitrate	mg/l	45 (No relaxation)	BDL(DL:0.5)	BDL(DL:1.0)
21	Alkalinity	mg/l	200 (600)	94	160
22	Phosphate	mg/l	---	BDL(DL:0.06)	BDL (DL : 0.06)
23	Zinc as Zn	mg/l	5 (15)	4.6	7.9
24	Mercury as Hg	mg/l	0.001 (No relaxation)	BDL(DL:0.0005)	BDL(DL:0.0005)
25	Arsenic as As	mg/l	0.01 (0.05)	BDL (DL:0.005)	BDL (DL:0.005)
26	Lead as Pb	mg/l	---	BDL (DL:0.005)	BDL (DL:0.005)
27	Barium	mg/l	0.7 (No relaxation)	46.7	55.9
28	Cadmium	mg/l	0.003 (No relaxation)	BDL (DL:0.005)	BDL (DL:0.005)
29	Total Coliform	MPN/100 ml	10 (No relaxation)	< 2	NA
30	Faecal coliform	MPN/100 ml	---	< 2	NA

Source: Eco services, India Laboratory

Note: *BDL- Below Detection Limit & DL- Detection Limit*
The figures in the brackets indicated permissible limit in absence of alternate source
Above permissible limit
Above desirable Limit

It is observed that in surface water sample from village Karjol (E-3238); levels of Fluoride and Barium are above the permissible limits. However, none of the any parameters exceeds the desirable limits. Higher value of Barium in water comes primarily from natural sources. The highest levels in drinking-water are likely to be associated with groundwater from granite-like igneous rocks, alkaline igneous and volcanic rocks and manganese-rich sedimentary rocks.

Levels of barium and flouride are above permissible limit for drinking water in sample collected from the bore well near Near Mallikarjun High School, Karjol Village (E-3237). The concentration of barium in the drinking water is well above the permissible limit. Also, the Total Dissolved solids are above the desirable limits in the drinking water. Higher value of Total Hardness is due to presence of minerals like Calcium and Magnesium and also due to presence of other minerals like Barium and Zinc.

4.2.11 Existing Traffic Conditions

The proposed project will involve transportation of components of Wind Turbine Generators (WTG) on trucks/trailers which may result in traffic congestions on village roads during peak phase. It is estimated that on an average, four trucks/trailers are required to bring the components of one turbine. Hence at peak phase, 20 trucks/trailers can be expected to ply on these roads considering a maximum of 5 WTGs will be setup at a time. In order to avoid adverse effects of such a situation and plan the transportation route accordingly, an estimation of the baseline traffic conditions is necessary.

The project villages are well connected internally by motor able roads which are further connected through arterial roads to the state and national highway network viz.

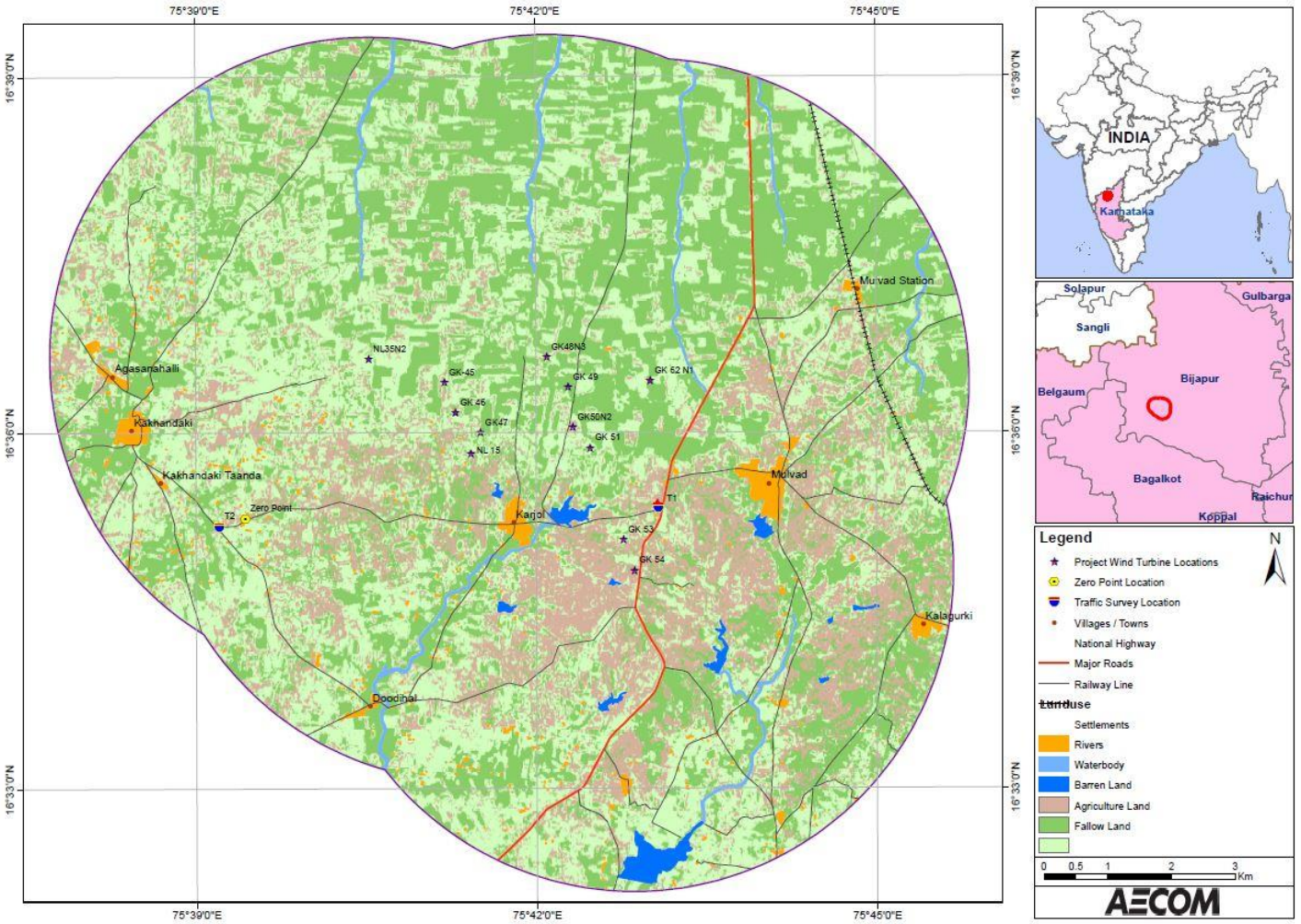
- **NH-218:** It's a National Highway connecting Vijayapura to Hubli and Humnabad, a part of earlier known four lanes NH-13, which is now known as NH-50, NH-218 and other state highways.
- **Village road from Kakhandaki to Doodihal:** It is a single lane undivided road.

Assessment of existing traffic conditions in the project area was undertaken to identify the problems with respect to traffic movement and to formulate the possible alternative solutions and the need for organizing the same in an efficient and economical manner. A traffic volume count survey was conducted by Eco Services India Private Limited (Eco Services) at two locations on the road junctions of the connecting road and the road to the project site, which will be used for transportation of the turbine components. The two way traffic volume counts were recorded for morning peak hours (7:00 am to 11:00am) and evening peak hours (04:00 pm to 08:00 pm) once during the study period to assess the existing peak hour traffic and traffic composition. The details of the traffic monitoring locations have been provided in **Table 4-14** and **Figure 4-10.**

Table 4-14: Traffic Monitoring Locations

S.No	Traffic monitoring location	Location ID	Date of Monitoring
1	Road junction between National Highways (from Vijayapura to Hubli) & Project road	T1	10-01-2017
2	Road junction between Village road (from Kakhandaki to Doodihal) & Project road	T2	11-01-2017

Source: Eco services, India Laboratory



Source : AECOM India Pvt. Ltd.

Figure 4-10: Traffic Monitoring Location Map

The traffic monitored has been divided into the following five categories/classes:

- Two wheelers (motor cycle, scooters);
- Three wheelers (auto rickshaw, motorized cart);
- Four Wheelers (cars, vans);
- Six Wheelers (light commercial vehicles, trucks and buses); and
- Bicycles and others (carts).

Since the vehicles are of different types, a factor needs to be accounted for each of them in order to express them at par in single unit terms. The factors, commonly known as Passenger Car Unit (PCU) factors that are generally adopted have been given in the following **Table 4-15.**

Table 4-15: PCU factors adopted for traffic volume survey

S.No	Vehicle Type	PCU Factor
1	Two Wheelers	0.50
2	Three Wheelers	1
3	Four Wheelers	1
4	Six Wheelers	3
5	Bicycles	0.5
6	Others (Carts)	6

Source: The Indian Roads Congress Code – IRC 109-1990

The traffic volume counts have been furnished in the following Tables.

Table 4-16: Traffic Volume Survey at T1- Road junction between National Highways (from Vijayapura to Hubli) & Project road

S. No	Vehicle Class	Total Number of Vehicles		Percentage (%)	
		Morning Peak	Evening Peak	Morning Peak	Evening Peak
1	Two Wheelers	439	494	74	71
2	Three Wheelers	8	11	1.3	1.6
3	Four Wheelers	108	147	18	21
4	Six Wheelers	28	30	4.7	4.3
5	Bicycles	9	9	1.5	1.3
6	Others (Carts)	3	2	0.5	0.2

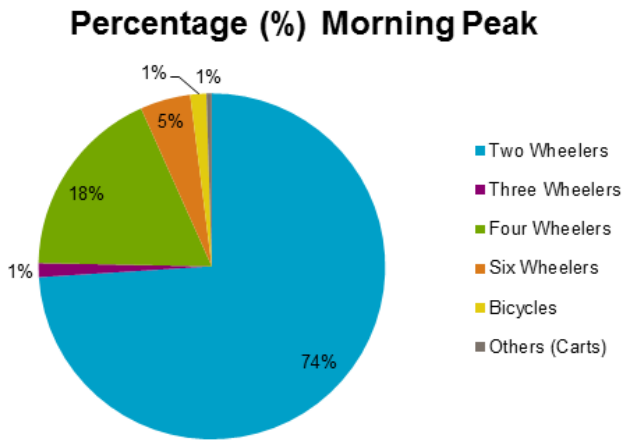
Source: Eco services, India Laboratory

Table 4-17: Traffic Volume Survey at T2- Road junction between Village road (from Kakhandaki to Doodihal) & Project road

S. No	Vehicle Class	Total Number of Vehicles		Percentage (%)	
		Morning Peak	Evening Peak	Morning Peak	Evening Peak
1	Two Wheelers	162	175	69	66
2	Three Wheelers	1	2	0.4	0.7
3	Four Wheelers	56	77	24	29
4	Six Wheelers	11	7	4.7	2.6
5	Bicycles	3	2	1.3	0.7
6	Others (Carts)	1	0	0.4	0

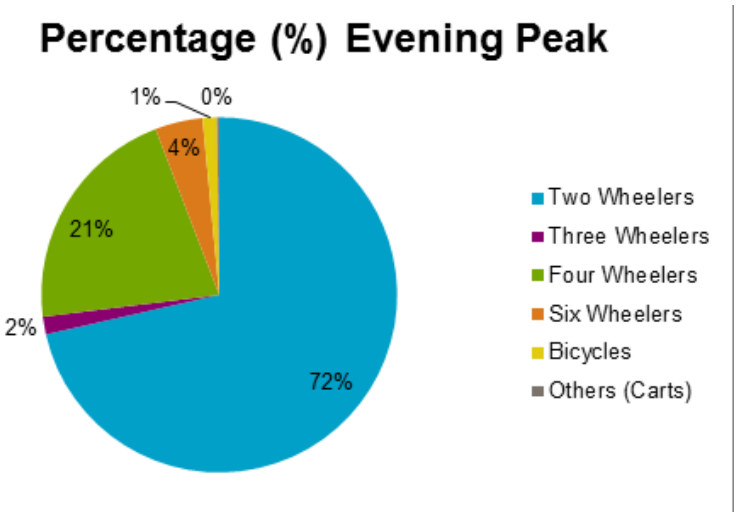
Source: Eco services, India Laboratory

The key observations and inference drawn from the traffic count survey have been illustrated and summarised in the following Figures.



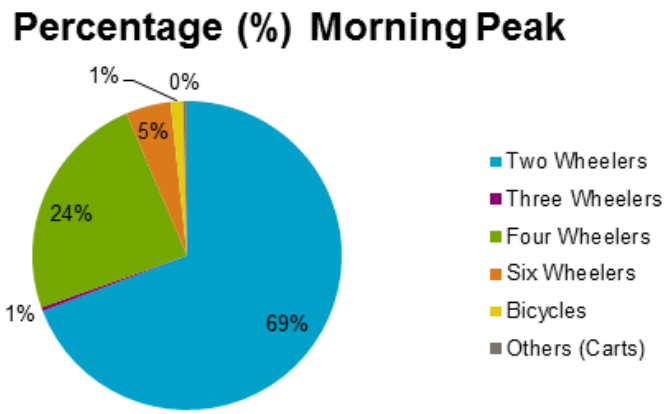
Source: AECOM India Pvt. Ltd.

Figure 4-11: Morning Percentage Composition at T1- Road junction between National Highway (from Vijayapura to Hubli) & Project road



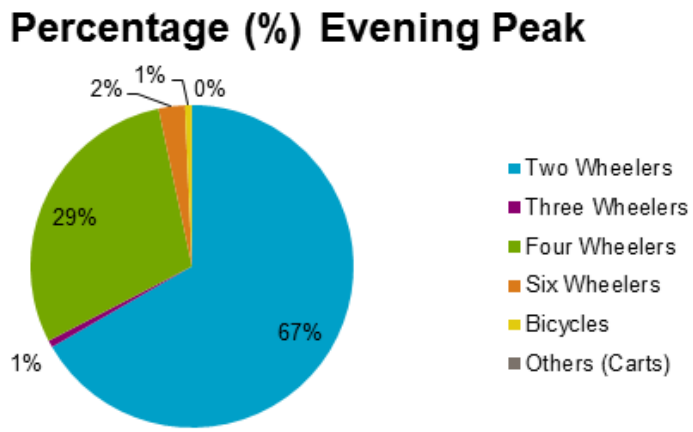
Source: AECOM India. Pvt. Ltd.

Figure 4-12: Evening Percentage Composition at T1- Road junction between National Highway (from Vijayapura to Hubli) & Project road



Source: AECOM India Pvt. Ltd.

Figure 4-13: Morning Percentage Composition at T2- Road junction between Village road (from Kakhandaki to Doodihal) & Project road



Source: AECOM India. Pvt. Ltd.

Figure 4-14: Evening Percentage Composition at T2- Road junction between Village road (from Kakhandaki to Doodihal) & Project road

Table 4-18: Key Observations of Traffic Count

S.No	Location	Traffic Composition	Traffic flow at Peak Hour
1	T-1, Road Junction between National Highways (from Vijayapura to Hubli) & Project road	The composition of vehicles at this stretch (two-way) indicates that of the total vehicles observed, highest % of vehicles observed is two wheelers followed by four wheelers, six wheelers, bicycles, three wheelers and other carts.	The morning and evening peak flow traffic was observed to be between 08:30 hours and 11:00 hours and between 16:00 hours to 19:30 hours respectively.
2	T-2, Road junction between Village road (from Kakhandaki to Doodihal) & Project road	The composition of vehicles at this stretch (two-way) indicates that of the total vehicles observed, highest % of vehicles observed is two wheelers followed by four wheelers, six wheelers, bicycles, three wheelers and other carts.	The morning and evening peak flow traffic was observed to be between 08:00 hours and 11:00 hours and between 16:00 hours to 19:00 hours respectively.

Source: Eco services, India Laboratory

4.3 Ecology

Hero Future Energies proposes to install a 50 MW wind power project in Vijayapura district of Karnataka.

The proposed project site spreads over the villages of Kakhandaki Tanda, Tonsyal and Karjol in Vijayapura district of Karnataka state in southwestern India. Geographically, the project site is a part of the Deccan Plateau of Karnataka.

For the purposes of ecological assessment, an area encompassed within an imaginary line joining the outermost wind-turbine locations, along with an area extending outwards from this line up to a distance of 5 km, was considered as the 'Study Area' and is hereinafter referred to as such.

4.3.1 Ecological Description of the Study Area

The area encompassed within an imaginary line joining the outermost wind-turbine locations, along with an area extending outward up to a distance of approximately 500 m from this line, was delineated as the "Study Area", and is hereinafter referred to as such.

The study area is geographically a part of the Deccan Plateau. It is situated north of the Middle Krishna Valley and south of the Lower Bhima Valley, both west-east flowing rivers, eventually draining into the Bay of Bengal. Politically, it falls within the villages of Kakhandaki, Tonsyal and Karjol in Vijayapura district of Karnataka state in southwestern India.

The terrain is either flat or shaped into very low and gently undulating hills and plateaux. It is drained by small, mostly seasonal, streams emptying their meagre waters into tributary rivulets of the Bhima River, itself a tributary of the Krishna River. Most of the streams have been dammed with earthen bunds, creating small and large reservoirs. Ground-water is being accessed through dug-wells and bore-wells. The water carried by the Kolar – Babaleshwar canal feeds many ponds within the study area.

Most of the cultivable plain areas are covered by farmlands, many of them fallow, with occasional small patches of sparse bushes. There are a few dispersed human habitations, mostly small villages, in the form of closely clustered homesteads. The study area is fragmented mainly by the National Highway No. 52 (NH-52) and the State Highway No. 55 (SH- 55), two major roads which transverse through it, besides a few metalled roads and a number of dirt roads and foot-trails. The aerial space of the study area is interrupted mainly by power-lines.

The soil is predominantly black cotton soil, with a few patches of red soil. All the WTGs that are part of the proposed project are distributed across the agricultural lands.

4.3.2 Study Period

The terrestrial ecological survey was carried out on 22nd and 23rd December 2016. The annual winter season had set in. The weather was cloudy and the temperature was low through the study-period.

4.3.3 Methodology

4.3.3.1 Primary Data

Flora

Primary data on the flora of the study area was generated through quadrat-based quantitative studies at eight (8) locations. At each location, a quadrat of approximately 20 m x 20 m was marked for recording the tree species, as well as, the number of individuals of each species, falling within the quadrat.

Similarly, a quadrat of approximately 5 m x 5 m for recording data on shrubs species and quadrats of 1 m x 1 m for recording data on herbs species were marked within the bigger quadrat.

The data recorded through the quadrat-studies was analysed to estimate the percentage frequency, abundance and density of each floristic species. Species richness was also calculated, separately for the woody and non-woody plants. The following formulae were used for calculating the percentage of frequency, abundance and density, as applicable, of the species identified in the eight quadrats studied:

$$\%\ \text{Frequency of species A} = \frac{\text{Number of quadrats of occurrence of species A}}{\text{Total number of quadrats studied}} \text{x } 100$$

$$\text{Abundance of species A} = \frac{\text{Number of individuals of species A in total quadrats studied}}{\text{Number of quadrats of occurrence of species A}}$$

$$\text{Density of species A} = \frac{\text{Number of individuals of species A in total quadrats studied}}{\text{Total area studied}}$$

Due to time and resource constraints, and given the preliminary nature of this survey, the emphasis of the studies was kept limited to the higher flora.

Fauna

Primary data on the fauna of the study area was generated through both, direct evidence, in the form of visual sightings, and indirect evidence, such as calls, nests, burrows, droppings, scats, moults, tracks, etc. These were observed generally, in course of a brief walk-over of the site.

Following the walk-over, the site was scanned with standard bird-watching binoculars for approximately fifteen-minutes to record bird-species in particular.

The survey was conducted during most of the diurnal faunal activity-period, from mid-morning till early evening. Due to time and resource constraints, and given the preliminary nature of this survey, the emphasis of the studies was kept limited to the higher and diurnal fauna.

In view of the known vulnerability of certain faunal groups, mainly avifauna and bats, to wind-farm impacts, a special focus was maintained on these during the survey.

Details of Quadrat sites

Table 4-19: gives the details of the eight sites at which quadrat studies were carried out.

Table 4-19: Details of the Quadrat Sites

Quadrat No.	Location Coordinates	Elevation (m)
1	16° 36' 17.1" N 75° 40' 57.9" E	623
2	16° 35' 50.4" N 75° 42' 19.4" E	615
3	16° 35' 48.0" N 75° 42' 53.7" E	618
4	16° 35' 14.3" N 75° 41' 55.7" E	588
5	16° 36' 21.1" N 75° 39' 38.7" E	599
6	16° 35' 50.8" N 75° 41' 23.8" E	620
7	16° 36' 53.9" N 75° 41' 14.0" E	623
8	16° 35' 55.6" N 75° 42' 43.8" E	630

Source: AECOM Primary Survey

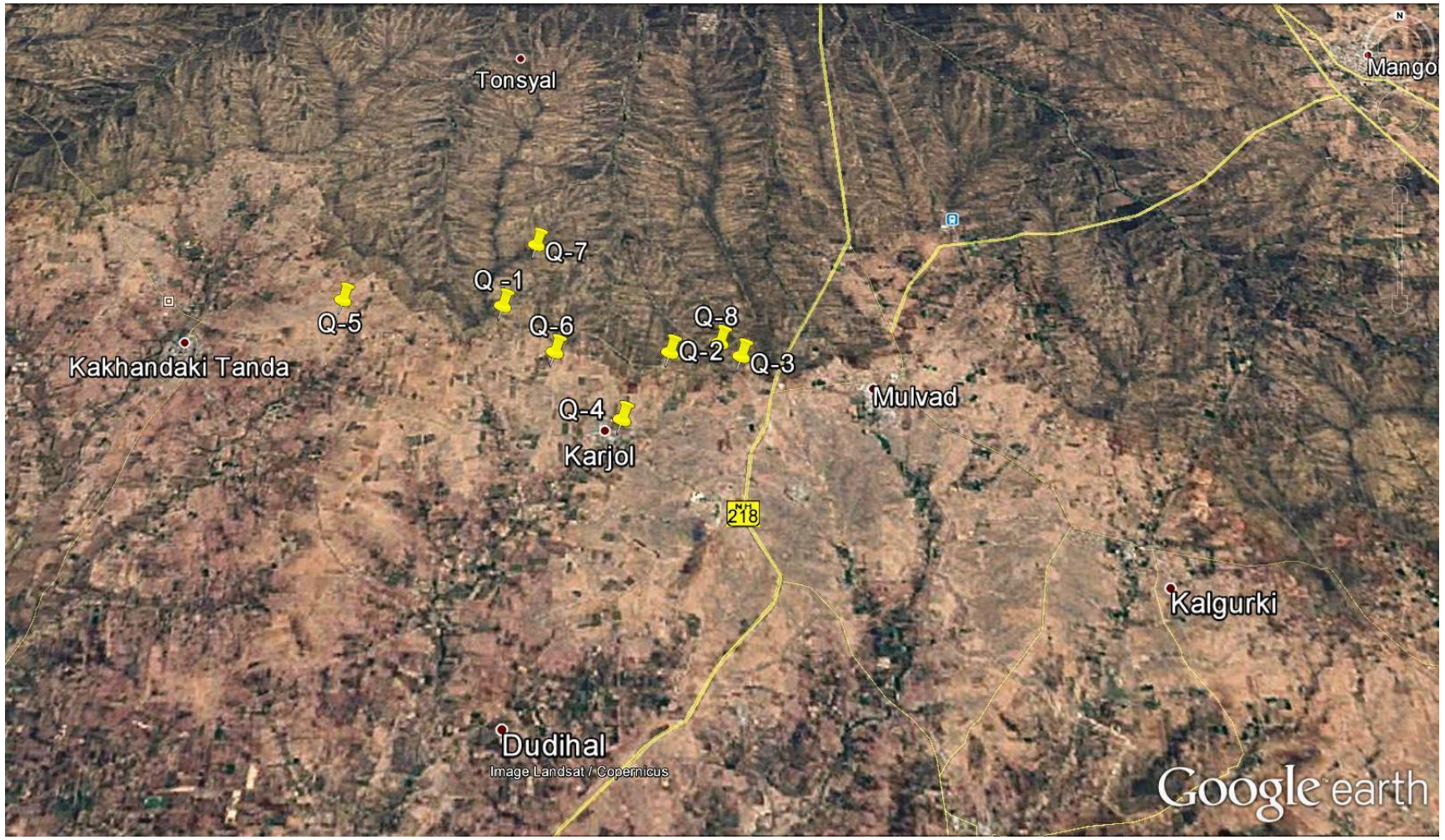


Figure 4-15: Map showing Locations of the Quadrat Sites

4.3.3.2 Secondary Data

Secondary data, to supplement the observations of the field survey, was collected from available published literature, such as books, field-guides, websites, research papers, media articles etc. Additional information was sourced from the project proponent, governmental institutions and local residents of the study area

4.3.4 Findings on the Flora

4.3.4.1 Forest Types

According to the Champion and Seth Classification of Indian Forests, the natural vegetation of the study area seems to be of the following forest-types:

Type 6A/C1 (Sub-group 6A - Southern Tropical Thorn Forest, Sub-division C1 – Southern Thorn Forest)

These forests are seen in peninsular India, throughout the dry tract to the lee of the Western Ghats. They are met with on shallow dry soil, or deep but sandy soil. The ground is usually flat or in the form of low undulating hills and plateau.

It is an open and low forest dominated by thorny species. The trees tend to be short with low-branching crowns that rarely meet to form a canopy. There is an ill-defined lower storey of large and small shrubs which tend to be spiny and show various xerophytic characters. A thin growth of grass appears during the moist season, but the ground remains largely bare through the rest of the year. Climbers are few, with most of the ones present also showing xerophytic adaptations.

Species associated with this type include:

Trees like Acacia catechu, *Acacia leucophloea, Acacia nilotica, Aegle marmelos, Ailanthus excelsa, Albizzia spp., Azadirachta indica, Balanites aegyptica, Chloroxylon swietenia, Dichrostachys cinerea, Dolichandrone falcata, Ficus spp., Flacourtia indica, Grewia spp., Ixora arborea, Randia spp., Santalum album, Strychnos potatorum* and *Zizyphus spp*.;

Shrubs like *Capparis decidua*, *Carissa spp., Cassia auriculata, Dodonaea viscosa, Euphorbia nivulia, Lantana camara* and *Opuntia elatior*;

Grasses like *Aristida spp*., and *Heteropogon contortus*; and

Climbers like *Ziziphus oenoplia*.

(Ecologically, such thorny woodlands and grasslands are considered to be the effect of excessive cutting and browsing, and thus, not a true climatic formation. Protection of such an area is likely to lead to the regeneration of elements of a tropical dry deciduous forest.)

Type 6/DS2 (Group 6 – Tropical Thorn Forests, Degradation Stage DS2 – Southern Euphorbia Scrub)

This type may represent either the ultimate stage in degradation of the previous forest type or extremely poor soil conditions. Though the Acacias and their associates continue to occur even in this stage, the trees are very stunted and take on a bush-like form. It is a very open form of forest in which the presence of fleshy Euphorbias is characteristic. Most of the soil is bear with only a thin cover of wiry grasses.

Species associated with this type include:

Large shrubs such as *Calotropis gigantea, Capparis decidua, Euphorbia antiquorum* and *Euphorbia tirucalli*

Small shrubs such *as Barleria buxifolia, Cassia auriculata, Dodonaea viscosa* and *Opuntia elatior*; and

Grasses such as *Aristida spp*. and *Cymbopogon spp*.

Type 5/DS4 (Group 5 – Tropical Dry Deciduous Forests, Degradation Stage DS4 – Dry Grassland)

Nearly all the climactic types of the above group can get reduced to open savannah forms through degradation due to intense biotic interference. This process results in a degraded scrub or dry grassland that is a more xerophytic kind of vegetation than the local climate warrants. Grass becomes conspicuous since repetitive lopping, grazing or burning favour it over other forms of vegetation.

Species associated with this type include:

Aristida spp., Bothriochloa spp., Chrysopogon spp., Cymbopogon spp, Cynodon dactylon, Eragrostis spp., Heteropogon contortus, Melanocenchris royleana and *Themeda spp*.

Source: H.G. Champion & S. K. Seth (2005). A Revised Survey of the Forest Types of India. Natraj Publishers, Dehradun.

4.3.4.2 Quantitative Floristic Data of the Study Area

Table 4-20 and **Table 4-21** lists, respectively, the woody and non-woody plant species recorded in the quadrat studies, along with the percentage of frequency, abundance and density of each species.

Table 4-20: Woody Flora recorded in the Study Area

S. No.	Species	Habit	% frequency	Abundance	Density per Ha
1	*Abutilon indicum*	Shrub	50	2	450
2	*Azadirachta indica*	Tree	63	1	19
3	*Acacia nilotica*	Tree	38	2	16
4	*Ailanthus excelsa*	Tree	13	2	6
5	*Balanites aegyptiaca*	Tree	13	1	3
6	*Calotropis procera*	Shrub	50	1	200
7	*Capparis decidua*	Shrub	13	1	50
8	*Cryptostegia grandiflora*	Climber	13	1	50
9	*Datura metel*	Shrub	13	5	250
10	*Ipomoea carnea*	Climber	13	2	100
11	*Lantana camara*	Shrub	25	3	300
12	*Leucaena leucocephala*	Tree	13	2	6
13	*Melia azedarach*	Tree	13	1	3
14	*Prosopis chilensis*	Tree	63	3	53
15	*Senna auriculata*	Shrub	25	3	300
16	*Ziziphus nummularia*	Tree	13	1	3

Table 4-21: Non-Woody Flora recorded in the Study Area

S. No.	Species	Habit	% frequency	Abundance	Density per Ha
1	*Achyranthes aspera*	Herb	25	2	3750
2	*Alternanthera sessilis*	Herb	25	4	8750
3	*Celosia argentea*	Herb	50	2	11250
4	*Cassia tora*	Herb	13	2	2500
5	*Hyptis suaveolens*	Herb	38	2	8750
6	*Indigofera sp*	Herb	13	2	2500
7	*Leucas aspera*	Herb	13	1	1250
8	*Parthenium hysterophorus*	Herb	63	5	30000
9	*Striga densiflora*	Herb	13	2	2500

S. No.	Species	Habit	% frequency	Abundance	Density per Ha
10	*Tribulus terrestris*	Herb	13	4	5000
11	*Tridax procumbens*	Herb	50	4	18750

Source: AECOM Primary Survey

Species Richness: The Species Richness of the woody flora of the project site is 16 and that of the non-woody flora is 11.

4.3.5 Findings on the Fauna

This section of the report presents the details of the higher faunal species, namely, birds, mammals, and reptiles having recorded ranges that include the study area.

Wind-farms are known to pose potential risks to fauna in terms of direct and indirect habitat-loss through occupation of habitat areas by wind-farm structures and through avoidance of wind-farm areas by fauna associated to the area, respectively. The death of aerially moving fauna either through collision with turbines, or as an effect of conditions created by operational turbines is another major potential risk of wind-farms.

Amongst the fauna, only three groups of species are identified as vulnerable to the risk of death or injury from interaction with wind turbines. These comprise two bird groups, namely raptors and migratory waterfowl, and one mammalian group, namely bats. Thus, the faunal species of the study area are divisible into windfarm-vulnerable species and other species, that is, those that are not vulnerable to windfarm-related risks of death or injury.

Details of the faunal species having recorded ranges that include the study area are accordingly presented under two separate sub-sections. The faunal tables that follow also give the conservation status of each species, as per the IUCN Red Data List, and the Schedule under which the species is protected by the Wildlife (Protection) Act (WPA), 1972, of India.

4.3.6 Windfarm Vulnerable Fauna of the Study Area

Raptors

Raptors are relatively large-sized birds, varyingly adapted for soaring and relatively less capable of manoeuvring in flight and, thus, are known to be particularly vulnerable to collision-risk with operating wind-turbines.

Amongst the raptors associated with a given windfarm area, the resident species are known to be relatively more vulnerable to windfarm-related collision risk.

Table 4-22 lists the resident, as well as, migratory raptor species with recorded ranges that include the study area. The Species listed in **bold** were sighted in the study area during the field survey

Table 4-22: Raptors of the Study Area

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
Resident Species				
1	*Falco chicquera*	Red-necked Falcon	LC	I
2	*Falco jugger*	Laggar Falcon	NT	I
3	*Elanus caeruleus*	Black-winged Kite	LC	IV
4	*Milvus migrans*	Black Kite	LC	IV
5	*Haliastur indus*	Brahminy Kite	LC	IV
6	*Pernis ptilorhynchus*	Oriental Honey Buzzard	LC	IV
7	*Neophron percnopterus*	Egyptian Vulture	EN	IV
8	*Gyps bengalensis*	White-rumped Vulture	CR	I
9	*Gyps indicus*	Indian Vulture	CR	I
10	*Sarcogyps calvus*	Red-headed Vulture	CR	IV

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
11	*Circaetus gallicus*	Short-toed Snake Eagle	LC	IV
12	*Spilornis cheela*	Crested Serpent Eagle	LC	IV
13	*Accipiter badius*	Shikra	LC	I
14	*Butastur teesa*	White-eyed Buzzard	LC	IV
15	*Aquila rapax*	Tawny Eagle	LC	IV
16	*Aquila fasciata*	Bonneli's Eagle	LC	IV
17	*Nisaetus cirrhatus*	Crested Hawk Eagle	LC	IV
Migratory Species				
18	*Falco tinnunculus*	Common Kestrel	Winter	LC	IV
19	*Falco peregrinus*	Peregrine Falcon	Winter	LC	I
20	*Pandion haliaetus*	Osprey	Winter	LC	I
21	*Circus aeruginosus*	Eurasian Marsh Harrier	Winter	LC	IV
22	*Circus macrourus*	Pallid Harrier	Winter	NT	IV
23	*Hieraaetus pennatus*	Booted Eagle	Winter	LC	IV

**Status assigned by the International Union for Conservation of Nature and Natural Resources, where – CR – Critically Endangered; EN – Endangered; NT – Near Threatened; and LC – Least Concern.*

*** Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). Birds of the Indian Subcontinent. Oxford University Press, pp 1-528; Salim Ali (2012) reprinted. The Book of Indian Birds. Oxford University Press, pp 1-326; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3; Schedules I to VI: Indian Wildlife (Protection) Act, 1972.

4.3.7 Migratory Waterfowl

Migratory waterfowl tend to carry out migratory flights by night when they are unlikely to spot and avoid wind-turbines and, thus, are vulnerable to collision-risk with operating wind-turbines.

Table 4-23 lists the migratory waterfowl species with recorded ranges that include the study area. Species listed in bold were sighted in the study area during the survey

Table 4-23: Migratory Waterfowl of the Study Area

S. No.	Scientific Name	Common Name	Season of Migration	IUCN Status*	WPA Schedule**
1	Anser indicus	Bar-headed Goose	Winter	LC	IV
2	***Tadorna ferruginea***	**Ruddy Shelduck**	**Winter**	LC	IV
3	*Anas strepera*	Gadwall	Winter	LC	IV
4	*Anas penelope*	Eurasian Wigeon	Winter	LC	IV
5	*Anas clypeata*	Northern Shoveler	Winter	LC	IV
6	*Anas acuta*	Northern Pintail	Winter	LC	IV
7	*Anas querquedula*	Gargeney	Winter	LC	IV
8	*Anas crecca*	Common Teal	Winter	LC	IV
9	*Aythya ferina*	Common Pochard	Winter	V	IV
10	*Anastomus oscitans*	Asian Openbill	Winter	LC	IV
11	***Plegadis falcinellus***	**Glossy Ibis**	**Winter**	LC	IV
12	*Ardea cinerea*	Grey Heron	Winter	LC	IV

S. No.	Scientific Name	Common Name	Season of Migration	IUCN Status*	WPA Schedule**
13	*Anhinga melanogaster*	Darter	Winter	LC	IV
14	*Phalacrocorax niger*	Little Cormorant	Winter	LC	IV
15	*Phalacrocorax fuscicollis*	Indian Cormorant	Winter	LC	IV
16	*Phalacrocorax carbo*	Great Cormorant	Winter	LC	IV
17	*Grus virgo*	Demoselle Crane	Winter	LC	IV
18	***Himantopus himantopus***	**Black-winged Stilt**	**Winter**	LC	IV
19	*Philomachus pugnax*	Ruff	Winter	LC	IV
20	*Gallinago gallinago*	Common Snipe	Winter	LC	IV
21	*Limosa limosa*	Black-tailed Godwit	Winter	NT	IV
22	*Numenius arquata*	Eurasian Curlew	Winter	NT	IV
23	*Tringa erythropus*	Spotted Redshank	Winter	LC	IV
24	*Tringa tetanus*	Common Redshank	Winter	LC	IV
25	*Tringa stagnatilis*	Marsh Sandpiper	Winter	LC	IV
26	*Tringa nebularia*	Common Greenshank	Winter	LC	IV
27	*Tringa ochropus*	Green Sandpiper	Winter	LC	IV
28	***Tringa glareola***	**Wood Sandpiper**	**Winter**	LC	IV
29	*Actitis hypoleucos*	Common Sandpiper	Winter	LC	IV
30	*Calidris minuta*	Little Stint	Winter	LC	IV
31	*Calidris temminckii*	Temminck's Stint	Winter	LC	IV
32	*Chlidonias hybrida*	Whiskered Tern	Winter	LC	-

***Status assigned by the International Union for Conservation of Nature and Natural Resources, where – NT – Near Threatened; VU – Vulnerable and LC – Least Concern.*
***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*
Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). *Birds of the Indian Subcontinent.* Oxford University Press, pp 1-528; Salim Ali (2012) reprinted. *The Book of Indian Birds*. Oxford University Press, pp 1-326; IUCN (2016). *The IUCN Red List of Threatened Species.* Version 2016-3; *Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

4.3.7.1 Bats

Bats are vulnerable to risk of death or injury, from not only collision with wind-turbines, but also from barotrauma (internal organ damage from rapid pressure-change), as an effect of flying through altered pressure-zones generated by wind-turbines in operation.

A correlation has been observed between low wind-speed nights and increased bat-fatalities around wind farms. Some evidence also suggests that bats may be attracted to turbines and that migratory and tree-roosting bats may have a higher risk of mortality.

Table 4-24 lists the bat species having recorded ranges that include the study area.

Table 4-24: Bats of the Study Area

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
1	*Taphozous longimanus*	Long-winged Tomb Bat	LC	-
2	*Megaderma lyra*	Greater False Vampire	LC	-
3	*Scotozous dormeri*	Dormer's Bat	LC	-

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
4	*Tylonycteris pachypus*	Flat- headed Bat	LC	-

***Status assigned by the International Union for Conservation of Nature and Natural Resources, where - LC – Least Concern*

***Schedules: Indian Wildlife (Protection) Act, 1972.*

Sources: Vivek Menon (2014), *Indian Mammals: A Field Guide.* Hachette Book Publishing India Pvt. Ltd., Gurgaon, India, pp 1-522; IUCN (2016). *The IUCN Red List of Threatened Species.* Version 2016-3; *Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

4.3.7.2 Other Fauna of the Study Area

The following higher fauna, other than windfarm-vulnerable groups, is having recorded ranged that include the study area. Though these faunal species are also likely to be directly or indirectly affected by the project, they are not perceived to be particularly vulnerable to known wind farm impacts.

4.3.7.3 Resident Birds

Table 4-25 lists the resident birds of the study area other than the windfarm-vulnerable species. Species listed in bold font were sighted in the study area during the survey**.**

Table 4-25: Resident Birds of the Study Area

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
1	*Francolinus pictus*	Painted Francolin	LC	IV
2	***Francolinus pondicerianus***	**Grey Francolin**	LC	IV
3	*Coturnix chinensis*	King Quail	LC	IV
4	*Perdicula asiatica*	Jungle Bush Quail	LC	IV
5	*Perdicula argoondah*	Rock Bush Quail	LC	IV
6	*Galloperdix spadicea*	Red Spurfowl	LC	IV
7	*Galloperdix lunulata*	Painted Spurfowl	LC	IV
8	*Gallus sonneratii*	Grey Junglefowl	LC	IV
9	***Pavo cristatus***	**Indian Peafowl**	LC	I
10	*Dendrocygna javanica*	Lesser Whistling Duck	LC	IV
11	*Nettapus coromandelianus*	Cotton Pygmy Goose	LC	IV
12	***Anas poecilorhyncha***	**Indian Spot-billed Duck**	LC	IV
13	***Tachybaptus ruficollis***	**Little Grebe**	LC	IV
14	***Mycteria leucocephala***	**Painted Stork**	NT	IV
15	*Ciconia episcopus*	Woolly-necked Stork	LC	IV
16	*Threskiornis melanocephalus*	Black-headed Ibis	NT	IV
17	***Pseudibis papillosa***	**Red-naped Ibis**	LC	IV
18	*Platalea leucorodia*	Eurasian Spoonbill	LC	I
19	*Butorides striata*	Striated Heron	LC	IV
20	*Nycticorax nycticorax*	Black-crowned Night Heron	LC	IV
21	***Ardeola grayii***	**Indian Pond Heron**	LC	IV

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
22	*Ardea purpurea*	Purple Heron	LC	IV
23	***Bubulcus ibis***	**Cattle Egret**	LC	IV
24	*Casmerodius albus*	Great Egret	LC	IV
25	*Mesophoyx intermedia*	Intermediate Egret	LC	IV
26	*Sypheotides indicus*	Lesser Florican	EN	I
27	*Amaurornis phoenicurus*	White-breasted Waterhen	LC	IV
28	*Amaurornis akool*	Brown Crake	LC	IV
29	*Turnix sylvaticus*	Small Buttonquail	LC	IV
30	*Turnix suscitator*	Barred Buttonquail	LC	IV
31	*Porphyrio porphyrio*	Purple Swamphen	LC	IV
32	*Gallinula chloropus*	Common Moorhen	LC	IV
33	*Fulica atra*	Eurasian Coot	LC	IV
34	*Burhinus indicus*	Indian Thick-knee	LC	-
35	*Esacus recurvirostris*	Great Thick-knee	LC	-
36	*Hydrophasianus chirurgus*	Pheasant-tailed Jacana	LC	IV
37	*Metopidius indicus*	Bronze-winged Jacana	LC	IV
38	***Vanellus malabaricus***	**Yellow-wattled Lapwing**	LC	IV
39	***Vanellus indicus***	**Red-wattled Lapwing**	LC	IV
40	***Charadrius dubius***	**Little Ringed Plover**	LC	IV
41	*Rostratula benghalensis*	Greater Painted Snipe	LC	IV
42	*Cursorius coromandelicus*	Indian Courser	LC	-
43	*Glareola lactea*	Small Pratincole	LC	-
44	***Sterna aurantia***	**River Tern**	LC	-
45	*Pterocles exustus*	Chestnut-bellied Sandgrouse	LC	IV
46	*Pterocles indicus*	Painted Sandgrouse	LC	IV
47	***Columba livia***	**Common Pigeon**	LC	-
48	*Streptopelia orientalis*	Oriental Turtle Dove	LC	IV
49	***Streptopelia decaocto***	**Eurasian Collared Dove**	LC	IV
50	*Streptopelia tranquebarica*	Red Collared Dove	LC	IV
51	*Stigmatopelia chinensis*	Spotted Dove	LC	IV
52	***Stigmatopelia senegalensis***	**Laughing Dove**	LC	IV
53	*Treron phoenicopterus*	Yellow-footed Green Pigeon	LC	IV
54	***Psittacula krameri***	**Rose-ringed Parakeet**	LC	IV
55	*Psittacula cyanocephala*	Plum-headed Parakeet	LC	IV

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
56	*Hierococcyx varius*	Common Hawk Cuckoo	LC	IV
57	*Cocomantis passerinus*	Grey-bellied Cuckoo	LC	IV
58	*Eudynamis scolopaceus*	Asian Koel	LC	IV
59	*Rhopodytes viridirostris*	Blue-faced Malkoha	NA	IV
60	*Taccocua leschenaultii*	Sirkeer Malkoha	LC	IV
61	*Centropus parroti*	Southern Coucal	LC	IV
62	*Tyto alba*	Barn Owl	LC	IV
63	*Otus bakkamoena*	Indian Scops Owl	LC	IV
64	*Glaucidium radiatum*	Jungle Owlet	LC	IV
65	*Athene brama*	Spotted Owlet	LC	IV
66	*Bubo bengalensis*	Indian Eagle Owl	LC	IV
67	*Ketupa zeylonensis*	Brown Fish Owl	LC	IV
68	*Strix ocellata*	Mottled Wood Owl	LC	IV
69	*Caprimulgus indicus*	Jungle Nightjar	LC	IV
70	*Caprimulgus asiaticus*	Indian Nightjar	LC	IV
71	*Caprimulgus affinis*	Savanna Nightjar	LC	IV
72	*Cypsiurus balasiensis*	Asian Palm Swift	LC	-
73	*Tachymarptis melba*	Alpine Swift	LC	-
74	*Hemiprocne coronata*	Crested Tree Swift	LC	-
75	*Apus affinis*	Little Swift	LC	-
76	*Upupa epops*	Common Hoopoe	LC	-
77	***Coracias benghalensis***	**Indian Roller**	LC	IV
78	***Halcyon smyrnensis***	**White-throated Kingfisher**	LC	IV
79	*Alcedo atthis*	Common Kingfisher	LC	IV
80	*Ceryle rudis*	Pied Kingfisher	LC	IV
81	***Merops orientalis***	**Green Bee-eater**	LC	-
82	*Ocyceros birostris*	Indian Grey Hornbill	LC	-
83	*Megalaima zeylanica*	Brown-headed Barbet	LC	IV
84	*Megalaima haemacephala*	Coppersmith Barbet	LC	IV
85	*Dendrocopos nanus*	Brown-capped Pygmy Woodpecker	LC	IV
86	*Dendrocopos mahrattensis*	Yellow-crowned Woodpecker	LC	IV
87	*Dinopium benghalense*	Lesser Goldenback	LC	IV
88	*Chrysocolaptes festivus*	White-naped Woodpecker	LC	IV
89	*Tephrodornis pondicerianus*	Common Woodshrike	LC	-

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
90	*Artamus fuscus*	Ashy Woodswallow	LC	-
91	*Coracina macei*	Large Cuckooshrike	LC	IV
92	*Aegithina tiphia*	Common Iora	LC	IV
93	*Pericrocotus cinnamomeus*	Small Minivet	LC	IV
94	***Lanius vittatus***	**Bay-backed Shrike**	LC	-
95	***Lanius schach***	**Long-tailed Shrike**	LC	-
96	*Lanius meridionalis*	Southern Grey Shrike	LC	-
97	***Dicrurus macrocercus***	**Black Drongo**	LC	IV
98	*Dicrurus caerulescens*	White-bellied Drongo	LC	IV
99	*Oriolus xanthornus*	Black-hooded Oriole	LC	IV
100	*Rhipidura aureola*	White-browed Fantail	LC	-
101	*Dendrocitta vagabunda*	Rufous Treepie	LC	IV
102	*Corvus culminatus*	Indian Jungle Crow	LC	IV
103	***Corvus splendens***	**House Crow**	LC	V
104	*Ptynoprogne concolor*	Dusky Crag Martin	LC	-
105	*Petrochelidon fluvicola*	Streak-throated Swallow	LC	-
106	*Hirundo smithii*	Wire-tailed Swallow	LC	-
107	*Cecropis daurica*	Red-rumped Swallow	LC	-
108	*Mirafra cantillans*	Singing Bushlark	LC	IV
109	*Ammomanes phoenicura*	Rufous-tailed Lark	LC	IV
110	*Eremopteryx griseus*	Ashy-crowned Sparrow Lark	LC	IV
111	*Alauda gulgula*	Oriental Skylark	LC	IV
112	*Pycnonotus jocosus*	Red-whiskered Bulbul	LC	IV
113	***Pycnonotus cafer***	**Red-vented Bulbul**	LC	IV
114	*Pycnonotus luteolus*	White-browed Bulbul	LC	IV
115	*Prinia hodgsonii*	Grey-breasted Prinia	LC	-
116	*Prinia sylvatica*	Jungle Prinia	LC	-
117	*Prinia socialis*	Ashy Prinia	LC	-
118	*Prinia inornata*	Plain Prinia	LC	-
119	*Cisticola juncidis*	Zitting Cisticola	LC	-
120	*Orthotomus sutorius*	Common Tailorbird	LC	-
121	*Dumetia hyperythra*	Tawny-bellied Babbler	LC	IV
122	*Turdoides caudata*	Common Babbler	LC	IV
123	*Turdoides malcolmi*	Large Grey Babbler	LC	IV

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
124	***Turdoides striata***	**Jungle Babbler**	LC	IV
125	*Turdoides affinis*	Yellow-billed Babbler	LC	IV
126	*Chrysomma sinense*	Yellow-eyed Babbler	LC	IV
127	*Zosterops palpebrosus*	Oriental White-eye	LC	IV
128	***Acridotheres tristis***	**Common Myna**	LC	IV
129	***Sturnia pagodarum***	**Brahminy Starling**	LC	IV
130	*Zoothera citrina*	Orange-headed Thrush	LC	IV
131	*Copsychus saularis*	Oriental Magpie Robin	LC	IV
132	*Saxicoloides fulicatus*	Indian Robin	LC	IV
133	*Saxicola caprata*	Pied Bushchat	LC	IV
134	*Chloropsis jerdoni*	Jerdon's Leafbird	LC	IV
135	*Dicaeum agile*	Thick-billed Flowerpecker	LC	IV
136	*Dicaeum erythrorhynchos*	Pale-billed Flowerpecker	LC	IV
137	*Leptocoma zeylonica*	Purple-rumped Sunbird	LC	IV
138	*Cinnyris asiaticus*	Purple Sunbird	LC	IV
139	*Passer domesticus*	House Sparrow	LC	-
140	*Gymnoris xanthocollis*	Chestnut-shouldered Petronia	LC	-
141	*Ploceus philippinus*	Baya Weaver	LC	IV
142	*Euodice malabarica*	Indian Silverbill	LC	IV
143	*Amandava amandava*	Red Avadavat	LC	IV
144	*Lonchura striata*	White-rumped Munia	LC	IV
145	*Lonchura punctulata*	Scaly-breasted Munia	LC	IV
146	*Lonchura malacca*	Black-headed Munia	LC	IV
147	*Motacilla maderaspatensis*	White-browed Wagtail	LC	IV
148	*Anthus rufulus*	Paddyfield Pipit	LC	IV

***** *Status assigned by the International Union for Conservation of Nature and Natural Resources, where - EN – Endangered; NT – Near Threatened; LC – Least Concern; NA – Not Assessed.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). *Birds of the Indian Subcontinent.* Oxford University Press, pp 1-528; IUCN (2016). *The IUCN Red List of Threatened Species.* Version 2016-3; *Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

4.3.7.4 Mammals (other than Bats)

Table 4-26 lists the mammal species (other than bats) having recorded ranges that include the study area.

Table 4-26: Mammals (other than bats) of the Study Area

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
1	*Macaca radiata*	Bonnet Macaque	LC	II
2	*Semnopithecus hypoleucos achates*	Southern Plains Langur	LC	II
3	*Moschiola indica*	Indian Chevrotain	LC	I
4	*Muntacus muntjak*	Indian Muntjac	LC	III
5	*Rusa unicolor*	Sambar	VU	III
6	*Axis axis*	Spotted Deer	LC	III
7	*Boselaphus tragocamelus*	Nilgai	LC	III
8	*Tetracerus quadricornis*	Four-horned Antelope	VU	I
9	*Gazella benettii*	Indian Gazelle	LC	I
10	*Antilope cervicapra*	Blackbuck	NT	I
11	*Sus scrofa*	Indian Wild Pig	LC	III
12	*Panthera pardus*	Common Leopard	NT	I
13	*Felis chaus*	Jungle Cat	LC	II
14	*Prionailurus bengalensis*	Leopard Cat	LC	I
15	*Prionailurus rubiginosus*	Rusty Spotted Cat	VU	I
16	*Paradoxurus hermaphroditus*	Common Palm Civet	LC	II
17	*Viverricula indica*	Small Indian Civet	LC	II
18	*Herpestes edwardsii*	Grey Mongoose	LC	II
19	*Herpestes smithii*	Ruddy Mongoose	LC	IV
20	*Hyaena hyaena*	Striped Hyena	NT	III
21	*Canis lupus*	Grey Wolf	LC	I
22	*Canis aureus*	Golden Jackal	LC	II
23	*Vulpes bengalensis*	Indian Fox	LC	II
24	*Mellivora capensis*	Honey Badger	LC	I
25	*Lepus nigricollis*	Indian Hare	LC	IV
26	*Manis crassicaudata*	Indian Pangolin	NT	I
27	*Anathana ellioti*	Madras or Southern Tree Shrew	LC	II
28	*Suncus murinus*	House Shrew	LC	-
29	*Hystrix indica*	Indian Crested Porcupine	LC	IV
30	*Funambulus palmarum*	Three-striped Palm Squirrel	LC	-
31	*Tetera indica*	Indian Gerbil	LC	-
32	*Vandeleuria oleracea*	Indian Long-tailed Tree Mouse	LC	V
33	*Mus musculus*	House Mouse	LC	V
34	*Mus booduga*	Little Indian Field Mouse	LC	V
35	*Millardia meltada*	Soft-furred Field Rat	LC	V
36	*Madromys blanfordi*	White-tailed Wood Rat	LC	V

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
37	*Golunda ellioti*	Indian Bush Rat	LC	V
38	*Bandicota indica*	Large Bandicoot Rat	LC	V
39	*Bandicota bengalensis*	Lesser Bandicoot Rat	LC	V
40	*Rattus rattus*	House Rat	LC	V

***Status assigned by the International Union for Conservation of Nature and Natural Resources, where – NT –Near Threatened; VU- Vulnerable and LC – Least Concern.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: Vivek Menon (2014), *Indian Mammals: A Field Guide.* Hachette Book Publishing India Pvt. Ltd., Gurgaon, India, pp 1-522; IUCN (2016). *The IUCN Red List of Threatened Species.* Version 2016-3.

4.3.7.5 Reptiles

Table 4-27 lists the reptile species having recorded ranges that include the study area.

Table 4-27: Reptiles of the Study Area

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
1	*Python molurus*	Indian Rock Python	VU	I
2	*Ahaetulla nasuta*	Common Vine Snake	LC	IV
3	*Amphiesma stolatum*	Buff-striped Keelback	NA	IV
4	*Argyrogena fasciolatus*	Banded Racer	NA	IV
5	*Atretium schistosum*	Olive Keelback Water Snake	LC	II
6	*Boiga trigonata*	Common Indian Cat Snake	LC	IV
7	*Coelognathus radiatus*	Copper-headed Trinket Snake	LC	IV
8	*Dendralaphis tristis*	Common Bronzeback Tree Snake	NA	IV
9	*Lycodon aulicus*	Common Wolf Snake	NA	IV
10	*Lycodon striatus*	Barred Wolf Snake	NA	IV
11	*Oligodon arnensis*	Banded Kukri Snake	NA	IV
12	*Ptyas mucosa*	Indian Rat Snake	NA	II
13	*Xenochrophis piscator*	Checkered Keelback Water Snake	NA	II
14	*Bungarus caeruleus*	Indian Krait	NA	IV
15	*Naja naja*	Spectacled Cobra	NA	II
16	*Ramphotyphlops braminus*	Brahminy Blind Snake	NA	IV
17	*Daboia russelii*	Russell's Viper	LC	II
18	*Echis carinatus*	Saw-scaled Viper	NA	IV
19	*Calotes versicolor*	Indian Garden Lizard	NA	-
20	*Chamaeleo zeylanicus*	South Asian Chamaeleon	LC	II
21	*Hemidactylus frenatus*	Asian House Gecko	LC	-
22	*Hemidactylus reticulatus*	Reticulated Gecko	LC	-

23	*Ophisops leschenaultii*	Leschenault's Lacerta	NA	-
24	*Mabuya carinata*	Keeled Grass Skink	LC	-
25	*Sphenomorphus dussumieri*	Dussumier's Litter Skink	LC	-
26	*Varanus bengalensis*	Bengal Monitor	LC	I
27	*Melanochelys trijuga*	Indian Black Turtle	NT	-
28	*Lissemys punctata*	Indian Flapshell Turtle	LC	I

***Status assigned by the International Union for Conservation of Nature and Natural Resources, where – LC – Least Concern; NA – Not Assessed.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: Indraneil Das, Snakes & other Reptiles of India; Romulus Whitaker & Ashok Captain, Snakes of India, The field guide, 2015; IUCN Red Data (2016-3) The IUCN Red List of Threatened Species. Version 2016-3; Schedules I to VI: Indian Wildlife (Protection) Act, 1972.

4.3.8 Habitat Profile of the Study Area

4.3.8.1 Natural Habitats

The natural habitats in the study area represent degraded Southern Tropical Thorn Forest and Tropical Dry Deciduous Forests, with their natural vegetation profile modified to varying extents from place to place. Near-pristine patches of vegetation were also observed near water bodies and seasonal streams. Though these natural habitats are patchy and not in a pristine state, they are likely to be providing habitat needs to some specialist species, including windfarm vulnerable species.

4.3.8.2 Modified Habitats

The modified habitats in the study area comprise farmlands, pasturelands, habitations, bunds, ponds, lakes, tanks, canal, roads and wind energy installations.

4.3.8.3 Critical Habitats

Habitats critical to the survival of IUCN-designated Critically Endangered or Endangered species, migratory species, congregatory species and endemic or restricted range species are considered to be critical habitats.

4.3.8.4 Critically Endangered / Endangered Species

Table 4-28 lists the species designated by the IUCN as Critically Endangered or Endangered having recorded ranges that include the study area.

Table 4-28: Critically Endangered/Endangered Species of the Study Area

S. No.	Scientific Name	Common Name	IUCN Status*
Birds			
1	*Neophron percnopterus*	Egyptian Vulture	EN
2	*Gyps bengalensis*	White-rumped Vulture	CR
3	*Gyps indicus*	Indian Vulture	CR
4	*Sarcogyps calvus*	Red-headed Vulture	CR
5	*Ardeotis nigriceps*	Great Indian Bustard	CR
6	*Sypheotides indicus*	Lesser Florican	EN

***** *Status assigned by the International Union for Conservation of Nature and Natural Resources, where CR – Critically Endangered and EN – Endangered*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). *Birds of the Indian Subcontinent.* Oxford University Press, pp 1-528; IUCN (2016). *The IUCN Red List of Threatened Species.* Version 2016-3.

4.3.8.5 Endemic / Restricted Range Species

Table 4-29 lists the species which are reported as being endemic to, or have restricted ranges that include, the region in which the study area is situated.

Table 4-29: Endemic / Restricted Range Species of the Study Area

S. No.	Scientific Name	Common Name	Range
	Birds		
1	*Galloperdix lunulata*	Painted Spurfowl	Peninsular India
2	*Galloperdix spadicea*	Red Spurfowl	Peninsular India
3	*Perdicula argoondah*	Rock Bush Quail	Western & Central India
4	*Gallus sonneratii*	Grey Junglefowl	Southern Peninsula
5	*Strix ocellata*	Mottled Wood Owl	Peninsular India
	Mammals		
6	*Anathana ellioto*	Southern Tree Shrew	Peninsular India
7	*Macaca radiata*	Bonnet Macaque	Peninsular India

Sources: Jathar, G.A. & Rahmani, A.R. (2006). *Endemic Birds of India.* Buceros: ENVIS Newsletter: *A Checklist of Mammals of India with their distribution and conservation status.* ZSI e-publication; IUCN (2016). *The IUCN Red List of Threatened Species.* Version 2016-3,

4.3.8.6 Migratory Species

The entire Indian subcontinent, including the study area, falls within the limits of the Central Asian Flyway (CAF), one of the eight globally identified flyways. The CAF connects a large swathe of the Palaearctic region with the Indian subcontinent and contains several well-established routes along which a number of bird-species migrate annually. This flyway covers a large part of the continental area of Eurasia and includes the whole of the Indian sub-continent. Thus, the study area is very likely to be situated in the flight-path of the various winter, summer and passage visitor-birds migrating either to or through the region in which it is situated.

Migratory species of the windfarm-vulnerable avifaunal groups namely raptors and migratory waterfowl are listed under the heading 'Windfarm Vulnerable Fauna of the Study Area' **Table 4-30** lists the migratory avifaunal species, other than raptors and migratory waterfowl, having recorded ranges that include the study area or waterbodies in the catchments of which the study area is situated.

Table 4-30: Migratory Birds of the Study Area

S. No.	Scientific Name	Common Name	Season of migration	IUCN Status*	WPA Schedule**
1	*Coturnix coturnix*	Common Quail	Winter	LC	IV
2	*Coturnix coromandelica*	Rain Quail	Winter	LC	IV
3	*Porzana pusilla*	Baillon's Crake	Winter	LC	IV
4	*Turnix tanki*	Yellow-legged Buttonquail	Winter	LC	-
5	*Clamator jacobinus*	Jacobin Cuckoo	Summer	LC	IV
6	*Asio flammeus*	Short-eared Owl	Winter	LC	IV
7	*Merops philippinus*	Blue-tailed Bee-eater	Passage	LC	-

S. No.	Scientific Name	Common Name	Season of migration	IUCN Status*	WPA Schedule**
8	*Jynx torquilla*	Eurasian Wryneck	Winter	LC	IV
9	*Pitta brachyuran*	Indian Pitta	Summer	LC	IV
10	*Coracina melanoptera*	Black-headed Cuckooshrike	Passage	LC	IV
11	*Lanius cristatus*	Brown Shrike	Winter	LC	-
12	*Dicrurus leucophaeus*	Ashy Drongo	Winter	LC	IV
13	*Oriolus kundoo*	Indian Golden Oriole	Winter	LC	IV
14	*Terpsiphone paradisiaca*	Asian Paradise Flycatcher	Winter	LC	IV
15	*Hirundo rustica*	Barn Swallow	Winter	LC	-
16	*Cecropis daurica*	Red-rumped Swallow	Winter	LC	-
17	*Acrocephalus stentoreus*	Clamorous Reed Warbler	Winter	LC	-
18	*Acrocephalus dumetorum*	Blyth's Reed Warbler	Passage	LC	-
19	*Phylloscopus trochiloides*	Greenish Warbler	Passage	LC	-
20	*Sylvia curruca*	Lesser Whitethroat	Winter	LC	-
21	*Sylvia althaea*	Hume's Whitethroat	Winter	LC	-
22	*Sturnia malabarica*	Chestnut-tailed Starling	Winter	LC	IV
23	*Pastor roseus*	Rosy Starling	Winter	LC	IV
24	*Luscinia svecica*	Bluethroat	Winter	LC	IV
25	*Phoenicurus ochruros*	Black Redstart	Winter	LC	IV
26	*Saxicola torquatus*	Common Stonechat	Winter	LC	IV
27	*Monticola solitaries*	Blue Rock Thrush	Winter	LC	IV
28	*Muscicapa daurica*	Asian Brown Flycatcher	Winter	LC	IV
29	*Ficedula parva*	Red-breasted Flycatcher	Winter	LC	IV
30	*Ficedula albicilla*	Taiga Flycatcher	Winter	LC	-
31	*Ficedula superciliaris*	Ultramarine Flycatcher	Winter	LC	IV
32	*Eumyias thalassinus*	Verditer Flycatcher	Winter	LC	IV
33	*Cyornis tickelliae*	Tickell's Blue Flycatcher	Winter	LC	IV
34	***Motacilla flava***	**Yellow Wagtail**	**Winter**	LC	IV
35	*Motacilla cinerea*	Grey Wagtail	Winter	LC	IV
36	*Motacilla alba*	White Wagtail	Winter	LC	IV
37	*Anthus godlewskii*	Blyth's Pipit	Winter	LC	IV
38	*Anthus trivialis*	Tree Pipit	Winter	LC	IV
39	*Anthus hodgsoni*	Olive-backed Pipit	Winter	LC	IV
40	*Carpodacus nipalensis*	Common Rosefinch	Winter	LC	IV
41	***Emberiza melanocephala***	**Black-headed Bunting**	**Winter**	LC	IV
42	*Emberiza bruniceps*	Red-headed Bunting	Winter	LC	IV

**Status assigned by the International Union for Conservation of Nature and Natural Resources, where –LC – Least Concern and NA- Not assessed.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). *Birds of the Indian Subcontinent.* Oxford University Press, pp 1-528; Salim Ali (2012) reprinted. *The Book of Indian Birds*. Oxford University Press, pp 1-326; IUCN (2016). *The IUCN Red List of Threatened Species.* Version 2016-3; *Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

4.3.8.7 Congregatory Species

Congregatory species include the species that gather in globally significant numbers at a particular site and at a particular time in their life cycle for feeding, breeding or resting (during migration).

Table 4-31 lists the congregatory species having recorded ranges that include the study area.

Table 4-31: Congregatory Species of the Study Area

S. No.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
1	*Phalacrocorax niger*	Little Cormorant	LC	IV
2	*Phalacrocorax fuscicollis*	Indian Cormorant	LC	IV
3	*Phalacrocorax carbo*	Great Cormorant	LC	IV
4	*Mycteria leucocephala*	Painted Stork	NT	IV

**Status assigned by the International Union for Conservation of Nature and Natural Resources, where NT – Near threatened; LC – Least Concern.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). *Birds of the Indian Subcontinent.* Oxford University Press, pp 1-528; Salim Ali (2012) reprinted. *The Book of Indian Birds*. Oxford University Press, pp 1-326; IUCN (2015). *The IUCN Red List of Threatened Species.* Version 2015-4; *Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

4.3.8.8 Species of Conservation Concern

Amongst the three groups of species considered to be especially vulnerable to risk of death or injury from interaction with wind turbines, namely, raptors, migratory waterfowl and bats, it is only the globally threatened or near-threatened species which, because of their already low or fast-decreasing numbers, face a risk from the proposed project at a species level, and thus represent a conservation concern.

Table 4-32 lists the species of raptors and migratory waterfowl that are designated as globally threatened or near-threatened by the IUCN and have reported ranges that include the study area. ***None of these was observed during the field survey.***

None of the bat species associated with the study area is designated by the IUCN as globally threatened or near-threatened.

Table 4-32: Species of Conservation Concern

S. No.	Scientific Name	Common Name	IUCN Status*
1	*Falco jugger*	Laggar Falcon	NT
2	*Neophron percnopterus*	Egyptian Vulture	*EN*
3	*Gyps bengalensis*	White-rumped Vulture	*CR*
4	*Gyps indicus*	Indian Vulture	*CR*
5	*Sarcogyps calvus*	Red-headed Vulture	*CR*
6	*Circus macrourus*	Pallid Harrier	*NT*
7	*Aythya ferina*	Common Pochard	*VU*

S. No.	Scientific Name	Common Name	IUCN Status*
8	*Limosa limosa*	Black-tailed Godwit	*NT*
9	*Numenius arquata*	Eurasian Curlew	*NT*

***** *Status assigned by the International Union for Conservation of Nature and Natural Resources, where CR – Critically Endangered; EN – Endangered; NT – Near Threatened and VU – Vulnerable.*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). *Birds of the Indian Subcontinent.* Oxford University Press, pp 1-528; Salim Ali (2012) reprinted. *The Book of Indian Birds*. Oxford University Press, pp 1-326.

4.3.9 Designated Areas

Designated areas include nationally or internationally recognized ecologically sensitive areas such as legally protected areas, namely, Protected Forests, Reserve Forests, Wildlife Sanctuaries and National Parks, as also, Important Bird Areas and Ramsar Sites.

4.3.9.1 Legally Protected Areas

No documented details of legally protected areas (such a Reserve Forest, Protected forest, etc.) around the site was available in the Public domain for review, however as per “state map series” of Survey of India for Karnataka state, 1992, there are no forest areas depicted within 10 km distance from the study area.

4.3.9.2 Important Bird Areas (IBA)

The Bhimgad Wildlife Sanctuary is the nearest Important Bird Area. It is situated approximately 185 km southwest of the study area.

4.3.9.3 Ramsar Sites

The nearest Ramsar Site is Kolleru Lake. It is situated about 600 km east of the study area.

4.3.10 Ecosystem Services

4.3.11 Provisioning Services

The study area provides provisioning ecosystem services through the soil in which agricultural crops are cultivated by the local communities, as also, wild plants that serve the food, fodder, fuel-wood and timber needs of the local communities.

Crops

Table 4-33 lists the major crops cultivated in the study area.

Table 4-33: Major Crops of the Study Area

S. No.	Species	Common Name	Type of Crop
1	*Sorghum vulgare*	Great Millet	Grain
2	*Pennisetum typhoideum*	Pearl Millet	Grain
3	*Zea mays*	Maize	Grain
4	*Triticum aestivum*	Wheat	Grain
5	*Cajanus cajan*	Pigeon Pea	Grain
6	*Amaranthus paniculatus*	Amaranth	Vegetable
7	*Allium cepa*	Onion	Vegetable
8	*Lycopersicum esculentum*	Tomato	Vegetable
9	*Capsicum frutescens*	Chili	Spice
10	*Abelmoschus esculentum*	Lady’s finger	Vegetable
11	*Curcuma longa*	Turmeric	Spice

S. No.	Species	Common Name	Type of Crop
12	*Saccharum officinale*	Sugarcane	Sugar
13	*Helianthus annuus*	Sunflower	Oil-seed
14	*Ricinus communis*	Castor	Oil-seed
15	*Gossypium herbaceum*	Cotton	Fibre
16	*Calendula spp.*	Marigold	Flower

Source: AECOM's site survey.

Fodder

The natural vegetation of the study area, including the plant cover of fallow lands, provides fodder to the livestock of the area.

Fuelwood and Timber

The trees and shrubs growing naturally in the study area provide fuel-wood and timber to the local communities.

4.3.12 Regulating Services

The natural functioning of the ecosystems in the study area leads to the following processes that provide both, direct and indirect benefits to the local communities.

Ground Water Recharge

The natural and seasonal water-flows present in the study area, contributes to the recharge of wells, ponds and lakes of the area which provide the freshwater needs of the local communities. The vegetation cover of the area also helps to slow down the surface run-off, which in turn increases the percolation of water into sub-surface layers, thereby promoting the recharge of groundwater.

Surface Water Purification

The plants and soil organisms of the study area absorb and process a number of chemical compounds dissolved in local water-flows, effectively recycling wastes and purifying the water. The vegetation cover of the study area, especially its collective root systems, also acts as a physical filtration system, filtering out particulate matter as the water flows towards the area's ponds, lakes, streams and rivers. Thus, the study area contributes to the regulation of the water-quality of the area by purifying surface water.

Soil Erosion Control

The vegetation cover of the study area anchors soil-particles and binds them together, lowering the rate of soil erosion by water and wind. Thus, the study area contributes to control of soil erosion in the area.

Pollination and Pest Control

The vegetation cover of the study area provides habitats to a range of faunal species that include pollinator species, such as, pollen or nectar feeding insects and birds, as well as, insectivorous species, including frogs, lizards, birds and bats. By harbouring such species, the study area provides pollinator-services and pest-control services to natural, as well as, agricultural plants in the area.

4.3.13 Supporting Services

The natural functioning of the ecosystems of the study area lead to the following processes that create or maintain basic natural resources, such as soil-nutrients and photosynthetic production, that support human life-sustaining activities, such as farming, food-gathering, cooking and grazing of livestock.

Nutrient Capture and Recycling

The food-chains constituted by the organisms of the study area are continuously involved in the capture and transfer of the macro and micro nutrients in the soil, water and air, effectively recycling nutrients and making them available in the nutrient-sinks of the local ecosystems. The biomass generated by the study area, and transferred

physically by water and wind, helps recharge the soil-fertility in the surrounding area. Thus, the natural vegetation and topography of the study area contribute to the natural productivity of the area.

Primary Production

The photosynthetic organisms of the study area act as primary producers, creating food-reserves that directly or indirectly support the consumers of the area, including the local communities. This primary production includes, besides a number of resources utilized directly by local communities (and covered under Provisioning Services), the grass blades and leaves consumed by grazing and browsing animals like grasshoppers, bugs, beetles, snails, goats and sheep, the flowers, pollen and flower-nectar consumed by butterflies, moths, bees and sunbirds, the seeds consumed by seed and grain-eaters like ants, sparrows, larks, pipits and mice, and the fruits consumed by birds and bats.

4.3.14 Cultural Services

A number of small temples situated in the study area are active places of worship providing cultural services to the local communities in the area.

4.4 Socio-Economic Environment

This section presents the baseline status of the socio-economic aspects in the Project area.

4.4.1 Approach and Methodology

The scope of work as detailed out in the Proposal has been the guiding criteria for undertaking the Environmental & Social Impact Assessment (ESIA) study. The turbine location and associated facilities of the project falls in Vijayapura District of the state of Karnataka.

In order to undertake the primary survey and identify and consult stakeholders of the project, the locations of the turbines and its associated facilities was considered for the study.

The villages from which land has been procured are defined as project villages. The villages falling within 5Km of the project area and likely to be affected due to the Project and its associated facilities such as access roads, transmission lines and substation are identified as Project Influenced Villages.

A structured questionnaire was prepared to undertake the focus group discussions and socio-economic survey of the project affected persons/families (land sellers). Besides the affected persons/families, other stakeholder groups were also consulted to understand the concerns, issues and interest that they might have on the project.

The approach that was adopted to study socio- economic condition has been based on the following elements:

4.4.1.1 Review of Secondary Information

A detailed review and assessment of the secondary information for the project district comprising locations of the turbines and associated facilities was undertaken. Review of documents was undertaken in order to attain a comprehensive understanding of the area in relation to its socio-economic characteristics. The following documents were assessed to supplement the desk based research:

- Primary Census Abstract (PCA) 2001;
- Primary Census Abstract (PCA) 2011;
- Village Directory (VD) 2001; and
- Government of India Planning Commission 2013.

4.4.1.2 Collation of Primary Data

Primary data on socio-economic status was collected from project affected persons/families belonging to the villages where the wind turbine and associated facilities of the project are proposed to be located. Apart from the

baseline information, stakeholders were also broadly identified and consulted during this activity to outline their concerns and interest in the project.

Interviews were conducted with local influential people, project affected persons/families and site representatives of the Project Proponent.

4.4.2 Administrative and Physical Setting

The State of Karnataka has been divided into four Revenue divisions, 49 sub-divisions, 30 districts, 177 taluks for administrative purposes. The details for the jurisdiction are presented in the **Table 4-34** below. Project area lies in the Belgaum Revenue division and comes under the jurisdiction of Bijapur.

Table 4-34: Jurisdictions of the Revenue Divisions of Karnataka

Name of Revenue Division	Location of RDK	Districts Under Jurisdiction
Bengaluru Revenue Division	Bengaluru	Bengaluru Urban, Bengaluru Rural, Chikaballapura, Chitradurga, Davanagere, Kolar, Ramanagar, Shimoga, Tumakur
Mysore Revenue Division	Mysore	Chamarajanagar, Chikamaglur, Dakshina Kannada, Hassan, Kodagu, Mandya, Mysore, Udupi
Belgaum Revenue Division	Belgaum	Bagalkot, Belgaum, Bijapur, Dharwad, Gadag, Haveri, Uttara Kannada
Gulbarga Revenue Division	Gulbarga	Bellary, Bidar, Gulbarga, Koppal, Raichur, Yadgir

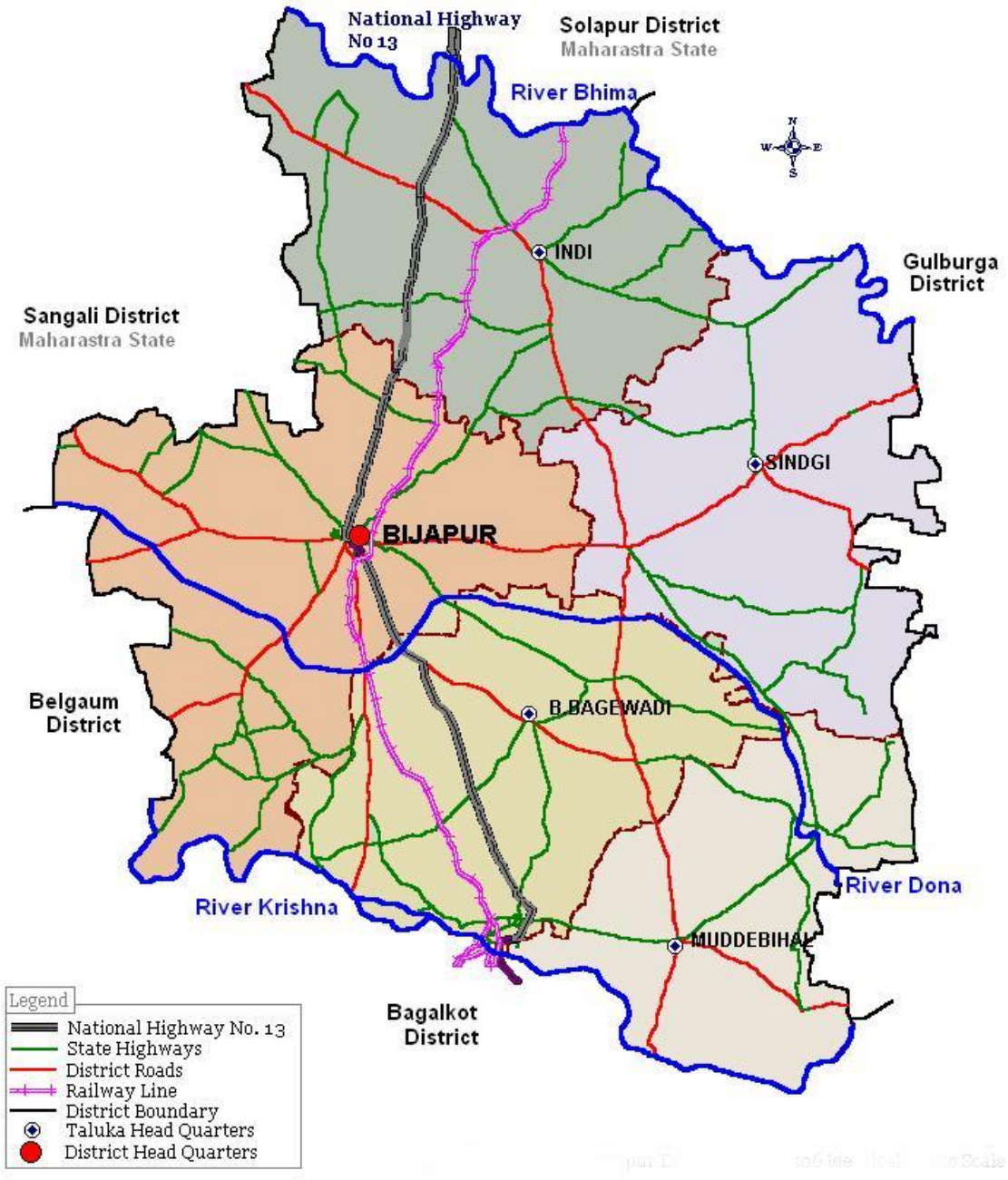
Source : http://nidm.gov.in/

Bijapur town is the headquarters of the district. The district has a total geographical area of 10,541 sq kms. The district has been divided into five taluks for administrative convenience viz. Basavana Bagewadi, Bijapur, Indi, Muddebial and Sindagi taluks. The population and density of the district as per the 2001 Census is 18, 06,918 and 245 respectively. Project Area for wind farm lies under the Bijapur Taluka.

Table 4-35: Taluk- wise Area, and the number of Villages

S. No	Taluk	Area (sq. km)	No. of villages
1	Basavana Bagewadi	1979	126
2	***Bijapur***	***2659***	***118***
3	Indi	2225	132
4	Muddebial	1502	153
5	Sindagi	2176	148

Source: Census, 2011



Source : Administrative atlas of India, Census of India, 2011

4.4.3 Project Affected Villages

As the study area falls within Bijapur taluka of Vijayapura District (officially known as Vijayapura) of Karnataka State, the administrative area of the study area have been provided in Table below

Table 4-36: Administrative Area within the Study Area

State	District	Taluka
Karnataka	Bijapur/ Vijayapur	Bijapur

The villages wherein the turbine location and associated facilities are situated have been selected as the study area. The lists of villages which fall within the study area are provided in **Table 4-37**.

Table 4-37: List of Villages falling within the Study Area

District	Taluka	Village Name
Bijapur/ Vijayapur	Bijapur	Tonsyal
		Karjol

District	Taluka	Village Name
		Kakhandaki

4.4.4 Demographic Profile

Details concerning the socio-economic and demographic profile of the study area will include one (01) district, one (01) taluka and the three (3) villages have been elaborated in the following sections of the report.

4.4.4.1 Population

District

The **Table 4-38** below highlights the demographic profile of the Project District.

Table 4-38: Demographic Profile of the District within the Study Area

District	2001			2011			Decadal Growth Rate (in %)
	Total Population	Total Male Population	Total Female Population	Total Population	Total Male Population	Total Female Population	
Bijapur/ Vijayapur	1806918	926424	880494	2177331	1111022	1066309	20.49

Source: 2001 and 2011 Census Data`

It can be observed from the **Table 4-38** above that there has been decadal growth of 20.49% in Vijayapura District between 2001 and 2011. The population density of Vijayapura District in 2011 was 207 inhabitants per sq.km.

Taluka

Below in **Table 4-39** the decadal growth of the population in the Taluka within the study area has been provided.

Table 4-39: Demographic Profile of the Taluka within the Study Area

District	Taluka	2001			2011			Decadal Growth Rate (in %)
		Total Population	Total Male Population	Total Female Population	Total Population	Total Male Population	Total Female Population	
Bijapur/ Vijayapur	Bijapur	569348	292,687	276,661	721075	367179	353896	26.64

Source: 2001 and 2011 Census Data

The table above depicts that there has been an increase of population in the project taluka in terms of decadal growth with both the rate of male and female population increasing at equal par.

Villages

In reference to the villages that fall within the study area, the decadal growth of population have been provided in **Table 4-40** below

Table 4-40: Demographic Profile of the Villages falling under the Study Area

Village	2001			2011			Decadal Growth Rate (in %)
	Total Population	Total Male Population	Total Female Population	Total Population	Total Male Population	Total Female Population	
Tonsyal	1720	903	817	1824	917	907	6.04

Karjol	3212	1665	1547	3413	1656	1757	6.25
Kakhandaki	7979	4033	3946	7038	3608	3430	-11.79

Source: 2001 and 2011 Census Data

It can be inferred from the table above that Tonsyal village and Karjol under Bijapur Taluka have seen a decadal growth in population between 2001 and 2011 at 6.04% and 6.25% respectively. Village Kakhandaki of Bijapur Taluka shows a decline in population from 2001 to 2011 and shows a decadal trend of – (minus) 11.79%.

4.4.4.2 Sex Ratio

District

According to the 2011 Census data, in Vijayapura District there are 960 females to every 1000 males. The average national sex ratio in India is 940 as per latest reports of Census 2011 Directorate. In 2011 census, child sex ratio in the district recorded was 931 girls per 1000 boys compared to figure of 928 girls per 1000 boys of 2001 census data.

Taluka

The sex ratio in the Bijapur Taluka shows a healthy trend with the ratio of females at 982 to every 1000 males.

Villages

The **Table 4-41** below shows the sex ratio that is present in the villages that fall within the study area.

Table 4-41: Demographic Profile of the Villages falling under the Study Area

Taluka	Village	Sex Ratio (no. of female to every 1000 males)
Bijapur	Tonsyal	989
	Karjol	1061
	Kakhandaki	951

Source: 2011 Census Data

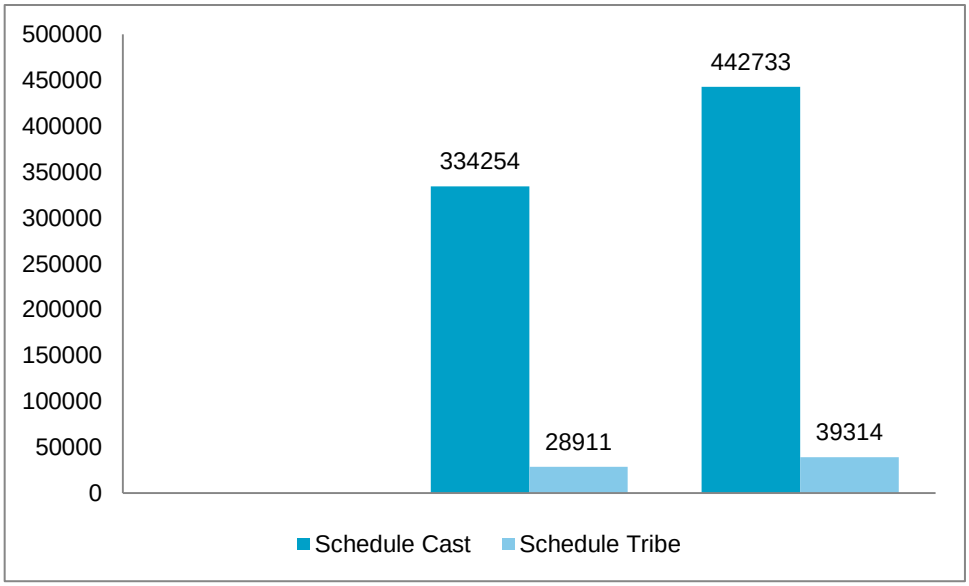
As observed from the table above, Karjol village has a sex ratio with 1061 females to every 1000 males. Tonsyal village has a sex ratio of 989 females followed by Kakhandaki with 951 females to every 1000 males.

4.4.4.3 Social Stratification

Social stratification is a concept which classifies people into groups based on the hierarchical structures of class and status in any society. In India, the society is stratified along caste and tribe lineage. The terminology of Scheduled Caste (SC) and Scheduled Tribe (ST) has been adopted in the Constitution of India and a sizeable amount of people fall within both these categories. These categories of people highlight the disadvantaged and oppressed classes.

District

The SC population in Vijayapura District grew to 4, 42,773 (20.34% of total population) in 2011 from 3, 34,254 (18.50% of total population) in 2001. The ST population of the District also grew up from 28,911(1.60%) in 2001 to 39314 (1.81%) in 2011. It can be observed that the District has shown a decade increase of 32.5 % in SC population and 36% in ST population.

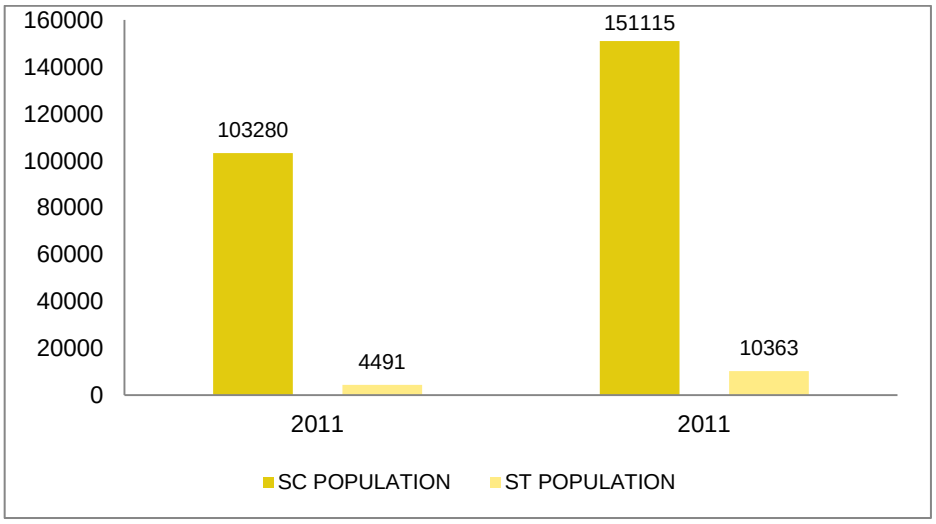


Source: 2001 and 2011 Census Data

Figure 4-16: Decadal Growth of SC and ST Population of Vijayapura District

Taluka

As observed from the figure below the SC population in 2011 has shown a variation at 151115 (20.96 as compared to the data available from 2001 which shows the SC population was 103280 (18.14 %). ST population has shown an increase in Bijapur Taluka from 0.79% in 2001 to 1.44% in 2011.



Source: 2001 and 2011 Census Data

Figure 4-17: Decadal Growth of SC and ST Population of Bijapur Taluka

Villages

Details of the SC and ST category of population residing in the villages within the study area have been depicted in **Table 4-42**.

Table 4-42: SC and ST Population in the villages falling under the Study Area

Village Name	2001		2011	
	SC Population	ST Population	SC Population	ST Population
Tonsyal	310	0	316	18
Karjol	1055	0	1150	24
Kakhandaki	1366	1	1485	1

Source: 2001 and 2011 Census Data

The above table shows the SC and ST population of all the villages within the study area of the project. As depicted in the table, in 2011 the highest SC population was observed to be in Kakhandaki village at 1485 persons followed by Karjol village at 1150 persons. The lowest SC population was observed in village Tonsyal at 316 persons. Karjol village of Bijapur Taluka showed ST population at 24 and Tonsyal at 18 persons while Kakhandaki villages showed just 1 person belonging to ST category.

4.4.4.4 Religious Demography

According to the 2011 Census Data, the religious demography of the population in the project district has been provided in **Table 4-43**.

Table 4-43: Religious Demography of the Population in the Project District

District	Religion Wise Data as per the Census 2011 (in %)							
	Hindu	Muslim	Christianity	Sikh	Buddhist	Jain	Others	Not Stated
Bijapur	82.07	16.97	0.11	0.03	0.02	0.40	0.02	0.39

Source: 2001 and 2011 Census Data

As observed from the table above, most of the population in Vijayapura District are the followers of Hinduism with 82.07%, 16.97% of population follows Islam. All other religion followings (Christianity, Sikh, Buddhist, Jain, Others) are found to be minimal.

4.4.4.5 Status of Poverty Level

The level of poverty in an area highlights the economic status of the people and whether they are able to afford certain amenities for their survival. The Below Poverty Level (BPL) status is taken by the Government of India as an economic benchmark and poverty threshold to indicate the economic disadvantage and identify individuals and households in need of government assistance and aid. The percentage of people living below poverty line in Karnataka has come down by 9.7% in the estimate of poverty for 2009-10, released by the planning commission. In 2004-05, the percentage of people living below poverty line was 33.3% while in 2009- 10, it was 23.6%. State Specific Poverty Lines for 2011-2012 is presented in table below.

Table 4-44: Karnataka State Poverty Line for 2011-2012

State	Monthly per capita (Rs.)	
	Rural	Urban
Karnataka	902	1089

Source: Government of India Planning Commission 2013.

The Department of Cooperation, Government of Karnataka provides with schemes aiming to expand and extend the credit base to the weaker sections and minorities in the society by enrolling them as members of Co-operative Societies. Economically weaker sections of the people belonging to BPL, SC, ST, BC, Minorities,

women, physically disabled will be able to get the facilities made available by the respective co-operative societies which will uplift them socially/financially.

The government has launched programme called anna bhagya yojana to supply food grains at free of cost to priority household (antyodaya anna yojana (aay) + below poverty line (bpl)) families across the state.

Table 4-45: BPL status of Households in Project Taluka

Taluka	No. of BPL card Holders		
	Anthyodaya[5]	Akshaya[6] with Cylinder	Akshaya without Cylinder
Bijapur	16269	7187	102308

Bijapur taluka has 16269, 7187 and 102308 Anthyodaya, Akshaya with cylinder and Akshaya without cylinder card holders respectively.

4.4.4.6 Status of Literacy Level

District

Table 4-46 below presents the literacy level in the project district i.e. Bijapur/ Vijayapur (as per Census 2001 and Census 2011 data).

Table 4-46: Literacy Level of Vijayapura District

District	2001			2011		
	Total	Male	Female	Total	Male	Female
Vijapura	866561	543869	322692	1248268	730566	517702

Source: 2001 and 2011 Census Data

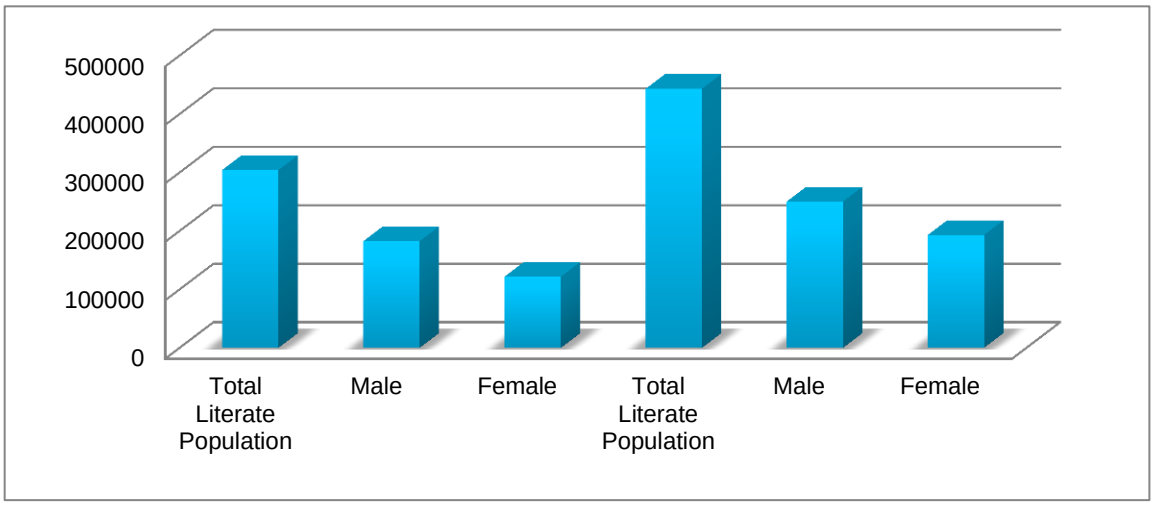
Average literacy rate of Vijayapura District is 67.15 % in year 2011 against the literacy rate of 57.01% in the year 2001. It is observed that male literacy rate in Vijayapura District of Karnataka is 77.21 % and female literacy rate is 56.72 % in the year 2011 whereas in 2001, the male and female literacy rate was 69.94% and 43.47% respectively.

Taluka

The literate population in the Taluka within the study area as per the 2001 and 2011 Census Data have been provided in **Figure 4-18** below.

[5] *Antyodaya families' are the poorest families amongst the Below Poverty Line (BPL) families identified by the State Government of Karnatka. Such families are entitled to receive food grains under the Antyodaya Anna Yojana Scheme initaied by the State Government.*

[6] *Akshaya cards are issued to BPL Card Holder Families. The families whose income is less than Rs.12,000/- per annum in Rural area and Rs.17,000/- per annum in urban areas are eligible to apply for the Akshaya cards.*



Source: 2001 and 2011 Census Data

Figure 4-18: Literacy Level in the Taluka within Study Area

As observed in the figure above, the percentage of literates as per Census 2001 records in Bijapur Taluka were 53% and in 2011 the percentage of literate had increased to 61% as per census 2011, thus showing an increasing trend of literates between 2001 and 2011.

Villages

The details of the literate population of the villages within the study area are provided in **Table 4-47**.

Table 4-47: Details of literate population in the villages falling under the Study Area

	2001			2011		
Village	Total Literate Population	Male	Female	Total Literate Population	Male	Female
Tonsyal	833	550	283	1029	623	406
Karjol	1068	710	358	1690	957	733
Kakhandaki	2788	1766	1022	3420	2054	1336

Source: 2001 and 2011 Census Data

As observed from the table above, in 2011 the highest literate population rate amongst the villages could be observed in Tonsyal village at 56% literates followed by Karjol at 50% literates. The highest male literate population can be observed at Tonsyal village with 61% literacy whereas the highest female literate population can be observed at Karjol village with 43% of females being literate.

4.4.5 Land Use Pattern

Villages

The details of the land use classification of the villages under study area have been provided in **Table 4-48**.

Table 4-48: Land use pattern of the villages in the Study Area

Villages	Total Area(ha)	Forest Land (ha)	Total irrigated Land (ha)	Un-Irrigated Land (ha)	Cultivable waste (ha)	Not available for Cultivation (ha)

Villages	Total Area(ha)	Forest Land (ha)	Total irrigated Land (ha)	Un-Irrigated Land (ha)	Cultivable waste (ha)	Not available for Cultivation (ha)
Tonsyal	1334	0	20.23	1192.16	34.6	87.01
Karjol	3565	0	38.84	2911.87	214.49	399.8
Kakhandaki	8724	0	1230.51	7160.43	49.77	283.29

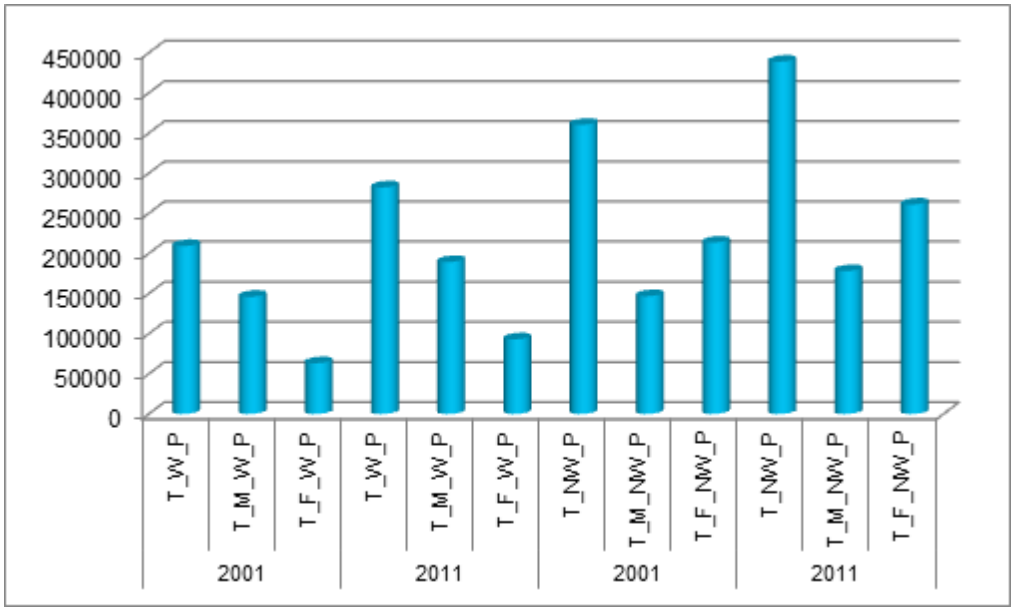
Source: Village Directory 2001

The table above highlights that most of the land area in the villages within the study area is used for agricultural activities based on rain-fed conditions. The highest irrigated area can be observed in Kakhandaki village while in village Tonsyal total irrigated land is the lowest at 20.23 (ha).

4.4.6 Socio-Economic Profile of the Project Area

4.4.6.1 Workforce Participation

District



Source: 2001 and 2011 Census Data

Figure 4-19: Details of Workforce Participation in the Vijayapura District

T_W_P: Total Working Population; T_W_M_P: Total Working Male Population; T_W_F_P: Total Working Female Population; T_NW_P: Total Non-Working Population; T_NW_M_P: Total Non-Working Male Population and T_NW_F_P: Total Non-Working Female Population

Work force participation rate is defined as the percentage of total workers (main and marginal) as compared to the total population. Details of the workforce participation in the Vijayapura District as per Census Data of 2001 and 2011 have been presented in **Figure 4-19**.

As observed from the figure above, the rate of workforce participation of Vijayapura District has shown a slight increase from the year 2001 with 39.7% to 42.6% in the year 2011 and the non-worker population has declined from 60.25% in the year 2001 to 55.2% in 2011. It has been found that there has been a decadal growth in the total male working population by 24.04% and total female working population by 38.7%.

Main workers are considered as those workers who have been engaged in any economically productive activity for 183 days or more while marginal workers are those that have worked for less than 183 days in a year. The breakup of main and marginal workers in the district as per the 2001 and 2011 Census Data have been provided in **Table 4-49**.

Table 4-49: Breakup of Main and Marginal Workers in Vijayapura District

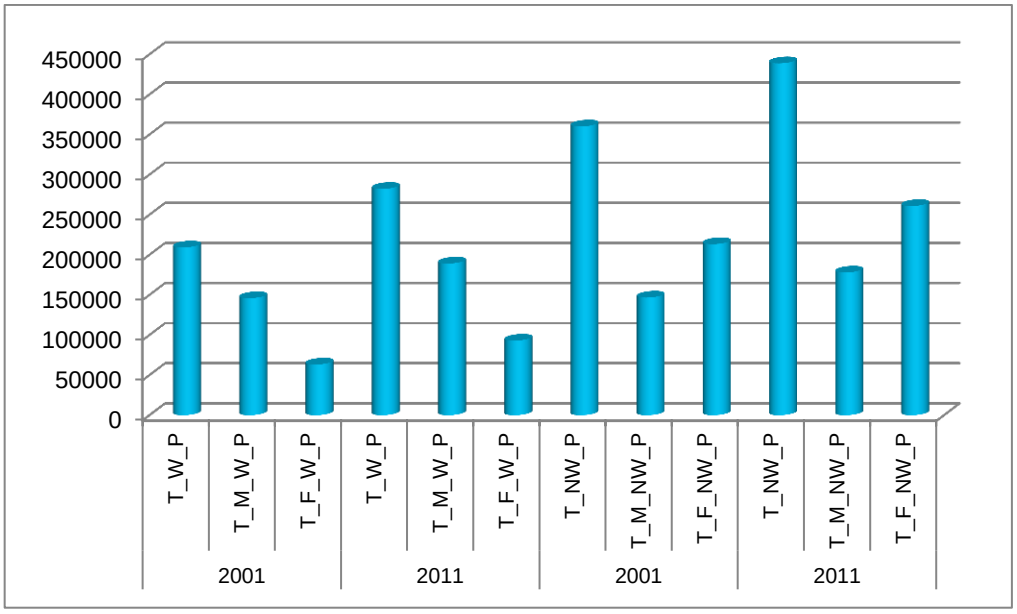
Area	Total Workers		Main Workers		Marginal Workers	
	2001	2011	2001	2011	2001	2011
Vijayapura District	718213	927722	551972	760083	166241	167639

Source: 2001 and 2011 Census Data

As observed from the Table above, the total number of main workers is higher as compared to that of marginal workers. The total number of main workers recorded in 2011 in Vijayapura District was760083 (56.75%) and marginal workers was 167639 (20.73%) of total working population.

Taluka

The details of the workforce participation of the population residing in the Bijapur Taluka have been presented in the figure below.



Source: 2001 and 2011 Census Data

Figure 4-20. Details of Workforce Participation of the Taluka

T_W_P: Total Working Population; T_W_M_P: Total Working Male Population; T_W_F_P: Total Working Female Population; T_NW_P: Total Non-Working Population; T_NW_M_P: Total Non-Working Male Population and T_NW_F_P: Total Non-Working Female Population
Source: 2001 and 2011 Census Data

As observed from the Figure above, the rate of workforce participation in 2011 in Bijapur taluka is 282254 (12.96%) and the total non-working population in 2011 was higher in Bijapur taluka at 438821 (20.15%) compared to the working population as per the 2011 census data.

The breakup of main and marginal workers in the Taluka within the study area is presented in Table below.

Table 4-50: Breakup of Main and Marginal Workers of the Taluka

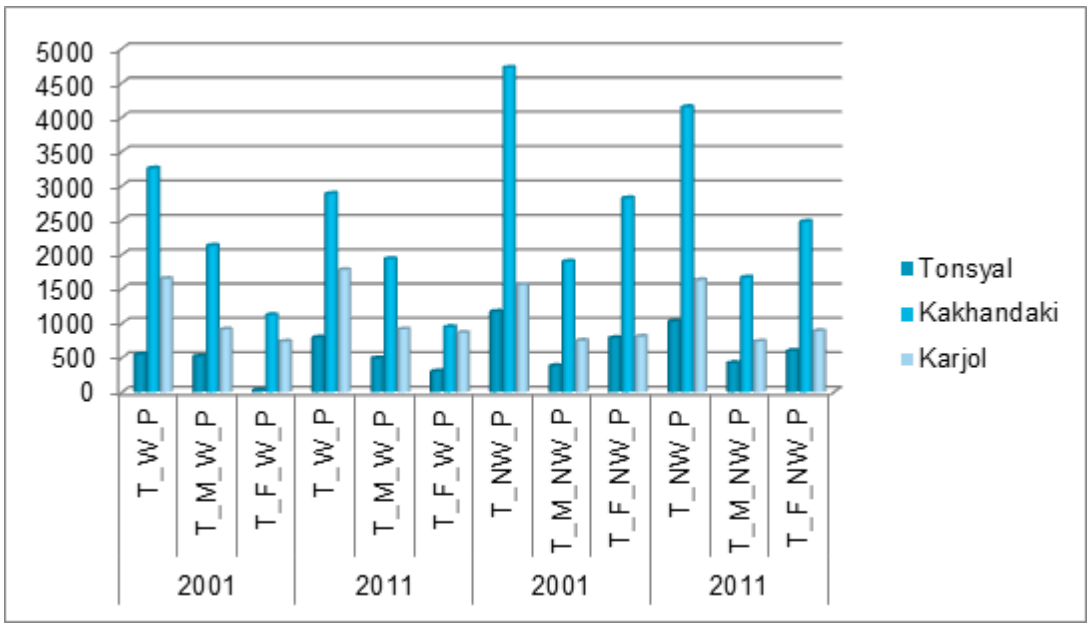
Area	Total Workers		Main Workers		Marginal Workers	
	2001	2011	2001	2011	2001	2011
Bijapur Taluka	209225	282254	167598	227949	41627	54305

Source: 2001 and 2011 Census Data

As depicted in the Table above, in 2011 the main workers in Bijapur are 227949 (80%) and marginal worker are 54305 (20%) of total working population engaged for more than 183 days in a year.

Villages

The details of the workforce participation of the population residing in the villages within the study area have been provided in **Figure 4-21** below.



Source: 2001 and 2011 Census Data

Figure 4-21: Details of Workforce Participation in the Villages falling under the Project affected Study Area

T_W_P: Total Working Population; T_W_M_P: Total Working Male Population; T_W_F_P: Total Working Female Population; T_NW_P: Total Non-Working Population; T_NW_M_P: Total Non-Working Male Population and T_NW_F_P: Total Nonworking Female Population

Source: 2001 and 2011 Census Data

As observed from the Figure above, the highest total working population in 2011 is present in Kakhandaki village with 2888 individuals engaged in some sort of activities. The lowest working population is available in Tonsyal village with 796 individuals working. The highest non-working population is also available in Kakhandaki village with 4150 individuals unemployed. The breakup of main and marginal workers in the villages falling under project affected study area is presented in **Table 4-51**.

Table 4-51: Breakup of the Total Workers in different classes of the Villages falling within the Study Area

Area	Total Workers		Main Workers		Marginal Workers		Non-Workers	
	2001	2011	2001	2011	2001	2011	2001	2011
Tonsyal	548	796	450	483	98	313	1172	1028

Area	Total Workers		Main Workers		Marginal Workers		Non-Workers	
	2001	2011	2001	2011	2001	2011	2001	2011
Karjol	1651	1781	1387	1693	264	88	1561	1632
Kakhandaki	3257	2888	2126	2254	1131	634	4722	4150

Source: 2001 and 2011 Census Data

From the table above, it can be observed that in 2011, the highest main workers were present in Kakhandaki at 2254 individuals engaged more than 183 days in a year. The highest marginal workers during the same period have also been reported from Kakhandaki Village at 634 individuals engaged less than 183 days in a year.

4.4.6.2 Occupation Pattern

Vijayapura, one of the famous heritage cities in Karnataka state is also one of the industrial developing locations in the state. The business sector in the Vijayapura area mainly constitutes of cements and sugar industries. However, agriculture and related business is the major livelihood of most of the people residing in Bijapur.

Cereals and pulses are some of the prominent crops cultivated in Bijapur. Sunflower, groundnut and safflower are the oilseed crop and grapes, pomegranate, guava, sapota and lime are the fruit crops cultivated in the farms of Bijapur. Cotton and sugarcane are the major commercial crops cultivated in the Vijayapura District. Mainly small scale industries like agriculture and food processing, textile industries and sugarcane production are seen in Bijapur, while large scale industries are rare in the area. Small scale industries and agriculture can be considered as the back bone of Vijayapura's economy.

Vijayapura is also one of the most heritage cities in Karnataka so tourism also contributes to the economy in the District. In Vijayapura, 74% of the total land area is used for cultivation and the main occupation of majority of the people in the area is cultivation. A total of 17.3% cultivated lands are irrigated regularly. Cultivation on the remaining land area largely depends upon rainfall.

District

The occupational pattern of the population refers to the choice of sector of employment that workers are dependent upon[7].The occupational pattern of the population as recorded during the 2001 and 2011 Census in Vijayapura District have been provided in the following **Table 4-52**.

Table 4-52: Occupation Pattern in the Vijayapura District

District	Main Workers				Marginal Workers			
	Cultivators	Agricultural Labourers	Household Activities	Other Workers	Cultivators	Agricultural Labourers	Household Activities	Other Workers
				2001				
Vijayapur	199145	163099	17497	172231	17911	123640	3640	21050
				2011				
Vijayapur	247031	260791	17788	234473	15186	90809	7591	54053

[7] *A cultivator is defined as a person whose major share of yearly income comes from farming their own land while an agricultural labour is defined as a person between 15 and 59 years old whose major share of income is from wages earned by working on other's farms. Household Industry is referred as an industry conducted by one or more members of the household at home or within the village in rural areas and only within the precincts of the house where the household lives in urban areas. The larger proportion of workers in the household industry consists of members of the household. Some of the typical industries that can be conducted on a household industry basis are: Foodstuffs, Beverages, Tobacco Products, Textile cotton, Jute, Wool or Silk, Manufacture of Wood and Wood Products, Paper and Paper Products, Leather and Leather Products, Petroleum and Coal Products, Service and Repairing of Transport Equipment etc. While all workers, i.e., Those who have been engaged in some economic activity during the last one year, but are not cultivators or agricultural labourers or in Household Industry, are 'Other Workers (OW)'. The type of workers that come under this category of 'OW' include all government servants, municipal employees, teachers, factory workers, plantation workers, those engaged in trade, commerce, business, transport banking, mining, construction, political or social work, priests, entertainment artists, etc.*

Source: 2001 and 2011 Census Data

As observed from the table above, in 2011, 247031 (32.5%) of the main workers were engaged as cultivator

While 260791 (34.3%) were engaged as agricultural labourers. Main workers engaged in household activities and other workers constituted 17788 (2.3%) and 234473 (30.8%) respectively. It is observed that cultivator population of the main workers has decreased from 36.07% of the total main working population in 2001 to 32.5% in 2011.In the marginal worker category; agricultural labourers have decreased from 75.80% in 2001 to 54.16% in 2011. The population of 'Other Workers' amongst the main and marginal workers has shown an increasing trend in both 2001 and 2011. This can be attributed to the fact that more workers are engaged in the service sector in and around Vijayapura for employment opportunities.

Taluka

The details of occupational pattern of the working population in the Taluka have been presented in **Table 4-53**

Table 4-53: Occupational Pattern in the Taluka within the Study Area

Taluka	Main Workers				Marginal Workers			
	Cultivators	Agricultural Labourers	Household Activities	Other Workers	Cultivators	Agricultural Labourers	Household Activities	Other Workers
					2001			
Bijapur	47517	36488	4601	78992	4881	27113	1196	8437
					2011			
Bijapur	58489	56685	6311	106464	3490	24191	2887	23737

Source: 2001 and 2011 Census Data

The occupational pattern in the Taluka shows that in 2011 'other works' was the highest category of workers engagement in Bijapur taluka (46.7) amongst the main workers and agricultural labourers were the highest Workers at 56685 (24.86%).

Villages

The details of the occupational pattern in villages within the study area are provided in **Table 4-54**.

Table 4-54: Occupational Pattern in the Village within the Project Area

Villages	Main Workers				Marginal Workers			
	Cultivators	Agricultural Labourers	Household Activities	Other Workers	Cultivators	Agricultural Labourers	Household Activities	Other Workers
				2001				
Tonsyal	418	3	2	27	25	68	4	1
Karjol	471	790	24	102	54	186	15	9
Kakhandaki	885x	852	80	309	168	913	8	42
				2011				
Tonsyal	207	197	7	72	1	158	9	145
Karjol	626	907	45	115	29	35	13	11
Kakhandaki	612	1270	29	343	8	575	14	37

Source: 2001 and 2011 Census Data

As observed from the table above in 2011, Kakhandaki village has the highest number of individuals engaged as agricultural labourer (main workers) at 1270 workers. Number of workers engaged as cultivators in villages Kakhandaki, Karjol and Tonsyal was 207, 626 and 207 respectively. Amongst marginal workers category, Kakhandaki village engages the highest number of agricultural labourers at 575 workers followed by Tonsyal at 158 workers.

4.4.7 Existing Social Infrastructure and Facilities

The availability and non-availability of social infrastructure amenities and facilities indicates the development pattern of the area and the well-being and quality of life of the population. The existing social infrastructure and facilities, within the villages falling under the project area have been provided in the subsequent sections through the interpretation of data available in the public domain particularly the Village Directory, 2001[8].

4.4.7.1 Existing Social Infrastructure and Facilities

The list of educational facilities present in the villages within the study area has been presented in **Table 4-55**.

Table 4-55: Details of Educational Facilities in the Villages falling within the Study Area

Taluka	Village Name	Primary School	Middle School	Secondary School	Senior Secondary School	College within Range (km)	Other Schools
Bijapur	Tonsyal	1	1	-	-	< 10	-
	Karjol	1	1	-	-	<10	-
	Kakhandaki	6	4	1	-	<10	-

Source: Village Directory, 2001

The table above depicts that all the three villages within the study area have primary schools and middle schools. There is one (1) secondary school in Kakhandaki and none in the other two villages. There are no senior secondary or other schools in the villages. Students from these villages have to travel more than 10 km from their residence in order to pursue higher studies.

4.4.7.2 Communication Facilities

Both the villages within the study area use the post office available at the village level. As per the Consultations held with stakeholders during the site visit it was informed that all the inhabitants own a mobile.

Table 4-56: Details of communication facilities in the villages falling under area

Village	Post_office	Telegraph_Office	Post_Telegraph	Phone
Tonsyal	1	1	1	1
Karjol	1	0	0	4
Kakhandaki	1	1	1	0

Source: Village Directory, 2001

It is to be noted that Tonsyal, Kakhandaki and Karjol villages have post offices within the villages.

Village Tonsyal and Kakhandaki also have telegraph offices and post and telegraph offices as per Village Directory 2001.

4.4.7.3 Electricity

In the district within the study area, electricity supply is available to all inhabitants for all kind of purpose (agriculture and domestic). As per the consultation conducted during the site visit, it was informed by the

[8] It should be noted that due to non-availability of Village Directory Data, 2011 in the public domain, excerpts of data from Village Directory, 2001 has been utilised in the report wherever required.

stakeholders that electricity supply is provided daily, phase wise, in the villages with an average of 4 hours of supply for agriculture purpose in the night and 3 -4 hours of supply for domestic purpose in the day time

4.4.7.4 Water Supply

In the village within the study area, water supply is available to all inhabitants. As per the consultation conducted during the site visit, it was informed that water supply is provided by the panchayat through pipelines to the villages. Reverse Osmosis (RO) Plant namely Shuddha Neeru (i.e. Pure Water) is installed in Karjol villages which is a pure water drinking plant that dispenses all time water at the rate of 10 paisa per litre.

During the site assessment it was observed that throughout the study area there was well channelized irrigation canal system provided by the government. As per the stakeholder consultation there were no grievances for water facility regarding irrigation and domestic purpose.

4.4.7.5 Transport and Connectivity

As per the consultations carried out with the stakeholders from the villages within the study area during the site visit, it was gathered that all the villages are connected by paved road. Regular bus services connect the villages with the towns and cities. However, internal roads of the village are not in good condition and required improvement.

4.4.7.6 Banking Facilities

The consultation held during the site visit revealed that the banking facilities are within the villages itself and all inhabitants from the villages use these services.

Table 4-57: Details of banking facilities in the villages falling within the study area

Village	Bank	Rang_com
Tonsyal	no	5-10 km
Karjol	no	<10 km
Kakhandaki	no	5-10 Km

Source: Village Directory, 2001

As per the Village Directory 2001, banking facility is not present in the project villages. However, during stakeholder consultation, it was noted that all the people had bank accounts and banking facility is present in the villages. It was noted during social consultation that Union Bank, Grahmin Bank and KJB banks are present in Kakhandaki village.

4.4.7.7 Health Facilities

The health care facilities present in the villages within the study area are presented in **Table 4-58**.

Table 4-58: Details of Health Care Facilities in the Villages falling within Study Area

Taluka	Village Name	Allopathic Hospital	Public Health Centre	Public Health Sub Centre	Maternity Home	Maternal and Child Welfare Centre
Bijapur	Tonsyal	-	-	-	-	-
	Karjol	-	-	1	-	-
	Kakhandaki	-	1	2	-	-

Source: Village Directory, 2001

As observed from the table above, there is one public health sub centres each present in Kakhandaki Village, two Public Health Sub Centre in Kakhandaki and one in Karjol. There is one Maternal and Child Welfare Centre at Kakhandaki. Allopathic hospital and maternity home are not present in any of the project villages.

4.4.8 Development Schemes and NGOs

The following government schemes are present in the study area:

Stree Shakti Sanga: The program was launched during 2000-01 and it is being implemented throughout the state to empower rural women and make them self-reliant. Stree Shakti Groups are formed at the village level to inculcate the savings habit in the members empowering the women economically. About 15 to 20 women members who are from below poverty line families, landless agricultural labourers, SC/ST women join together to form a Group or Stree Shakthi Sanga. Stree Shakthi Groups are formed through Anaganwadi workers and taluk federations.

The Stree Shakthi Sanga to form self-help group based on thrift and credit principles which builds self-reliance and enable women to have greater access and control over resources. This self-help group also contributes in increasing the income levels of rural women by engaging them in income generating activities and creating financial stability.

Stree Shakthi Sanga provides opportunities to the members of the groups to avail the benefits of other departmental schemes by converging the services of various departments and lending institutions to ensure women's access to credit financing. The women in the study area deposit Rs.50/- per week in the common account created with an interest of Rs.1 and withdraw an amount whenever required.

Accredited Social Health Activist (ASHA): One of the key components of the National Rural Health Mission is to provide every village in the country with a trained female community health activist ASHA or Accredited Social Health Activist. Selected from the village itself and accountable to it, the ASHA will be trained to work as an interface between the community and the public health system.

Shuddha Neeru: In Karnataka the government has installed RO plants in the villages where 7000 units are sanctioned in last three years i.e., 1000 units were sanctioned in 2013-14, 2000 units in 2014-15 and subsequently 4000 units in 2015-16. This vision was translated to mission by designing unique model (Gadag Model) of installation of pure drinking water plant that dispenses all time water at the rate of 10 paisa per liter.

4.4.9 Cultural Environment

There are no major cultural heritage sites in or around the project site

5. Stakeholder Engagement and Public Consultation

5.1 Introduction

Stakeholder consultation is an important process through which a two way dialogue is created between the project proponent and the stakeholders. Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively.

A reconnaissance survey and site visit was undertaken to the study area on 17th and 18th December 2016. The details of the meetings conducted during site visit have been furnished in the following **Table 5-1**. Name of the attendees and the village they belong to are provided below as **Table 5-1**

Table 5-1: Schedule for the Socio-Economic Survey and Stakeholder Consultation

Date	Task	Participants
17th December 2016	Understanding project details, status of project, land procurement process, etc.	• Hero Future Energies (HFE) representatives • AECOM representatives
18th December 2016	Consultation with the landowners and local community	• AECOM representatives; • Hero Future Energies (HFE) representatives • Mr. Sanjeev (Village Kakhandaki) • Mr. Badarinath (Village Kakhandaki) • Mr. Shivo (Village Kakhandaki) • Mr. Raju (Village Kakhandaki) • Mr. Ittchuappa Baraddi (Village Kakhandaki) • Mr. Siddu Badari (Village Kakhandaki) • Mr. Babu Nadanvinakar (Village Kakhandaki) • Mr. Ravi Nidoni (Village Kakhandaki) • Mr. Narayan Salunke (Village Kakhandaki) • Mr. Shrikant Chanagund (Village Kakhandaki) • Mr. Danesh Bivadar (Village Kakhandaki) • Mr. Ravi Shankar (Village Babaleshwar) • Mrs. Shashikala Kurnal (Village Karjol) • Mrs. Savitri (Village Karjol) • Mrs. Mallama (Village Karjol)

Source: AECOM, Site visit

5.2 Stakeholder Consultation Objectives and Scope

The stakeholder for the project was prioritized by identifying the direct and indirect stakeholders. The key stakeholders that were consulted as part of the study included the following,

a) Land Owners who sold their land for the project and its associated facilities;
b) Local Communities;
c) Member of Gram Panchayat of Karjol; and Kakhandaki
d) Representatives of HFE.

5.2.1 Methodology Adopted

The stakeholder consultation comprised primarily of a socio-economic survey and consultation initiated by AECOM professionals. The consultations revolved around getting information relating to the socio-economic status of the resident population within the study area, the concerns/issues of the local population and benefits/ expectations from the project. The findings of the consultations are based mainly on the use of participatory methods like key informant interviews and natural interviews. These methods give an in depth and intensity to the discussion and incorporates the local population point of view within a short duration of time.

The process of stakeholder consultation included:

- Identification of the relevant stakeholders including all those individuals, groups and organizations potentially influenced by or interested in the project;
- Imparting information about the project and its potential impacts on their lives in local and simple language;
- Verifying if the area proposed for the project does not infringe the formal or informal rights of the local
- Population;
- Recording of their concerns and aspirations through discussions; and
- Responding to their queries in a neutral manner.

A questionnaire with a list of open-ended questions was used to initiate the discussion process. Lands Owners from the villages within the study area were interviewed along with the local Communities. In addition, the representative from HFE was also consulted.

5.3 Consultation Undertaken with various Stakeholders

The section below details excerpts of the consultations undertaken with various stakeholders during the site visit.

5.3.1 Views expressed by Local Community and Stakeholders

On consultation with the local community during the site assessment it was noted that the procedure adopted by the Project Proponent for land procurement was in compliance of 'willing buyer/willing seller' conditions and the local community from Karjol had adhered during the land purchase Process. However during the consultation the site management (Stakeholder) informed that wind turbines GBR101, GBR102, GBR103, GBR104, GBR105 which falling in Tonsyal village have a Right of way(ROW) issue of land for the access route and procurement of these turbines has not taken place yet in Tonsyal Village due to the ROW issue . The local community from Village Karjol also informed that they were aware of the developing windfarm and were content with development and the respondents replied in the affirmative of the land price determined were higher than the prevailing market value.

Perception about the Project

Information on the perception of the Project gathered during the consultation process with the landowners has been broadly provided in **Table 5-2**.

Indigenous Population

As informed by the Site Representative that none of the landowners belonged to the Scheduled Tribe (ST) category.

Cultural Heritage

According to the consultations undertaken, it was learnt that neither were there any sites of cultural significance in any of the land parcels purchased nor around the vicinity of the land area.

Table 5-2: Details on the Perception of the Project

S. No.	Key Questions	Broad Replies received from Interviewee
1	Awareness of the Project? How were the land prices determined between the project proponent and landowners?	All respondents consulted affirmed that they were aware about the project. All respondents (landowners interviewed) were uniform in their replies that land prices were determined on the basis of one to one negotiation with the Gamesa's Land Team.
2	Was negotiation of the land prices undertaken? Was it above the prevailing market value? If so, how much?	All respondents replied in the affirmative. They were uniform in their replies that the land was sold above the market value. The prevailing market value of the land as informed by Gamesa's Land Team was INR 3 to 4 lakhs per acre. The land prices determined were two (02) times higher than the determined were higher than the prevailing market value.
3	Was the payment received adequate?	All respondents confirmed in the affirmative that they are satisfied with the payment received.
4	Has the entire amount transferred to your bank account?	The respondents (landowners/ representatives) consulted were in the affirmative that they received the entire amount.

S. No.	Key Questions	Broad Replies received from Interviewee
5	What was the payment (income received from sale of land) used for?	It was noted that land owners have used the money in starting new business, education of their children, house renovation, paying off their loans, daughter's marriage and few have also planned to purchase other land in lesser rate and do cultivation
6	Has the land prices increased in the area with the coming of the project?	All the respondents were of opinion that land price has definitely increased in the area with the coming of the project.
7	Concerns/Issues relating to the Project	All respondents consulted replied that they did not have any issues/concerns relating to the project.
8	Benefit/Expectation from the Project	Respondents were of the opinion that supply of electricity and road conditions will improve in the area with the project being set up in the vicinity of their village. They were also of the opinion that infrastructure development will take place and project will also bring employment opportunities for the locals.
9	Any other concerns	No Specific concerns

Need Assessment

A need assessment was undertaken amongst the respondents to highlight the expectations of the local population in the study area from the project proponent. These views were collated in order to comprehend the need of the locals so that prioritising of welfare activities by the project proponents can be better chalked out in the future in case of implementation of Corporate Social Responsibility (CSR) activities. The detail of the areas wherein utmost priority needs to be given is provided below:

- Electricity supply has been named as an area which needs priority. The respondents were of the opinion that with coming of the project to the area, the electricity supply would improve.
- Infrastructure development comprising of development of internal roads was another area which needs attention in the project villages.
- Respondents from village Karjol also mentioned about development of Hospitals and improvement of sanitation conditions in their village were required.
- Improvement in education and health facilities is also required in the project villages because of lack of higher education facilities and health care facilities.
- The respondents were of the opinion that employment opportunities would improve in the area and felt that the Project would up avenues for generation of employment for the local population.
- Gamesa as a part of Corporate Social Responsibility (CSR) activities had provided benches to approximately five (5) to seven (7) schools. Further it was explained by the site management that the wood remains from manufacture of blades are used for making benches as a part of waste management.

5.3.2 Views expressed by Member of Gram Panchayat

Consultation with one of the members of Gram Panchayat of Kakhandaki Village (falling within the project area) was also undertaken during site visit. The details of his replies have been provided in **Table 5-3**.

Table 5-3: Details of Responses received from Member of Gram Panchayat

S. No.	Key Questions	Broad Replies received from Interviewee
1	What is the main occupation pattern of the location population?	He replied that agriculture is the main occupation of the local people. Agricultural labourer as an occupation is also quite prominent in the area. People work as agriculture labour in the same villages in the farmland of those farmers who have irrigation facilities. Besides this, people also work in the factories and in shops in Bijapur town.
2	What is the average family income of the local population per annum?	Average family income of the locals in village is in the range of INR 1, 00,000 to 1, 20,000 per annum.
3	Are you aware of the project and about the Land purchase for the project in the area?	He replied that he was aware of the project and the land parcels that were sold for the project and its associated facilities.

S. No.	Key Questions	Broad Replies received from Interviewee
4	What was the land use pattern of the area before it was sold to the project proponent?	As per him all 100% of the land was agricultural land
5	Are there any cultural heritage/archaeological sites near the project area?	He replied that there are no sites of cultural or archaeological significance in the study area
6	Are there any other development projects in the adjoining area?	He replied that no other development except for all the windfarm that were being developed by Gamesa in the adjoining area he was aware off.
7	Do you anticipate any risks associated with the project's operation?	He replied that he did not anticipate any risks associated with the project's operation.
8	Are there any large birds or different species of animals seen in this locality?	He replied in negative to this question.
9	Any benefit/expectation from the Project.	He replied that the project will bring development and employment opportunities in the area and also power supply in the project villages will improve.

Source: Information collected during Site Visit

General Profile (Socio-Economic Status of Women)

To comprehend the existing living pattern of the local population residing across the study area, a look at the socio-economic status of women and the role that women have been playing both at the domestic and economic level needs to be taken into consideration. As the patriarchal values are entrenched in Indian society, women often play a more subordinated and dependent role. Even though they constitute almost half the population, various indicators pertaining to literacy level, labour force participation, mortality rate etc. reveal the dismal status of women to that of men.

According to the UN Gender Development Index, 2014 India ranks 132 out of 187 countries worldwide.[9] As per the 2011 Census data, Karnataka has a total female population of 30,128,640 with sex ratio of 973 females to every 1000 males. A total of 68.08% of the female population are literates in the State.

While interacting with the Member of the Gram Panchayat, information relating to the gender profile in the area was also gathered. It was noted that no government schemes for women have been introduced in the Gram Panchayat. The main activities undertaken by women were mostly in the form of engagement of agriculture activities in their own farms and household chores. It was also noted that no medical problems are prevalent among the women and there no vocational centres catering to women however, women Self-Help Groups (SHGs), namely "Mahila Samiti" are prominent in the area. The SHGs usually consist of 20-25 members and funds collected within the SHGs are utilised in the agricultural activities or purchase and sale of cattle for milk and other dairy products.

[9] http://hdr.undp.org/en/content/table-5-gender-related-development-index-gdi

6. Evaluation of Impacts

6.1 Impact Assessment Methodology

6.1.1 Introduction

Significance as a concept is at the core of impact identification, prediction, evaluation and decision-making in an ESIA process. This section elaborates the methodology adopted to evaluate the "Significance" of Impacts associated with the project.

For the purpose of this report, "Impact Significance" has been rated as a) ***Negligible***, b) ***Minor***, c) ***Moderate***, and d) ***Major***. The evaluation has been carried out on the basis of Relative / Potential Magnitude of the Impact against Sensitivity of an environment / resource to react to external events. The Criteria for Significance have been primarily adopted and modified from methods established in Canter, L.W., 1996, and Canter L.W. and Canty, G.A., 1993. Subsequent sections present steps involved in evaluating the "Impact Significance" whilst establishing Criteria and Rating for such evaluation.

6.1.2 Approach for Impact Assessment

Potential Impacts associated with the project may be ***Direct***, ***Indirect***, ***Induced***, and ***Cumulative*** and are defined as below:

a) ***Direct*** impacts result from a direct interaction between the Project activity or related component and resource / receptor;

b) ***Indirect*** impacts result from direct interactions between the Project and its Environment following subsequent interactions within the Environment;

c) ***Induced*** impacts result from other activities (which are not part of the Project) but which occur as a consequence of the Project; and

d) ***Cumulative*** impacts result as a consequence of combined impact on the same resource / receptor from other ongoing developments which are also being affected by Project activities.

Figure 6-1 below presents the methodology flow adopted for evaluating the "Impact Significance" resulting from project related activities.

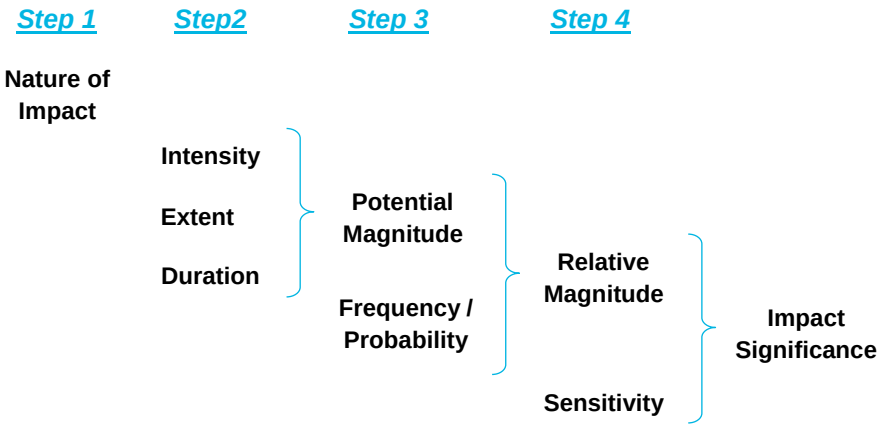


Figure 6-1: Methodology – Evaluation of Impact Significance

Various criteria have been considered to determine the "Impact Significance". Criteria presented in **Figure 6-1** have been rated and defined in **Table 6-2**.

Potential Magnitude as a result of project activity is a function of one or more criteria, which include a) ***Intensity***, b) ***Extent*** and, c) ***Duration*** of Impact. ***Magnitude*** of an Impact is also dependent on the ***Frequency*** of occurrence of project associated activities or likelihood i.e. ***Probability*** of any unexpected / unintended events (unplanned incidents such as earthquake and flooding incident). However, this is expressed in relative terms with respect to ***Potential Magnitude*** of any impact that is primarily dictated by parameters such as Intensity, Duration and Extent of Impact. ***Relative Magnitude*** therefore equals to the potential magnitude weighted by frequency or

probability factors. ***Sensitivity*** of environment / resource to react to external events affecting it helps in evaluating the overall Significance of a particular Impact. Definition of each of the parameters presented in **Figure 6-1** have been outlined in **Table 6-1** and limits / confines of ratings associated with such parameters have been presented in **Table 6-2**. Concluding "Impact Significance" criteria have been outlined in **Table 6-3**.

Table 6-1: Approach used for Impact Evaluation

Step	Criteria and Definition
Step 1: Determining whether the environmental effects are adverse	a) **Nature of Impact:** Nature of Impact is the type of change resulting as consequence of project activity. Activities may either adversely (negatively) affect, (or) cause no change / positively (beneficially) affect environmental / ecological / socio-economic components.
Step 2: Evaluating Potential Magnitude of adverse / beneficial effects of project activity by assessing Extent, Duration and Intensity of Impact	a) **Extent or Spatial Scale of the Impact:** Extent or Spatial Scale of an impact expresses the spatial influence (geographical extent) of the effects produced by the impact; b) **Duration of the Impact:** Duration of an impact describes the time period during which a component is changed by the impact and also includes the time taken for an Environmental / Social / Ecological component to recover and return to its original or near original state; and c) **Intensity of the Impact:** Intensity of Impact or degree of disturbance to biophysical systems / components expresses the change in the health, functioning and/or role of the system or component as a result of an activity. For the purpose of this project, the "Intensity of Impact" is a change to the baseline condition that may result as a consequence of project activity. This may be either detrimental or positive affect.
Step 3: Determining whether the impact is likely and assessing Relative Magnitude of the Impact. The potential magnitude weighted by frequency or probability factors is the Impact's Relative Magnitude	a) **Frequency of activities causing the impact:** The rate (varying frequencies) at which a particular (planned) project activity is being conducted that results in impacts; and b) **Probability:** Probability relates to unexpected events (for example a traffic accident, or earthquake). The probability that an unplanned event occurs is evaluated on a qualitative scale and provides the degrees of occurrence ranges from "unlikely" to "certain".
Step 4: Determining Significance of Impact by weighing Impact Magnitude along with Sensitivity of Environmental / Ecological / Socio-Economic Component	a) **Sensitivity:** For the purpose of this project, Sensitivity has been defined in three ways. For physical (Environmental components such as water) sensitivity to change in quality will be considered. For resource / receptor that are Ecological (Marine and Terrestrial Ecology) sensitivity towards adapting to an impact and conservation / vulnerability status will be considered. And for Human and Socio-Economic factors the vulnerability of the individual / community / society towards the impact will be considered.

Source: Adopted and modified from Canadian Environmental Assessment Agency, 1992

Criteria as defined in **Table 6-1** have been rated with respect to varying scales of their severity in **Table 6-2**. Severity levels (or) Ratings assigned to Impact Criteria have defined limits. Combinations between Ratings assigned for Impact Criteria are assessed to determine 'Impact Magnitude' and subsequently evaluate overall 'Impact Significance'.

Table 6-2: Ratings of Impact Criteria

Criteria	Rating	Rating definition and limits
Nature of Impact	a) Negative (Adverse Impacts) b) Positive (Beneficial Impacts)	a) If activities associated with project at any stage result in adversely impacting Environmental / Ecological / Socio-Economic components; b) If activities associated with project at any stage result in positively impacting Environmental / Ecological / Socio-Economic components. Impacts that may be considered as benefits.
Extent or Spatial Scale	a) Low (Local spread) b) Medium Spread c) High Spread	a) Impact is restricted within 0.5 km from the project location (Impact spread < 0.5 km); b) Impact is spread beyond 0.5 km and within 2 km from each WTG location (0.5 km < Impact spread < 2 km); c) Impact spread extending beyond 2 km each WTG location (2 km < Impact spread)
Duration	a) Low (Short term) b) Medium (Medium term) c) High (Long term)	a) Impact is likely to last for duration (considered temporary) below one month or less (or) ceases on completion of project associated activity. These impacts are quickly reversible; b) Impact is likely to extend beyond one month and within three months or lasts during the construction stage. These impacts are reversible over time; c) Impact is likely to extend beyond three months and may last throughout the life span of the project. The impact may be permanent in nature or may take considerable time for the Environmental / Ecological component to recover.
Intensity	a) Insignificant b) Low c) Moderate d) Strong	a) Impact negligibly alters the quality, use and integrity of the Environmental, Socio-Economic component / system but component / system continues to function with insignificant to nil affect and maintains original integrity (nil or limited impact). These impacts are quickly reversible; b) Impact alters the quality, use and integrity of the Environmental, Socio-Economic component / system but component / system continues to function in a moderately modified manner and maintains general integrity. These impacts are reversible within short time; c) Impact affects the continued viability of the Environmental, Socio-Economic component / system and the quality, use, integrity and functionality of the component / system is weakened to a considerable extent. Involves medium to high costs of rehabilitation, and remediation and may take considerable time; d) Impact affects the continued viability of the Environmental, Socio-Economic component / system and the quality, use, integrity and functionality of the component / system permanently ceases and the impact is generally irreversible. Rehabilitation and remediation often is not feasible.
Frequency	a) Occasional b) Periodic c) Routine	a) Impact is due to one off or due to intermittent planned activity. Impact is a result of remote or one off activity or time to time / intermittent activity affecting Environmental / Socio-Economic component / system; b) Impact is due to periodic planned activity. Impact is a result periodic activity (for example an activity conducted on a weekly or a monthly basis) affecting Environmental / Socio-Economic component / system; and

Criteria	Rating	Rating definition and limits
		c) Impact is due to continuous planned activity. Impact is a result of continuous ongoing (scheduled) activity affecting Environmental / Socio-Economic component / system;
Probability or Likelihood	a) Low b) Medium c) High	a) The chance of the impact occurring is considerably low; b) The chance of the impact occurring is moderately expected; and c) The chance of the impact occurring is either certain or very high i.e. the probability is 1 or close to 1. *Note: Impact is due to unplanned activity is a result of accidental events and causes failure / affects project infrastructure or Environmental / Socio-Economic component / system. This impact is assessed in terms of Risk i.e. taking into account both the consequence of the event and the probability of its occurrence (risk = probability x consequence). This criterion is only triggered in case of unplanned or accidental events (for example this may include earthquake incident etc.). Generally, for all planned activities "Frequency" will be considered and for all unplanned accidental or unforeseen events "Probability" will be considered. "Probability" is rated 'N/A' (Not Applicable) for all planned activities and vice versa.*
Sensitivity / vulnerability of resource / receptor	a) Low b) Medium c) High	***Sensitivity of Environmental Resource / Receptors*** a) Existing quality of the physical Environment is well within applicable Indian standards and / or the ecological resource that the physical Environment supports, is not sensitive to disturbance; b) Existing quality of the physical Environment is under stress and / or the ecological resources that the Environment component / system supports, could be sensitive to change either quality or physical disturbance; and c) Existing quality of the physical Environment is already under stress and exceeds applicable standards and / or the resources that the Environment component / system supports, is very sensitive to change. ***Sensitivity of Socio-Economic, Human Health Resources / Receptors*** a) Human or Socio-Economic or Cultural receptors are not likely to be affected due to the project related activities and no considerable effort (Economic or otherwise) is required in adapting to change; b) Human or Socio-Economic or Cultural receptors are likely to be affected but retain the ability to at least in part adapt to change brought by the project and opportunities associated with it. Minimal effort (Economic or otherwise) is required in adapting to change; c) Human or Socio-Economic or Cultural receptors are vulnerable and lack the ability to adapt to change brought by the project and opportunities associated with it. Significant effort (Economic or otherwise) is required in adapting to change; ***Sensitivity of Ecological Resources / Receptors*** a) Ecological receptors that are abundant, common or widely distributed and that can adapt to changing environments. Receptors are not endangered

Criteria	Rating	Rating definition and limits
		or protected and are of Least Concern (LC) conservation status; b) Ecological receptors that have low abundance, restricted ranges, and are currently under stress in the existing conditions or are slow to adapt to changing environments. Species are valued locally / regionally or listed as Near Threatened (NT) / Vulnerable (V); and c) Ecological receptors that have very low abundance, restricted ranges, and currently under stress in the existing conditions or highly sensitive to changing environments. Species are valued nationally / globally or listed as Endangered (EN) / Critically Endangered (CR).

Source: Adopted and modified from a) Canadian Environmental Assessment Agency, 1992; b) Canter, L.W., 1996; c) Canter L.W. and Canty, G.A., 1993; d) Haug, P.T., Burwell, R.W., Stein, A. and Bandurski, B.L.., 1984.

Table 6-3: Impact Significance Rating

Criteria	Rating	Interpretation
Impact significance	a) Negligible b) Minor c) Moderate d) Major	a) Impact is of an insignificant order and therefore likely to have no real effect. In case of adverse impacts, mitigation may not be required. Social, Cultural and Economic activities of communities have near to nil or nil effect; b) Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Measures and solutions for mitigation are easily implementable and costs associated with such measures are not significant. Social, cultural and economic activities of communities can continue unchanged. In case of beneficial impacts, alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming; c) Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and practically possible. Social, cultural and economic activities of communities are changed, but can be continued (whilst providing alternatives to complement losses). Modification of the project design or considerable mitigation measures or alternative action / planning may be required. In case of beneficial impacts, other means of achieving this benefit requires equal time, cost and effort; d) Impact is of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is limited possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural and economic activities of communities are disrupted to an extent that cause unrest and may halt such activities. In case of beneficial impacts, the impact is of a substantial order within the bounds of impacts and benefits either Environmental or Socio-Economic aspects more than other alternatives can.

6.2 Impact Evaluation Matrix for Determining "Impact Significance"

With respect to Criteria outlined in **Table 6-1**, **Table 6-2** and **Table 6-3**, "Impact Significance" for "Adverse" and "Beneficial" impacts has been developed as per significance matrix presented in **Table 6-6** and **Table 6-7** respectively.

Impact matrix in **Table 6-4** outlines the ratings assigned for "Potential Magnitude", which is in turn determined through ***Spread / Spatial Extent*** of Impact, ***Duration*** of Impact and ***Intensity*** of Impact. Criteria presented in **Table 6-2** have been taken into consideration for adverse impacts. However, for project associated activities that may generate beneficial impacts, ***Potential Magnitude*** and ***Sensitivity*** have been considered to determine corresponding "Impact Significance".

Table 6-4: Determining Potential Magnitude for Adverse Impacts

Spread	Duration	Intensity	Potential Magnitude
Low	Low	Insignificant	**Insignificant**
Low	Low	Low	
Low	Medium	Insignificant	
Medium	Low	Insignificant	
Low	Low	Moderate	**Low**
Low	Medium	Low	
Medium	Low	Low	
Medium	Medium	Insignificant	
Low	High	Insignificant	
High	Low	Insignificant	
Medium	High	Insignificant	
High	Medium	Insignificant	
Low	Low	Strong	**Medium**
Low	Medium	Moderate	
Low	High	Low	
Low	High	Moderate	
Medium	Low	Moderate	
Medium	Medium	Low	
Medium	Medium	Moderate	
Medium	High	Low	
Medium	High	Moderate	
High	Low	Low	
High	Low	Moderate	
High	Medium	Low	
High	High	Insignificant	
Low	Medium	Strong	**High**
Low	High	Strong	
Medium	Low	Strong	
Medium	Medium	Strong	
Medium	High	Strong	
High	Low	Strong	
High	Medium	Moderate	
High	Medium	Strong	
High	High	Low	
High	High	Moderate	
High	High	Strong	

Table 6-5: Impact Matrix for determining Relative Magnitude of Adverse Impacts

		Frequency / Probability *		
		Occasional / Low	*Periodic / Medium*	*Routine / High*
Potential Magnitude	*Insignificant*	Insignificant	Insignificant	Insignificant
	Low	Insignificant	Low	Low
	Medium	Low	Medium	Medium
	High	Medium	Medium	High

* ***Note:*** *Probability is only triggered in case of unplanned or accidental events (for example this may include earthquake incident or occurrence of flooding onsite). Generally, for all planned activities "Frequency" will be considered and for all unplanned accidental or unforeseen events "Probability" will be considered. "Probability" is rated 'N/A' (Not Applicable) for all planned activities and vice versa.*

Table 6-6: Impact Matrix for determining Significance of Adverse Impacts

		Sensitivity / vulnerability of resource / receptor		
		Low	*Medium*	*High*
Relative Magnitude	*Insignificant*	Negligible	Negligible	Negligible
	Low	Negligible	Minor	Minor
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

Table 6-7: Impact Matrix for determining Significance of Beneficial Impacts

		Sensitivity / vulnerability of resource / receptor		
		Low	*Medium*	*High*
Potential Magnitude	*Insignificant*	Negligible	Negligible	Negligible
	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

6.3 Activity – Aspect interaction and Associated Impacts

The project will have the following key activities:

- **Pre-construction Phase:** activities associated with pre-construction phase includes the following:
  - Execution of land procurement;
  - Clearance of vegetation
- **Construction Phase:**
  - Construction and setting up of auxiliary facilities such as storage yard;
  - Foundation excavation and erection of each WTG;
  - Construction of internal / access roads connecting each WTG;
  - Transportation of components / materials to each WTG location;
  - Erecting WTG, and internal electrical lines between each WTG location; and
  - Construction of pooling substation and transmission line.
- **Operation Phase: Key activities associated with operation phase include the following:**
  - Operations associated with power generation from WTGs; and

  - Scheduled maintenance activities (at WTGs and at sub-station)

- **Decommissioning Phase: Activities during decommissioning phase include:**
  - Removing WTG parts and other ancillary facilities;
  - Removing internal transmission lines;
  - Restoration of land.

Matrix of impacts associated with activities during different phases is presented in **Table 6-8** below.

Table 6-8: Matrix for Impacts identified resulting from Activity – Aspect Interaction

S. No	Project phase	Project activity	Land use	Land and Soil Environment	Water Environment	Ambient Air Quality	Ambient Noise Quality	Ecology	Settlements and Community Access	Land based Livelihoods	Social and Demographic	Economy and Employment	Cultural Environment	Community/ Occupational Health and Safety
1.	Pre-construction Phase	Execution of land procurement							☒	☒				
		Clearance of vegetation from identified activities	☒	☒		☒		☒		☒				
2.	Construction Phase	Construction and setting up of auxiliary facilities such as storage yard	☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	☒
		Foundation excavation and erection of each WTG	☒	☒	☒	☒	☒	☒				☒		☒
		Construction of internal / access roads connecting each WTG	☒	☒	☒	☒	☒	☒	☒			☒		☒
		Transportation of components / materials to each WTG location				☒	☒		☒					☒
		Erecting WTG	☒	☒		☒	☒	☒				☒		☒
		Erecting internal electrical lines between each WTG location	☒	☒		☒	☒	☒				☒		☒
		Construction of transmission line from pooling substation to grid	☒	☒		☒	☒	☒				☒	☒	☒
3.	Operation phase	Operations associated with power generation from WTGs					☒							
		Scheduled maintenance activities (at WTGs and at sub-station)		☒	☒									☒
4.	Decommissioning	Removing WTG parts and other ancillary facilities	☒	☒	☒	☒	☒	☒				☒		☒
		Removing internal transmission lines	☒	☒	☒	☒	☒	☒				☒		☒
		Restoration of land	☒		☒	☒			☒		☒		☒	☒

6.4 Environmental Impacts

6.4.1 Land use Change

6.4.1.1 Pre-construction and Construction phase

The total land procured for the 12 WTGs of proposed project is 60 acres of which 42 acres for setting of 12 WTG locations and remaining 18 ha for construction of internal access roads and pooling substation. The WTG locations are sited in such a way that they are approachable by existing Government roads both state highways and as well as village internal roads thereby minimising the requirement for additional land for approach roads. However, a bypass has been developed to avoid discomfort for villagers by movement of heavy vehicles. The land identified for the project comprises entirely of private land. No forest land or government land is being diverted for the project.

It is anticipated that loss of agricultural or grazing land due to installation of WTGs and access roads will have an impact on land use of the project site. It may be noted that the wind farm layout for the proposed project was finalised taking into consideration the following:

- Wind Resource Assessment;
- Environmental factors so as to avoid forest land, sanctuaries or other environmentally sensitive or protected areas;
- Social factors so as to identify land owners who are willing to sell and who in the process would not be rendered landless and are not prevented to sell their land under national laws and rules.

Upon selecting general wind intensive area, specific WTG locations were finalized after accounting for individual land use. Following types of land use were encountered, with respective land use impacts as detailed below.

- Loss of Agricultural Land: Land selected comprises of private agricultural land bought on willing buyer - willing seller basis. It was noted during stakeholder consultation that price offered is much higher than market price; local community is willing to sell part of the land owned by them and continue farming in the remaining portion. Compensation obtained from selling their land, will be used for their children's education and upkeep of the remaining portion of land. Therefore, no significant loss of livelihood and impact on land use is anticipated.
- Loss of private land used for Grazing purpose: Loss of private fallow land used for grazing purposes will not have any significant impact, as only a small portion of the procured land for the project is cordoned off by fences, while the remaining portion will be available for grazing.

Although the change in land use is irreversible, the land foot print of the project is limited and does not allow any restriction on access to the internal access roads and area outside the fenced WTG and its transformer yard.

The land sellers who would be providing part of their land for transmission poles and towers are likely to face inconvenience in farming in those plots.

The land use of the project area will not be altered to a large extent as only small areas comprising of the WTG and the transformer will be utilized while the remaining area will be left open for use by locals of the area. Therefore, minimal impact on land use is expected. Also no forest land or ecologically sensitive areas are involved.

Social impact has been dealt with separately under social impacts section.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Medium	Medium	Minor
Duration	High			
Intensity	Low			
Frequency	Routine			
Likelihood	N/A			
Sensitivity	Low			

6.4.1.2 Mitigation measures for Pre-construction and Construction phase

Adequate measures have been incorporated during the planning phase itself as indicated below and only minor impacts due to siting activities have been anticipated.

- The site clearance for tower erection, access road and ancillary facilities shall be restricted to the necessary footprint area;
- The land use of the project area used as grazing will not be altered to a large extent as only a small area occupied by WTG and the transformer will be fenced and the remaining open area may be used for grazing land;
- Similarly, care will be taken to locate wind turbine at edges of agricultural fields, thus minimising agricultural land lost;
- Additionally, the layout for access roads and transmission lines shall consider minimum land requirement and shall avoid procurement of agricultural land as far as possible and will stick on grazing land or barren land.

6.4.2 Visual Impacts

6.4.2.1 Construction and Operation phase

Visual and aesthetic impacts are among the most commonly expressed concerns about the development of wind energy projects. Determination of what constitutes an adverse visual impact is highly subjective because it depends on the values, beliefs, and experiences of individual viewers. Opinions about the aesthetic qualities of wind energy facilities can vary greatly among different segments of the population and from one location to another.

An adverse visual impact is defined as an unwelcome visual intrusion that diminishes the visual quality of an existing landscape. Changes that can be perceived as visual intrusions generally result from the introduction of visual contrast to the existing scene, based on differences in form, line, colour, and/or texture. Visual contrast with the existing landscape is often unavoidable because of the size and typical location of wind farms. Nevertheless, there are some measures that can be incorporated into the design of the project facilities to limit the degree of visual contrast and reduce the prospect that the contrast would be widely perceived as an adverse visual effect, or at least reduce the degree of the effect.

To avoid conflicts and problems with acceptance, visual aspects should play an important part in the planning and communication in the realization phase of wind parks. It is critical to recognize that wind turbines cannot be adjusted to meet visual criteria alone. The turbines must be located in the areas with appropriate wind resources in order for the project to be viable.

The layout for the wind turbines has been finalised based on a siting exercise which has accounted for visual impacts. All the wind turbines will have uniform visual characteristics such as colour, size, and design so that no significant impact is caused to the surrounding communities.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	w	Low	Negligible
Duration	Low			
Intensity	Moderate			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

6.4.2.2 Mitigation Measures

The following mitigation measures shall be incorporated:

- Maintaining uniform size and design of turbines by having same direction of rotation, type of turbine and height on a wind farm or adjoining wind farm;

- Layout or adjustment should be such that turbine blades rotate in the same direction;
- Preference to be given to large turbines rather than too many small turbines. Flat landscape fit well with the turbine distribution in rows;
- Ensuring absence of any auxiliary structures except the required ones such as access roads and transformer yards which accompany the turbines; and
- Use of underground cables only.

6.4.3 Water Environment

6.4.3.1 Pre-construction and Construction Phase

Erection and commissioning of the WTG's shall involve construction activities like establishment of foundation for the tower support, construction of transformer pad, welding of tower components, installing the turbine components and erection of towers. Similarly, construction of roads will involve levelling, excavation and compacting activities which may have an impact on water quality. Prior to start of construction activity, transportation and storage activities of all materials required for construction phase have a potential to cause water pollution. Also, disposal of wastewater has the potential impacts on water quality.

Hazardous waste generated during construction of wind farms requires adequate disposal measures as per the requirements of Hazardous Waste Management Handling and Transboundary Movement Rule 2016. Improper disposal of hazardous waste can also lead to contamination of ground water, which could result in indirect impacts to humans, flora and fauna.

One water body, at a distance of approximately 700 m from WTG No. GK 53 near Karjol village was observed in the project area. During construction phase, there is a possibility of contaminated run-off from the site entering the water body in the surrounding area. Also, the domestic water runoff from the portable toilets into water body in the surrounding area may lead to degradation of water quality.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Medium	Low	Negligible
Duration	Low			
Intensity	Moderate			
Frequency	Occasional			
Likelihood	N/A			
Sensitivity	Low			

6.4.3.2 Mitigation measures for pre-construction and construction phase

The following mitigation measures shall be incorporated to avoid/reduce the potential impacts:

- The portable toilets shall be provided with septic tank and soak pits;
- The natural drainage pattern of the area will not be disturbed during construction to the extent possible;
- The access roads will be provided with adequate storm water drainage facilities;
- Temporary paved areas shall be constructed to be used while refuelling the machineries;
- Storage of oil shall be undertaken on paved impervious surface and secondary containment shall be provided for fuel storage tanks;
- In case of any leaks, vehicles and machinery will be maintained and repaired immediately;
- Drip pans shall be provided with vehicles with leaks to prevent contamination of soil.

6.4.3.3 Operation Phase

The proposed wind farm will have around 40 technical and support staff at site during the operation phase. Hence at the rate of 45 litres per capita per day, it is estimated that 1800 l/day of water per day will be required

for the site office. Water requirement for blade cleaning @ 2 m^3 per turbine once in 5 year, will be met through private tankers.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Medium	Medium	Minor
Duration	High			
Intensity	Low			
Frequency	Routine			
Likelihood	N/A			
Sensitivity	Low			

6.4.3.4 Mitigation measures for Operation phase

As per the best industrial practices it is recommended not to use ground water and water from surface water bodies for any project related activities. The water requirement during the operation phase of the project shall be met through supply from authorised tanker. The drinking water requirement for the site personnel shall be met through packaged drinking water. With respect to generation of wastewater from site office, adequate number of septic tanks shall be provided. Use of water shall be done efficiently and discharge of wastewater if any, shall be done in compliance to the national and local standards.

6.4.4 Soil Environment

6.4.4.1 Pre-construction and Construction phase

During construction phase, following are the prevalent negative impacts on land/soil:

- Considerable disturbance to soil and nearby superficial geology due to activities such as excavations for foundations, construction of access roads and drainage, etc.;
- Removal of existing vegetation for construction will decrease the rigidity of soil and make it loose and open to erosion;
- Top soils and sub soils will be extracted during excavation which will lead to loose soil generation and its subsequent dispersal by wind. Excavation can disturb the original topography of the area and consequently lead to soil erosion;
- Direct and indirect impact on the landscape of the region such as modification of initial appearance of the site, abandoning of certain parts of the site by its users due to installation of wind turbines;
- Construction debris, excavated soils or solid waste generated when workers are on site, if dumped in nearby fields will affect the quality of soil;
- Random disposal of excavated soil and construction debris in nearby fields and private land; and
- Soil contamination due to oil leaks/spillage from machinery and vehicles.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Low	Low	Negligible
Duration	Medium			
Intensity	Low			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

6.4.4.2 Mitigation measures for pre-construction and Construction phase

The following steps shall be taken to avoid/reduce the impact on the soil quality during the construction phase:

- Limit construction activities to months having moderate climate conditions when there is no heavy wind or rainfall, to avoid top soil removal;
- To minimise runoff, channels and drains are to be fully established and bedded as quickly as possible;
- While transporting, construction materials such as sand, cement and other such fine-grained materials should be covered;
- Construction debris and excavated material can be used for filling low-lying areas;
- Paved spaces should be constructed for handling machineries or vehicles, while refuelling etc. if there is a spillage, that portion of the soil is to be cut out and stored separately to be disposed with the hazardous waste;
- Re-vegetate the area surrounding turbine locations as early as possible, to reduce the negative effect on soil; and
- All construction material shall be stored in a designated/demarcated storage area within the site and covered with tarpaulin sheet to avoid dispersal with wind.

6.4.4.3 Operation phase

During the operational phase of the wind farm project, some quantities of hazardous waste in the form of lubricant oil, transformer oil, oily rags, containers holding oil and paints that may be generated during maintenance and general upkeep activities is envisaged to be generated. This waste requires adequate disposal as per the requirements mandated under the Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules, 2016 (hereinafter referred as HWR, 2016). Improper disposal of hazardous waste can lead to contamination of both soil and ground water.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Medium	Low	Minor
Duration	High			
Intensity	Moderate			
Frequency	Occasional			
Likelihood	N/A			
Sensitivity	Medium			

6.4.4.4 Mitigation measures for Operation phase

The following mitigation measures shall be incorporated in the operational phase of the project:

- Generation of waste to be minimised as far as practicable;
- Waste oil generated shall be stored separately in containers in a secured location. The storage location and the containers shall be properly marked;
- The waste/used oil storage area shall be provided with adequate weather protection. The area shall accessible to authorised personnel only;
- The waste/used oil from the turbines shall be disposed off to a CPCB/KSPCB authorized vendor;
- Secondary containment for fuel storage tanks and for temporary storage of other fluids such as lubricating oils and hydraulic fluids;
- Transformer oil shall be returned to the manufacturers as per the agreement of purchase;
- A hazardous waste inventory shall be maintained as per the provisions of the HWR, 2016;
- Documentation (i.e., various forms) as prescribed under HWR shall be properly maintained.

6.4.5 Noise Quality

6.4.5.1 Pre-construction and Construction phase

The construction activities and sources which will lead to noise generation include the following:

- Site preparation and earthworks using bulldozers, trucks etc.;
- Foundation and construction using mobile equipment, cranes and concrete mixing;
- Heavy vehicles utilized to deliver construction materials and the turbine parts; and
- Use of diesel generator sets for power generation.

The above mentioned activities and sources will generate noise and vibration which may affect the habitations lying in close proximity to the proposed locations and may even scare away the grazing animals around the site. **Table 6-9** below presents the various types of vehicles and equipment likely to be used on site during the construction works for the Project and the typical sound levels that they generate.

Table 6-9: Typical sound level from various types of construction vehicles and equipment

S. No	Type of Vehicle	Description	Typical Sound Power Level (dB)
1	Passenger Vehicle	Passenger Vehicle	85
2	Trucks	10 ton capacity	95
3	Cranes	Overhead and mobile	109
4	Mobile Construction Vehicles	Front end loaders	100
5	Mobile Construction Vehicles	Excavators	108
6	Mobile Construction Vehicles	Bull Dozer	111
7	Mobile Construction Vehicles	Dump Truck	107
8	Mobile Construction Vehicles	Water Tanker	95
9	Stationary construction equipment	Concrete Mixer	110
10	Compressor	Air compressor	100
11	Compressor	Vibratory compactor	110

Source: Gold Coast Desalination Alliance (GCDA) – 2006

It is to be noted that ambient noise levels depend on various factors such as the exact number of vehicles/equipment being used at the construction site, number of hours of operation, etc. Due to unavailability of such information, the cumulative noise levels from simultaneous use of construction vehicles and equipment is difficult to ascertain. However, the construction activities will be temporary in nature and will not last for more than 15-20 days for a particular turbine site.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Medium	Medium	Minor
Duration	Medium			
Intensity	Low			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

6.4.5.2 Mitigation measures for Pre-Construction and Construction phase

- Construction activities shall be planned in consultation with local communities (if required);
- Construction equipment will be maintained in good working order and properly muffled;
- Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated, for example with silencers, acoustic louvers and enclosures;

- Provision of rubber paddings/noise isolators at equipment/machinery used for construction;
- Construction vehicles shall be well maintained and idling time will be minimized for vehicles when not in use;
- Site workers working near high noise equipment use Personal Protective Equipment (PPEs) to minimize their exposure to high noise levels.

6.4.5.3 Operation phase

Noise from WTGs

The sources of noise generation from operating wind turbines can be divided into two categories, mechanical sounds, from the interaction of turbine components, and aerodynamic sounds, produced by the flow of air over the blades.

Mechanical Sounds

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

Since the emitted sound is associated with the rotation of mechanical and electrical equipment, it tends to be tonal (i.e., of a common frequency), although it may have a broadband component. Center for Energy Efficiency and Renewable Energy. (2002), RERL (Renewable Energy Research Laboratory). White paper on Wind Turbine Noise Issues (Retrieved from http://www.windcows.com/files/WindTurbineNoiseIssues.pdf)

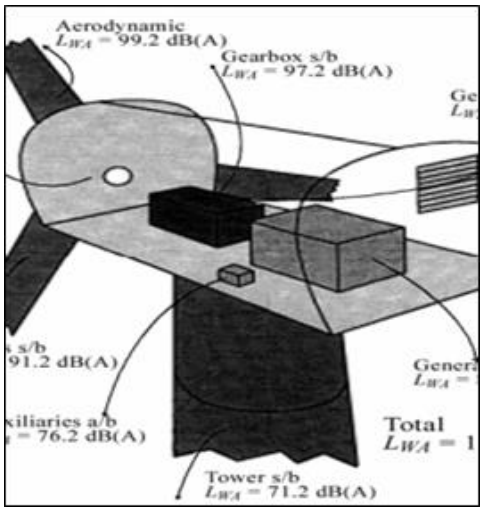


Figure 6-2. Components and Total Sound Power Level of a Wind Turbine

Source: Center for Energy Efficiency and Renewable Energy. (2002), RERL (Renewable Energy Research Laboratory). White paper on Wind Turbine Noise Issues. Retrieved from http://www.windcows.com/files/WindTurbineNoiseIssues.pdf

Aerodynamic Sounds

Aerodynamic noise originates from the flow of air around the blades. It increases with the rotor speed and can be classified into three groups namely; Low Frequency, Inflow Turbulence and Air Foil Self Sounds. Low frequency sound is generated when the rotating blade encounters localized flow deficiencies such as wind speed changes, flow around the turbines etc. Inflow Turbulence depends on the amount of atmospheric turbulence which tends to

result in local pressure fluctuations around the blade. And finally, Air Foil Self Sounds includes the sound generated by the air flow right along the surface of the air foil with broadband characteristics. **Figure 6-3** below shows the schematic representation of flow around a rotor blade.

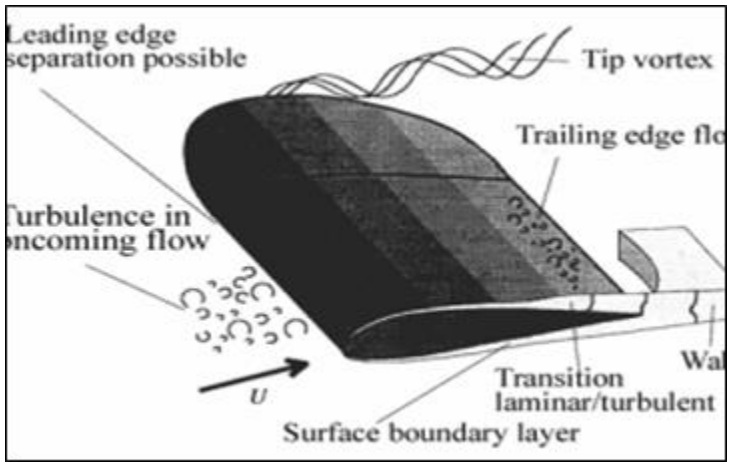


Figure 6-3: Schematic of Flow around a Rotor Blade

Source: Center for Energy Efficiency and Renewable Energy. (2002), RERL (Renewable Energy Research Laboratory). White paper on Wind Turbine Noise Issues. Retrieved from http://www.windcows.com/files/WindTurbineNoiseIssues.pdf

The proposed project comprises of 12 identified locations for WTGs of Gamesa make, G-114 model of 2.0MW unit rated capacity with rotor diameter of 114 m and hub height of 106 m and Tubular tower. Noise impact due to operation of the proposed project (12 WTG) and the 13 other WTGs falling in the adjacent villages was analysed using numerical calculations from EMD's WindPRO Software version 2.7 which is specifically designed for wind turbine noise. WindPRO contains pre-configured noise calculation models in order to calculate predicted noise levels at each of the selected noise receptor plus a ready built catalogue of wind turbines and noise emission data.

Methodology for Prediction of Impacts

The ISO 9613-2 General noise calculation model was used which considers frequency dependant attenuation due to geometric divergence, atmospheric absorption, and ground effect. The model is valid for downwind propagation under a well-developed moderate ground based temperature inversion, which are conditions favourable to noise propagation from source to receiver.

The numerical results were then used to produce a noise map that visually plots the extent of the incremental noise emissions from the Project site. The noise emissions were modelled for estimated wind speed of 4.9 m/s, retrieved from wind mast located at Somadevarahatti (553989 m E, 1867551m N), around 40 km from project area.[10] The direction of the wind is not taken into consideration as the wind could blow from any direction.

The results of the modelling exercise have been presented in below. Detailed Noise Modelling report has been attached as **Appendix B**.

Identified Noise Receptors

During the site survey, residential properties, workplaces, learning and places of worship and or health care spaces/facilities located within 2000 m[11] of the project turbines were identified as sensitive receptors. About 3 such receptors were identified as potential noise and shadow receptors. The details of the noise receptors are provided in **Table 6-10** and the same have been represented in **Figure 6-4.**

[10] http://niwe.res.in/assets/Docu/List_of_WMS_30.11.16.pdf
[11] IFC guidelines on Environmental, Health, and Safety Guidelines - Wind Energy dated 7th August 2015

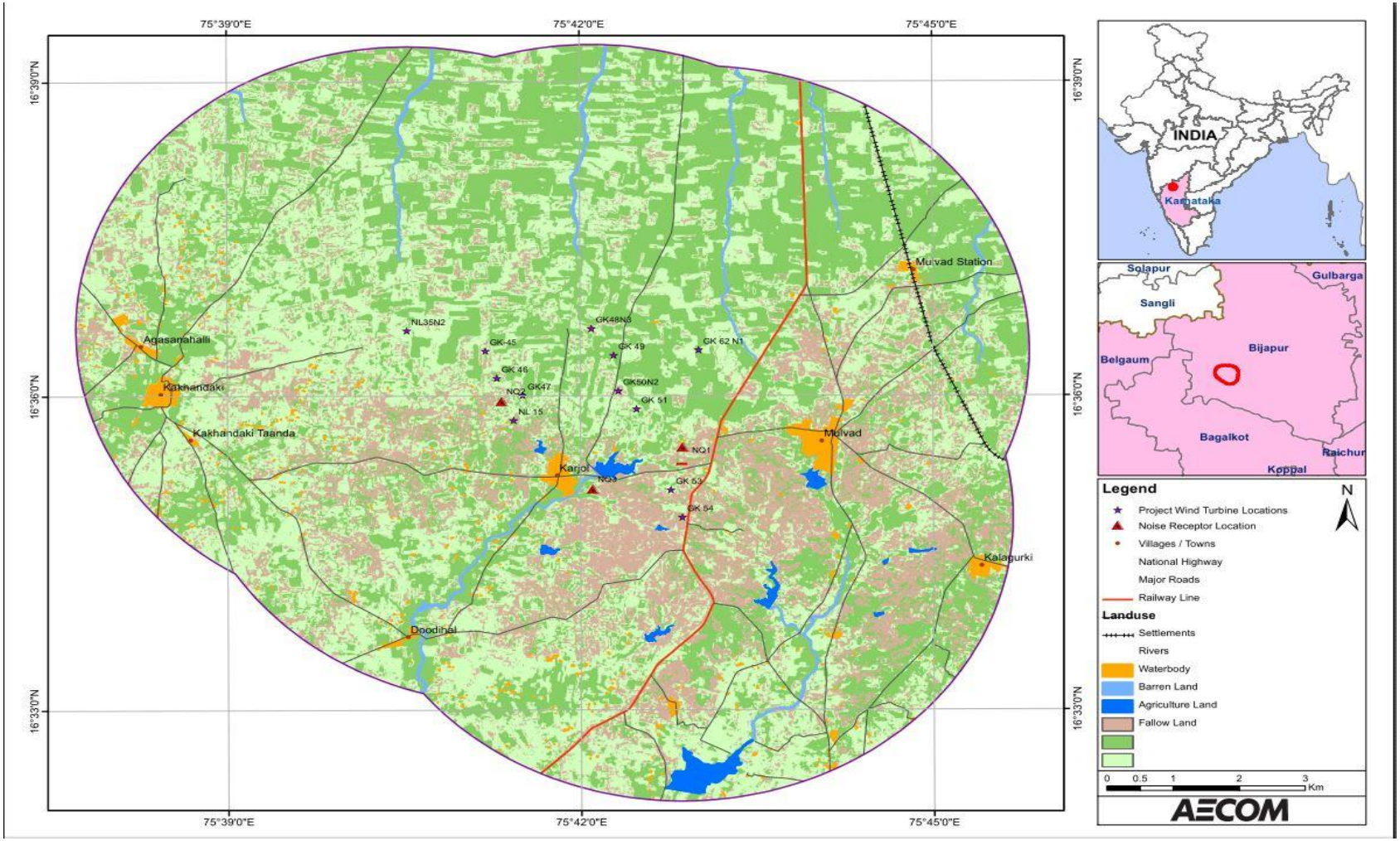


Figure 6-4: Map Showing Noise Receptor Locations

Table 6-10: Description of Identified Noise Receptors

Noise Receptor ID	Geographical Coordinates	Description	WTGs within 2000 m from the Noise Receptor
Residential Unit	573466 m E, 1835337 m N	A house in the West boundary of substation, Kajrol Village	GK49, GK44N1 , GK45, GK46, GK47, GK48N3, GK50N2, NL 15, NL35N2
School 1	576271 m E, 1834311 m N	Near Kuthurraichammal High. Sec. School – Karjol cross Road	GK 51, GK 53, GK 54, GK 62 N1, GK50N2
School 2	574988 m E, 1833924 m N	Near Govt. Middle School, Karjol village	GK 51, GK 53, GK 54, GK47, GK50N2, NL 15

Source: AECOM Survey

Ambient baseline sound levels is the function of activities such as movement of vehicles, operation of local machinery and the interaction of wind with ground cover, buildings, trees, power lines, etc. It varies with the time of day, wind speed and direction and the level of human activity in the area. The baseline noise levels at all the sampling locations were found to be within limits of the prescribed noise standards for Residential Area. The results of the modelling exercise have been presented and illustrated in **Table 6-11.**

Table 6-11: Resultant Noise Levels at Receptor Locations

Receptor	Baseline Noise dB(A)		Incremental Noise dB (A)	Resultant Noise dB (A)		Additional Exposure dB (A)	
	Day	Night	From WTG	Day	Night	Day	Night
PN1	46.7	34.7	45.3	49.0	45.7	2.37	11.0
PN2	50.8	38.2	38.5	51.0	41.4	3.2	3.2
PN3	54.7	43.3	35.4	54.7	43.9	0.0	0.6
CPCB Prescribed Limits	**55.0**	**45.0**	**--**	**55.0**	**45.0**	**--**	

Inference

The results from the modelling exercise indicate that the incremental noise due to operation of WTGs is in the range of 35.4 - 45.3 dB (A). The additional exposure to noise will be in the range of 0.0 - 3.2 dB (A) during day time and 0.6 -11.0 dB (A) during Night time.

The estimated resultant noise levels are mostly within the prescribed noise limits for both day and night time i.e. 55 dB (A) and 45 dB (A) at all the identified noise receptors except for the Receptor Location PN1 where the prescribed limit exceed during the night time by 0.7dB(A). However, the additional exposure to night time baseline noise levels exceeds the norms[12] of 3 dB (A) at receptor location PN1 i.e. a Residential Unit in the West boundary of the substation. Since the resultant noise levels calculated at all the receptor locations except for PN1 do not exceed the CPCB prescribed standards the impact is accessed to be minor.

The cumulative Noise Impact for 25 turbines (2 Projects) is taken into account, but the cumulative noise impact due to other turbines (100 in total) in this area cannot be ascertained now, since the exact information of the number of operational WTGs is not confirmed by the client

[12] *The additional exposure to noise meets the noise guideline specified in IFC's Environmental, Health and Safety Guidelines of Wind Energy viz., maximum increase in background levels of 3 dB (A) at the receptor location.*

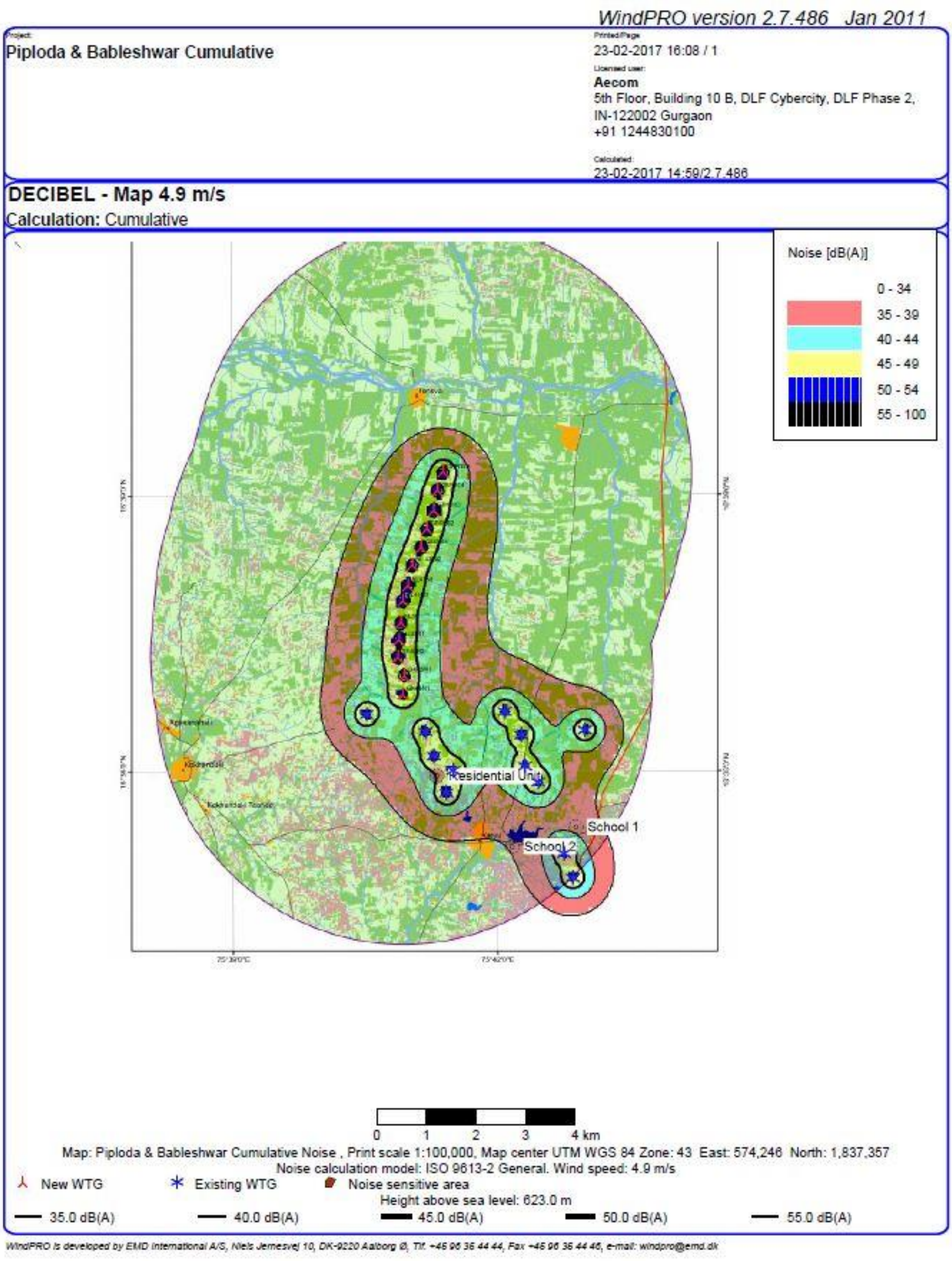


Figure 6-5: Noise Level Distribution During Operation Phase

Impact Significance

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Low	Low	Minor
Duration	Low			
Intensity	Low			
Frequency	Routine			
Likelihood	N/A			
Sensitivity	Medium			

6.4.5.4 Mitigation measures for Operation phase

Following mitigation measures are suggested to be implemented during operation phase of the proposed Project:

- Increase in dense vegetation coverage around the receptor locations which shall act as noise barrier;
- Wind turbines shall be designed in accordance with the international acoustic design standards and maintained throughout the operational life so as to limit noise generation;
- The wind turbines shall be maintained in good running conditions throughout the operational life of the project through routine maintenance;
- Operation and Maintenance staff to be provided with personal protective equipment (PPEs) such as ear plugs and ear muffs when working close to turbine in operation;
- It is suggested that ground vegetation such as shrubs and bushes are cleared to the minimum extent possible during site clearance activities;
- Consult with the locals periodically to assess noise generation and set up a procedure to locate source of noise and steps taken to minimize them;
- Implement a complaint resolution procedure to assure that any complaints regarding operational noise are promptly and adequately investigated and resolved;
- Undertake ambient noise level monitoring from NABL/MoEFCC accredited laboratories on an annual basis in order to understand the increase in noise levels due to the project operation.

6.4.6 Shadow flicker

6.4.6.1 Impact during Operation Phase

Shadow flicker occurs when the shadow cast by the moving blades of a wind turbine passes through a window or a door. The effect of the shadow moving around with the blade makes it seem as if a shadow is flickering with each blade passing by (most large wind turbines have three blades, so three times per rotation) - comparable to someone turning on and off the light in rapid succession.

There is anecdotal evidence inter nationally 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.

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). There are no uniform standards defining what distance from the turbine is regarded as an acceptable limit beyond which the shadow flicker is considered to be insignificant. There are also no uniform standards in India for the number of hours of flicker that are deemed to be acceptable. However, IFC on Environmental, Health and Safety Guidelines for Wind Energy recommends that that predicted duration of shadow flicker effects experienced at a sensitive receptor not exceed ***30 hours per year and 30 minutes per day*** on the worst affected day, based on a worst-case scenario. The details of the shadow receptor are provided in the **Table 6-12**.

Table 6-12: Details of Shadow Receptor Locations

Receptor ID	Type of Receptor	Geographical Coordinates
PS1	A house in the West boundary of substation, Kajrol Village – Residential Unit	573466 m E, 1835337 m N
PS2	Near Kuthurraichammal High.Sec.School – School 1	576271 m E, 1834311 m N
PS3	Near Govt. Middle School, Karjol village – School 2	574988 m E, 1833924 m N

Source: Site survey

Shadow flicker modelling was performed using EMD's WindPRO Software version 2.7, a wind modelling software program. WindPRO is used to calculate detailed shadow flicker map across an area of interest with site-specific locations using shadow receptors.

The software was used to analyse the Cumulative flicker caused by 25 turbines of which 12 WTG are the turbines of Bableshwar project and the rest 13 Turbines lie in adjacent villages.

Shadow maps, which indicate where shadows will be cast and for how long, can be calculated at varying resolutions. Normal resolution was used for this study; it represents shadow flicker calculations that determine the sun angle every 5 minutes, every 7th day, over the period of an entire year, over a grid resolution of 20 meters by 20 meters.

Shadow flicker at each shadow receptor location is calculated every minute of every day throughout the entire year. Shadow receptors can be configured to represent an omni-directional window of a specific size (greenhouse mode) or a window facing a single direction of a specific size (single direction mode). The shadow receptors used in this analysis were configured as single direction-mode receptors representing a 1.5 meter wide by 1.5 meter high window.

The inputs for the WindPRO shadow flicker model include the following:

- The geographic locations and characteristics of the proposed WTGs;
- The locations of identified shadow receptors; and
- Turbine Model Specifications; and
- Topography was assumed to be flat as a *theoretical worst case* scenario.

The WindPRO software calculates the position of the sun throughout the day in accordance to the curvature of the earth, the time of year and the project site's position. The software calculates the occurrences of shadow flicker at each of the identified receptor. Analysis was conducted to represent a *theoretical worst case* scenario, with the following conditions:

- The sun is shining all day, from sunrise to sunset with clear skies;
- Rotor is perpendicular to the incident direction of the sunlight;
- Distances between the rotor plane and the tower axis are negligible;
- There are no obstructing features such as trees and vegetation;
- Light refraction in the atmosphere is not considered; and
- The wind turbines are always operating i.e. there is continuous wind of sufficient speed and no maintenance or down time.

The result of the modelling exercise is given below in **Table 6-13** and the Shadow flicker map showing shadow hours at identified receptors has been presented in **Figure 6-6**.

Table 6-13: Results of Shadow Flicker Modelling

Receptor ID	Shadow hours per year	Shadow days per year	Max shadow hours per day	Shadow Causing WTG	Distance and Direction from WTG
	h/year	days/year	h/day		m

Receptor ID	Shadow hours per year	Shadow days per year	Max shadow hours per day	Shadow Causing WTG	Distance and Direction from WTG
	h/year	days/year	h/day		m
PS1	1:40	14	0:10	GK50N2	1783, 264°
PS2	0:00	0	0:00	--	--
PS3	0:00	0	0:00	--	--

IFC guidelines on Wind Energy (August 2015) have suggested ***30 hours of shadow flicker per year*** and ***30 minutes of shadow flicker per day*** as the threshold of significant impact, or the point at which shadow flicker is commonly perceived as an annoyance. Accordingly, the above threshold parameters were used in this analysis to evaluate potential shadow flicker impacts on the receptors. As seen in the Table above, flickering shadows are witnessed at PS1 i.e. a Residential Unit in the West boundary of the substation. The Shadow causing WTG is identified as GK50N2 which is at a distance of 1783 m (264°, West direction). However, it is within the threshold limit.

The modelling exercise accounts for the placement of turbines, receptors and sun angle such that the time when the turbine is in between the sun and the receptor is included in the total minutes per day and hours per year that shadow flicker could occur. This is a conservative analysis that does not account for maintenance time, calm winds when the turbines will not operate, light permeable obstacles such as trees and other structures, or the cloud covered days of the year. Therefore, the estimated theoretical worst-case scenario certainly overstates the actual frequency of shadow flicker that would be experienced at any given receptor location at any given time of the year.

Project:
Piploda & Bableshwar Cumulative

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SHADOW - Map

Calculation: Cumulative

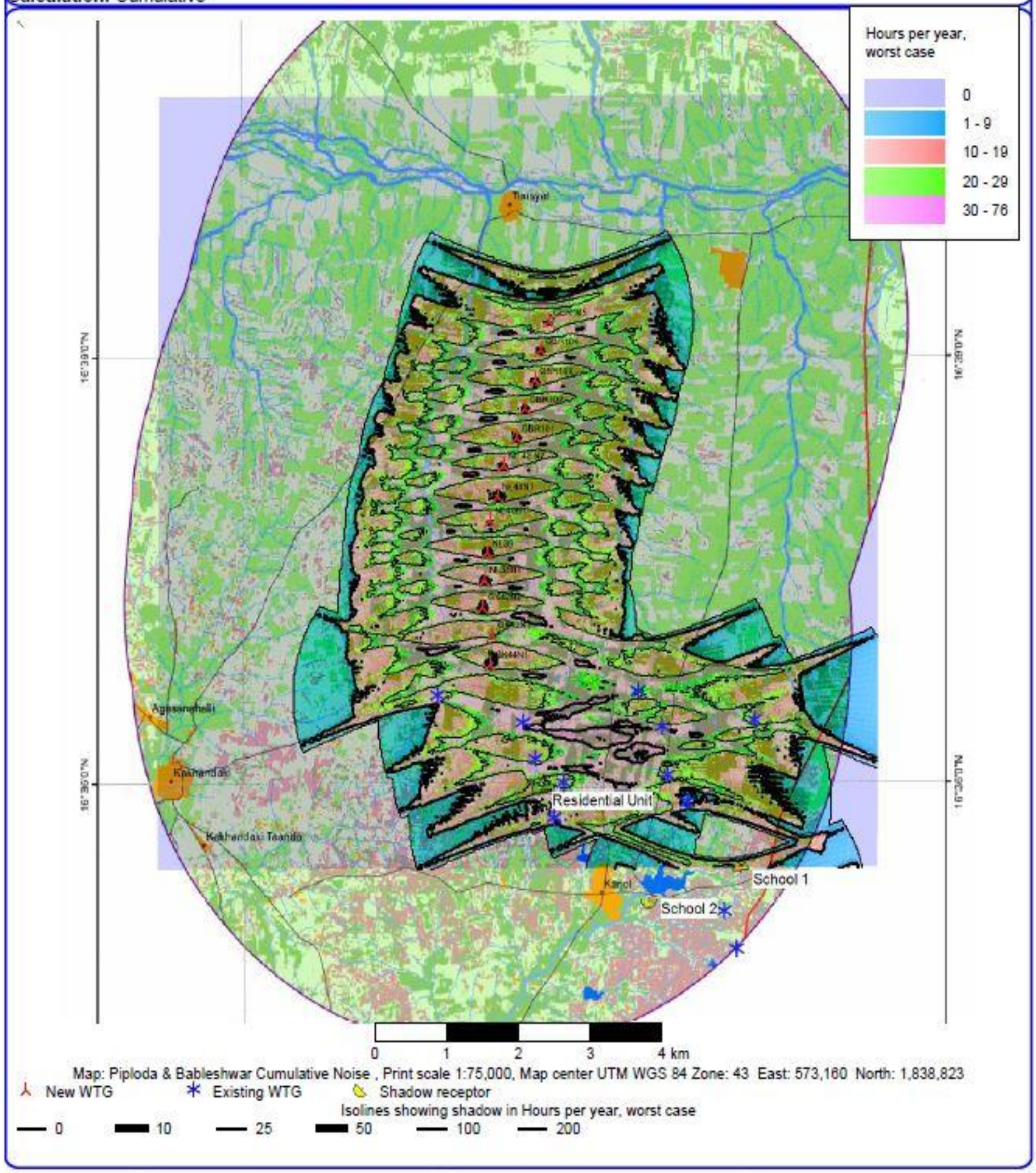


Figure 6-6: Shadow Flicker Map Showing Hours at Identified Receptors

Impact significance:

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Medium	Medium	Minor
Duration	Medium			
Intensity	Low			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

6.4.6.2 Mitigation measures during Operation Phase

With the possibility of shadow flickering on identified receptor locations, it can be mitigated by the following suggestions:

- Strategic planting of trees and ensure increase in dense vegetation coverage to screen the impacted receptor location from sun;
- Installation of blinds such as curtains, window coverings, or awnings at the concerned window facing the turbine; and
- Formulating a complaint resolution procedure for the local community so that any issues or concerns associated with shadow flicker are reported to the site staff. Also, appropriate and timely action taken in case of receipt of such complaints will be documented and maintained for records.

Impact significance post adoption of Mitigation Measures

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Low	Low	Negligible
Duration	Low			
Intensity	Low			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

6.4.7 Air Quality

6.4.7.1 Pre-construction and Construction Phase

Air pollutant emissions in a wind power projects can be predominantly associated with the construction phase. Dust generated during dry spells and exhaust emissions from construction vehicles are the main emission sources. The activities associated with wind farm projects, such as operation of diesel generators during construction phase, transportation of construction materials, storage of construction material, other construction works like excavation activity, hot mix plant (if any), etc. will also generate some amount of greenhouse gases (GHG), though in negligible quantities.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Low	Low	Negligible
Duration	Medium			
Intensity	Low			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

6.4.7.2 Mitigation measures for Pre-Construction and Construction Phase

The following mitigation measures shall be incorporated:

- Covered transportation of loose construction material will aid in mitigation of fugitive emissions in transit;
- Cover stockpiles of loose construction material on-site to minimize dust generation;
- Implementation of dust suppression techniques like localized sprinkling of water at areas shall be undertaken for the entire duration of construction;
- Loose excavated soils shall be kept covered or kept wet in designated storage areas to prevent dust generation;
- Regular maintenance of vehicles shall be carried out and Pollution under Control (PUC) certificates shall be maintained;
- Idling time of vehicles will be reduced to the extent possible;
- All construction equipment shall be maintained in good condition as per manufacture's recommendations and regular maintenance shall be carried out.
- In case hot mix plants are used during construction phase, they shall be placed at least 500 m away from human settlements and preferably located on leeward side of most dominant wind direction. The construction contractor shall have the necessary Consents from State Pollution Control Board to establish (CTE) and operate (CTO) such plants. All conditions stipulated in the consents shall be implemented/ complied with.

The construction work of a windfarm is only for a short duration of time and temporary. Hence, adhering to the above mentioned mitigation measures, the impact of project on air quality during construction phase will not substantial.

6.4.7.3 Operation phase

The baseline air quality will not vary to a considerable extend as the operation of wind turbines doesn't involve any significant air polluting activities. Except for the minor emissions such as carbon monoxide and nitrogen oxides released from Diesel Generators during preventive maintenance period which are not likely to exceed air quality standards, there are no direct emissions from the wind turbines. Hence the overall impact on air quality during operation phase is expected to be negligible.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Insignificant	Insignificant	Negligible
Duration	Low			
Intensity	Insignificant			
Frequency	Routine			
Likelihood	N/A			
Sensitivity	Low			

6.5 Ecological Impacts

6.5.1 Impacts Assessment

6.5.1.1 Construction phase

Loss/Degradation/Fragmentation of Habitats

The natural vegetation in and around the proposed turbine sites and road alignments will be removed for site preparation. The removal of vegetation cover will result in direct loss or fragmentation of hitherto contiguous habitats. The resources associated with natural vegetation which provide food and shelter to faunal species, are likely to get degraded or lost permanently. The wildlife corridors connecting the various faunal populations in the

region would be degraded due to habitat fragmentation. The clearing activities, in themselves, may result in death or injury to the ground organisms occupying the affected land areas.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Medium	Low	Negligible
Duration	High			
Intensity	Moderate			
Frequency	Occasional			
Likelihood	N/A			
Sensitivity	Low			

6.5.1.2 Mitigation measures for Construction Phase

- Degradation and loss of habitats caused by removal of natural vegetation could be minimized by removing only the most obstructive plants and conserving the existing ground cover of the area as much as possible. There shall be no clearing of vegetation cover of lands which are not directly under construction footprints.
- The site clearance for tower erection, access road and ancillary facilities shall be restricted only to the minimal area required for the respective purpose.
- The number and width of access roads shall be kept to the minimal possible. The use of existing roads should be preferred.
- It is recommended that the compensatory plantation of native species be done in all suitable areas around turbines and along roads.

6.5.1.3 Operation phase

Injury/Death of Birds/Bats

The principal direct risk posed by operational windfarms to birds is the potential for individuals to be injured or killed as a result of collision with moving rotors. Raptors, which are relatively large-sized birds adapted for soaring and relatively less capable of manoeuvring in flight, and migratory waterfowl, which tend to carry out migratory flights by night when they are unlikely to spot and avoid wind-turbines, are the two groups of birds which are especially vulnerable to collision-risk with operating wind-turbines. During cloudy weather, night-flying migratory birds tend to get attracted towards lights around their flight-height, such as those installed around ridge-top windfarms, leading to collisions with the turbines or other windfarm infrastructure.

Bats, besides being vulnerable to injury or death from direct collision with wind turbines, are also vulnerable to Barotrauma, that is, internal haemorrhaging induced by flying through the low-pressure zone around an operational turbine, leading to disruption of natural life-processes and eventual death. A correlation has been observed between low wind-speed nights and increased bat-fatalities around wind farms. Some evidence also suggests that bats may be attracted to turbines and that migratory and tree-roosting bats may have a higher risk of mortality.

Other risks posed by windfarms to both, birds and bats, in general, include potential of entanglement with guy-wires or over ground transmission lines and electrocution by contact with uninsulated wiring.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	High	High	Medium	Moderate
Duration	High			
Intensity	Moderate			
Frequency	Occasional			
Likelihood	N/A			
Sensitivity	Medium			

6.5.1.4 Mitigation measures for Operation phase

The following mitigation measures should be considered for avoiding injury or death of birds and bats during the operation phase:

- Designing the project layout to provide adequate spaces between every two turbines for movement of birds, thereby reducing the potential for accidental collision.
- Underground intra-farm wiring, thereby reducing the hindrance to birds.
- Insulating overground wiring, if any, thereby avoiding any chance of electrocution.
- Providing daytime visual markers on any guy wires used to support wind-masts or towers, thereby enhancing visibility of the wires to birds;
- Installing visibility-enhancing objects, such as marker balls, bird deterrents or diverters along any over-ground transmission lines, thereby enhancing visibility of the transmission lines to birds;
- Keeping windfarm lighting switched off when not needed;
- Opting for lighting fixtures that are hooded and directed downward to minimize the skyward and horizontal illumination that could attract night-flying birds to the vicinity of wind turbines;
- Moving potential rodent-habitats, such as heaps of rocks or earthen mounds, away from the wind-farm-area, thereby avoiding attracting raptor bird-species into the area;
- Removing any carcasses from the site, thereby avoiding attracting scavenging raptors, such as vultures, into the area;
- Instituting appropriate storm-water management measures, thereby avoiding creating potential migratory waterfowl habitats, such as pools or bogs, in the windfarm area;
- Keeping the wind-turbines in operational on low wind-speed nights, thereby minimizing risk of barotrauma to bats flying in/through the windfarm area.

It is recommended that a long-term programme, designed to monitor avifaunal activity with reference to wind-turbines, be instituted at the project-site. The main purpose of such a monitoring programme should be to generate the base-line data required for prediction of collision-risk for the bird-species utilizing the wind-turbine envelope around the year, and, assessment of the significance of such risk to the concerned bird-populations.

6.6 Impacts on Socio-Economic Environment

This section describes the potential socio-economic impacts during various phases of the project.

6.6.1 Impact on community and nearby settlements owing to land procurement

6.6.1.1 Pre-construction phase

The land identified for the WTGs and its associated facilities comprises of private agricultural land. Based on the consultation undertaken with the land owners, all of them have sold a portion of their land holdings and still have a sizeable amount of land with them. It was mentioned that since they are getting high amount (thrice the market price), and because they require money at this point of time, these land owners have decided to sell their land parcels. As the land parcels purchased till date are on private land, no impact on surrounding land areas is envisaged. None of the access roads to the turbines are obstructing access to settlements and sites of cultural heritage within the project area.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Insignificant	Insignificant	Negligible
Duration	Low			
Intensity	Insignificant			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

6.6.1.2 Mitigation measures

The project will have minimal impact due to loss of land. The following mitigation measures will however be incorporated to reduce the impact due to loss of land:

- The site clearance for tower erection, access road and ancillary facilities should be restricted to the necessary footprint area. The remaining area should be accessible for grazing or cultivation once the construction activities are completed;
- A formal consultation should be undertaken to apprise the villagers of the project activities on a regular basis;
- The EPC contractor should map access roads and implement strict driving instructions to adhere to such roads without going off-road thus destroying agricultural activities.

6.6.2 Labour Rights and welfare

6.6.2.1 Construction phase

It is anticipated that the labour requirement will range from 250 to 300 workers during construction activities.

Most of the workforce as reported will be engaged from surrounding areas and hence, requirement for migrant labour would be minimal. The EPC Contractor will require providing the minimum wages to the labourers including overtime wage as per the Building and Others Construction Workers Act. In addition, benefits in terms of Employee State Insurance should be provided to each worker engaged on site. The workers should be aware of their rights and benefits due to them so that no issues emerge. Toilet facilities and drinking water should be provided to all workers on site as well. Grievance Redressal Mechanism for workers should be developed and communicated to the workers so that the workers can approach the management if any concerns or issues are faced by them without any fear of retribution or intimidation.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Insignificant	Insignificant	Negligible
Duration	Low			
Intensity	Insignificant			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

6.6.2.2 Mitigation measures

The following measures shall be adopted:

- CWPPL through the contractor agreement shall ensure that the construction contractors commit and adhere to social obligations including community relations, handling complaints and grievances, adherence to labour laws and international commitments etc.
- The water usage amongst the labourers shall be monitored and controlled to minimize generation of wastewater.
- CWPPL shall ensure that no child or forced labour is engaged by contractors and all wage payments are done without any discriminations or delays by the contractors.
- CWPPL to ensure that adequate sanitation and waste disposal facility shall be provided at project site.

6.6.3 Migrant Labour Engagement

6.6.3.1 Construction phase

Migrant labour if engaged on site may involve following issues:

- Conflict amongst workers, and between workers and local community, based on cultural, religious or behavioural practices.
- Discontent amongst local community on engagement of outsiders.
- Mild outbreaks of certain infectious diseases due to interactions between the local and migrant populations. The most common of these are respiratory (TB), vector borne (Malaria, Dengue), water borne (Stomach infections, typhoid) and sexually transmitted diseases (HIV, Syphilis and Hepatitis).
- Security issues to local women from migrant workforce.
- Use of community facilities such as health centres, temples, transport facility etc. by migrant labour may lead to discontent with local community.
- Wherein contractors would be bringing in unskilled migrant labour, there stands the risk of exploitation of a labourer. This can happen in the form of hiring underage labourers, low and unequal wage payments, forced labour and discrimination on basis of the basis of caste, religion or ethnicity.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Insignificant	Insignificant	Negligible
Duration	Low			
Intensity	Insignificant			
Frequency	N/A			
Likelihood	Low			
Sensitivity	Low			

6.6.3.2 Mitigation measures

The following measures shall be adopted:

- The project proponent shall ensure engagement of local population as workforce in the construction activity, as far as possible. Community expectations for employment and other local benefits should be addressed and managed. Regular updates on opportunities and skill requirements shall be provided to the community.
- CWPPL through the contractor agreement shall ensure that the construction contractors commit and adhere to social obligations including community relations, handling complaints and grievances, adherence to labour laws and international commitments etc.
- The contractor shall provide adequate information to workers on expected social behaviour and hygiene practices to be followed at site.
- The water usage amongst the labourers shall be monitored and controlled to minimize generation of wastewater.
- CWPPL to ensure local contracting and vendor opportunities as far as possible.
- CWPPL should undertake medical test of the contract workers prior to engagement to identify any communicable disease.

6.6.4 Impact on local Economy and Livelihoods

6.6.4.1 Impact during Project Lifecycle

As reported during consultations with land owners, the project will create employment opportunities for the local population in terms of direct and indirect work. This will benefit the population in terms of developing a new skill set as well as diversifying the local economy. Subsidiary employments in terms of shops, eateries, garages, etc. would also see an increase with the development of the project in the area. Job creation in relation to petty vendors and contractors would also see an increase with the various project activities envisaged to be initiated.

Potential Magnitude	Sensitivity	Impact Significance
Medium	Low	Minor

6.6.4.2 Mitigation Measures

The following measures should be adopted,

- CWPPL should give preference to local vendors and contractors.
- CWPPL should give first preference to the local population in sourcing for the required vacancies that will emerge during the project life cycle.
- Skill development trainings should be provided to the local population in terms of welfare activities to be initiated by the Project Proponent so that the local population can apply for vacancies that might emerge in the project.

6.6.5 Community Health and Safety

6.6.5.1 Impact during Construction Phase owing to Traffic

The living standards of neighbouring community and local villagers from nearby villages are likely to be disturbed due to the increased road traffic movement during the construction phase of the project.

The traffic density on the roads in the proposed Project area is medium. However, with the commencement of the construction activities for the Project, the traffic movement will increase due to transportation of turbine components and site personnel. The turbine components such as blades, tower nacelle will be brought to the yard site and will then be sent to the individual turbine locations as per the requirement.

On an average, about 7-8 trucks/trailers will be required to bring the components of one turbine. Considering that at a particular instant of time, construction works for 10 turbines will be carried out simultaneously, a maximum of 70-80 trucks/trailers will ply on these roads. This kind of traffic movement may disturb the local population in the area and also pose increased risks of road accidents. The possible impacts associated with road traffic movement include the following:

- increase in traffic movement on the road network linked to the project leading to traffic congestion and delays;
- short term closure of existing transport routes during proposed construction/widening of access roads thereby causing disruption and delays in traffic;
- increase in traffic related noise and emissions;
- damage to existing roads and related structures due to heavy vehicular/ equipment movement;
- increase of probability of road accidents to livestock and people; and
- parking of vehicles in open fields and other non-project locations.

As the bypass developed by CWPPL will be used for movement of heavy vehicle, therefore the impact on community health and safety is assessed to be medium.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Low	Insignificant	Negligible
Duration	Low			
Intensity	Moderate			
Frequency	N/A			
Likelihood	Low			
Sensitivity	Low			

6.6.5.2 Mitigation Measures

The following measures shall be adopted:

- Project transportation through community areas shall be avoided to the extent possible;

- The routes for transport of construction material for road development shall be finalised after conducting survey of the existing road conditions;
- The transportation of WTG components shall be avoided during peak traffic hours as identified during traffic volume survey;
- Routes shall be planned along wider and less-restrictive roads. Where road widths are insufficient, either temporary widening of the road with gravel or full depth widening of the pavement structure to be undertaken;
- Widening of shoulders and development of new roads will be discussed with the community and undertaken only after all concerns are addressed;
- All vehicles engaged for transportation shall be verified for fitness and valid Pollution Under Control (PUC) certificates issued by registered authorities;
- Any incidence of breakdown shall be attended immediately to ensure smooth flow of vehicle along the road. Movement of vehicle shall be restricted to the identified routes and only trained drivers shall be employed;
- High noise generating construction activities shall not be carried out during night time as far as possible;
- All public utilities like power transmission cables, telephone cables, water/sewerage lines, drains, tube wells etc. falling within road land width shall be inventoried, and arrange for relocation /shifting to adjacent areas in consultation with the respective agencies/authorities and community; and
- CWPPL will develop and implement the Traffic Management Plan for minimising community disturbance due to WTG components and material transportation.

6.6.6 Electromagnetic Fields (EMF) Effects

6.6.6.1 Impact during Operation Phase

Electromagnetic Fields (EMF) emanate from any wire carrying electricity. Possible effects associated with the electric and magnetic fields from transmission lines (or similar electrical sources) fall into two categories:

- Short-term effects that can be perceived and may represent a nuisance;
- Possible long-term health effects.

The issue of whether there are long-term health effects associated with exposure to fields from transmission lines and other sources has been investigated for several decades. There is little evidence that electric fields cause long-term health effects. Estimates of magnetic-field exposures have been associated with certain health effects in studies of residential and occupational populations. Research in this area is continuing to determine whether such associations might reflect a causal relationship. The lists of exposure limits for general public/occupational exposure to electric and magnetic fields published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) is as given in the **Table 6-14** and **Table 6-15** below.

Table 6-14: ICNIRP Exposure Limits for General Public Exposure

Frequency	Electric Field (V/m)	Magnetic Field (µT)
50 Hz	5000	100
60 Hz	4150	83

Source: ICNIRP (1998): "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz).

Table 6-15: ICNIRP Exposure Limits for Occupational Exposure

Frequency	Electric Field (V/m)	Magnetic Field (µT)
50 Hz	10,000	500
60 Hz	8300	415

Source: ICNIRP (1998): "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz).

There are no specific standards or guidance on EMF in India though the Indian Electricity Act and Rules early stipulate the minimum clearances required. Hence the ICNIRP standards and guidelines have been considered.

For the general public (up to 24 hours a day) an exposure level of 1,000 mG or 100 µT is suggested. The EMF generated by 220KV unit will be lesser than the suggested value.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Insignificant	Insignificant	Negligible
Duration	Low			
Intensity	Low			
Frequency	N/A			
Likelihood	Low			
Sensitivity	Low			

6.6.6.2 Mitigation Measures

- Preventive measures should be taken, for instances avoid selecting a site close to an airport, an important radar system, a defence site and human settlements to avoid EMI issues. In case of unavoidable circumstances, obtain No Objection Permission (NOP) from the Civil Aviation Authority and Ministry of Defence;
- In order to avoid long-term impacts, a buffer distance of 9.2 km from Air Traffic Control (ATC) should be maintained;
- Avoid setting up wind turbines within defence air radar lines. To avoid EMI interference with defence radar, there is a restriction on height. The height of wind turbine is calculated by the equation given below:

$$\text{Maximum wind turbine height} = (R_{NM}/1.23 - (\text{Radar antenna height})^{1}/_{2})^{2}$$

6.6.7 Telecommunication Services

6.6.7.1 Impact during Operation Phase

Like any other large structures, wind turbines have the potential to cause interference with telecommunication signals such as, television and radio broadcasts, mobile phone services and radio communication services which tend to occur in proximity to habitations and often utilise the same ridgelines that provide optimum locations for wind turbines.

In general, very high frequency (VHF, 30 MHz – 300 MHz) and ultra-high frequency (UHF, 300 MHz – 3 GHz) band radio signals and digital voice-based technologies are essentially unaffected by wind turbines. This includes land mobile repeaters, radio, the audio component of analogue television and mobile phones.

For broadcast signals which are usually omni-directional (or point to area), interference can generally be avoided by locating wind turbines distant from the broadcast tower or transmitter antenna. A clearance distance of at least 100 m to > 200 m is recommended for frequencies ranging from 100 MHz to > 1000 MHz[13]

No broadcast or mobile communications towers were identified in close vicinity of the proposed project WTGs. Therefore, the development of the proposed wind project is not expected to have any widespread adverse impact on the telecommunication services.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Insignificant	Insignificant	Negligible
Duration	Low			
Intensity	Low			
Frequency	N/A			
Likelihood	Low			
Sensitivity	Low			

[13] *C. Salema and C. Fernandes, "Co-Siting Criteria for Wind Turbine Generators and Transmitter Antennas, "Proceedings of Conf. de Telecomunicacoes, Sesimbra, Portugal, pp. 466-470, 1999*

6.6.7.2 Mitigation Measures

Following mitigation measures are recommended:

- A monitoring framework is required to investigate and rectify any interference to television reception;
- Complaints from neighbours regarding interference with TV or other electromagnetic signals must be addressed immediately;
- Modifications or replacement of antennas and if it not works, switch over to digital TV reception. If both methods are ineffective then provide installation of satellite or cable TV;
- Some other mitigation measures include:
  - Installation of higher quality or directional antenna
  - Direct antenna towards an alternative broadcast transmitter
  - Installation of an amplifier

6.6.8 Blade Throw

6.6.8.1 Impact during Operation Phase

Blade throw is a potential safety hazard which involves dropping of a rotor blade or the blade being thrown from the nacelle of the wind turbine in a high wind zone. The occurrence of blade throw can be due to two types of infrastructure failure:

- The whole blade detaching from the rotor and falling away from the turbine; or
- Part of the blade breaking off and falling away from the turbine;

Occurrences of these two scenarios could be caused by the factors such as:

- Design or manufacturing defect;
- Poor maintenance regime;
- Excessive winds during a storm;
- Exceeding maximum design loads;
- Rotor over-speed; or
- Lightning or fire.

Wind Energy specific EHS guidelines indicate that probability of rotor blade failure which may result in the 'throwing' of a rotor blade endangering public safety, is extremely low. The same document refers to Taylor and Rand (1991) indicating that the risk of being hit by turbine parts within a distance of 210 m is 1:10,000,000.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Insignificant	Insignificant	Negligible
Duration	Low			
Intensity	Low			
Frequency	N/A			
Likelihood	Low			
Sensitivity	Low			

6.6.8.2 Mitigation Measures

CWPPL to maintain setback distance and must provide an adequate buffer between wind generators and consistent public exposure to minimize the risk of damage or injury from component failures.

The following mitigation measures are recommended.

- Establishing safety setbacks and siting WTGs away from existing buildings and populated areas within possible trajectory range of the blade;
- WTGs may be equipped with vibration sensors to enable emergency shutdown of WTG if necessary;
- Regular blade maintenance; and
- Warning signs to the public.

6.7 Occupational Health and Safety

6.7.1 Impacts during Construction Phase

- Working at heights will be involved during construction activities, including the assembly of wind tower components, transmission towers etc. Working at height is associated with hazards of fall and slip and can lead to fatal injuries;
- Uses of wielding and electrical operations during construction phase are also prone to fire and electric hazards;
- Other occupational risks associated with erection of WTGs will include physical injury during loading and unloading of turbine components, accident and injury from crane failure during handling of wind turbines, trip and fall hazards due to improper storage and placing of components and accident and injury due to vehicle collision etc.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Low	Low	Negligible
Duration	Low			
Intensity	Moderate			
Frequency	Routine			
Likelihood	N/A			
Sensitivity	Low			

6.7.2 Mitigation Measures for Construction Phase

Loading-Unloading

- Operation of loading –unloading equipment shall be undertaken under the guidance/ supervision of trained professional;
- All lifting appliances shall be thoroughly examined by a competent person, prior to engagement with the project. The contractor shall ensure that no person is engaged in driving or operating lifting appliances unless he is sufficiently trained, competent and reliable, possess the knowledge of inherent risks involved in the operation and is medically examined periodically;
- The contractor shall ensure that machinery is equipped with a legible, durable load chart that shows the manufacturer's recommended load configurations and maximum load weights. The chart must be securely attached to the cab and easily visible to operators when they are seated at the control station;
- All the required safety measures based on the individual's job profile shall be provided (as per working guidelines, use of personal protective equipment like gloves, helmets, ear muffs, safety belts etc.) for construction workers through the contractors;
- Excess waste debris and liquid spills shall be cleaned up regularly to avoid slips and falls. CWPPL shall ensure effective work permit system for hot work, electrical work, working at height, working in confined space etc. and shall ensure good housekeeping at the construction site to avoid slips and falls;
- Lifting /dropping/lowering of construction material or tool to be restricted and undertaken only under strict supervision, if required.

Storage of Turbine Components and Associated Facilities:

- Storage of turbine components will be made in an identified location at site. The storage area will be fenced and guarded;

- Storage area will be provided with proper lighting and space for access of lifting equipment;
- All material will be arranged in a systematic manner with proper labelling and without any protrusion or extension onto the access corridor;
- The construction material for transmission tower will be kept at site and carried to individual towers as per requirement.

Road Construction

The following measures shall be adopted to ensure safety of workers involved in road construction:

- Reduction of maximum vehicle speeds in work zones;
- Training of workers in safety issues related to their activities, such as the hazards of working on foot around equipment and vehicles.

General

- CWPPL shall ensure that personal protective equipment for all personnel present at site is made available;
- Arrangement for fire control measures shall be made. Display of phone numbers of the city/local fire services, etc. at site shall be done;
- Proper sanitation facilities shall be provided at the site;
- The working conditions shall be as per the provisions of Factories Act and working hours will be specified. Job rotation shall be done and adequate breaks shall be provided.

6.7.3 Impacts during Operation Phase

- The maintenance activities for the turbines will also involve working at heights. The operation and maintenance activities will be carried out by Gamesa.
- The operation and maintenance activities will include electrical/fire hazards such as electric shock, and thermal burn hazards. The hazard is associated with use of tools and equipment that can contact power lines.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Low	Low	Negligible
Duration	Low			
Intensity	Moderate			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

6.7.4 Mitigation Measures for Operation Phase

Working at Heights

Working at height for cleaning and maintenance of turbines will require adherence to precautions and safety measures as provided:

- CWPPL shall ensure that Gamesa (O&M contractor) to provide instructions and procedures to all the workers involved in service repair of wind turbines, which will consider wind speeds and other external conditions in such a manner that service, maintenance and repair work on the wind turbine can be performed safely;
- Ensure use of safety belt and need for safety net as required;
- All work at height to be undertaken during daytime with sufficient sunlight;
- Work permit system shall be implemented for working at height (typically when working over 2 m above) and for hot jobs;
- Prior to undertaking work, integrity of structures shall be inspected;
- Fixtures shall be installed on tower components to facilitate the use of fall protection systems;

- Only workers trained in climbing techniques and use of fall protection measures to be engaged in inspection, maintenance, and replacement of fall protection equipment for work at height;
- Workers handling electricity and related components will be provided with shock resistant gloves, shoes and other protective gears. Adequate training regarding health and safety will be provided to the workers;
- The switchyard building will be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire;
- Safety incidents will be recorded and monitored. The objective shall be to gradually reduce and attain zero incidences.

Electrical/Fire Hazards

The following safety measures shall be adopted to minimise the risk of electrical/fire hazards:

- Wind turbines shall be equipped with an earthing system;
- Access to areas containing exposed electrical equipment shall be enclosed and posted with warning signs;
- Workers involved in electric operations shall be provided with Personal Protective Equipment (PPE) such as rubber gloves etc.;
- Employees involved in electrical works shall be trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements that pertain to their respective job assignments.

6.8 Impacts for Decommissioning Phase

The key issues associated with decommissioning phase will include:

- Issue of loss of job when the workers will be asked to leave after construction because wind farm project will not require more individual for operations phase;
- Improper disposal of construction waste and debris from deconstruction of campsites, storage area, etc. will lead to contamination of soil and discontent of community;
- Deconstruction activity will lead to generation of dust which can be carried downwind to habitations;
- Deconstruction activities are associated with health and safety issues such as structural collapse, trip and fall, electrical hazard etc.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Low	Insignificant	Negligible
Duration	Low			
Intensity	Moderate			
Frequency	N/A			
Likelihood	Low			
Sensitivity	Low			

6.8.1 Mitigation Measures

Construction demobilisation will require removal of machinery, workers and other temporary structures. The mitigation measures for demobilisation shall include:

- The contractor shall inform the workers and local community about the duration of work;
- The workers shall be clearly informed about the expected schedule and completion of each activity;
- Reduction of worker will be done phase wise and corresponding to completion of each activity;
- The reduction in workers shall be done based only on the requirement of his/her skill set and not guided by any other factor;
- A transparent mechanism shall be prepared wherever choice is to be made between individuals of similar capability;

- All waste generated from demobilisation shall be collected and disposed at the nearest municipal disposal site. Structures that can be reused will be carried back by the contractors or sold to vendors;
- All necessary Personal Protection Equipment (PPE) shall be used by the workers during demobilisation; and
- Workers shall be briefed about the use and requirements of PPE.

7. Analysis of Alternatives

7.1 Introduction

This section of the report presents the analysis of the alternatives considered for the Project. The following scenarios have been considered:

- Project versus No project Scenario;
- Alternate methods of power generation;
- Alternate location for the proposed project; and
- Alternate routes for transmission lines.

7.2 No project scenario

Peak demand in Karnataka was 10, 001 MW in FY 2014-2015, of which only 9549 MW could be met resulting in energy deficit of nearly 452 MW i.e. 4%. Month wise power supply position for Karnataka State for 2014-2015 (in terms of peak demand) as per Load Generation Balance Report (LGBR) 2015-2016 is as presented in **Table 7-1** below:

Table 7-1: Month Wise Power Supply Position for 2014-2015 for Karnataka

Month	Peak			
	Demand (MW)	Availability (MW)	Surplus (+)/ Deficit (-)	
			MW	%
April 14	10001	9503	-498	-5.0
May 14	9285	8499	-786	-8.5
June 14	9388	8261	-1127	-12.0
July 14	8953	8137	-816	-9.1
August 14	8433	7878	-555	-6.6
September 14	8300	7973	-327	-3.9
October 14	8352	7574	-778	-9.3
November 14	8818	7955	-863	-9.8
December 14	9410	8967	-443	-4.7
January 15	9825	9175	-650	-6.6
February 15	9810	9349	-461	-4.7
March 15	9889	9549	-340	-3.4
Annual	10001	9549	-452	-4.5

Source: Load Generation Balance Report 2015-16, Ministry of Power, Government of India

Peak supply and peak shortage estimation till 2022 as per Karnataka Power Road Map is presented in **Table 7-2** below.

Table 7-2: Projected peak supply-demand gap for Karnataka State

	FY-14	FY-15	FY-16	FY-17	FY-18
Projected Peak Demand	10899	11542	12234	12979	13781
Estimated Peak Supply	9355	10203	10936	12459	13032
Residual Peak demand (%)	14%	12%	11%	4%	5%

Source: Load Generation Balance Report 2015-16, Ministry of Power, Government of India

The current power supply scenario and the future forecasts indicate a progressive deficit in supply. In order to bridge this gap between the demand and supply, renewable/non-conventional sources of power are required to supplement the conventional sources. The proposed project being a non-conventional source of power generation intends to contribute towards bridging the demand supply deficit as projected.

The State of Karnataka will remain a pioneer in the area of renewable energy development in the country. As a part of its endeavour to be on par with the renewable energy obligations set by the National Action Plan for Climate Change and maximizes the potential from the renewable energy sources, Government of Karnataka intends to realize a minimum capacity addition of 3600 MW during the policy period (Draft Karnataka Renewable Energy Policy 2014-2020. (Wind, Small Hydro, Biomass, Cogeneration and MSW)) in a phased manner from various technologies. The proposed year-wise targets are as given in **Table 7-3** below.

Table 7-3: Year wise target of addition of Renewable Energy in Karnataka

RE Source	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	Total
Wind Power	350	400	425	450	475	500	2600
Mini, Micro and Small Hydro	50	100	100	100	125	125	600
Biomass, Cogeneration and MSW	35	65	75	75	75	75	400
Total	435	565	600	625	675	700	3600

The wind power generation capacity in India is 49,130 MW as per the official estimates in the Indian Wind Atlas (2010) by National Institute of Wind Energy (NIWE) erstwhile known as Centre for Wind Energy Technology (C-WET). The Indian wind energy sector has an installed capacity of 24,376.26 MW (as on September 30, 2015). In terms of wind power installed capacity, India is ranked 5th in the World. National Institute of Wind Energy (NIWE) published the Indian Wind Atlas in 2010, showing large areas with annual average wind power densities of more than 200 Watts/m^2 at 50 meter above ground level. The potential sites have been classified according to annual mean wind power density ranging from 200 W/m^2 to 500 W/m^2. Sites with Annual Mean Wind Density above 200 W/m^2 are considered suitable for wind power projects. There are 339 such sites identified in the country, out of which 27 sites are located in Karnataka with Vijayapura among one of them. It is estimated that total wind power potential of Karnataka State is 13236 MW with Vijayapura at 794.97 MW.

Considering the huge renewable energy potential yet to be tapped, the State can accomplish more substantial achievement to make it the leading Renewable Energy State in the Country. The State wishes to put due emphasis on accelerating the growth of renewable energy sector in future. As an initiative state has set up Karnataka Renewable Energy Policy covering wind, small hydro, biomass, cogeneration and municipal solid waste (MSW). Karnataka Renewable Energy Policy 2009-2014 is in force and Karnataka Renewable Energy Policy 2014-2020 is in draft stage. Main objectives of the policy include, achieving a minimum capacity addition 3600 MW by 2020 in a phased manner; provision of “single window” for clearances, approvals and technical consultation, etc. A High Level Committee for Renewable Energy (HLC-RE) with Chief Secretary, GoK (Government of Karnataka) as Chairman was constituted by the GoK under this policy in order to fast track implementation of renewable energy projects and thus capacity addition in the State.

The State has an installed renewable energy capacity of 4386 MW at the end of FY 2013-14. [14]Karnataka has installed wind capacity of 2639.45 MW as on March 2015. [15]

The proposed project presents an opportunity to utilize the potential for wind power generation. A “No Project Scenario” will not address the issue of power shortage. An alternative without the project is undesirable, as it would worsen the power supply-demand scenario, which would be a constraint on economic growth.

The Project being a wind power project will not lead in any CO2 and SO2 emissions during the operation phase. It does not deplete the natural resources and most importantly, only a small part of land will be permanently utilised by the turbines, ancillary facilities and access roads.

[14] Draft Karnataka Renewable Energy Policy 2014-2020.
[15] http://www.inwea.org/installedcapacity.htm

7.3 Alternate Methods of Power Generation

Wind energy is the most eco-friendly mode of power generation as it avoids any kind of emissions from the operation. There are no fuel requirements or large quantities of water for operation of the plant. The conventional sources of power (thermal power plants) have a very high environmental cost compared to non-conventional sources. The construction phase of thermal power plants are also longer than that of wind energy projects which requires short lead time to design, install, and start-up – a maximum of 2 months after micro siting, approvals and land purchase.

India has an installed capacity of 310005.28 MW as of 31st December, 2016[16]. Thermal power plants account for 69 % of India's installed electricity capacity followed by hydropower which accounts for approximately 14%, renewable energy for 15% and nuclear for about 2%. All India installed capacity in MW of power station as on 31st December 2016 is presented below in **Table 7-4**.

Table 7-4: Installed Capacity (in MW) of Power Stations in India

Particular	Capacity (in MW)	% of total
Coal Fired Thermal Power Plant	188967.9	87.8
Gas Fired Thermal Power Plant	25282.13	11.7
Oil Fired Thermal Power Plant	918.89	0.5
Total Thermal Power Plant	**215168.9**	**69**
Nuclear	5780	2.0
Hydro (Renewable)	43139.43	14
Renewable Energy Sources (RES)	45916.95	15
Total	**284303**	**100**

Source: MNRE, As on 31st December 2016

Breakup of renewable energy sources installed in India as on 31st December 2015 is presented in **Table 7-5** below:

Table 7-5: Breakup of Renewable Energy Sources in India

Small Hydro Power	Wind Power	Bio Power		Solar Power	Total Capacity
		BM Power/Cogen.	Waste to Energy		
4323.37	28082.95	4882.33	115.08	8513.23	45916.95

As per the prevailing Ministry of Environment and Forest laws, (the Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated January 19, 2009), 38 activities are required to undertake environmental impact assessment studies. Since wind is one of the cleanest sources of energy, Environmental Impact Assessment study is not required for wind mill projects as there is no negative environmental impact due to the project activity. According to the International Renewable Energy Association (IRENA), wind power sector has generated 48,000 jobs (direct and indirect) in India.

Considering all the above mentioned favourable scenarios existing nationally and locally for wind power generation, there is no requirement of an alternative method. Wind power is the most suitable and environment friendly option for power generation.

[16] http://powermin.nic.in/power-sector-glance-all-india

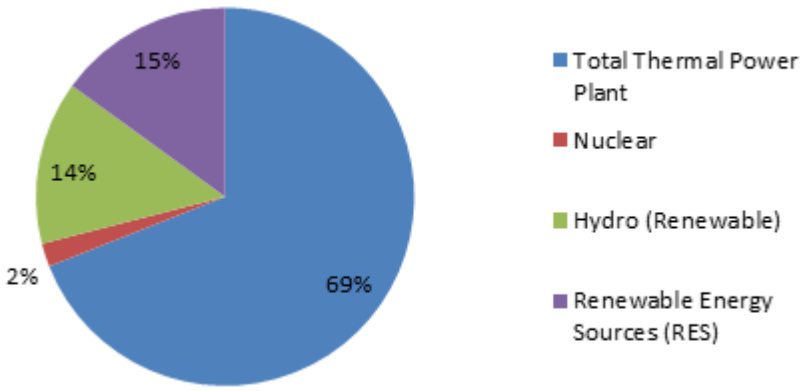


Figure 7-1: Source wise installed Capacity (As on 31st December 2016)

Installed Capacity of power utilities in Karnataka as on 31st December 2016 is presented in **Table 7-6** below.

Table 7-6: Installed capacity (in MW) of power utilities in Karnataka

Ownership/ Sector	Mode wise Breakup							Grand Total
	Thermal				Nuclear	Hydro (Renewable)	RES (MNRE)	
	Coal	Gas	Diesel	Total				
State	4220.0	0.00	127.92	4347.92	0.00	3599.80	155.33	**8103.05**
Private	2060.00	0.00	106.50	2166.50	0.00	0.00	5310.16	**7476.66**
Central	2028.46	0.00	0.00	2028.46	475.86	0.00	0.00	**2504.32**
Sub-Total	**8308.46**	**0.00**	**234.42**	**8542.88**	**475.86**	**3599.80**	**5465.49**	**18084.03**

As on 31st December 2016
RES: Renewable Energy Source. RES include Small Hydro Power, Bio Power, Urban &Industrial waste power, Solar and Wind Energy Source: CEA

The various power generation options as discussed in the earlier section can be evaluated on the levelised cost of power generation which includes the capital and O&M costs, reliability of power generation in terms of plant load factor and the greenhouse gas (GHG) emission. The comparative analysis of various power generation options based on these factors has been presented in **Table 7-7**.

Table 7-7: Comparative analysis of various power generation options

Alternative	Cost (₹/kWh) *	Plant Load Factor **	Average Lifecycle GHG Emission (tonnes CO_2e/GWh) ***
Coal	2.5	65-85%	888
Natural Gas	3.9	70-85%	500
Hydro	3.8	30-50%	26
Nuclear power	2.5-5.7	65-85%	28
Wind Energy	4.2	25-40%	26
Solar	15.3-17.1	10-15%	85

Source: ** - LBNL, CERC, CSTEP & NPCIL*
***- Renewable UK*
**** - World Nuclear Association Report*

The power generation options using conventional sources offer advantages such as lower levelised costs of power generation and higher plant load factors. The operation and maintenance of wind farms does not typically

involve air emissions or effluent discharges. There are no fuel requirements or large quantities of water required for the operation of the plant. GHG emissions and other environmental pollution (stack emissions, ash management etc.) issues are also insignificant. Also, there are no significant social issues associated with wind energy projects.

India being a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) has formulated a National Action Plan on Climate Change (released in June 2008) to promote the development of renewable energy in the country. Karnataka Renewable Energy Development Limited, Bangalore has been formulated to promote, develop, encourage and carry out consultancy, field research and experiments for implementation of non-conventional / renewable energy projects in the area.

Every mode of electricity generation offers various advantages and disadvantages with respect to operational cost, environmental impact, and other factors. In relation to GHG emissions, each generation method produces GHGs in varying quantities through construction, operation (including fuel supply activities), and decommissioning. Table 7-8 highlights some of the advantages and disadvantages of various electricity generating options with GHG emissions. Coal fired power plants release the majority of GHGs during operation.

Table 7-8: Environmental advantage and disadvantages of various electricity generating options

Mode	Disadvantage	Advantage
Thermal Power Plant (Coal based)	• Consumption of large quantities of fossil fuel which is an exhaustible resource • Large quantities of water requirement for cooling operations • High volume of stack emissions during operation phase • Accumulation of fly ash (for coal powered) • Upstream impact from mining • GHG emission estimated as 888 tonnes CO_2e/GWh	• Large scale production potential • Moderate period of commissioning
Hydropower Plant	• Site specific, dependent on reservoir/river etc. • Downstream impact on flow • Long gestation period • Social and Ecological impacts	• Inexhaustible fuel source • Limited environmental impact (air and water) • Can be reproduced on small scale • GHG emission estimated as low as 26 tonnes CO_2/GWh for run of river projects
Solar Power	• Large land requirement • Site specific to solar insolation	• Pollution levels are insignificant • Inexhaustible source • GHG emissions as low as 85 tonnes CO_2/GWh for the Production Chain
Wind Power	• Site specific (associated to wind pattern) • Involve issues like shadow flicker and noise generation and may pose impact on avifauna	• Pollution levels are insignificant • Inexhaustible source • GHG emissions as low as 26 tonnes CO_2/GWh for the Production Chain
Nuclear Power	• Less availability of fuel source • Hazards associated with radioactive material • Long start-up period	• GHG emissions as low as 28 tonnes CO_2/GWh

Source: International Atomic Energy Agency (IAEA), Comparison of Lifecycle Greenhouse Gas Emissions of Various Electricity Generation Sources (World Nuclear Association)

7.4 Statutory & Policy Requirements

The Ministry of New and Renewable Energy (MNRE) has announced Generation based incentive for Grid interactive Wind Power Projects, vide letter No.53/1/2008-E dated 23-7-2008. The Ministry will provide through Indian Renewable Energy Development Agency (IREDA), a generation based incentive of Rs.0.50 per unit (KWH) for a period of ten years to the eligible project promoters. However, the components of the scheme will be reviewed when projects aggregating to 49 MW, which are estimated to generate about 0.9 billion units of electricity are registered by IREDA.

As per Karnataka Renewable Energy Policy, following facilities will be extended to all the Renewable Energy Projects**:**

- **Grant of Incentives Available to Industries:** "Generation of electricity from Renewable Energy Sources will be treated as Industry under the provisions of the Industrial policy 2009 and entry tax exemptions and all other incentives available to industrial units under such schemes will also be extended to the Renewable Energy Power Projects irrespective of the Zone."
- **Renewable Energy Obligation:** The state Government is committed to procure & utilize the renewable Energy power as required and determined by Government of Karnataka by time to time, subject to Karnataka Electricity Regulatory Commission (KERC) guidelines.
- **Feed in Tariff:** Various sources of Renewable Energy power procurement by the Energy Supply Companies/distribution licensees will be at Tariffs as determined by the KERC.
- **Banking of Electricity:** The banking facility for the power generated shall be allowed as determined by KERC from time to time for the energy banked with the Karnataka Power Transmission Company Limited / distribution licensee.
- **Power Purchase Agreement (PPA):** The sale of electricity by Power Producer of Energy Supply Company will be governed by the Power Purchase Agreement executed between the Power Producer and witnessed by Karnataka Electricity Regulatory Commission.
- **Exemption from Demand cut:** Exemption of demand cut to the extent of 50% of the installed capacity assigned for captive use purpose, will be allowed.

7.5 Alternate Location for the Project

Wind energy projects are site specific and its feasibility depends on a number of factors which can be broadly categorized as wind resource assessment, land availability, cost of land and impact on community.

7.6 Identification of sites for WTG's

Independent Wind Resource Assessment study for the site has been carried out to ascertain wind energy potential of the site. The site was observed to be feasible for the proposed project. Locations of WTGs are based on WRA study.

The following additional criteria have been considered for site selection:

- The sites selected for the wind turbine generators does not fall under any reserved or protected forests;
- No environmentally sensitive features such as forests, archaeological sites are located in the immediate site surroundings;
- The proposed site does not involve any physical displacement;
- At present the project site is used mostly for private agriculture land and grazing was seen carried out in the surroundings of the few WTG locations. The plot for wind farm is chosen such that minimal arable land is lost and the grazing areas will not be disturbed as only a small area around the wind farm will be fenced;
- Access roads of the project site can be used by the native inhabitants; and
- Willingness of people to sell their land for the project.

Therefore, considering all the above details of the location and site settings, the identified site was considered as a suitable option for the project.

7.7 Alternate routes for transmission lines

The 33/ 220 KV pooling substation is under construction at Karjol village for the power evacuation of entire 100 MW project. From this pooling sub-station, the generated electricity will be delivered to KPTCL's 220/110 kV Bijapur sub-station.

The route for the transmission line will be selected based on the following factors:

- Transmission line route will be planned to avoid any habitations along the route;
- No house or community structures will be located under the transmission line;
- Areas requiring extensive clearing of vegetation will be avoided;
- Selection of the transmission route shall avoid any environmental sensitive site if identified;
- Right of way/access roads will be shared with the common user of the substation.

The shortest possible route after considering the above factors will be selected for the transmission lines. Consideration of all the above factors will reduce the environmental and social footprint of the transmission line.

7.8 Conclusion

As discussed in the previous sections, a significant gap between demand and supply of power exists in the state of Karnataka. Power generation using conventional sources of power generation result in greenhouse gas emissions and destruction of the natural habitats. It is thus proposed to develop a wind power project at the site because of wind resource availability, incentives being offered by the government and low pollution levels associated with wind power generation.

Considering all the factors mentioned in the sections above, such as favourable environmental and social settings; low GHG emissions during the entire project life cycle; availability of appropriate lands and local community's acceptance of wind energy projects in the region, wind energy based power generation is the most appropriate alternative in the project area.

8. Environmental and Social Management Plan

8.1 Introduction

This chapter addresses the requirement of IFC Performance Standard-1 which highlights the importance of managing the social and environmental performance throughout the life of the project. HFE/ CWPPL is committed to implement an effective Environmental and Social Management System (hereinafter referred as ESMS) to continuously manage and communicate the potential social and environmental impacts and risks imposed on the project employees (direct and indirect) and the local communities residing in the immediate vicinity of the project area.

8.2 Environmental and Social Management System

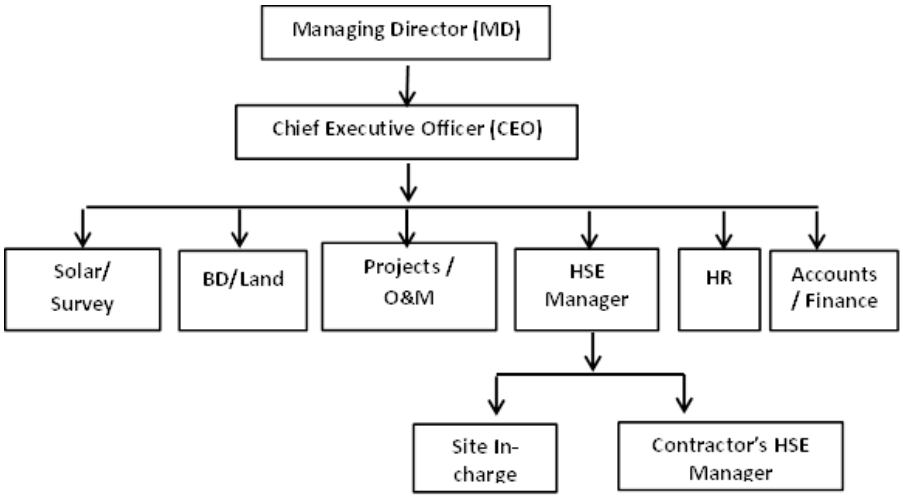
The ESMS describes the mitigation measures for all the identified potential impacts associated with the proposed project during its construction and operation phases. The environment and social management plan (ESMP) shall delineate the monitoring and management measures to avoid and/or minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures. Also the ESMP shall ensure a continuous communication process between CWPPL, their workers (including sub-contractors), local community and other stakeholders.

CWPPL has an obligation to ensure compliance to all the commitments towards Environment, Social, Health and Safety Standards while executing all the project related activities for the proposed wind power project. This ESMP shall be applicable to all the employees of CWPPL and its sub- contractors. Also, CWPPL shall ensure that Gamesa, the EPC and O&M contractor of this project is brought under the umbrella of the ESMS and it shall implement the provisions of this Environment and Social Management Plan.

8.3 Organization Structure

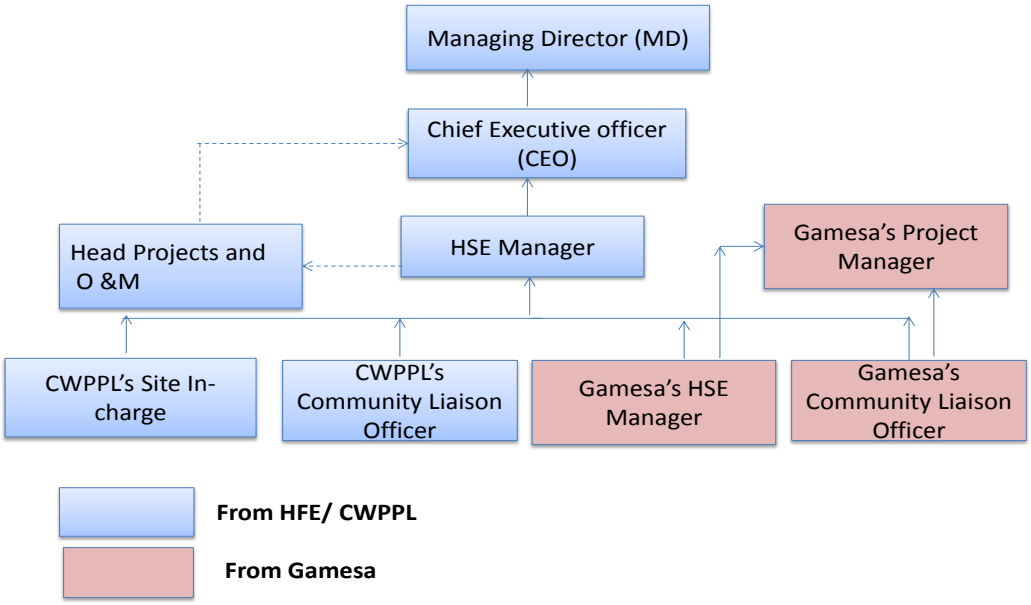
HFE has developed Occupational Health Safety & Environment (HSE) Policy dated 7th September 2015 and is committed to safeguard occupational health, safety and environment of its employees, contractors, clients, stakeholders and the communities in which they operate. (HSE) team of HFE is headed by Managing Director (MD) followed by Chief Executive Officer (CEO). HSE Manager of HFE, who reports to MD and CEO, is responsible for HSE related issues at all the sites. HFE as a practice recruits its own Site-In charge at each Site who is responsible for overall management of project and is also responsible for HSE related issues at site and report to HSE Manager of HFE. The key contractors are also required to depute an HSE Officer for management of environment, health and safety related issues at site level. A community liaison officer will be engaged at all project till the construction phase by HFE, while during operation phase the contractor will be required to engage a community liaison person. Organisation structure of HFE is presented as Figure below.

Figure 8-1: Organogram Structure of HFE



The project does not attract any significant adverse social impacts or risks as indicated in the previous sections. The project footprint area is limited to its immediate vicinity and a particular range of stakeholders. As per the Company Policy, one representative of CWPPL at site level will be deputed as Site In-charge, responsible for overall management of project including HSE related aspects. CWPPL's Site In-charge will work in co-ordination with HSE Manager of Gamesa and report to HSE Manager of HFE. A community liaison officer will be engaged at all project till the construction phase by HFE, while during operation phase Gamesa will be required to engage a community liaison person. Site specific organogram is as presented in Figure below.

Figure 8-2: Site Specific Organogram Structure for Project



8.4 Roles and Responsibilities

HSE Manager:

- Incorporating Environment, Health and Safety (EHS) and social elements into new and existing projects after considering the technical and financial aspects;
- Monitor the ESMS through review of audits and other assessments programs;
- Review the feedbacks on various project through different channels;
- Communicate the shortcomings and improvement mechanism to all project / operating companies; and
- Guide on all issues related to Environment, Health and Safety and Social.
- Undertake periodic audit and review contractor's performance

CWPPL's Site In-charge

The Site In-charge will have the following EHS related responsibilities:

- Review and understand data collected and ensure implementation of recommended mitigation measures
- Interact with subcontractors and overview the workers performance with respect to environment and social
- Ensure legal compliance and need for renewals
- Monitor compliance to ESMP and other legal requirements
- Assist HSE manager in implementation of ESMS

CWPPL's Community Liaison Officer

The community liaison officer will have the following responsibilities:

- Liaison with the government authorities and all project stakeholders;
- Coordinate with land aggregator during land procurement

- Supervise and coordinate the social activities of the project
- Manage the social impact mitigation measures
- Plan and execute public consultation and disclosure and CSR activities.
- Manage all grievances of the project and their outcomes;
- Undertaking community development initiatives

8.5 Training

CWPPL shall ensure that the job specific training and EHS Induction training needs are identified based on the specific requirements of ESMS and existing capacity of site and project personnel (including the Contractors and Sub-contractors). Special emphasis shall be placed on traffic management, operation of cranes, stakeholder's engagement and grievance redressal.

General environmental awareness shall be increased among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. This will help in minimising adverse environmental impacts, ensuring compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment shall be imparted to the contractors and sub- contractors prior to the commencement of the project.

An environmental and social management training programme shall be conducted to ensure effective implementation of the management and control measures during construction and operation of the project. The training programme shall ensure that all concerned members of the team understand the following aspects:

- Purpose of action plan for the project activities;
- Requirements of the specific action plans;
- Understanding of the sensitive environmental and social features within and surrounding of the project areas; and
- Aware of the potential risks from the project activities.

A basic occupational training program and specialty courses shall be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments. Training shall be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards.

Workers with rescue and first-aid duties must receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their co-workers. Through appropriate contract specifications and monitoring, the employer shall ensure that service providers, as well as contracted and subcontracted labour are trained adequately before assignments begin.

8.6 Monitoring and Review Process

In order to implement the ESMP, the on-site team shall adhere to a time-bound and action-oriented Environmental and Social Action Plan to implement the mitigation measures provided for each of the identified environmental and social impacts. This ESMP shall be monitored on a regular basis, quarterly or half-yearly and all outcomes would need to be audited in accordance with existing EHS commitments.

The monitoring process shall cover all stakeholders including contractors, labourers, suppliers and the local community impacted by the project activities and associated facilities thereby increasing the effectiveness of suggested mitigations measures. CWPPL shall ensure that all the contractors comply with the requirements of conditions for all applicable permits, suggested action plans and scheduled monitoring. The inspections and audits shall be carried out by an internal trained team and external agencies/experts. The entire process of inspections and audits shall be documented and key findings of which shall be implemented by the proponent and contractors in their respective areas.

8.7 Reporting and Documentation

Documentation and record keeping system has to be established to ensure updating and recording of requirements specified in ESMP. Responsibilities have to be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained and that document control is ensured.

The following records shall be maintained at site:

- Documented Environment Management System;
- Legal Register;
- Operation control procedures;
- Work instructions;
- Incident reports;
- Emergency preparedness and response procedures;
- Training records;
- Monitoring reports;
- Auditing reports; and
- Complaints register, and issues attended/closed.

8.8 Management Plans and Procedures

The section below gives an overview of the various management plans/procedures required to manage the key aspects of the proposed project. These management plans set out the actions for monitoring and evaluation of the project during its various phases of life cycle. Following plans and procedures are described in detailed below:

- Construction Labour Management Plan;
- Occupational Health & Safety Management Plan;
- Stakeholder Engagement Plan; and
- Grievance Redressal Mechanism

8.8.1 Construction Labour Management Plan

The proposed wind power project is in its initial phase of construction. It is envisaged that during construction phase of the project, labourers for various jobs will be hired through authorised manpower agencies. The labour requirement will range from 250-300 during peak construction activities. Therefore, it is also envisaged that many of the labourers will be employed from outside the region and hence, accommodation will be provided. These labourers are and will be accommodated in a temporary campsite of Gamesa near the project area.

8.8.1.1 Objectives

The influx of outside labour will have both negative and positive impacts on the nearby community and local environment. The labour will be accommodated in temporary campsite near the project site, which can have significant interface with the nearby community. However, the influx of workers would lead to a transient increase of population in the immediate vicinity of the project area for a limited time. This would put pressure on the local resources such as roads, fuel wood, water etc.

Hence, a plan has been designed to demonstrate the:

- Potential impacts associated with influx on the host population and receiving environment are minimized;
- Provision of safe and healthy working conditions, and a comfortable environment for labour; and
- To ensure compliance with the IFC PS 2and 4 and national labour laws.

8.8.1.2 IFC Performance Standards

International Finance Cooperation (IFC) Performance Standard 2- Labour and Working Conditions is specific to labour and working conditions. This Standard focuses on the protection of the basic rights of workers, fostering constructive worker-management relationships, as well as promoting fair treatment and the provision of a safe and healthy workplace. The basic provisions for migrant workers under PS 2 are enumerated below:

- As per the provisions of PS 2, the client shall identify migrant workers engaged through third party and ensure that they are engaged on substantially equivalent terms and conditions to non-migrant workers carrying out similar work (if any);
- The Developer shall ensure provision of adequate accommodation, transportation, and basic services including water, sanitation, and medical care for the workers working on that project;
- The compensation paid to the migrant workers, if any, should be non-discriminatory and the principle of equal opportunity and fair treatment to be followed; and
- Wastewater, sewage, food and any other waste materials are to be properly handled, in compliance with local standards– whichever is more stringent – and without causing any significant impacts to the biophysical environment or surrounding communities.

IFC PS 4 – Community Health, Safety and Security carries health and safety through to the community environment. The objectives of the Performance Standard are:

- To minimise and manage health and safety risks to local communities; and
- To ensure that the project does not harm community health and safety.

8.8.1.3 General Requirement

All the labour from outside are envisaged to be accommodated in temporary campsite near the project area. If migrant workers are accompanied by their families, provisions should be made accordingly. Guidance on Workers Accommodation developed by IFC and EBRD is also referred for inclusion of requirements for labour camp to be established by developers during construction phase of the project[17]. Developer(s) shall ensure implementation of the following measures to minimize the potential negative impacts of worker accommodation and workers on local communities:

Cleanliness: Pest extermination, vector control and disinfection are to be carried out throughout the living facilities in compliance with local requirements and/or good practice;

Complaints and incident reporting: A formal Complaints Procedure will be implemented to ensure timely and transparent response to complaints as received from labour;

Labour education: The workforce will be sensitized to local social and cultural practices through provision of an induction course for all employees that stipulates expected behaviour;

Labour behaviour in campsite provided: A Code of Behaviour governing appropriate behaviour in the accommodation facilities to be kept in place and to be strictly enforced. The Developer shall ensure implementation of the “rules of engagement” between labours living in campsite and community and shall be implemented by construction contractors for all engaged labours.

Labour Compensation and Accommodation: Client shall ensure that labours are provided with benefits such as annual leave, weekly rest day, etc. Accommodation to be provided for the construction labour which cover facilities (including catering facilities, dining areas, washing and laundry facilities etc.) and supporting utilities.

8.8.1.4 Hiring and Recruitment Procedure

The manpower contractor shall, wherever possible, locally recruit the available workforce and shall provide appropriate and requisite on job and EHS training as necessary. The following general measures shall be considered for the workforce during their employment tenure:

- The contractor shall not employ any person below the age of 18 years nor will have any forced labour;
- The construction labourers will be provided with documented information regarding their rights under national labour and employment law such as but not limited to Factories Act, Minimum Wages Act, Trade Unions Act and Workmen’s Compensation Act;
- First priority for employment of labour should be given to those impacted by the project such as landowners who have lost land;

[17] *http://www.ebrd.com/downloads/about/sustainability/Workers_accomodation.pdf*

- No discrimination shall be done by the construction contractor with respect to recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, termination of employment or retirement, and disciplinary practices;
- The contractor to ensure that work hours are set at eight hours a day, 48 hours a week, with a weekly rest day for all engaged labours;
- Every labour is entitled for maximum of only two hours a day as Overtime (OT) work. OT pay is twice the hourly remuneration;
- CWPPL shall ensure equal wages for male and female workers for work of equal nature or value is maintained;
- A grievance redress mechanism for workers shall be put in place by the contractor to raise workplace concerns. The workers will be informed about the grievance mechanism at the time of recruitment; and
- CWPPL shall ensure that their contractors develop and implement a procedure to review the performance of their sub-contractors.

The procedure developed should include regular inspection of the camp sites, maintaining information pertaining to labours sourced by sub-contractors.

8.8.1.5 Worker's Accommodation

The following measures shall be provided:

- The labour will be provided with accommodation on twin sharing basis made of insulated material and locally available building material, etc.;
- The migrant workers, if any, with families shall be provided with individual accommodation comprising bedroom, sanitary and cooking facilities;
- The units will be supported by common latrines and bathing facilities duly segregated for male and female labour;
- Adequate number of toilets shall be provided in the accommodation facilities. A minimum of 1 unit to 15 males and 1 unit for 10 females shall be provided;
- The contractor shall provide a canteen facility for the construction workers and the food will be of appropriate nutritional value and will take into account religious/cultural backgrounds;
- All doors and windows shall be lockable and mobile partitions/curtains shall be provided for privacy;
- Facilities for the storage of personal belongings for workers shall be provided within the campsite only;
- Dustbins shall be provided for collection of garbage and will be removed on a daily basis;
- It is also required to provide first aid box in adequate numbers; and
- Ventilation should be appropriate for the climatic conditions and provide workers with a comfortable and healthy environment to rest and spend their spare time.

8.8.1.6 Provision of Drinking Water

Access to an adequate and convenient supply of free potable water is necessity for workers. The domestic water supply shall be made available by the contractor.

- Safe drinking water conforming to the IS 10500:2012 for drinking water shall be provided;
- CWPPL should regularly monitor the quality of drinking water made available at the labour camp. In case of non-compliance with the drinking water specifications, additional treatment shall be provided or alternative sources of water supply shall be arranged; and
- All tanks used for the storage of drinking water are constructed and covered as to prevent water stored therein from becoming polluted or contaminated.

8.8.1.7 Cooking Arrangement

The construction phase will involve engagement of large number of people in the project area for a limited time. Hence, there shall be requirement of provision of cooking facilities (kitchen) as listed below:

- Places for food preparation are designed to permit good food hygiene practices, including protection against contamination between and during food preparation;
- Adequate personal hygiene including a sufficient number of washbasins designated for cleaning hands with clean, running water; and
- All kitchen floors, ceiling and wall surfaces adjacent to or above food preparation and cooking areas are built using durable, non-absorbent, easily cleanable, non-toxic materials;
- Food preparation tables are equipped with a smooth, durable, easily cleanable, non-corrosive surface made of non-toxic materials.

To ensure that the fuel need of labourers in the project area does not interfere with the local requirements, necessary arrangements for supply of fuel wood to the labourers shall be done by the contractor. Fuel requirement for cooking purposes are only to be met by fuel wood that to be purchased only from authorized vendors only.

8.8.1.8 Wastewater Management

There will of generation of wastewater from the campsite. About 80% of water used shall be generated as sewage/wastewater. CWPPL shall ensure that the campsite is equipped with septic tank and soak pit for disposal of sewage. It is also recommended that the storm water and sewage system should be separate. The surface water drainage shall include all necessary gutters, down pipes, gullies, traps, catch pits, manholes etc. Sanitary and toilet facilities are constructed of materials that are easily cleanable. Sanitary and toilet facilities are required to be cleaned frequently and kept in working condition.

8.8.1.9 Solid Waste Management

The municipal solid waste generated from campsite will mostly comprise of compostable wastes like vegetable matters (kitchen waste) and combustible waste like paper, cans, plastic and some non-degradable waste like glass/glass bottles. Improper disposal of solid waste will lead to environmental degradation and health hazards to labour as well as nearby community.

The following measures shall be adopted for ensuring effective management of solid waste:

- The solid wastes of domestic nature generated shall be collected and stored separately in appropriate containers with proper sealing on them;
- Separate bins with proper markings in terms of recyclable or non-recyclable waste shall be provided in sufficient numbers for collection of garbage;
- Food waste and other refuse are to be adequately deposited in closed containers and removed frequently to avoid accumulation; and
- The contractor shall identify and tie up with the concerned local body for disposal of waste at frequent intervals.

8.8.1.10 Medical Facility

Effective health management is necessary for preventing spread of communicable diseases among labour and within the adjoining community. The following medical facilities shall be provided by contractors for the construction workers:

- Adequate first aid kits shall be provided in the campsite in accessible place. The kit shall contain all type of medicines and dressing material;
- Contractor shall identify and train an adequate number of workers to provide first aid during medical emergencies;
- Regular health check-ups shall be carried out for the construction labourers every six month and health records shall be maintained;
- Labours should have easy access to medical facilities and first aider; where possible, nurses should be available for female workers;
- First aid kits are adequately stocked. Where possible a 24/7 first aid service/facility is available.

- An adequate number of staff/workers is trained to provide first aid; and
- Information and awareness of communicable diseases, AIDS etc. shall be provided to workers.

8.8.1.11 Inspection of Accommodation Facility

Campsite shall be inspected at frequent intervals to ensure that the facilities are well organized and maintained to acceptable and appropriate standards by the Contractor. The key areas are:

- Daily sweeping shall be undertaken;
- Regular cleaning of sanitary facilities shall be undertaken;
- The kitchen and canteen premises shall be established under good hygiene conditions;
- Daily meal times shall be fixed for the labour;
- Smoking and alcohol consumption shall be prohibited in the workplace; and
- Water logging shall be prevented at areas near the accommodation facilities and adequate drainage is to be provided.

CWPPL shall ensure that adequate labour camp, which is appropriate for its location and be clean, safe and, at a minimum, meet the basic needs of workers, be provided.

- Labour camp should not be constructed in immediate vicinity of any drainage channel;
- It should be ensured that the labour camp should have basic amenities such as electricity, drinking water, health & sanitation facility, kitchen and rest room;
- Tanks used for the storage of drinking water are constructed and covered as to prevent water stored therein from becoming polluted or contaminated and all the workers will be instructed accordingly;
- CWPPL should ensure that accommodation which is provided is not overcrowded and does not pose a risk to the health and safety of workers;
- The labour camp will be equipped with septic tanks and soak pits and avoid presence of stagnant water is a factor of proliferation of potential disease vectors such as mosquitoes;
- CWPPL should ensure that the disruption of local communities is minimum, in particular local communities' transport infrastructures; and
- Security staff has a clear mandate and have received clear instruction about their duties and responsibilities, in particular their duties not to harass, intimidate, discipline or discriminate against workers.

8.8.1.12 Grievance Redressal Mechanism

A Grievance Redress Mechanism (GRM) shall be formulated for the construction labourers (local and migrant) comprising of a review committee including representatives elected by labour and management representatives. A documented GRM shall have the following elements:

- Proper system for lodging grievances;
- Provision for raising anonymous complaints;
- Appropriate level of management for addressing concerns;
- Workers and members of the surrounding communities have specific means to raise concerns about security arrangement and staff;
- Provision for timely action and feedback;
- Monitoring and review of grievances raised and action taken; and
- Scope for continual improvement of the system.

8.8.2 Occupational Health & Safety Management Plan

HFE has formulated a HSE (Occupational Health, Safety and Environment) policy that is committed towards protecting the environment and safeguarding public interest and safety. The corporate policy shall be circulated to all staff, contractors, and other stakeholders and displayed at the corporate office and company website.

8.8.2.1 Purpose and Scope

The purpose of this Health & Safety (H&S) Plan is to identify all hazards and risks associated with the wind farm project during construction and operation phases and further recommend guidance on safe working conditions. H&S plan also lists out requirements to statutory compliance based on applicable IFC guidelines, national and state laws, rules, and regulations.

The H&S manual is applicable to all CWPPL employees, including their staff, contractors, and labourers. Even though the contractor oversees its implementation on the work site to ensure safety of labourers, overall responsibility to ensure its implementation lies with CWPPL's site in-charge. Therefore, it is recommended that CWPPL work out an arrangement to ensure implementation of the H&S plan during the contract phase itself. This may further be vetted by CWPPL by creating daily, weekly and monthly HSE checklist for site specific tasks and equipment and work environment. CWPPL's Site In-charge will in turn monitor implementation of the same requirements.

8.8.2.2 Applicable Regulations

The applicable regulations and statutory laws related to health and safety are presented below.

- IFC Performance Standard 2: Labour and Working Conditions
- Indian Labour Laws
- International Labour Law (169), 1989

8.8.2.3 Activities Requiring Safety Considerations

The major activities involved in the construction and the operation phase requiring safety intervention are presented below:

- Excavation Works;
- Drilling Works;
- Working at Heights;
- Electrical/ Fire Hazards;
- Welding and Electrical operation;
- Transportation, Loading and unloading of turbine components.

The identified hazards and the suggested safety measures have been discussed below.

<u>The following activities are carried out during construction phase of wind farm development.</u>

Excavation Works

The proposed project will involve excavation work. The identified hazards include mainly trip and fall which may lead to injuries, bodily harm or may even prove fatal.

The following safety measures are proposed:

- No material or load shall be placed or stacked near the edge of any excavation, shaft, pits or opening in the ground which may endanger persons working below.
- All loose stones, projecting clumps of earth and unstable material that may come down on workers in trench shall be removed and the excavated sides shall be adequately braced and trench suitably guarded as required considering soil conditions and depth of excavation.
- Additional bracing precautions shall be provided for sites having vibration due to adjacent machinery, vehicles, railroads, and other sources. Labourers should not enter excavated area until it has been suitably braced and secured or declared safe otherwise.
- Restricted access should be granted to excavated areas to prevent innocent bystanders from entering the area and suffering injuries or bodily harm.
- Excavation areas shall be adequately lit for night work if carried out.

- Excavated areas must be secured at night or at the end of construction activity, to prevent unsolicited entry or accidental entry of stray animals. Additionally, signs indicating construction area and danger of trip and fall hazard must be put up to prevent accidents.
- Visitors shall not be allowed on the scene of excavations unless a supervisor accompanies them.

Drilling Works

The proposed project may involve drilling works at construction stage of the project. Safety measures to prevent occurrence of hazards with various kind of tools are listed below.

Hand & Power Tools

- Regular Maintenance
- Inspect tool before each use
- Operate only according to manufacturer's instructions and use for that purpose only
- Use of proper personal protective equipment (PPE)
- Use of guards

Liquid Tools – Powered by liquid fuels such as HSD

Precautionary Measures while handling liquid tools include the following:

- it should not be enclosed in a poorly ventilated area
- Before refilling fuel, shut down engine and allow it to cool down.

Power Actuated Tools

Precautionary Measures while handling power actuated tools include the following:

- Users must be trained
- Should be tested regularly
- Use of appropriate PPE as indicated in manufacturer's instructions.

Jacks

Precautionary Measures while handling jack include the following:

- Manufacturer's capacity should be rated and not exceeded
- Do not exceed stop indicator
- Block load after lifted
- If the foundation is flimsy, place a block underneath it.

Use of Machinery

The following safety measures shall be incorporated:

- All machines will be kept in good working order, will be regularly inspected and properly maintained to the satisfaction of the site Engineer.
- No employee will be exposed to a noise level greater than 90 dB(A) for a duration of more than 8 hours per day.
- Provision of ear plugs, ear muffs etc. and undertake rotation of shift of workers operating near high noise generating areas.
- Training programs will be organized for the operational workforce regarding proper usage of PPEs, handling and storage of fuels and chemicals etc.
- Hard hat areas will be marked and informed to all workers.
- Extreme weather must be defined and working hours must be limited in such conditions.

Activities common to construction & operation phases of wind farm development are discussed below.

Working at Heights

Hazards - Fall and slip hazards that can lead to fatal body injuries e.g., muscle sprain, ligament tear, fracture, haemorrhage etc.

Safety Measures –

The following measures will be incorporated:

- Work permit system shall be implemented for working at height (typically when working over 2m above). Prior to undertaking work, integrity of structures shall be inspected. Only workers trained in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment shall be engaged for work at height.
- Appropriate fall-protection system will be provided as per the requirement. Safety belts will be mandatory and shall be monitored for wear and tear on regular basis. While operating power tools at height, workers will be provided with a second (backup) safety strap.
- Ensure use of safety belt and need for safety net as required
- All work at height to be undertaken during daytime with sufficient sunlight
- Prior to undertaking work, integrity of structures shall be inspected.
- Fixtures shall be installed on tower components to facilitate the use of fall protection systems.
- Only those workers who are trained in climbing techniques and use of fall protection measures; shall be engaged for work at height.

Electrical/Fire Hazard

Hazards - Electrical shocks, Eye injuries (retina damage, photokeratitis), Thermal burns, Fire and/or explosion hazards

Safety Measures –

The following measures will be incorporated:

- Wind turbines shall be equipped with an earthing system.
- Personal Protective Equipments (PPEs) e.g., shock resistant rubber gloves, shoes, other protective gear etc. should be provided to workers handling electricity and related components.
- The transformer yard should be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire.
- Employees involved in electrical works shall be trained in and familiar with the safety-related work practices, safety procedures and other safety requirements that pertain to their respective job assignments.
- An accident reporting and monitoring record shall be maintained.

Welding Operations

Hazards - Electrical shocks, Eye injuries (retina damage, photokeratitis), Thermal burns and Fire and/or explosion hazards.

Safety Measures –

The following measures will be incorporated:

- The contractor should conduct an awareness/training programme so that all the workers involved in such activities are made aware of the possible risks.
- Work permit system for hot work should be implemented.
- Workers should be provided with PPEs e.g., welding masks, shock resistant rubber gloves, fireproof outfits etc.
- Adequate number of fire extinguishing equipments should be provided and be handy to handle any possible fire outbreak.

Transportation, Loading and unloading of turbine components

Hazards - Crane failure during handling of wind turbine, trip and fall hazards, physical injuries (due to improper ergonomics) and accident and injury due to vehicle collision/slip along terrain

Safety Measures –

The following measures will be incorporated:

- Loading and unloading operation of equipment should be done under the supervision of a trained professional;
- All lifting appliances shall be thoroughly examined by a competent person, prior to engagement with the project;
- The contractor shall ensure that no person is engaged in driving or operating lifting appliances unless he is sufficiently trained, competent and reliable, possesses the knowledge of inherent risks involved in the operation and is medically examined periodically;
- The contractor shall ensure that machinery is equipped with a legible, durable load chart that shows the manufacturer's recommended load configurations and maximum load weights;
- The chart must be securely attached to the cab and easily visible to operators when they are seated at the control station;
- Excess waste debris and liquid spills shall be cleaned up regularly to avoid slips and falls;
- An accident reporting and monitoring record should be maintained. The objective shall be to minimize such occurrences in the future and attain zero accidents.

8.8.2.4 General Safety Considerations during WTG Operation

Following points to be taken into consideration with respect to safety.

- Relevant safety documents to be reviewed before initiating any work activity;
- Observe labels in and around the WTG and take appropriate precautions to prevent an injury;
- Operate WTG as per operation manual alone and check weather conditions before starting work;
- Refer ‘Operations manual’ for details on unsafe weather conditions;
- Place clear sign indicating that ‘work is not in progress – Do not Operate’. Remove sign only after completion of said work is done and WTG is safe to operate again;
- Recheck safety devices before restarting operations;
- Electrical work should be done by qualified, certified staff alone in accordance with safety procedures and preventive measures;
- Do not suspend loads over any personnel;
- Use of PPE for all operations is a must as defined in operations manual;
- Wait for suitable time, until working parts cool down after suspension of operations;
- Take suitable precautions when placing fingers, gloves or clothing near rotating machine parts.

Other safety considerations indicate that the project has following disclaimers.

Danger: Hazardous situation that will result in serious injury or death, or trip or fall incidents.

Warning: Hazardous situation which could result in serious injury or death, flammable liquids, risk from rotating machine parts, from unauthorized start-up, from extreme weather conditions, risk of falling due to working at height, risk of electric shock due to high voltage, from overhead loads, risk of pulmonary diseases due to hazardous vapours or gases.

Caution: Hazardous situation which could result in minor or moderate injury, risk of hearing defect from noisy machines, danger of burns due to hot WTG components.

8.8.2.5 Health and Safety Management System

As discussed in earlier section, overall management and co-ordination will be carried out by MD who will be supported by CEO and HSE Manager to ensure HSE related compliance. HSE Manager will take care of day to day HSE related activities in co-ordination with Site In-charge and Contractor 's HSE Manager.

8.8.2.6 Training

Following trainings to be carried out at regular intervals:

- Induction Training on Construction Health and Safety;
- Tool Box Training;
- Mass Training;
- Special Job Hazard Training;
- Fire safety;
- First Aid; etc.

8.8.2.7 Safety Meetings

Weekly meetings shall be organized between the contractor's HSE Manager and CWPPL's Site In-charge to discuss the efficacy of the safety measures incorporated in the current operations, incidents, any other health and safety concerns and safety measures to be incorporated in further course of work. Monthly meetings shall also be organized with the HSE Manager to update him on the health and safety aspects in site operations and to seek his/her guidance in developing safety measures.

8.8.2.8 Incident Reporting

Any incident or activity irrespective of its severity shall be reported and recorded. The EHS Supervisor shall thoroughly investigate the actual cause of the injury and the potential corrective actions to prevent future incidents. Proper documentation shall be maintained in timely and accurate manner to mitigate against similar situations which lead to the accident causing another accident.

8.8.2.9 Health and Safety Audits

CWPPL shall conduct internal Health and safety audits once in a quarter to assess the addressal of health and safety aspects onsite. External Health and Safety Audits shall also be conducted every year by a competent organisation. The findings of the audit shall be discussed between and time bound corrective action plan shall be formulated and implemented. The EHS Supervisor shall supervise and monitor the implementation of the corrective actions.

8.8.2.10 Safety Documentation and Report Writing

Proper documentation shall be maintained in the project office and shall be accessible to only authorised personnel. The following records shall be maintained:

- Incident/Accident Reports
- Jobsite Inspection Reports
- Regulatory Inspection Reports
- First Aid Log
- All Training Records
- All Safety Meetings and Logs

8.8.3 Stakeholder Engagement Plan

Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. They can comprise individuals, communities, social groups, organizations etc. It is often observed that the poor and the

marginalized are often ignored either due to the fact that they are unaware or do not have a forum to voice their opinion.

The purpose of the Stakeholder Engagement Plan (SEP) is to ensure that the direct and indirect impacted stakeholders of the project are regularly apprised of the project activities. The plan has been developed in order to draw out an outline wherein the communication process associated with the activities of the project cycle is to be undertaken.

8.8.3.1 Stakeholder Engagement

The stakeholders in the project were identified based on their level of interest and influence over the project activities. The stakeholders were primarily divided into direct and indirect and further regrouped as internal and external. In the table below, the types of stakeholders as per their level of interest and influence have been provided.

Table 8-1: Types of Stakeholder as per their interest and influence

S. No.	Types of Stakeholders	Description	Groups + Individuals
1	Direct Internal Stakeholders	Direct internal stakeholders comprise the parent company or the project proponent and the employees of the company that are directly controlled by the parent company.	• HFE (Project Owner) • Gamesa (EPC Contractor)
2	Direct External Stakeholders	Direct external stakeholders comprise the project affected people/families, contractors, supply chain and financial intermediary who are directly affected by the project activities but are not directly controlled by the project proponent.	• Project Affected Persons/Families (Land Owners) • Karnataka Power Company Limited (KPCL) • Hubli Electricity Supply Company Limited (HESCOM) • Financial Intermediary • Contractors • Vendors
3	Indirect Internal Stakeholders	Indirect internal stakeholders consist of the secondary stakeholders who would have a more indirect interest but within the direct influence of the project.	• Families of Direct Employees
4	Indirect External Stakeholders	Indirect external stakeholders comprise of those stakeholders who might be not be involved directly in the day to day operation of the project but have an interest in the activities of the project.	• Local Community residing within the 2 villages of the project area • Opinion Leaders of local communities residing within the 2 villages of the project area • Local Government Institutions of 2 Villages • Karnataka State Pollution Control Board • National Institute of Wind Energy formerly known as " Centre for Wind Energy Technology" Chennai • Karnataka Renewable Energy Development Limited (KREDL) • Local Media

8.8.3.2 Stakeholder Analysis

Stakeholder analysis takes a more comprehensive view of the stakeholder's group interests, how they would be affected and to what extent and influence they could have on the project. These aspects cumulatively provide the basis for constructing the stakeholder engagement strategy. The key stakeholders identified in the previous section have been categorised into four major groups: Government Agencies, Positively Influenced Stakeholders, Critical to Engage and Donors. The categorisation list of key stakeholders has been provided in the following table.

Table 8-2: Categorization List of Key Stakeholders

Categorization	Key Stakeholders
Government Agencies	• Karnataka Power Company Limited (KPCL) • Hubli Electricity Supply Company Limited (HESCOM) • Karnataka State Pollution Control Board • National Institute of Wind Energy

Categorization	Key Stakeholders
	• Karnataka Renewable Energy Development Limited (KREDL)
Positively Influenced Stakeholders	• Project Affected Persons/Families (Land Owners) • Families of Direct Employees • HFE (Project Owner) • Gamesa (EPC Contractor) • Local Community residing within the 2 villages of the project area • Contractors • Vendors
Critical to Engage	• Opinion Leaders of local communities residing within the 2 villages of the project area • Local Government Institutions of 2 Villages • Local Media
Lenders	• Financial Intermediary

In order to map the interest/influence of the stakeholders on the project activities, a matrix showcasing the stakeholders and their interest/influence has been developed. This step is to assess the interest/influence into high, medium and low levels. In the table below, **Table 8-3** the interest matrix has been provided.

Table 8-3: Interest Matrix of Stakeholders

Categorisation	Key Stakeholders	Influence Power to facilitate or impede project	Interest in the Project
Government Agencies	Karnataka Power Company Limited (KPCL)	High	High
	Hubli Electricity Supply Company Limited (HESCOM)	High	High
	Karnataka State Pollution Control Board	High	High
	National Institute of Wind Energy	High	High
	Karnataka Renewable Energy Development Limited (KREDL)	High	High
Positively Influenced Stakeholders	Project Affected Persons/Families (Land Owners)	Low	High
	Families of Direct Employees	Low	High
	HFE (Project Owner)	Low	High
	Gamesa (EPC Contractor)	Low	High
	Local Community residing within the 2 villages of the project area	Low	High
	Contractors	Low	High
	Vendors	Low	High
Critical to Engage	Opinion Leaders of local communities residing within the 2 villages of the project area	Low	High
	Local Government Institutions of 2 Villages	Low	High
	Local Media	Low	Medium
Lenders	Financial Intermediary	High	High

8.8.3.3 Communicative Method

Stakeholder engagement becomes a successful exercise when proper and participatory communicative methods are used. This ensures that the stakeholders are kept engaged and well informed of the project development at every stage. A combination of communicative methods is usually used to engage with the stakeholders. To determine which option is best suited to the various stakeholders, a benefit analysis of each option has been carried out. The communicative methods are:

- General Information consisting of the project's various activities, the operation stage and impacts that might arise shall be made available:
  - on information board of the Gram Panchayat's office within the project area
  - on information board of CWPPL's site office
  - on HFE's website
  - in local newspaper
- Detailed information including documents like ESIA report; Occupational, Health & Safety and Environment Policy, Environment Management Plan, Social Management Plan including environmental decisions shall be in hard copies and disseminated to:
  - CWPPL's site office
  - Electronic version of these documents will be made available at HFE's website.
- In addition to this, a host of tools and techniques can be adopted to engage with the stakeholders in a transparent and accountable manner. Below a list of the tools and techniques which can be adopted are mentioned:
  - Public Meeting: This tool can be used to disclose information on a large scale involving the stakeholders of a particular village. A schedule of the meeting can be circulated well in advance and discussions can involve feedback session from the stakeholders. The meeting can be conducted in the premise of the village school for proximity and familiarity purposes. Once the meeting concludes, minutes of the same should be kept as a record with the site office and a copy given to the village head. Schedules of future meetings should be discussed and finalised so that the stakeholders can gauge the seriousness of the project proponent in continuing the engagement process.
  - Focus Group Discussion (FGDs): FGDs are important when gauging with a particular group of stakeholders on issues related to the project activities. It can be used to understand the needs, perceptions and concerns of the group. The discussion will give space for the members to voice their concerns and suggestions. The moderator of the discussion should be impartial in his/ her view and should encourage everyone present to participate in the discussion. Records of the FGDs should be maintained and updated regularly.
  - Participatory Workshops: Participatory workshops are meetings which enable local people to analyse, share and enhance their knowledge to plan, manage and evaluate development projects and programmes. Visual aids – such as mapping, videos, illustrations, timelines, card sorting and ranking, Venn diagrams, seasonal calendar diagramming and body maps are often used in participatory workshops to engage participants and capture knowledge. They are often an effective means of getting participants to reflect on issues and their own personal experiences. These workshops also pay particular attention to group dynamics and breaking down distinctions between 'uppers' – those with power, standing, influence etc. within a community – and 'lowers' – those with less power, influence and standing within a community. To initiate such a workshop, an expert familiar with participatory tools and conducting such workshops shall be engaged.
  - Participatory Rural Appraisal (PRA) Techniques: PRA techniques are usually adopted to emphasize local knowledge by enabling local people to make their own appraisal, analysis and plan. PRA uses group animation and exercises to facilitate information sharing, analysis and action among stakeholders. This process can be useful when the project proponent initiates any developmental activities in the area and uses the local knowledge to plan and strategize so that they feel responsible for delivery of the objectives.

8.8.3.4 Stakeholder Engagement Programme

The consultation with the stakeholders will be conducted by the Community Liaison Officer/Social Officer (CWPPL) and Social/CSR Officer (Gamesa) who will work in collaboration with HSE Manager (Gamesa) and Site In-charge (CWPPL) at the site level. Any grievances from the community relating to any issues that might arise from the project activities will be managed by the nominated Grievance Officer based at the Site Office. The Community Liaison Officer is to report directly to the CWPPL's Site In-charge based at the Site level.

Consultations with the government agencies will be conducted as per the schedule that will be created with the Community Liaison Officer and CWPPL's Site In-charge. These stakeholders will be informed in advance of the

planned project activities. The development of the facilities will be based on the ESIA procedures and mitigation issues once an ESIA study has been completed.

Consultations with the direct internal stakeholders will involve meetings, information boards announcements and an Intranet system to apprise the direct employees of CWPPL and Gamesa regarding the procedures of emergency response system, incident/accident reporting, grievance redressal mechanism, HR Policies and Procedures, welfare measures etc. In addition, communication of general employment conditions, company's code of conduct for work site, EHS concerns, use of PPEs, information and awareness about the requirements of labour laws and minimum wages, working hours, grievance redressal, retrenchment process etc. should be also be conducted with workers engaged with contractors.

Project related information will be posted on the informational boards at the site office as well as at the Corporate Level. Information on the project milestones will be published in advance on the company's website to be available for the public and non-governmental organizations in the area to comprehend the attitude of the external stakeholders. In addition, the company will publish information on the project in the local newspapers.

In turn, if any issues are raised by the stakeholders, the project proponent management comprising of the Grievance Redressal Committee at the Site Level will respond accordingly in the shortest possible time. Details of which have been provided in the Grievance Redressal Mechanism section of the report.

The responsibility for the SEP implementation will be held by the Community Liaison Officer (CWPPL) based at the Site Office. He will be supported by the Site In-charge (CWPPL), Social/CSR Officer (Gamesa), Site In-charge (Gamesa) and nominated Grievance Officer at the site level.

A summary of the consultation activities that the project proponent shall undertake as part of the Engagement Plan pertaining to the villages around the project area and other stakeholders have been provided below:

Table 8-4: Summary of Consultation Activities

Stakeholder	Objective and Consultation Method	Proposed Timeline	Responsibility
Local Community, Opinion Leaders, Local Media at Project Site	• Disclosure of the project at both villages within the project area and progress of the work to be displayed at the Information Board of Gram Panchayats office within the project area. • Website of the Company	Before the commissioning of the Project	Community Liaison Officer from the Company and Local Leaders of the 2 villages.
Government Authorities	Information meetings and consultations	On-going on a permanent basis (every six monthly)	Company: HSE Manager (HFE), Site In-charge (CWPPL), HSE Manager (Gamesa) and Community Liaison Officer (CWPPL)
Direct Employees	• Internal meetings of direct employees and managers • Day to day contact	• On-going process on a permanent basis: monthly • On-going on a permanent basis	• Company: Site In-charge & Community Liaison Officer • HSE Manager - Gamesa
Contractors (Third Party)	• Meetings with contractors and their respective managers	On-going on a permanent basis: monthly basis	Site In-charge (CWPPL), Project Manager (Gamesa) and Community Liaison Officer
Lenders	• Information on project status • Submission of annual reports, information on any project-related events that could potentially create an increased risk of the project	On-going process on a permanent basis	Company: HSE Manager of HEF, Site In-charge (CWPPL) and Community Liaison Officer.

The stakeholder engagement process should be carried out at two levels, namely, local community and local governing bodies. A summary of the proposed plans that is to be initiated by CWPPL have been described below:

Table 8-5: Summary of Proposed Plan of Activities

Sl. No.	Key Stakeholders	Proposed Plan of Activities
1	Positively Influenced Stakeholders/ Local Communities	• Announcement of vacancies (skilled/unskilled) at proposed site • Announcement of contract work for small scale work associated with the proposed project • CSR Activities to be initiated by Project Proponent • Consultation with village panchayats about movement of heavy vehicles • Information on route and timing of vehicle movement to be provided to village administrations • Set up a grievance redress mechanism and inform the community about the procedure • Discuss the management plan with the community and incorporate the comments
2	Local Governing Bodies	• Compliance with legal requirements • Involvement of various CSR Activities
3	Lenders	• Compliance with International Guidelines (IFC Sustainability Framework & other national and local legal requirements) • Regular Reporting

It is to be noted that the proposed plan of activities relating to the stakeholder engagement can change as per the future planning of activities by CWPPL.

8.8.3.5 Monitoring and Evaluation

Monitoring: Monitoring of project activities is necessary to cater to the stakeholder's concerns by ensuring transparency in guaranteeing the project proponent's commitment in implementing the mitigation measures that addresses the environmental and social impacts arising from the project.

Through this information flow, the local stakeholders feel the sense of responsibility for the environment and welfare in relation to the project and feel empowered to act on issues that might affect their lives.

Internal monitoring of project related activities as well as associated activities involving the local communities should be contemplated upon on a regular yearly basis (by identified staff from the Corporate level) to bring in openness in the company's commitment. In addition, external monitoring of a company's environmental and social commitments can strengthen stakeholder engagement processes by increasing transparency and promoting trust between the project and its key stakeholders.

CWPPL should undertake a commitment in undertaking internal audits every once in a year. All related information shall be readily maintained at the site office and produced at the time of the audits.

Audit reports shall be accordingly created after every yearly audit and submitted to MD of HFE All records of these reports shall be maintained at the site office as well as the Corporate Office. In addition, an external auditor shall be engaged every six months to assess the activities of the project and its mitigation measures. The auditor shall accordingly submit a report to the company for review and this should be forwarded to the lender financing the project as well.

Reporting: Performance of CWPPL will be reviewed yearly against the Stakeholder Engagement Plan. The report will include, but not be limited to, the following:

- Informative materials disseminated, its types, frequency, and location
- Place and time of formal engagement events and level of participation
- Activities of community welfare undertaken
- Feedback on CSR initiatives
- Other interactions with the community; and

- Numbers and types of grievances (both from the community and workers) and the nature and timing of their resolution.

8.8.4 Grievance Redressal Mechanism

Grievance Redressal Mechanism (GRM) is an important criterion for development projects wherein ongoing risks and impacts of projects are probable. The GRM provides a way to reduce risks for projects, offer communities an effective avenue for expressing concerns and achieving remedies and promote a mutually constructive relationship.[18] It is an important tool through which the communities concerns, and complaints are registered and addressed. This mechanism is a significant pillar of the stakeholder engagement process as it creates opportunities for the project proponent and communities to identify problems and determine solutions together. The mechanism tends to meet the requirements of stakeholder engagement process, prevent and address community concerns, reduce risk, and assist the processes that create positive social change.

The GRM has been developed with an intention of it being an effective tool for early identification, assessment and resolution of complaints during project implementation. It is a means through which acceptance, assessment and resolution of community complaints concerning the performance or behaviour of the project proponent are ascertained and addressed. The GRM prepared should be implemented to the entire life cycle of the proposed project.

8.8.5 Steps for Developing a Grievance Mechanism

CWPPL/ Gamesa while developing the Grievance Mechanism are required to adhere to the following steps:

- **Development of Procedures**: CWPPL/Gamesa should ensure that procedures for lodging and registering of grievances are in place before the plan is implemented at the site level. The procedures of Grievance Mechanism should comprise of identifying the personnel (Grievance Officer at Site level) who will be responsible for receiving and addressing the grievances at the site level and handle the cases at the escalation level. The procedures to be developed should include assessment procedures, procedure to determine the appropriate resolution process, procedures for making decisions on proposed settlements, appropriate time frames for each step in the grievance resolution process and notification procedure to the complainant about eligibility, assessment results, proposed settlements and the like.
- **Develop Resolution Options and Response:** Once CWPPL/Gamesa developed procedures, formal and informal resolution options should also be developed along with preparation of formulating a response. General approaches to grievance resolution many include proposing a solution, reaching a resolution through discussion or negotiation, using a third party to either informally or formally resolve the matter through mediation and through traditional and customary practices.
- **Publicise the Grievance Mechanism**: Once the procedures for Grievance Mechanism has been developed by CWPPL/Gamesa, it has to be publicised through various stakeholder engagement activities as detailed out in the Stakeholder Engagement Plan. CWPPL /Gamesa should inform the local community in the first instance and then remind them of this mechanism on a regular basis during the project construction and operation phases. Various communicative methods can be adopted in disseminating the information like printed materials, displays, face to face meetings and website updation. The grievances redress mechanism (GRM) shall be documented in English, Hindi and Kannada and copies shall be kept at the project site office and corporate office. The GRM is also to be displayed at notice board at the project site office and training on the GRM shall also be provided during induction. CWPPL /Gamesa is to ensure that the contractor would keep the workers informed about the grievance mechanism at the time of recruitment and make it easily accessible to them. All the relevant contact numbers to be made available to them.
- **Training/ Workshops on Grievance Redressal Mechanism**: A separate training/ workshop should be undertaken by CWPPL/ Gamesa at the community and worker level to discuss the process of how a grievance gets registered, the local contact person's/grievance officer details of receiving grievances, the significance of grievance boxes, the timelines for addressing the grievances and the personnel involved in the redressal process. These trainings should be held every half yearly and feedback/suggestions from the community should be acknowledged and changes to the GRM should accordingly be undertaken to make it more user friendly.

[18] A Guide to Designing and Implementing Grievance Mechanisms for Development Projects by The Office of the Compliance Advisor/ Ombudsman for IFC and MIGA, 2008.

- **Recording of Grievances:** Once the stakeholders are aware of the mechanism and access it to raise grievances, CWPPL/Gamesa is required to acknowledge the same and keep the complainant's identity anonymous. Consequently, CWPPL/Gamesa is required to collect grievances by checking the grievance boxes once every fifteen days, record and register the grievances that have come in as per the identified formats and track them throughout the redressal process to reflect on their status and important details. A Grievance Log or database emphasising the records and status of the grievance is to be maintained by the identified Grievance Officer at the site level. The Grievance Log can be used to analyse information about grievance and conflict trends, community issues and project operations to anticipate the kinds of conflicts that the project proponents might expect in the future both to ensure that the grievance mechanism is set up to handle such issues and to propose organizational or operational changes.[19]
- **Appeal:** If the grievance redressal solution is not acceptable or agreed by the project proponent, the complainant should be offered to an appeal process. Circumstance revolving around when an appeal can be made should be set by CWPPL/Gamesa so that accountability and transparency is promoted by them in every step. National Court or convening of a senior and independent panel of individuals to seek appropriate resolution of the case with representation from both government and civil society is often encouraged. This panel may also play the role of providing strategic oversight and assurance of the mechanism through review monitoring and tracking data.
- **Resolve and Follow Up:** Once the corrective action has been agreed upon, a good practice is to collect proof of those actions in terms of taking photographs, documentary evidence, getting confirmation from the complainant and filing the same within the case documentation. In addition, monitoring and follow up on the resolution agreed upon should be conducted once to close the case accordingly. CWPPL/Gamesa are required to provide regular (yearly) reports to the public that track the number of complaints received, resolved, not resolved and referred to a third party. In addition, the funding agency also needs to be constantly apprised of the yearly reports in order to support CWPPL/Gamesa in early identification of developing risks.

8.8.6 Proposed Grievance Redressal Mechanism for CWPPL/Gamesa

CWPPL/Gamesa in order to implement the Grievance Redressal Mechanism are required to identify the contact person/grievance officer involved at the site level for registering the grievances, the process of registering and action taken thereon for the resolution of the grievance, the timeline required in each step and criteria in escalation of the case to the higher level.

A site level approach is proposed to be developed for redressal of all cases of grievances. The steps of grievance redressal for CWPPL/Gamesa have been provided below:

Receive and Register a Complaint

- Any stakeholder with concerns pertaining to onsite work such as community health and safety, local employment, community risk, migrant labour etc. may register their complaint in writing to the nominated person/grievance officer at site level;
- Secured grievance boxes shall be placed at the entrance of the site office;
- If any stakeholder or community member wishes to remain anonymous, he/she can write down the grievances and drop in the available complaint box;
- Once a complaint has been received it shall be recorded in the grievance log register or data system.

Assessment and Addressal of Complaint

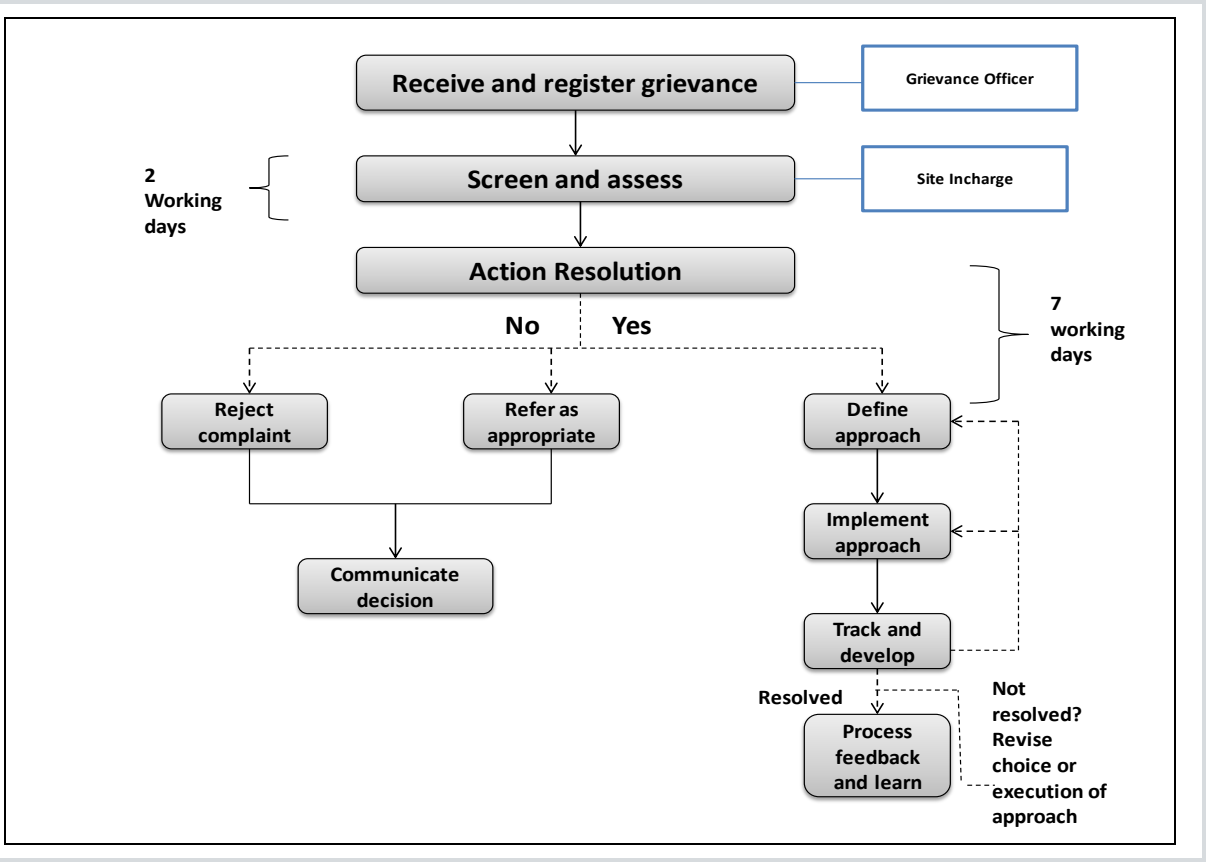
- The identified Grievance Officer will open the complaint boxes every fifteen (15) days and forward the grievances to the CWPPL's Site In-charge for further action;
- The grievance will be assessed by the CWPPL's Site In-charge within two (2) working days to determine if the issues raised by the complaint fall within the mandate of the grievance mechanism or not;
- During the assessment of complaints, the GRC team (CWPPL's Site In-charge, Gamesa's Project Manager, Community Liaison Officer and CSR Officer of Gamesa) will gather information about the key issues and concerns and helps determine whether and how the complaint might be resolved;

[19] A Guide to Designing and Implementing Grievance Mechanisms for Development Projects by 'The Office of the Compliance Advisor/ Ombudsman' for IFC and MIGA, 2008.

- The grievances will be redressed at the Site Level by the GRC within 7 working days;
- If the grievance fails to be addressed at this level the complainant will have the option to approach the appropriate court of laws for redress;
- The complainant will have the opportunity to be present at the committee meetings and discuss the grievance faced by him/her.

The Grievance Mechanism proposed for CWPPL/Gamesa to consider and implement has been provided in the figure below:

Figure 8-3: Proposed Grievance Mechanism Structure for CWPPL/Gamesa



Source: Adapted from CAO's Guide to Designing and Implementing Grievance Mechanisms for Development Projects

8.8.7 Resources Required for Grievance Mechanism Implementation

A Grievance Mechanism becomes successful if adequate resources are assigned in its implementation. Adequate resources here refer to people, systems and processes and associated financial resources. In order to incorporate the responsibility of designing, implementing and monitoring the grievance mechanism, the senior management at the corporate level of HFE should be involved in executing the various tasks.

For a grievance mechanism to function effectively, it is important to establish a governance structure and assign responsibilities for the mechanism's implementation. The following roles and responsibilities have been identified for grievance mechanism implementation:

Nominated Grievance Officer

The Community Liaison Officer (CWPPL) based at the Site Level is to be nominated as the Grievance Officer. The incumbent is to work in tandem with the CWPPL's Site In-charge, Gamesa's Project Manager, Community Liaison Officer and CSR Officer of Gamesa. They cumulatively form the Grievance Committee at the site level.

8.8.8 Engagement of Third Party

To maintain ultimate transparency and accountability for the grievance mechanism process, third parties such as local governments, local community etc. can at times be involved in the grievance redressal process. These

parties can serve as process organizers, places to bring a complaint to be passed on to the company or as facilitators, witnesses, advisors or mediators. Third parties can assist in enhancing the trust level from communities as well as overcome limitations of project-level mechanism.

Through the involvement of third parties as facilitators, the community's confidence in project level grievance mechanism can be increased and the project proponent can gain a better reputation with and greater trust from stakeholders. In addition, cost-efficiency and supplement of internal resources can also be achieved if this step is contemplated upon.

8.8.9 Monitoring and Reporting

Monitoring and reporting are requisite tools of measuring the effectiveness of the grievance mechanism, the efficient use of resources, determining broad trends and acknowledging recurring problems so that they can be resolved before they reach a higher level of contention. They also create a base level of information that can be used by the project proponent to report back to the stakeholders.[20]

Monitoring

Depending on the extent of project impacts and the volume of grievances, monitoring measures like internal (by identified Corporate level staff) and external audits (third party consultants) every once in a year based on the complexity of the nature of grievances can be adopted by CWPPL. Grievance records maintained should provide the background information for these regular monitoring exercises. Through the review of each grievance and analysis of its effectiveness and efficiency, CWPPL can draw on the complaints to evaluate systematic deficiencies. In addition, monitoring of the grievance mechanism helps to ensure that the design and implementation of the mechanism is adequately responding to stakeholder's comments in a cost-effective manner.

Reporting

All grievances registered have to be recorded and regularly updated. The site management or Grievance Officer is responsible to discharging this responsibility and he should be able to produce this document whenever any audits take place. All minutes of meetings with stakeholders, complainants and Grievance Committee are to be recorded and documented regularly for reference purposes. In addition, through the process of monitoring and the reports produced thereafter, assurance of continual improvement of the company's operations is guaranteed. The company can also use these monitoring reports to report back to the community on its implementation of the mechanism and the modification/ changes proposed to make it more user-friendly.

[20] IFC's Good Practice Note on Addressing Grievances from Project-Affected Communities

8.9 Project specific Environmental and Social Management Plan

An Environment and Social Management Plan has been developed following the delineation of impacts and mitigation measures. These measures shall be adopted by CWPPL and imposed as conditions of contract of the sub-contractor(s) employed for respective phases of the proposed wind power project. The mitigation measures suggested during operation will be made part of the regular maintenance and monitoring schedule. The ESMP includes the following:

- Mitigations suggested for adverse environmental and social impacts and associated risks;
- Institutional arrangement - management tools and techniques for the implementation of environmental impacts and risk mitigations;
- Monitoring and reporting of requirements and mechanisms for the effective implementation of the suggested mitigations;
- Monitoring arrangements for effective implementation of suggested mitigations for the proposed project; and
- Reporting requirement to the regulatory agencies and funding institutes.

Table 8-6: Proposed Environmental and Social Management Plan of the project

S. No	Aspects	Potential Impacts	Suggested Mitigation/Management Measures	Monitoring/training Requirement	Management Responsibility
Construction Phase					
1	Social/ Livelihood Pattern	• Loss of land, • Labour rights and welfare; • Migrant Labour Engagement; • Increase of traffic.	***Loss of Land*:** • The site clearance for tower erection, access road and ancillary facilities should be restricted to the necessary footprint area. The remaining area should be accessible for grazing or cultivation once the construction activities are completed; • A formal consultation should be undertaken to apprise the villagers of the project activities on a regular basis; • The EPC contractor (Gamesa) should map access roads and implement strict driving instructions to adhere to such roads without going off-road thus destroying agricultural activities. ***Increase of Traffic Movement:*** • Transportation through community areas shall be avoided to the extent possible; • Transport routes for construction material shall be planned after survey of existing road conditions; • Shoulder widening and road development shall be discussed with community and executed only after addressing all concerns; • High noise generating activities shall not be carried out at night as far as possible; • All public utilities viz. transmission cables, telephone cables etc. falling within road land shall be inventoried and arranged for relocation/ shifting to adjacent areas in consultation with community/agencies. ***Migrant Labour Engagement:*** • Sourcing of construction labour to be done from local region to the extent possible. • Ensure local contracting and vendor opportunities as far as possible. • CWPPL through the contractor agreement shall ensure that the construction contractors commit and adhere to social obligations including community relations, handling complaints and grievances, adherence to labour laws and international commitments etc. • The contractor shall provide adequate information to workers on expected social behaviour and hygiene practices to be followed at site.	• All vehicles engaged for transportation shall be verified for fitness. • Regular training of drivers shall be undertaken. • Construction contractors shall adhere to social obligations, labour laws and international commitments. • Water usage shall be monitored and controlled to minimise the wastewater generation. • CWPPL shall ensure that no child labour and non-discrimination, payment of wages laws are complied with by the contractors.	Community Liaison Officer
2	Ambient Noise Levels	The construction activities will lead to generation of noise and vibration which may affect the habitations lying in close proximity to the proposed locations and may even scare away the grazing animals around the site.	• Construction activities shall be planned in consultation with local communities (if required); • Construction equipment will be maintained in good working order and properly muffled; • Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated, for example with silencers, acoustic louvers and enclosures; • Provision of rubber paddings/noise isolators at equipment/machinery used for construction; • Construction vehicles shall be well maintained and idling time will be minimized for vehicles when not in use; • Site workers working near high noise equipment use personal protective equipment (PPEs) to minimize their exposure to high noise levels.	• Verify the license, permits and consents issued to construction material supplier at least once in 6 months. • Random inspect the vehicles used for transporting construction material to see if they are complying with the recommended mitigation measures.	CWPPL's Site In-charge/ Gamesa's HSE Manager
3	Ecology	• Loss/ degradation/ fragmentation of habitats	• Degradation and loss of habitats caused by removal of natural vegetation could be minimized by removing only the most obstructive plants and conserving the existing ground cover of the area as much as possible. There shall be no clearing of vegetation cover of lands which are not directly under construction footprints. • The site clearance for tower erection, access road and ancillary facilities shall be restricted only to the minimal area required for the respective purpose.	The entire workforce shall be sensitized (by the construction contractor) to possible adverse ecological impacts during the construction phase by conducting awareness programs.	CWPPL's Site In-charge/ Gamesa's HSE Manager

S. No	Aspects	Potential Impacts	Suggested Mitigation/Management Measures	Monitoring/training Requirement	Management Responsibility
			• The number and width of access roads shall be kept to the minimal possible. The use of existing roads should be preferred. • It is recommended that the compensatory plantation of native species be done in all suitable areas around turbines and along roads		
4	Occupational Health and Safety (OHS)	• Material handling and storage; • Possible injuries associated with working at height (≥ 2m); • Electrical work injuries (eye injuries, shocks, burns, fires /explosion); and • Other occupational hazards	• All material will be arranged in a systematic manner with proper labelling and without any protrusion or extension onto the access corridor. The construction material for transmission tower will be kept at site and carried to individual towers as per requirement; • Loading and unloading operation of equipment shall be done under the supervision of a trained professional; • All work at height to be undertaken during daytime with sufficient sunlight; • Proper PPEs shall be provided to workers handling welding, electricity and related components; • Fire extinguishing equipment shall be provided in adequate number on site to handle any possible fire outbreaks; • Effective work permit system for hot work, electrical work, working at height shall be ensured; • Excess waste debris and liquid spills shall be cleaned up regularly to avoid slips and falls; • Clear traffic ways shall be made to avoid driving of heavy equipments over loose scrap. • Controlling vehicle traffic through use of one way traffic route, establishment of speed limits, and on site trained flag people wearing high visibility vests or outer clothing covering to direct traffic.	• The labour engaged for working at height shall be trained for temporary fall protection devices and use of personal fall arrest systems shall be ensured; • All the workers shall be made aware of the possible occupational risks/hazards by the way of an OHS training/awareness programme; • Periodic inspection of PPEs shall be done to ensure that they are in proper condition by keeping records; • The contractor shall ensure that machinery is equipped with a legible, durable load chart that shows the manufacturer's recommended load configurations and maximum load weights; • The contractor shall ensure that no person is engaged in driving or operating lifting appliances unless he is sufficiently trained, competent and reliable, possesses the knowledge of inherent risks involved in the operation and is medically examined periodically; • An accident reporting and monitoring record should be maintained. The objective shall be to minimize such occurrences in the future and attain zero accidents.	CWPPL's Site In-charge/ Gamesa's HSE Manager
5	Soil Quality	• Excavation can disturb the original topography of the area which can further lead to soil erosion; • Soil contamination due to dispersion of construction material and oil leaks/spillages from vehicles and machinery operating at site.	• Re-vegetation shall be done in the area after the completion of construction in order to reduce the risk of soil erosion; • Excavated material will be stock piled and used for backfilling of foundations, trenches etc.; • Temporary paved areas shall be constructed to be used while refuelling the machineries. In case of any accidental spill, the soil will be cut and stored securely for disposal with hazardous waste; • All construction material shall be stored in a designated/demarcated storage area within the site and covered with tarpaulin sheet to avoid dispersal with wind.	• The workforce shall be sensitized to handling and storage of hazardous substances viz. fuel oil, machine oil/fluid etc. • The workers engaged in handling of hazardous substances shall be briefed about the possible hazards and the need to prevent contamination.	CWPPL's Site In-charge/ Gamesa's HSE Manager
6	Ambient Air Quality	• Dust generation and subsequent dispersal by wind during site preparation activities; • Pollutant (SOx, NOx, PM) discharge into surrounding air from exhaust emission of construction vehicles and D.G sets.	• Localized sprinkling of water at areas if possible shall be undertaken for the entire duration of construction; • Loose excavated soils shall be kept covered or kept wet in designated storage areas to prevent dust generation; • Regular maintenance of vehicles shall be carried out and Pollution under Control (PUC) certificates shall be maintained. • Idling time of vehicles will be reduced the extent possible.	• Monitoring of dust deposition in the adjoining areas on a regular basis; • The employees shall be made aware of the dust minimisation measures; • A monitoring record/register shall be maintained for all the vehicles. It shall contain details of the vehicle PUC status, repair/maintenance schedules, etc.	CWPPL's Site In-charge/ Gamesa's HSE Manager
7	Water Quality	• Possibility of contaminated runoff from the site entering the nearby water bodies; • Domestic water runoff from the portable toilets into neighbouring water bodies can lead to degradation of water quality.	• Temporary paved areas shall be constructed to be used while refuelling the machineries; • Machinery and vehicles shall be thoroughly checked for the presence of leaks if any; • Drip pans shall be provided with vehicles with leaks to prevent soil contamination; • Storage of oil shall be undertaken on paved impervious surface and secondary containment shall be provided for fuel storage tanks; and • Adequate drainage of road based on road width, surface material, compaction and maintenance.	• The entire workforce shall be sensitized to optimal use of water; • Storm water drains shall be checked regularly to prevent clogging; • A record for daily supply and consumption of water shall be maintained in order to assess usage and wastage of water; and • Housekeeping activities (e.g., clearing of debris) shall be supervised on a regular basis.	CWPPL's Site In-charge/ Gamesa's HSE Manager

Operation Phase

S. No	Aspects	Potential Impacts	Suggested Mitigation/Management Measures	Monitoring/training Requirement	Management Responsibility
1	Social/Livelihood Pattern	• Land Use • Visual Aesthetic • Electromagnetic Field (EMF) interference • Shadow flicker • Potential of Blade Throw	• The entire land use in the project area shall not be altered since only a small area (0.1%) is occupied by WTGs; • The land in the project area should be made available for alternative uses like agriculture, grazing and other activities; • CWPPL shall hold negotiations with farmers providing area for transmission poles/ towers and consider possible adjustment of the pole/ tower locations towards convenience of the farmers; • The layout for access roads and transmission lines shall be developed considering the minimum land requirement as needed; • Consider the landscape character during turbine sitting; • Maintaining uniform size and design of turbines by having same direction of rotation, type of turbine and height; • Maintaining a minimum distance of 168 m between WTGs and receptors; • Formulate a complaint resolution procedure for the local community so that any issues or concerns associated with shadow flicker are reported to the site staff; • Reducing the occurrence of impacts due to blade glint by application of non-reflective paints; • Ensuring absence of any auxiliary structures except the required ones such as access roads and transformer yards which accompany the turbines; • The WTGs to be equipped with vibration sensors that can react to any imbalance in the rotor blades and automatically shut down the turbine if necessary, to avoid any chance of blade throw.	• Review and inspect the mitigation measures undertaken for addressing land use, aesthetic and visual impact aspect on environment.	• Community Liaison Officer
2	Ambient Noise Levels	Noise generation due to operation of wind turbines.	• Increase in dense vegetation coverage around the receptor locations which shall act as noise barrier; • Wind turbines shall be designed in accordance with the international acoustic design standards and maintained throughout the operational life so as to limit noise generation; • The wind turbines shall be maintained in good running conditions throughout the operational life of the project through routine maintenance; • Operation and Maintenance staff to be provided with personal protective equipment (PPEs) such as ear plugs and ear muffs when working close to turbine in operation; • It is suggested that ground vegetation such as shrubs and bushes are cleared to the minimum extent possible during site clearance activities; • Consult with the locals periodically to assess noise generation and set up a procedure to locate source of noise and steps taken to minimize them; • Implement a complaint resolution procedure to assure that any complaints regarding operational noise are promptly and adequately investigated and resolved; • Undertake ambient noise level monitoring from NABL/MoEFCC accredited laboratories on an annual basis in order to understand the increase in noise levels due to the project operation.	• Undertake ambient noise level monitoring on an annual basis in order to understand the increase in noise levels due to the project operation	CWPPL's Site In-charge/ Gamesa's HSE Manager
3	Ecology	Injury/Death of Birds/Bats	• Designing the project layout to provide adequate spaces between every two turbines for movement of birds, thereby reducing the potential for accidental collision. • Underground intra-farm wiring, thereby reducing the hindrance to birds. • Insulating overground wiring, if any, thereby avoiding any chance of electrocution. • Providing daytime visual markers on any guy wires used to support wind-masts or towers, thereby enhancing visibility of the wires to birds;	• Periodic Bird/Bat carcass survey to be undertaken during operation phase	CWPPL's Site In-charge/ Gamesa's HSE Manager

S. No	Aspects	Potential Impacts	Suggested Mitigation/Management Measures	Monitoring/training Requirement	Management Responsibility
			• Installing visibility-enhancing objects, such as marker balls, bird deterrents or diverters along any over-ground transmission lines, thereby enhancing visibility of the transmission lines to birds; • Keeping windfarm lighting switched off when not needed; • Opting for lighting fixtures that are hooded and directed downward to minimize the skyward and horizontal illumination that could attract night-flying birds to the vicinity of wind turbines; • Moving potential rodent-habitats, such as heaps of rocks or earthen mounds, away from the wind-farm-area, thereby avoiding attracting raptor bird-species into the area; • Removing any carcasses from the site, thereby avoiding attracting scavenging raptors, such as vultures, into the area; • Instituting appropriate storm-water management measures, thereby avoiding creating potential migratory waterfowl habitats, such as pools or bogs, in the windfarm area; • Keeping the wind-turbines in operational on low wind-speed nights, thereby minimizing risk of barotrauma to bats flying in/through the windfarm area.		
4	Occupational Health and Safety	• Possible injuries associated with working at height (≥ 2m) • Electrical work injuries (eye injuries, shocks, burns, fires/explosion) • Other occupational hazards	• Work permit system shall be implemented for working at height (typically when working over 2m) and also for hot jobs; • The use of safety belt and need for safety net as required shall be ensured; • All work at height shall be undertaken during daytime with sufficient sunlight; • Integrity of structures shall be checked prior to undertaking work; • Fixtures shall be installed on tower components to facilitate the use of fall protection systems; • Only those workers who are trained in climbing techniques and use of fall protection measures shall be engages for working at height; • Regular inspection, maintenance, and replacement of fall protection equipment to be undertaken; • Wind turbines shall be equipped with an earthing system; • Personal Protective Equipments (PPEs) e.g., shock resistant rubber gloves, shoes, other protective gear etc. should be provided to workers handling electricity and related components; and • The transformer yard should be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire.	• Gamesa shall provide instructions and procedures to all the workers involved in service repair of wind turbines, which will consider wind speeds and other external conditions in such a manner that service, maintenance and repair work on the wind turbine can be performed safely; • Acquaint all workers and make them thorough with operation and maintenance manuals of model of installed WTGs; • Employees involved in electrical works shall be trained in and shall be made familiarize with the safety-related work practices, safety procedures and other safety requirements that pertain to their respective job assignments; • An accident reporting and monitoring record shall be maintained at site.	CWPPL's Site In-charge/ Gamesa's HSE Manager
5	Soil Quality	• Soil contamination due to improper disposal or spillage of hazardous waste (waste/used oil).	• Waste oil generated shall be stored separately in containers in a secured location in the maintenance room. The storage location and the containers shall be properly marked; • The waste/used waste oil from the turbines shall be disposed of through CPCB/KSPCB authorized vendor; • Transformer oil shall be returned to the manufacturers as per the agreement of purchase; • A hazardous waste inventory shall be maintained as per the provisions of the HWR, 2016.	• Site engineers and maintenance staff need to be aware and trained about the procedure for proper storage and disposal of waste oil and how to act in case of accidental oil spillage; • Ground water sample and soil sample testing needs to be undertaken at the waste oil handling and storage location once in every three years.	CWPPL's Site In-charge/ Gamesa's HSE Manager
6	Water Resources and Quality	• Burden on local ground/surface water resources due to water demand of onsite personnel; • Wastewater generated from site office.	• The water requirement during the operation phase of the project shall be met through water tankers from suppliers' authority by government. • The drinking water requirement for the site personnel shall be met through packaged drinking water. • Adequate number of septic tanks shall be provided for treatment of wastewater generated.	• Ground water sample testing at the project site once in every 6 months.	• CWPPL's Site In-charge/ Gamesa's HSE Manager

Decommissioning Phase

S. No	Aspects	Potential Impacts	Suggested Mitigation/Management Measures	Monitoring/training Requirement	Management Responsibility
1	• Socio-Economic • Waste Generation • Health & Safety	• Issue of loss of job when the workers will be asked to leave after end of work; • Improper disposal of demolition waste and obsolete machineries will lead to contamination of soil and discontent of community; • Demolition activity will lead to generation of dust which can be carried downwind to habitations in the surrounding area; • Deconstruction activities are associated with health and safety issues such as structural collapse, trip and fall, electrical hazards etc.	• The proponent shall inform the workers and local community about the duration of work; • The workers shall be clearly informed about the expected schedule and completion of each activity; • The reduction in workers shall be done based only on the requirement of his/her skill set and not guided by any other factor; • A transparent mechanism shall be prepared wherever choice is to be made between individuals of similar capability; • All waste generated from demobilization phase shall be collected and disposed off at the nearest municipal disposal site; and • All necessary Personal Protection Equipment (PPE) shall be used by the workers during demolition work.	• Inspect all the demobilised sites for satisfactory compliance to mitigation measures.	CWPPL's Site In-charge/ Gamesa's HSE Manager

9. Conclusion and Recommendations

The ESIA has assessed the overall impacts on Environmental and Social components as a result of construction and operation of proposed 24 MW wind power project at Babaleshwar site falling in Vijayapura District of Karnataka. The impacts due to the project is minimal, site specific and has reversible impacts on the micro environment of the project site owing to the construction activities, shadow flickering and noise generation from the wind turbine generators and involvement of agricultural land.

The project is assessed to generate some environmental and social impacts due to construction, operation and establishment of associated facilities. Mitigation measures for potential impacts on air environment, water quality, land, soil, noise, traffic, ecology, and socio-economic have been specified through proper:

- Follow up of best practice of public disclosure about the project to the local community, and grievance management;
- Planning & designing of wind farm sites, WTG location preparation and access route, construction, drainage, traffic movement etc.;
- Application of standards for Health and Safety; and
- Clearances and permits required for each sub activity.

This ESIA study together with mitigation measures and follow up of recommendations on management actions will help CWPPL in complying with national/state regulatory framework and meet the requirements of IFC Performance Standard.

Based on the ESIA study conducted the proposed project can be categorized as '***Category B'*** (as per IFCs categorisation of projects), as the social and environmental impacts are limited, site specific, largely reversible and can be readily addressed through the proposed mitigation measures.

The rationale for categorisation is provided below:

- The land for the proposed project comprises of private agricultural land and does not involve any involuntary resettlement;
- Private land required for the project has been procured on willing seller willing buyer basis with individual negotiation with the land owners and locals expressed their desire to sell their land during community consultations;
- The project is not located in an ecologically sensitive area;
- The operation of turbine will have limited environmental and social impacts;
- There are no indigenous communities in the project area;
- Any adverse environmental and social impacts may be readily addressed with mitigation measures as outlined in Environmental and Social Management Plan.

Appendix A (Photolog of the Floristic and Bird Species in the Study Area)

FLORISTIC SPECIES RECORDED IN THE STUDY AREA

Datura metel

Cryptostegia grandiflora

Leucas aspera

Striga densiflora

Capparis decidua

Azadirachta indica

Alternanthera sessilis

Calotropis procera

Ailanthus excelsa

Abutilon indicum

Hyptis suaveolens

Prosopis chilensis

BIRD SPECIES RECORDED IN THE STUDY AREA

Plegadis falcinellus (Glossy Ibis)

Charadrius dubius (Little Ringed Plover)

Vanellus malabaricus (Yellow-wattled Lapwing)

Vanellus indicus (Red-wattled Lapwing)

Tringa glareola (Wood Sandpiper)

Streptopelia decaocto (Eurasian Collared Dove)

Merops orientalis (Green Bee-eater)

Lanius vittatus (Bay-backed Shrike)

Sturnia pagodarum (Brahminy Starling)

Dicrurus macrocercus (Black Drongo)

Himantopus himantopus (Black-winged Stilt)

Halcyon smyrnensis (White-throated Kingfisher)

Ardeola grayii (Indian Pond Heron)

Emberiza melanocephala (Black-headed Bunting)

Mycteria leucocephala (Painted Stork)

Tadorna ferruginea (Ruddy Shelduck)

Anas poecilorhyncha (Indian Spot-billed Duck)

Motacilla flava (Yellow Wagtail)

Appendix B (Detailed Noise Monitoring Report)

WindPRO version 2.7.486 Jan 2011

Project:
Piploda & Bableshwar Cumulative

Printed/Page
23-02-2017 14:56 / 1

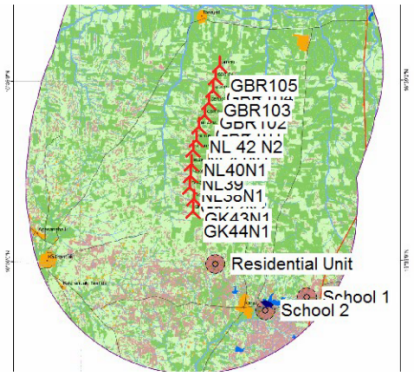
Licensed user:
Aecom
5th Floor, Building 10 B, DLF Cybercity, DLF Phase 2,
IN-122002 Gurgaon
+91 1244830100

Calculated:
23-02-2017 14:55/2.7.486

DECIBEL - Main Result

Calculation: Piploda

Noise calculation model:
ISO 9613-2 General
Wind speed:
4.9 m/s
Ground attenuation:
General, Ground factor: 0.0
Meteorological coefficient, C0:
0.0 dB
Type of demand in calculation:
2: WTG plus ambient noise is compared to ambient noise plus margin (FR etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure and Impulse tone penalty are added to WTG source noise
Height above ground level, when no value in NSA object:
5.0 m Allow override of model height with height from NSA object
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)



Scale 1:200,000

New WTG Noise sensitive area

WTGs

	UTM WGS84 Zone: 43				WTG type						Noise data								
	East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Creator	Name	Wind speed	Status	Hub height	LwA,ref	Pure tones	Octave data	
	UTM WGS84 Zone: 43		[m]					[kW]	[m]	[m]			[m/s]		[m]	[dB(A)]			
GBR101	573,141	1,839,898	616.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
GBR102	573,257	1,840,276	613.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
GBR103	573,393	1,840,646	611.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
GBR104	573,470	1,841,035	606.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
GBR105	573,585	1,841,409	601.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
GK42N2	572,669	1,837,709	626.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
GK43N1	572,803	1,837,348	627.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
GK44N1	572,774	1,836,969	632.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
NL 42 N2	572,959	1,839,548	619.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
NL38N1	572,695	1,838,059	624.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
NL39	572,731	1,838,409	623.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
NL40N1	572,770	1,838,834	622.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)
NL41N1	572,876	1,839,143	621.0	GAMESA G114 2000 114.0 !O! hub:...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	4.9	Interpolated	106.0	101.3	0 dB	Generic	*)

***)Notice: One or more noise data for this WTG is generic or input by user**

Calculation Results

Sound Level

Noise sensitive area		UTM WGS84 Zone: 43			Demands			Sound Level			Demands fulfilled ?
No.	Name	East	North	Z	Imission height	Ambient noise	Additional exposure	Ambient+WTGs	From WTGs	Ambient+WTGs	Additional exposure	Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	
Residential Unit	A house in the West boundary of substation, Kajrol Village	573,466	1,835,337	626.0	5.0	34.7	3.0	45.0	29.0	35.7	1.0	Yes
School 1	Near Kuthurraichammal High.Sec.School –	576,271	1,834,311	624.0	5.0	38.2	3.0	45.0	21.6	38.3	0.1	Yes
School 2	Near Govt. Middle School, Karjol village	574,988	1,833,924	606.0	5.0	43.3	3.0	46.3	22.6	43.3	0.0	Yes

Distances (m)

WTG	School 1	Residential Unit	School 2
GBR101	6404	4573	6253
GBR102	6683	4943	6584
GBR103	6958	5310	6909
GBR104	7284	5698	7271
GBR105	7589	6073	7615
GK42N2	4952	2502	4439
GK43N1	4610	2117	4062
GK44N1	4392	1773	3765
NL 42 N2	6196	4241	5979
NL38N1	5180	2829	4728
NL39	5415	3159	5021
NL40N1	5720	3566	5388
NL41N1	5905	3851	5630

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